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"LET KNOWLEDGE GROW FROM MORE TO MORE
AND THUS BE HUMAN LIFE ENRICHED."

A New Survey of Universal Knowledge

NCYCLOPÆDIA BRITANNICA

Volume 19

RAYNAL TO SARRAUT

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RAYNAL TO SARRAUT

RAYNAL, GUILLAUME THOMAS (1713–1796), French writer and propagandist, widely read and very influential in his day, was an important precursor of the French Revolution. Born at Saint-Geniès in the Aveyron, April 12, 1713, he was educated at the Jesuit college at Rodez, and himself became a Jesuit. He taught at Pézenas, Clermont and Toulouse, left the Society of Jesus at about the age of 34 and went to Paris; he exercised minor ecclesiastical functions at Saint-Sulpice. Meanwhile he entered the world of letters and from 1747 to about 1752 was literary correspondent to the duchess Dorotea of Saxe-Gotha to whom he addressed his *Nouvelles litte'raires.* His first major publications were *Histoire du stadhoudkrat* (1747) and *Histoire du Parlement d'Angleterre* (1748), both hack work. In the first he appeared as an opponent of despotism; in the second, as an advocate of absolute monarchy, a discrepancy to be explained by the different orientation of French foreign policy in relation to Holland and to Great Britain. From 1750 to 1754 he edited the *Mercure de France.* This literary activity won for him a place in French society and he became a guest at the tables of Helvétius and D'Holbach and a friend of Montesquieu.

His most celebrated work was *Histoire philosophique* et *politique des e'tablissements et du commerce des Européens dans les deux Indes,* first published in 1770 in six volumes, revised in 1774 and again, with changes of an outspoken and audacious character, in 1780. This was not his unaided work. Diderot, in particular, contributed extensively to it and Alexandre Deleyre, a disciple of Montesquieu, is reputedly responsible for the 19th book, which contains a general statement of political philosophy and is of more lasting interest than the rest. The whole work is a compendium of information and ideas on history, economics and politics, with an advanced anticlerical bias. Reprints were extremely numerous. The book fell foul of the Holy See in 1774, when it was placed on the Index, and of the *parlement* of Paris in 1781, when it was sentenced to be burned and the author was sent into exile. Raynal thereupon went first into Belgium, where he was the subject of many hostile lampoons, then into Prussia, where his reception at the hands of Frederick II was less cordial than he expected, and finally into Switzerland. In 1784 he was permitted to return to France, though not to Paris. He settled first at Toulon, then at Marseilles, where he entertained the youthful Napoleon, who read *Histoire philosophique.* His banishment from Paris was rescinded in 1790; he returned to the metropolis and engaged cautiously in political activity. He died at Chaillot on March 6, 1796.

See A Feugère, *Un précurseur de la Revolution: l'abbé Raynal (1922)* and *Bibliographie critique de l'Abbé Raynal* (1922) ; *H.* Wolpe, *Raynal et sa machine de guerre* (1957). (*R*T. S.)

RAYNALD OF CHÂTILLON (d. 1187), a knight in the service of Constance, princess of Antioch, whom she chose for her husband in 1153, four years after the death of her first husband, Raymund (*q.v.*). One of Raynald's first acts was a brutal assault on the patriarch of Antioch; while two years later he made an unjustifiable attack on Cyprus, in the course of which the island was ravaged. The act brought its punishment in 1159, when he had to humiliate himself before the emperor Manuel, doing homage and promising to accept a Greek patriarch; and when Manuel came to Antioch in the same year, and was visited there by Baldwin III, Raynald led his horse into the city. Later in the year he was captured by the Mohammedans and held for 17 years. Released in 1176, he married Stephanie, the widow of Humphrey of Toron, and heiress of Krak and Mont Royal, to the southeast of the Dead Sea—fortresses which controlled the trade routes between Egypt and Damascus. and gave him access to the Red sea. In Nov. 1177, at the head of the army of the kingdom, he won a victory over Saladin, who only escaped with difficulty from the pursuit. But in 1181 the temptation of the caravans which passed by his fortress proved too strong, and in spite of a truce between Saladin and Baldwin IV, he began to plunder. Saladin demanded reparations from Baldwin IV. Baldwin could only reply that he was unable to coerce his unruly vassal. The result was a new outbreak of war between Saladin and the Latin kingdom (1182). In the course of the hostilities Raynald launched ships on the Red sea, partly for buccaneering, partly, it seems, with the design of attacking Mecca, and of chaiienging Mohammedanism in its own hoiy place. His ships were captured by one of Saladin's officers; and at the end of the year Saladin himself attacked Raynald in his fortress of Krak, at a time when a number of guests were assembled to celebrate the marriage of his stepson, Humphrey of Toron. The siege was raised, however, by Count Raymund of Tripoli; and until 1186 Raynald was quiet. In that year he espoused the cause of Sibylla and Guy de Lusignan against Count Raymund, and his influence contributed to the recognition of Guy as king of Jeru-

salem. His policy at this crisis was not conceived in the best interests of the kingdom; and a step which he took at the end of the year was positively fatal. Hearing of a rich caravan. in which the sister of Saladin was traveling. he swooped down from his fortress upon it. Thus, for the second time, he broke a truce between the kingdom and Saladin. Guy could not extort from him the satisfaction which Saladin demanded: Raynald replied that he was lord in his lands, and that he had no peace with Saladin to respect. Saladin swore that Raynald should perish if ever he took him prisoner; and next year he was able to fulfill his oath. He invaded the kingdom, and, at the battle of Hittin, Raynald along with King Guy and many others fell into his hands. Saladin, after rebuking Raynald strongly for his treachery, offered him his life if he would become a Mohammedan. He refused, and Saladin slew him with his own hands or caused him to be slain.

RAYNAUD'S DISEASE, first described by P. Edouard Raynaud in 1862, is characterized by a reaction in a susceptible person following exposure to cold or emotional disturbance such as anger or fear. Typically there are three stages. During the first, the affected parts, most commonly the fingers or toes, less commonly the nose, cheeks or ears, become blanched or waxen and cold. They are relatively bloodless and if cut bleed little. This is caused by a spasm in the arterioles, the smallest arteries through which blood normally flows to the capillaries. In some patients the local colour changes to slate gray (the second stage). This persists while the stimulating factor continues and is associated with numbness, tingling and sometimes pain. Return to a warm environment or release from tension results in the relaxation of the arterioles and a flush of blood into the area together with a throbbing sensation, increased local warmth and intense redness. after which the part returns gradually to normal. The symptoms of this disease may occur frequently for years, with no evidence of serious damage; gangrene is extremely rare. The underlying cause is unknown. The onset usually occurs between the ages of 15 and 35 years; 90% of the cases are in females.

A similar phenomenon, Raynaud's syndrome, is known to be present in some patients in the early stages of arteriosclerosis and thromboangiitis obliterans, two diseases affecting the arteries of the extremities (see ARTERIES, DISEASES OF). The syndrome may also develop following repeated blows to a hand. as in the use of a pneumatic hammer or in the playing of handball, and has occurred in concert pianists and typists. Since it does not occur in all who are exposed, individual susceptibility must be assumed. Raynaud's syndrome is also associated with other diseases, such as scleroderma, a condition producing a hardening of the skin and sometimes the deeper tissues, and with some blood diseases such as cryoglobulinemia, in which the blood solidifies if reduced much below the usual body temperature.

Treatment for the classical Raynaud's disease is not specific. The patient should try to avoid exposure to stimulating factors. A warm climate is beneficial and it is advisable for the patient to wear warm gloves and socks and to avoid winter sports. Neurologic surgery has been widely used; it is more successful for Raynaud's disease of the feet than of the hands. Many drugs have been tried without much effect.

Treatment of Raynaud's syndrome secondary to some other condition must depend on the primary condition. If repetitive injury is responsible, the only recourse is to discontinue the activity causing it. The primary diseases mentioned above must be treated. In addition cold, being an aggravating factor, must be avoided.

See I. S. Wright, Vascular Disease in Clinical Practice, 2nd ed. (1954).
(I. S. W.)

RAYNOUARD, FRANÇOIS JUSTE MARIE (1761–1836), French dramatist and Romance philologist who also played some part in the politics of the Revolutionary and Napoleonic period, was born at Brignoles in Provence, Sept. 18, 1761, and educated for a legal career. Sent as deputy to the legislative assembly in Paris (1791), he was imprisoned on the fall of the Girondins (1793) but released in the Thermidorian reaction (1794). His first play *Caton d'Utique* was then published. After practising as a lawyer at Draguignan, he returned to Paris in 1803. His second play, Les *Templiers* (1805), was a great success in the theatre. He was made a member of the Corps Législatif (1806) and of the Académie Française (1807). His next play, Les *États* de Blois, ou la *mort* du *duc* de Guise (1810), offended Napoleon and was banned; his later tragedies attracted little notice. After Waterloo, Raynouard abandoned politics. despite the protests of constituents in the Var *département,* and devoted himself to the study of the language and literature of the troubadours. His major works were *Choix* des poe'sies originales des troubadours, 6 vol. (1816–21; vol. 6 was also published separately as *Grammaire comparée* des langues de *l'Europe latine dans leurs* rapports avec la langue des *troubadours,* 1822) and the posthumous Lexique roman, 6 vol. (1838–44). He was a member of the Académie des Inscriptions from 1816.

Raynouard died at Passy on Oct. 27, 1836.

RAYON: see SYNTHETIC FIBRES.

RAYONNANT STYLE, in architecture, the fully developed French Gothic style (see GOTHIC ARCHITECTURE) of the latter half of the 13th and the first three-quarters of the 14th centuries. It is characterized by a complete mastery of the structural ideas of the Gothic vaulted church; great skill in stone-cutting; the elimination of wall surface; the reduction in area of all supports to the minimum; thorough development and lavish use of bar tracery (*q.v.*) based on geometric forms; reduction in size and importance of the triforium gallery; and a general attempt to accent all vertical lines. In carved ornament the spherical crocket of the earlier Gothic was replaced by a fully opened, upturned leaf and naturalistic foliage-decorated capitals, string courses and the like.

"Rayonnant" pertains to the radiating tracery of the rose windows, a single, although characteristic, detail; the term has been nearly abandoned, even in France. Marcel Aubert in Robert de Lasteyrie's posthumous work, *L'Architecture* Religieuse en *France* a *l'Epoque* Gothique, vol. ii. p. 5, calls the style from 1140 to 1200 *le gothique primitif* and that of the years 1200 to 1400 simply *gothique.*

Characteristic examples are: Sainte Chapelle, Paris (1243–48); the choir of Amiens cathedral (1258–69); additions to the transepts of Notre Dame in Paris (1258–1315); St. Urbain in Troyes (1262–76); Portail des Libraires at Rouen cathedral (1280); and the choir of the abbey church of St. Ouen at Rouen (1318). Chronologically, this phase of French Gothic corresponds to the Decorated period (*q.v.*) in England and the High Gothic style in Germany. In France it was followed by the Flamboyant style (*q.v.*).
(P. F.)

RAYY, one of the great cities of Iran, the ancient Ragha, Latin Rhages. The expedition of the Boston and Pennsylvania museums disclosed a prehistoric settlement on the site dating from the third millennium B.C. Rayy is mentioned in the Avesta as a sacred place and is also mentioned in the Apocrypha. In the 9th century, the Caliph Al-Mahdi became governor and there his son, Haroun-al-Rashid, was born. Under Al-Mahdi's rule the city rapidly became a magnificent metropolis, rivaled in western Asia only by Damascus and Baghdad. It covered at least 25 sq.mi., and according to Mustawfi it contained 20,000 mosques, 2,750 minarets, innumerable baths and colleges. It continued to be a city of political, commercial and artistic importance through Seljuk times. In the 12th century it was tormented and greatly weakened by the fury of rival religious sects, was overcome by the Mongols in 1220 and, according to some probably much exaggerated reports, completely destroyed and the inhabitants massacred. Mongol occupation, however, terminated the dominance of Rayy. It was famous for its decorated silks of an unsurpassed finesse and artistic perfection. Rayy has been wrongly credited with the bulk of the luxurious type of Persian pottery of the 12th and 13th centuries. (See POTTERY AND PORCELAIN: Persia and tlze Near East.) Only one architectural monument, the tower of Toghrul (1137) survives. The centre of Rayy was situated about 6 mi. S. of modern Tehran.

RAZI, AL- (FAKHR AL-DIN ABU ABDALLAH MOHAMMED IBN UMAR IBN AL-HUSAIN AL-RAZI) (1149–1209), Moslem theologian and scholar, was born the son of a preacher at Rayy (Rhagae),

near the modern Tehran. After devoting himself to alchemy in his youth, he studied theology and philosophy at Rayy and Maragha. In law he followed the school of Shafi'i (*q.v.*), on whose merits he composed a celebrated book; in theology that of Ash'ari (*q.v.*). Although he could not come to terms with the anti-intellectualism of the mystics. he was recognized as an authority on the mystic life as well as on scholastic theology and the law. As a student of tradition, however, he was considered weak. His contemporaries saw in him above all the defender of orthodoxy against dissenters and heretics. During an extensive journey to Khwiirizm and Transoxiana he preached (in Arabic and Persian) against the local sectarians and more particularly against the philosophical school of the Mu'tazilites, who, in the end, compelled him to withdraw to his birthplace. Subsequently, he found honour at the court of Shihāb ad-Din Ghūrī (d. 1205) and especially in the entourage of the Khwārizmshāh 'Alā' ad-Din Mohammed (1199–1220), whom he followed to Khurasan. Later he settled in Herāt, where he died, as some would have it, poisoned by one of the sects which he had combated.

His greatest work, *Mafātīḥ al-Ghaib* ("Keys of the Hidden"), an extensive commentary on the Koran, has been printed at various times in Cairo and Istanbul. Razi studied the Koran also from the point of view of its style and examined the rare expressions in the holy book. Some of his dogmatic and legal writings continue to enjoy a high reputation, as do his contributions to philosophy. His dogmatic position was analyzed by Schmolders in his *Essai sur les écoles philosophiques chez les Arabes* (1842). His disputations with the Mu'tazilites were studied by P. Kraus in *Islamic Culture* (1938) and the *Bulletin de l'Institut Egyptien* (1939).

For a list of Razi's works see C. Brockelmann, Geschichte der *arabi*schen Litteratur, 2nd ed., vol. i, pp. 666–669 (194349); and M. Schreiner, Zeitschrift d. deutschen morgenlaend. *Gesellschaft*, vol. lii. The most extensive source for his biography is Tāj ad-Din Subki (d. 1370), *Ṭabaqāt ash-Shāfi'iyya al-kubrā* (1323–24 and 1905–06).

(G. E. V. G.)

RAZIN, STENKA (STEPHEN TIMOFEEVICH) (d. 1671), Cossack hetman and rebel, whose parentage and date and place of birth are unknown. We first hear of him in 1661 in a diplomatic mission from the Don Cossacks to the Kalmuck Tatars, and in the same year we meet him on a pilgrimage of 1,000 miles to the great Solovetsky monastery on the White Sea "for the benefit of his soul." After that all trace of him is lost for six years, when he reappears as the leader of a robber community established at Panshinskoe, among the marshes between the rivers Tishina and Ilovlya, from whence he levied blackmail on all vessels passing up and down the Volga. His first considerable exploit was to destroy the "great water caravan" consisting of the treasury barges and the barges of the patriarch and the wealthy merchants of Moscow. He then sailed down the Volga with a fleet of 35 galleys, capturing the more important forts on his way and devastating the country. At the beginning of 1668 he defeated the voivode Jakov Bezobrazov, sent against him from Astrakhan, and in the spring embarked on a predatory expedition into Persia which lasted for 18 months. Sailing into the Caspian, he ravaged the Persian coasts from Derbend to Baku, massacred the inhabitants of Resht, and in the spring of 1669 established himself on the isle of Suina, off which, in July, he annihilated a Persian fleet sent against him. Stenka, as he was generally called, had now become a potentate with whom princes did not disdain to treat. In Aug. 1669 he reappeared at Astrakhan, and accepted a fresh offer of pardon from the tsar there. In 1670 Razin rebelled against the government, captured Cherkask, Tsaritsyn and other places, and on June 24 burst into Astrakhan. After massacring all who opposed him, and giving the rich bazaars of the city over to pillage, he converted Astrakhan into a Cossack republic. After a three weeks' carnival of blood and debauchery Razin quitted Astrakhan with 200 barges full of troops to establish the Cossack republic along the whole length of the Volga, as a preliminary step toward advancing against Moscow. But his forces were stayed by the resistance of Simbirsk, and after two bloody encounters close at hand on the banks of the Sviyaga (Oct. 1st and 4th), Razin was ultimately routed and fled down the Volga.

But the rebellion was by no means over. The emissaries of Razin, armed with inflammatory proclamations, had stirred up the inhabitants of the modern governments of Nizhniy-Novgorod, Tambov and Penza, and penetrated even so far as Moscow and Great Novgorod. It was difficult to rouse the oppressed population by the promise of deliverance from their oppressors. Razin proclaimed that his object was to root out the boyars and all officials, to level all ranks and dignities, and establish cossackdom, with its corollary of absolute equality, throughout Muscovy. Even at the beginning of 1671 the issue of the struggle was doubtful. Eight battles had been fought before the insurrection showed signs of weakening, and it continued for six months after Razin had received his quietus. At Simbirsk his prestige had been shattered. Even his own settlements at Saratov and Samara refused to open their gates to him, and the Don Cossacks, hearing that the patriarch of Moscow had anathematized Stenka, also declared against him. In 1671 he was captured at Kagalnik, his last fortress, and carried to Moscow, where, on June 6, after bravely enduring unspeakable torments, he was quartered alive.

See N. I. Kostomarov, The Rebellion of Stenka Razin, 2nd ed. (1859); S. M. Solovev, History of Russia, vol. ii (1895); R. N. Bain, *The* First Romanovs (1905). (R. N. B.)

RAZOR. The razor is an instrument used for shaving. The early razor of modern times was made of steel which had a wedge-shaped section, with straight sides tapering to a sharp edge, and although simple in form it was a good and durable instrument for its purpose. Early in the 19th century, the practice was introduced of hollowing out the sides of the blade by grinding, to facilitate sharpening the blade, and improve fineness of the cutting edge. At first the degree of hollowness, or concavity of the sides of the blade was small, but with great skill, hollow-grinding has been carried considerably further, increasing the lightness and flexibility of the blade. The full hollow blade is thinner in the centre than nearer the cutting edge.

Safety Razor.—The razor is naturally considered a dangerous instrument, and many attempts have been made to make it safe. Not until the introduction of the "Gillette" type of razor, at the beginning of the 20th century, was a satisfactory solution found. The principle of the "safety" razor is to place a guard between skin and cutting edge of the razor blade, so that the guard permits the edge to pass over the uneven surface of the part to be shaved, removing the hair without cutting the skin. In some cases devices are provided to enable the user to strop or resharpen the blades. Other safety devices are based on the desire to retain the general form of the ordinary razor, while rendering it safe in use. These take the form of fitting a suitable guard to the blade of the ordinary razor, or the substitution of a holder, carrying an adjustable blade of the strip-steel type.

Electric Razor.—With the invention of the Schick Dry Shaver by Jacob Schick, an entirely new technique was introduced to the art of shaving. This dry shaver consists of a shearing head mounted on a powerful little motor encased in an insulated handle. The shearing head includes an outer and an inner member—the outer member having a very thin shear plate with openings or slots in it to rest against the skin, while the inner member has teeth which co-operate with the nether edges of the walls of the shear plate slots or openings in a shearing action. The toothed inner member is held up tightly against the inside surface of the shear plate by means of springs or other appropriate means and is made to reciprocate very rapidly underneath the shear plate by the motor. The hairs of the face which penetrate the openings or slots in the shear plate are thus sheared off by the reciprocating motion of the inner member in co-operation with the nether edges of the slot walls of the stationary shear plate.

The electric dry shaver operates without the use of sharp blades, soaps, brushes, creams and lotions.

RAZOR-BILLED AUK (RAZORBILL), ***Alca torda***, a member of the auk family (Alcidae), known also as marrot, murre, scout, tinker or willock; some of these names it shares with guillemot (*q.v.*) and puffin (*q.v.*). It is a common sea bird of the North Atlantic, resorting in vast numbers to rocky cliffs for

breeding, and returning to the open sea for the rest of the year. It is in many respects intermediate between the guillemot and the garefowl (*q.v.*). In habits the razorbill agrees with the guillemots, laying its single egg on ledges of cliffs. It breeds on both sides of the north Atlantic, wandering as far south as the Mediterranean on the east and Long Island on the west in winter. It feeds on fish.

RAZZIA (an adaptation of the Algerian Arabic *ghāzīah*, from ghasw, to make war), a foray or raid made by African Moslems. As used by the Arabs, the word denotes a military expedition against rebels or infidels, and razzias were made largely for punishment of hostile tribes or for the capture of slaves. English writers in the early years of the 19th century used the form ghrazzie, and Dixon Denham in his Travels (1826) styles the raiding force itself the ghrazzie. The modern English form is copied from the French, while the Portuguese variant is *gazia, gaziva.*

RE, ÎLE DE, an island 1½ mi. off the port of La Pallice in the southwestern part of France. The island, with a northwest-southeast length of 15 mi. and an average width of 2¼ mi., is separated from the coast of Vendée to the north by a shallow bay, the Pertuis Breton, 6 mi. broad, and from the island of Oléron to the south by another, the Pertuis d'Antioche, 7½ mi. broad. The Atlantic coast is reef-fringed, but there are small-craft harbours on the landward side. The most important of these is La Flotte. The largest shore indentation on the east coast, the Fier d'Ars, nearly divides the island, leaving an isthmus only 230 ft. wide to maintain the island's continuity. Dunes and salt marshes cover a large part of the northern end of the island. Many salt pans for the collection of salt by evaporation have been built along the landward shore. Industries are fishing, oyster cultivation, and the collection of seaweed for fertilizer. The island has some cropland which is in vineyards or in early spring vegetables. Île de Ré is included in the department of Charente-Maritime. Population of the island (1946), 7,908.

REA, SAMUEL (1855–1929), **U.S.** railroad official, was born at Hollidaysburg, Pa., on Sept. 21, 1855. In 1871 he entered the service of the Pennsylvania railroad as chainman and rodman. From 1875 to 1877 he was assistant engineer on construction of the Monongahela river bridge at Pittsburgh. He was next appointed assistant engineer for the Pittsburgh and Lake Erie railroad and returned to the Pennsylvania lines in 1879 in a similar capacity. In 1888 he was appointed assistant to the second vice-president of the Pennsylvania railroad, which position he retained until 1889 when he was made chief engineer on construction of the belt line tunnel under Baltimore for the Baltimore and Ohio railroad.

In 1892 he again returned to the Pennsylvania railroad as assistant to the president, and became first vice-president in 1911. In 1913 he was elected president. He was in charge of the construction of the Pennsylvania station in New York city (completed in 1910), the connecting tunnels under the Hudson and East rivers, the New York Connecting railroad and Hell Gate bridge over the East river (opened in 1917). In 1917 he became a member of the executive committee on national defense of the American Railway association, known as the Railroads War Board. He retired from the presidency of the Pennsylvania railroad on Sept. 30, 1925. He died at Gladwyne, Pa., on March 24, 1929. He wrote *The* Railways Terminating in London (1888).

REACTION KINETICS is that branch of physical science which deals with the determination and interpretation of the rates of chemical change. The subject includes the consideration of the rates both of everyday but complicated reactions such as hard-boiling an egg (an example of protein coagulation) and of simpler but less commonplace reactions such as the one between hydrogen and chlorine. Rates have been measured for slow reactions (*e.g.*, the disintegration of ordinary uranium, only half of which will decompose in 5,000,000,000 years) and for fast reactions (*e.g.*, the dissociation of oxygen from haemoglobin, which is almost complete in a tenth of a second). An attempt is made in each case to show quantitatively the effect of changes in the experimental conditions upon the reaction velocity, and to describe in as much detail as possible the behaviour of the molecules at the moment of their reaction.

Many familiar processes involve chemical reactions which proceed at measurable rates. For example, the rusting of iron, the fermentation of sugar, the "drying" of paint, the hardening of plaster of Paris, the baking of bread and the growth of plants, all involve chemical reactions of greater or lesser complexity, and for each example there is considerable interest in the rate of reaction. In general, these familiar processes are very complex, partly because many of the materials are not single pure compounds, but mixtures. It is well known, however, that the rusting (oxidation) of iron requires both air and water, and that the reaction proceeds much more rapidly near the ocean (where salt is deposited on the iron) than it does elsewhere. The rate of rusting also depends upon the composition of the metal (pure iron and stainless steel corrode less rapidly than do cast iron and mild steel) and on temperature (corrosion is rapid in a stream of steam and air). (See CORROSION AND OXIDATION OF METALS.)

Scientists have been largely concerned with measuring the rates of reactions such as the decomposition of ozone, the oxidation of sulphur dioxide and the nitration of hydrocarbons; they assume that an understanding of these and similar reactions of pure chemicals will eventually lead to an understanding of more complex (if more familiar) reactions.

Studies of reaction velocity have not only played a fundamental role in the growth of theoretical chemistry; the concepts developed in these studies have also been highly fruitful in industry, especially in the field of catalysis (*q.v.*). A case in point is the Haber process for the manufacture of ammonia (*q.v.*), which is based in part on studies of reaction kinetics. Both theoretical and practical research in the field of reaction kinetics was by mid-century under way in hundreds of laboratories.

A specific example of a rate study is the work on the decomposition of hydrogen iodide to form hydrogen and iodine.

$$2HI \longrightarrow H_2 + I_2 \qquad (1)$$

This reaction proceeds at a rate convenient for measurement in the neighbourhood of 320° C., at which temperature not only the hydrogen and hydrogen iodide but even the iodine is gaseous. (This reaction is a reversible one; however, for the moment, it is better to postpone discussion of this complication and to consider only the reaction as written.) The rate of decomposition of hydrogen iodide increases as the quantity of hydrogen iodide per unit volume is increased; quantitatively, the rate is proportional to the square of the concentration of hydrogen iodide. The rate increases by a factor of 1.9 when the temperature is increased from 320° C. to 330° C. The reaction occurs within the body of the gas, and not on the glass walls of the vessel in which the experiment is performed.

The facts just cited have been interpreted to indicate that when two molecules of hydrogen iodide collide, a chemical change occurs only if the velocity of one of them with respect to the other exceeds 2.4 km./sec. (about 5,000 m.p.h.). The average diameter (so far as collision is concerned) of these hydrogen iodide molecules can also be calculated from the kinetic data; it is of an order of magnitude (0.8×10^{-8} cm.), roughly consistent with the results of other measurements of the sizes of molecules. The effective collisions (*i.e.*, those which lead to reaction) result in a simple interchange of atoms; here the hydrogen and iodine atoms in each of the two colliding molecules of hydrogen iodide separate; simultaneously, the two hydrogen atoms combine to form a hydrogen molecule, and the two iodine atoms combine to form an iodine molecule.

For the discussion of even the simple example of the decomposition of hydrogen iodide, it has been necessary to employ the elementary concepts of chemistry (*q.v.*) and of the kinetic theory (*q.v.*) of matter. For the more detailed treatment of reaction kinetics which follows, a somewhat more extensive knowledge of these subjects is assumed. In the last sections of this article, a precise presentation is attempted.

History.—Gross differences in the rates of chemical reactions have long been recognized. By the beginning of the 19th century, several instances were known where the rate of a chemical change could be greatly increased by adding to the reacting system a small quantity of some apparently inert material. For example, it was discovered in 1796 that the dehydrogenation of alcohols pro-

ceeds much more rapidly in the presence of metals than it does in their absence. In 1836, Jons Jakob Berzelius grouped together many reactions of this type and gave the name "catalysts" to the materials which accelerate chemical change. (The modern definition of catalysts is given below.) Although the qualitative concept of reaction rate was by that time well established, the first quantitative measurement and mathematical formulation of reaction velocity is generally credited to L. F. Wilhelmy, who, in 1850, measured the rate of "inversion" (hydrolysis) of cane sugar.

Definitions. — Chemical reactions can be classified as homogeneous or heterogeneous. Homogeneous reactions are those (like the decomposition of hydrogen iodide) which occur completely within one phase (gaseous, liquid or solid). Heterogeneous reactions are those (like the reaction between a metal and an acid) where the reactants are components of two or more phases (solid and gas, solid and liquid, two mutually immiscible liquids, etc.) or where one or more reactants undergo chemical change at an interface; *i e*, on the surface of a solid catalyst.

Reactions may also be classified as "reversible" or "irreversible." An irreversible reaction is one in which the reactants, if mixed in the proper proportions, are almost completely converted to the reaction products; a reversible reaction is one in which appreciable quantities of all the reactants and of all the reaction products are present in the system no matter how long the reaction is allowed to proceed. The mixture eventually formed in such a reversible reaction is called the equilibrium mixture; the same equilibrium mixture may be prepared from suitable amounts of either the reactants or the reaction products. For example, the same equilibrium mixture of hydrogen, iodine and hydrogen iodide (at definite temperature and pressure) can be prepared by starting either with equivalent quantities of hydrogen and iodine or with pure hydrogen iodide. If the definition of equilibrium is that adopted in thermodynamics (*q.v.*), then every reaction is, in principle, reversible. There are reactions, however, where the extent of the reverse reaction is too small to be detected by any experimental means at present known; such reactions are usually regarded, for the purposes of kinetics, as irreversible.

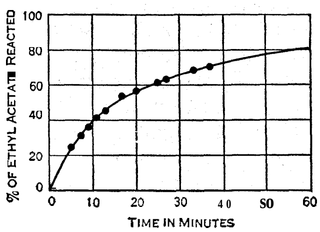

FIG. 1.—SAPONIFICATION OF 0.01M ETHYL ACETATE WITH 0.01M NaOH AT 25° C. CIRCLES, EXPERIMENTAL POINTS, LINE. THEORETICAL FOR $k = 6.5\ \text{MIN}^{-1}\ (\text{M/l})^{-1}$

"Order" of Reaction. — The fundamental law of reaction kinetics was developed by C. M. Guldberg and P. Waage around 1867 (an independent and similar formulation was made by Jacobus Henricus van't Hoff). These authors assumed that, at constant temperature, the rate of any simple chemical reaction is proportional to the product of the concentrations of the various reacting substances. They showed in a general way that their law of chemical change is consistent with the kinetic molecular theory of matter, and that the data for many chemical reactions could be formulated quantitatively in terms of their theory. Since 1870, the concepts of Guldberg and Waage have been extended and modified, but most of reaction kinetics is still based upon their work.

Consider the simple homogeneous, irreversible reaction between two compounds, A and B (the reactants), to form C and D (the reaction products).

$$A + B \longrightarrow C + D \qquad (2)$$

An example of this sort of reaction is the saponification of ethyl acetate by alkali:

$$\underset{A}{CH_3CO_2C_2H_5} + \underset{B}{OH^-} \longrightarrow \underset{C}{CH_3CO_2^-} + \underset{D}{C_2H_5OH} \qquad (2')$$

Equations (2) and (2') as written represent the stoichiometry of the chemical change; *i.e.*, the equations show the relationship between the weights of the initial reactants and those of the final products. The reaction rate may be proportional to the concentrations of the reactants which appear in the stoichiometric equation; if, however, the reaction occurs in several consecutive chemical steps, or requires a catalyst, the kinetics may be more complicated (see below) than those which could he impiied from the stoichiometry. The treatment for a simple case follows.

At the beginning of the reaction, the compounds A and B are present in definite concentrations, say a_0 and b_0 moles per litre respectively[1]; the concentrations of C and D are zero. As the reaction proceeds, the concentrations of A and B decrease, whereas the concentrations of C and D increase. If the concentrations of A and B at any instant are represented by the symbols (A) and (B), then the law of Guldberg and Waage states that wherever equation (2) represents the true kinetic course of the reaction, the reaction velocity, v, is proportional to (A) and to (B). This statement in mathematical form is

$$v = k(A)(B) \qquad (3)$$

where k, the proportionality factor, is called the rate constant. Note that the rate of reaction, v, and the rate constant, k, are not the same, but are connected by an equation of the form of (3).

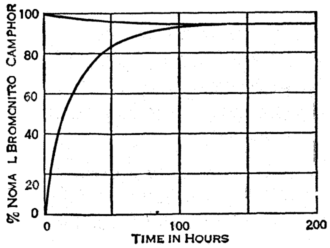

FIG. 2.—RATES AT WHICH EQUILIBRIUM IS ESTABLISHED BETWEEN THE TWO FORMS OF BROMONITROCAMPHOR

An equation such as (3) may accurately describe the rate of a chemical reaction. Unfortunately, however, a good experimental method for directly measuring the rate, *v*, of a reaction is usually not to be found. The quantities which can usually be determined experimentally are the time and the concentrations of the reactants or reaction products. An equation such as (3) can be transformed by the methods of calculus (*q.v.*) into an equation expressing a relationship between these concentrations and time. Although the details of this transformation are in no way necessary for the succeeding argument, they are nevertheless presented here for the sake of continuity.

If the concentration of C at any instant is represented by x, then the rate, *v*, of formation of C is dx/dt, the derivative of x with respect to time; and equation (3) can be replaced by (3').

$$v = \frac{dx}{dt} = k(A)(B) = k(a_0 - x)(b_0 - x) \qquad (3')$$

The integrated form of equation (3) is

$$\log_e \frac{b_0(a_0 - x)}{a_0(b_0 - x)} = kt(a_0 - b_0) \qquad (4)^2$$

where *t* is the time measured from the beginning of the reaction; the other symbols have been previously defined. In principle, it should be possible to obtain for every reaction an equation, analogous to (4), from which the concentrations of the various reactants and products at any moment may be calculated.

One method of testing experimentally whether equations (3) and (4) adequately describe the rate of any particular reaction is to measure x (the concentration of C) at several different times, *t*. An attempt is then made to choose a single value for the rate constant k such that all the sets of corresponding values of x and t satisfy equation (4). If this attempt is successful, the experiment is then repeated at the same temperature but with different initial concentrations (a_0 and b_0). If these new data also satisfy equation (4) with the rate constant k unchanged, the demonstration that the reaction obeys the rate equations (3) and (4) is complete. The constant, k, is thus independent of the initial concentrations of A and B; it is, however, a function of the temperature and it depends of course

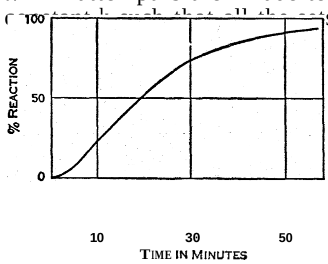

FIG. 3.—SUCCESSIVE FIRST ORDER REACTIONS, WHERE THE RATE CONSTANT OF THE SECOND IS FOUR TIMES AS GREAT AS THAT OF THE FIRST (DIAZOTIZATION OF PHENYL MERCURIC NITRATE IN 20% HNO_3 WITH 0.16 M/l HNO_2)

[1] For reactions in the gas phase, the partial pressure of each gas is used as a measure of its concentration.

[2] Where $a_0 = b_0$, the corresponding equation is $\frac{x}{a_0(a_0 - x)} = kt \qquad (4')$

upon the chemical nature of the reactants A and B. Fig. 1 is a graphical representation of equation **(4)** for the saponification of ethyl acetate.

If the equations for various chemical reactions are treated as was equation (3) for reaction (2′), then these reactions fall into a number of different classes. A reaction, the rate of which may be described by an equation of the form

$$v = k(\mathrm{A}) \qquad (5)$$

is called a first order reaction; one described by an equation of the form

$$v = k(\mathrm{A})^2 \quad \text{or} \quad v = k(\mathrm{A})(\mathrm{B}) \qquad (6) \text{ or } (6')$$

is called a second order reaction, etc. In general, a reaction the rate of which may be described by the equation

$$\mathrm{v} = k(\mathrm{A})^m(\mathrm{B})^n(\mathrm{C})^p(\mathrm{D})^q \ldots\ldots \qquad (7)$$

is called a reaction of order r, where $r = \mathrm{m} + n + p + q +$. Such a reaction is said to be of order m with respect to A, of order n with respect to B, etc. (Some reactions may be of nonintegral order; *e.g.*, half-order. The majority of known reactions are of first or second order.)

In certain reactions, such as the inversion of cane sugar,

$$\mathrm{C_{12}H_{22}O_{11}} + \mathrm{H_2O} \longrightarrow 2\mathrm{C_6H_{12}O_6} \qquad (8)$$

the rate is proportional to the concentration of some substance (in this instance, the hydronium ion of the acid) (see ACIDS AND BASES), which does not appear among either the reactants or the reaction products in the chemical equation; the reaction cited (equation [8]) is said to be catalyzed by hydronium ion $\mathrm{H_3O^+}$, or hydrated hydrogen ion.

$$v = k(\mathrm{C_{12}H_{22}O_{11}})(\mathrm{H_3O^+}) \qquad (9)$$

If the catalyst is one of the reaction products, the reaction is said to be autocatalyzed.

Reversible Reactions. — The reactions hitherto described have been assumed to be irreversible, in the sense defined above. If the reaction between the compounds A and B, on the one hand, and C and D, on the other, is reversible, then equation **(2)** must be rewritten.

$$\mathrm{A} + \mathrm{B} \rightleftharpoons \mathrm{C} + \mathrm{D} \qquad (2'')$$

Wherever equation **(2″)** represents the true kinetic course of the reactions, the rates v_f of the "forward" and v_r of the "reverse" reactions are given by equations (10) and (10′).

$$v_f = k_f(\mathrm{A})(\mathrm{B}) \qquad (10)$$

$$v_r = k_r(\mathrm{C})(\mathrm{D}) \qquad (10')$$

If the reaction is begun by mixing A and B (either pure or in solution), the initial concentrations of C and D are each zero; hence the rate, v„ of the reverse reaction is also zero. However, as A and B react to form C and D, these products in turn react to regenerate A and B. The net rate at which C and D are formed is therefore the difference between v_f and a,.

$$v = v_f - v_r = k_f(\mathrm{A})(\mathrm{B}) - k_r(\mathrm{C})(\mathrm{D}) \qquad (11)$$

The net rates of the forward and reverse reactions for a particular case are shown graphically in fig. 2. In the reaction in question, a mixture of the two tautomers (see TAUTOMERISM) of bromonitrocamphor is formed both from the normal (N) and from the pseudo (P) isomer.

The rate at which the equilibrium mixture is formed from pure N is shown in the upper curve; the rate at which the equilibrium mixture is formed from pure P is shown in the lower curve.

As the latter reaction proceeds, P is converted into N; hence. the forward rate decreases and the reverse rate increases. Eventually, the two rates become equal, and the net rate, v, is zero; thus, a dynamic equilibrium is achieved. This state of dynamic equilibrium is not a condition in which no reaction occurs, but is one in which the rates of the forward and reverse reactions are equal. This kinetic concept of dynamic equilibrium has been experimentally verified by the use of radioactive tracers (see ISOTOPE).

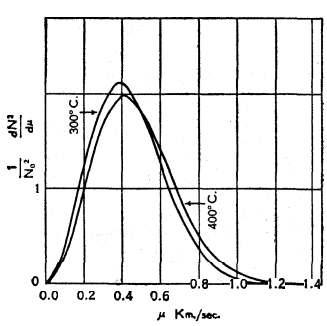

FIG. 4A.—MAXWELL-BOLTZMANN DISTRIBUTION OF PAIRS OF MOLECULES OF HYDROGEN IODIDE (AT 300° C. AND AT 400° C.). THE VELOCITY OF ONE MEMBER OF ANY PAIR RELATIVE TO THE OTHER MEMBER OF THE PAIR IS μ

When, for a reaction which follows equation (2″), the forward and reverse reactions proceed at equal rates, it is seen that

$$v_f = v_r = k_f(\mathrm{A})(\boldsymbol{B}) = k_r(\mathrm{C})(\boldsymbol{D}) \qquad (12)$$

From equation **(12)** it follows that

$$\frac{(\mathrm{C})(\mathrm{D})}{(\mathrm{A})(\mathrm{B})} = \frac{k_f}{k_r} = \mathrm{K_e} \qquad (13)$$

where $\mathrm{K_e}$, the ratio of the rate constants for the forward and reverse reactions, is called the equilibrium constant. Equation (13) gives the relative concentrations of the compounds A. B, C, and D at equilibrium; these concentrations need not be even approximately equal, for in general the rate constants of the forward and reverse reactions differ considerably from one another.

An equation analogous to (13) but more general is obtained by a parallel treatment of a reaction (7). Although this more general expression is correct as a first approximation, it nevertheless disagrees with the precise thermodynamic definition of equilibrium. Consideration of this and similar difficulties is postponed to the sections on collision theory and on activated-complex theory.

Complex Reactions. — The reactions so far considered are of simple types; all sorts of combinations of these types are possible. For example, reactions sometimes occur in several steps.

$$\mathrm{A} \longrightarrow \mathrm{B} \longrightarrow \mathrm{C} \qquad (14)$$

Here the rate of formation of B is proportional to the concentration of A, and the rate of formation of C is proportional to the concentration of B. Since, initially, the concentration of B is zero, the initial rate of formation of C is zero. Fig. 3 shows graphically the concentration of C at any time, t, in a system where the rate constants for the two consecutive reaction steps are of comparable magnitude. Other cases of interest are those in which one of the successive reactions is reversible, or of second order, etc. Considerable complexity is not only possible but common.

What has already been said makes it evident that the kinetic equation for a reaction cannot be inferred from the chemical equation, which gives only the relationship between the weights of reactants which will combine with one another and the weights of the final products (*i.e.*, the stoichiometric relations). The kinetic expression, it is true, must account for the stoichiometric findings, but it should do more than that. Usually more than one reaction path between the initial reactants and the final products is conceivable. Under favourable conditions kinetic considerations permit the selection of just one of these reaction paths, and kinetic measurements demonstrate that the path selected, and no other, is the one which the reaction takes. Under less favourable conditions, kinetic considerations are insufficient to eliminate all reaction paths but one. Even here, however, they serve to rule out many of those paths which from mere stoichiometric considerations might be considered possible.

A simple example will illustrate the ideas just expressed. A chemist might investigate an irreversible reaction, the stoichiometric expression for which is A⟶ C. This expression means that each molecule of the reactant A is converted (eventually) into one molecule of the product, C. It does not tell whether each molecule of A is converted directly into a molecule of C or whether each molecule of A is converted first into a molecule of an intermediate, B, which is in turn converted into a molecule of C. In the former instance, the proper kinetic expression for the reaction A ⟶ C may coincide with the stoichiometric expression. In the latter instance, the proper kinetic expression is A ⟶ B ⟶ C. Measurements of the extent of the reaction at various stages in its course are often sufficient to decide questions of the kind here raised. In the particular instance cited, if the reaction followed a curve of the sort shown in fig. 3, that fact would show that the kinetic expression for the reaction was A ⟶ B ⟶ C. If, on the other hand, the reaction followed a curve predicted from equation (j), and somewhat resembling the one shown in fig. 1, that fact would show that the kinetic expression for the reaction was **A ⟶** C, coinciding with the stoichiometric expression.

This fact alone would not rule out compound B as an intermediate, but it could be an intermediate in the reaction only under certain special circumstances (*i.e.*, the reaction B → C would have to be very fast as compared with the reaction A → B).

If any individual reaction is to be thoroughly understood, its reaction kinetics must be investigated. The object in view is to determine by inference from the kinetic measurements whether the reaction proceeds in one or more stages, to determine the order of each reaction stage with respect to each one of the reactants, and to determine for each particular stage whether or not it is catalyzed by some substance (possibly an ion) which does not appear in the stoichiometric expression for the over-all reaction. It should, however, be stated that kinetic considerations by themselves, although they greatly aid in the treatment of the problem stated, are often insufficient for its solution in all details.

If a kinetic study shows that two molecules (of the same or of different compounds) react with one another directly, then the reaction is said to be bimolecular. In a many-stage reaction, some individual step may be bimolecular, although the over-all reaction is not of second order and may indeed (like [14]) be of no definite order. It is likewise possible for a reaction to be of the second order, but to contain no single step which is truly bimolecular. The interpretation of the reaction kinetics for any individual reaction is thus a difficult matter, and for many important reactions the conclusions are still tentative.

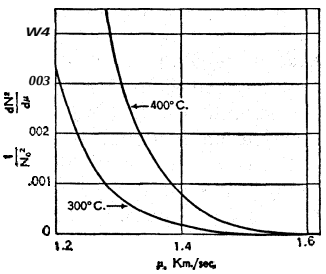

FIG. 4B.—EXPANDED SCALE DRAWING OF HIGH-VELOCITY END OF FIG. 4A

Application of the Kinetic Molecular Theory.—Guldberg and Waage assumed that the rate of any reaction is proportional to the product of the concentrations of the reactants (equation [7]); they interpreted this hypothesis in terms of the kinetic molecular theory. The number of collisions between the molecules of compound A and the molecules of compound B is proportional to the product (A)(B) of their concentrations; Guldberg and Waage's law amounts then to a statement that molecules react only if they collide, and that the rate at which they react is proportional to the number of collisions per second.

But although reaction between two molecules cannot occur unless these molecules collide, it does not follow that reaction must occur every time two molecules collide, even though these are molecules of substances which can react chemically one with another. For most reactions, it has been fully determined that the vast majority of collisions are "elastic"; *i e*, that the molecules rebound from one another without chemical reaction. It is possible by means of the kinetic molecular theory to compute the number of collisions per second between the molecules of two compounds which are present in a solution or a gas in known concentrations. For example, the number of collisions between pairs of molecules of hydrogen iodide at a temperature of 320° C. and a total Pressure of one atmosphere is approximately 10^{28} per cubic centimetre per second. Under the conditions stated, there are only about 10^{19} molecules of hydrogen iodide in a cubic centimetre of gas. Hence, if every collision between two molecules of hydrogen iodide led to chemical change, the reaction would be over in a small fraction of a second, too short a time indeed to measure. It has been computed that in the system described, only one collision in about 10^{15} leads to chemical change.

Temperature Coefficients of Reaction Rates.—Another (and historically older) consideration leading to the conclusion that not all collisions cause reaction is based on the increase of reaction rates with increase in temperature. According to kinetic-molecular theory, the number of collisions between molecules of two compounds present at definite concentrations increases as the square root of the absolute temperature. For example, the number of collisions at 25° C. (298° absolute) is only about 1.5% greater than the number at 15° C. (288° absolute). But the rates of most reactions increase by a factor of two or more when the temperature is raised by 10° C.; as much material may react in an hour at 100° C. as in a year at 0° C. In some instances, such as the denaturation of egg albumin, the reaction rate increases one hundredfold when the temperature is raised 10° C.

However, the assumption that only those molecules which collide with high energy of impact react with one another not only furnishes an explanation for the high temperature coefficients of reaction rates, but also accounts for the fact that collisions effective in bringing about chemical change are usually rare. To bring out the connection between the assumption and the conclusions, it is necessary to consider the velocity of one molecule relative to another. This relative velocity is not the same for all colliding pairs, but there is a determinable probability that for any one particular pair the relative velocity will lie close to any chosen value, u, of the relative velocity. This probability is calculated from the Maxwell-Boltzmann distribution curve (see KINETIC THEORY OF MATTER) shown in figs. 4a and 4b for hydrogen iodide at 300° C. and 400° C. The horizontal co-ordinate represents the velocity, μ, in km./sec., of one molecule of hydrogen iodide relative to the one with which it collides; the vertical co-ordinate represents the probability that the relative velocity is μ. (More precisely, the ordinate is equal to $1/N_0^2 d(N^2)/d\mu$, where N_0 is the total number of molecules under consideration, and $d(N^2)$ is the number of pairs of molecules with velocity lying between μ and $\mu+d\mu$.) Fig. 4b is an enlargement in vertical scale of part of fig. 4a. Figs. 4a and 4b indicate (1) that only a minute number of molecular pairs have relative velocities in excess of the 2.4 km./sec. required for reaction (see above), and (2) that, although the average value of the relative velocity is not greatly increased by raising the temperature from 300° C. (573° absolute) to 400° C. (673" absolute), the number of molecular pairs with high relative velocities is increased by a large factor. Thus the assumption that reaction is limited to molecular pairs with high relative velocities at the moment of collision qualitatively explains both the fact that few collisions are "effective" in producing reaction and the fact that the rates of most chemical reactions increase sharply with increase in

The complete equation (24) for the reaction rate derived from the kinetic collision theory is given in the next to last section of this article. Here it is sufficient to say that this complete equation is consistent (within experimental error) with an empirical equation (15) advanced by Svante August Arrhenius in 1889 which has proved

$$\log_e \frac{k_2}{k_1} = \frac{Q}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right) \qquad (15)$$

In equation (15) k_1 and k_2 are the rate constants at the absolute temperatures T_1 and T_2 respectively, Q is a constant called the activation energy, and R is the gas constant (1.98 cal./mole degree) (log, refers to natural logarithms). The larger the value of Q, the more sensitive is the reaction rate to changes in temperature. Reactions with values of Q varying from less than 500 up to about 100,000 cal./mole have been discovered. Q divided by the number of molecules in a mole (Avagadro's number) is (roughly) equal to the relative kinetic energy of a molecular pair which is just sufficient to make the members of the pair react upon collision.

Reaction Mechanism.—In this section, it will be shown how reaction kinetics may be used to determine the path or mechanism of a somewhat puzzling reaction. The example chosen is the reaction in aqueous solution between acetone and bromine. Here the stoichiometric

$$CH_3COCH_3 + Br_2 \longrightarrow CH_3COCH_2Br + HBr \qquad (16)$$

expression (16) is of the same form as equation (2). In 1904, however, A. Lapworth discovered that the rate of this reaction is proportional to the concentration of the acetone and of the hydrogen bromide (one of the reaction products) but independent of the concentration of the bromine and of all other substances known to be present in the system. The kinetic equation, therefore, is

$$v = k(CH_3COCH_3)(HBr) \qquad (17)$$

These facts suggest the hypothesis that the acetone is slowly converted into some reactive intermediate by the action of the acid;

this reactive intermediate then combines rapidly with bromine. The hypothesis has more recently been elaborated as follows:

$$(CH_3)_2CO + H_3O^+ \rightleftharpoons (CH_3)_2COH^+ + H_2O \text{ ("steady state" rapidly reached)} \quad (18)$$

$$(CH_3)_2COH^+ + H_2O \longrightarrow CH_3C(OH)=CH_2 + H_3O^+ \text{ (slow reaction)} \quad (18')$$

$$CH_3C(OH)=CH_2 + Br_2 \longrightarrow CH_3COCH_2Br + HBr \text{ (rapid reaction)} \quad (18'')$$

The proposed reaction between the catalyst and the acetone results in the transformation of the acetone into a reactive intermediate (the "enolic" modification of acetone; see TAUTOMERISM), which subsequently reacts rapidly with bromine. The rate, v, of the entire reaction is equal to that for the slowest step in the process. namely reaction (18'). The kinetic equation for this step is

$$v = k'((CH_3)_2COH^+) \quad (19)$$

The concentration of water is essentially constant and does not enter into equation (19); its concentration can be included in the rate constant, k'. The ion $(CH_3)_2COH^+$ would be in equilibrium with the acetone and acid present in the solution if it were not for the reactions (18') and (18'') which slowly but essentially irreversibly remove some of this ion.

The ion $(CH_3)_2COH^+$ is described as in pseudoequilibrium with acetone and acid, or as in a "steady state." The "steady state" concentration of the ion is given to a good approximation by the equilibrium expression

$$\frac{[(CH_3)_2COH^+]}{[(CH_3)_2CO][H_3O^+]} = K \quad (19')$$

When the theoretical equations (19) and (19') are combined, the experimentally verified kinetic equation (17) for the bromination of acetone is obtained; the rate constant k is the product of k' and K.

Not only does the mechanism presented in equations (18), (18') and (18'') agree with equation (17), but it will further explain many other facts. It is consistent, for example, with the observation that acetone reacts with chlorine, or with iodine at the same rate as it does with bromine. This is in accord with the proposed mechanism, since equation (18'), which does not involve the halogen at all, is postulated as the rate-determining step in the halogenation.

A more detailed investigation of the reaction has revealed that it is catalyzed not only by hydronium ion but also by molecules of un-ionized acids; it is also catalyzed by bases. The catalysis by un-ionized acid molecules can be accounted for by substituting equation (18'') for equation (18')

$$(CH_3)_2COH^+ + B \longrightarrow CH_3C(OH)=CH_2 + BH^+ \quad (18'')$$

where B represents a molecule of any base. (The detailed mathematical analysis needed to prove the above statement, although beyond the scope of this article, is treated by L. P. Hammett in *Physical Organic* Chemistry.)

The proposed mechanism is thus consistent with a large and varied selection of auantitative kinetic evidence. This is a necessary. condition, but not a sufficient one to establish the mechanism; it does, however, make the proposed mechanism quite probable.

Catalysis. — A catalyst is defined as a substance which increases the rate of a chemical reaction, but which can be recovered quantitatively and unchanged at the end of the reaction. There are many substances which (for specified reactions) approach this definition closely. Typical examples of homogeneous catalysis are the action of acids to increase the rate of hydrolysis ("inversion") of cane sugar, the action of bases to increase the rate of polymerization in the preparation of bakelite, the action of oxides of nitrogen in the chamber process for manufacturing sulphuric acid. Typical examples of heterogeneous catalysis are the action of finely divided iron to increase the rate at which nitrogen and hydrogen combine to form ammonia, the action of vanadium pentoxide to increase the rate at which sulphur dioxide and oxygen combine to form sulphur trioxide in the contact process for manufacturing sulphuric acid, and the action of finely divided nickel to increase the rate at which hydrogen combines with vegetable oils to form solid fats (*e.g.*, "Crisco"). (For a discussion of theory, manufacture and use of catalysts see CATALYSIS.)

Catalysts accelerate chemical reactions in various different ways. The bromination of acetone (cited above) illustrates one of the most common modes of action. Here the acid which in this case is the catalyst combines with one of the reactants (acetone) to form an intermediate chemical compound. Then, in a later step of the complex reaction, the catalyst is regenerated and so becomes available for further reaction. In this way the catalyst goes through a complete cycle, and a trace of catalyst increases the rate at which a large amount of material reacts.

It is interesting to note that a catalyst can increase the rate of a chemical reaction but cannot change its point of equilibrium. If this statement were not correct, it would be possible to construct a perpetual motion machine. Since perpetual motion is an impossibility (see THERMODYNAMICS), it follows that in a reversible reaction the catalyst must accelerate both the forward and the reverse rate and in the same proportion.

Photochemical Reactions. — Reactions which take place in the presence of light but not in the dark are called photochemical reactions; their rate depends upon the amount of light absorbed. This subject is treated fully in the article on PHOTOCHEMISTRY. The principles here needed are the following: (1) Only the light which is absorbed by the system is effective in promoting chemical change; (2) radiant energy (light) is available only in units called quanta (see LIGHT); (3) a molecule which absorbs light and is thereby activated (*i.e.*, enters into a reaction with light) absorbs one and only one light quantum (A. Einstein). Subsequently, the activated molecule may enter into other, more complicated chemical reactions.

Chain Reactions. — Hydrogen gas reacts with chlorine at room temperature provided that the mixture is illuminated; the reaction (except under special circumstances, see below) does not occur in the dark. The form of the equation for the chemical reaction

$$H_2 + Cl_2 \longrightarrow 2HCl \quad (20)$$

resembles that of the reaction for the formation of hydrogen iodide (reverse of equation 1); the kinetics of the two reactions are, however, quite different. The reaction between hydrogen and chlorine proceeds when visible light is used. Since light of this wave length is absorbed by chlorine, but not by hydrogen, it follows that chlorine is the reactant affected by the light. Measurements have shown that as many as 1,000,000 molecules of hydrogen chloride are produced for every light quantum absorbed. Evidently a very special mechanism must be postulated to account for this fact. It has been assumed (W. Nernst, M. Bodenstein) that, as an indirect or direct result of the illumination. the molecules of Cl_2 which absorb light quanta are dissociated into chlorine atoms (21). These atoms then react as shown in equations (21') and (21'').

$$Cl_2 \longrightarrow 2Cl \quad (21)$$

$$Cl + H_2 \longrightarrow HCl + H \quad (21')$$

$$H + Cl_2 \longrightarrow HCl + Cl \quad (21'')$$

Each chlorine atom obtained by the illumination reacts with a molecule of hydrogen to produce a molecule of hydrogen chloride and an atom of hydrogen (21'); the latter in turn reacts with a molecule of chlorine to produce another molecule of hydrogen chloride and to regenerate an atom of chlorine (21''). The cycle is then repeated. Reactions characterized by such cycles are called chain reactions. If there were no side reactions to destroy the intermediate hydrogen and chlorine atoms, then, in principle, one chlorine atom could convert all the hydrogen and chlorine in the system to hydrogen chloride. In fact, the chain length varies from a few units to a million, depending upon the experimental conditions. The chains are broken (or terminated) when the chlorine or hydrogen atoms are removed. There are several means of removing these reactive atoms. For example, oxygen combines with either chlorine or hydrogen atoms, and traces of oxygen are effective in decreasing the rate of the reaction in question. In this reaction then, oxygen acts as a negative catalyst, or an inhibitor, or a chain breaker. (These terms are not, however, exactly synonymous.) Another means of breaking the chain is

the combination of hydrogen atoms and chlorine atoms present in the gas mixture to form hydrogen chloride. Such combination occurs on the walls of the vessel, or when a hydrogen atom and a chlorine atom, in what is called a three-body collision, collide simultaneously with some third particle (such as a chlorine molecule); interestingly, the combination does not occur when only a hydrogen and a chlorine atom collide. Such a combination independent of the wall or of any third particle would violate either the law of the conservation of momentum or the law of the conservation of energy, or both. (*See* MECHANICS.) The fact that no such combination is observed simply means that the molecular system in question obeys the laws of mechanics, as do the molecular systems in all similar reactions which have been carefully studied.

The validity of the proposed chain mechanism for the reaction between hydrogen and chlorine is supported (1) by the high photochemical yield of the reaction (*i.e.*, the large amount of hydrogen chloride produced per quantum of light absorbed), (2) by the fact that kinetic equations based upon the chain mechanism adequately describe the reaction velocity and (3) by experiments showing that the reaction can be initiated in the dark by the introduction into the reaction mixture of hydrogen or chlorine atoms from some outside source. There is good reason to believe that hydrogen atoms are produced by an electric arc discharge in hydrogen gas, and that chlorine atoms are produced in the reaction between sodium vapour and chlorine. If the products from either of these reactions are rapidly introduced into a mixture of hydrogen and chlorine, the formation of hydrogen chloride is initiated.

Reaction kinetics has provided much evidence to show that many reactions either in the gas phase or in solution proceed by chain mechanisms.

Heterogeneous Reactions.—Heterogeneous reactions include the solution of solids in solvents, and the reverse process, the crystallization of solids from solution. The reaction of metals with acids and problems of corrosion are part of the subject of heterogeneous reactions. However, by far the majority of the research on heterogeneous reactions is devoted to heterogeneous catalysis (*e.g.*, reactions between gases or liquids catalyzed by solids, etc.). For example, finely divided iron greatly accelerates the rate at which nitrogen and hydrogen unite to form ammonia. Recent studies have shown that iron adsorbs nitrogen in such a fashion as to activate it (by a reaction analogous to the formation of iron nitride); the hydrogen subsequently reacts with the adsorbed nitrogen. Although heterogeneous reactions of this sort are of considerable theoretical and practical interest (*see* ADSORPTION; CATALYSIS) the present article is devoted largely to a consideration of homogeneous reactions.

Enzymes.—Almost the earliest chemical reactions known are the fermentations by which sugar is converted to alcohol or vinegar (fermentation) or lactic acid (souring of milk). These and similar reactions occur in the presence of living organisms, such as yeasts, fungi, etc. In 1897 E. Buchner discovered that, in the fermentation of sugar, the function of the living yeast is to produce a catalyst for the reaction. He destroyed the yeast cells by grinding them with sand. The filtered juice, although it contained no living organisms, nevertheless rapidly converted sugar to alcohol. The complex organic catalysts produced by living cells are called enzymes; those so far investigated in detail have proved to be protein complexes.

The extensive investigation, largely by methods of reaction kinetics, of the fermentation of sugar has revealed the fact that the reaction is a complex one in which many enzymes take part. Active research is at present under way to elucidate the path of many enzymatic processes, and to determine if possible the detailed mechanisms by which enzymes function as catalysts.

There are enzymatic systems which convert starch into sugar and sugar into alcohol; others hydrolyze proteins into a mixture of amino acids; still others synthesize proteins in the body; such systems are responsible for the conversion (by a form of combustion) of sugar to carbon dioxide and water, with the liberation of energy. The accelerating effect of some of these enzyme systems is enormous. For example, one part of beef catalase can be detected in 25,000,000 parts of water by the acceleration it produces in the decomposition of hydrogen peroxide. Since the mechanism of enzyme action is unknown, and since the kinetics of enzyme action differs considerably from the kinetics of reactions accelerated by ordinary catalysts, direct comparisons are difficult and likely to be inaccurate. As a rough first approximation, however, catalase is about 10,000 times as active a catalyst as is an equal weight of ferrous ion in catalyzing the decomposition of hydrogen peroxide, and urease is about 10,000 times as active (at 20° C. and in neutral solution) as is an equal weight of sodium hydroxide in accelerating the hydrolysis of urea.

Explosions.—Chemical explosions are rapid reactions which are strongly exothermic; that is to say, these reactions are very rapid ones which evolve large quantities of heat. The hot gases formed in the chemical reaction, or the air heated by the energy released, produce a region of high pressure near the site of the explosion. This region of high pressure travels outward through the air in the form of an explosion wave which usually causes much of the destruction resulting from the explosion (*see* COMBUSTION; EXPLOSIVES). It is of interest to inquire what are the necessary conditions, and what are the possible mechanisms for a reaction which consumes many pounds of material in (say) 10^{-5} seconds. There are two well-known types of mechanism for explosions: the chain branching mechanism and the thermal mechanism. The latter type was suggested by Van't Hoff, the former by N. N. Semenoff; examples of both types have been discovered.

The theory of the chain-branching mechanism is that, during the early stages of a chain reaction, more chains are initiated per unit time than are terminated. The most spectacular example of an explosion caused by chain branching is the fission of atomic nuclei, such as occurs in atomic bombs. Here the disintegration of a particular sort of uranium, U^{235} (or of plutonium) is initiated by neutrons, but, in the disintegration, neutrons are also produced. (*See* ATOMIC ENERGY; ISOTOPE; NUCLEUS.) If exactly one neutron were produced from each disintegrating nucleus of U^{235}, a chain reaction analogous to the reaction between hydrogen and chlorine would result. In fact, however, more than one neutron is produced by each nuclear disintegration; the average number is probably about two. An equation for the atomic disintegration is

$$U + n \longrightarrow I + Y + 2n \qquad (22)$$

where U, n, I and Y are the symbols for uranium, the neutron, iodine, and yttrium, respectively. (Other elements besides iodine and yttrium are also produced in the disintegration; the principles involved are, however, the same.) The faster the reaction proceeds, the more rapidly are neutrons produced and the more rapidly does the reaction rate increase. Since the disintegration of the uranium is accompanied by a large evolution of energy, the reaction is an explosion.

The second type of explosion mechanism is the thermal one. Most chemical reactions are carried out under conditions such that the heat evolved (or absorbed) by the reaction is taken away (or supplied) by the surrounding medium. If, however, a highly exothermic reaction is carried out under conditions such that the heat is not carried away by the surroundings, the reaction mixture must become hotter. At the more elevated temperature, the rate of the reaction is much greater; the rate of heat evolution, therefore, becomes much greater also, and the reaction mixture rapidly becomes still hotter. Such a reaction must necessarily lead to an explosion. The question whether a particular exothermic reaction will lead to an explosion is thus largely a question of the conditions under which the reaction is carried out. If the reaction can be made to proceed at such a rate that the heat lost to the surroundings per unit time is small compared with the heat input caused by the chemical reaction during the same interval, a thermal explosion ensues.

Reactions of Isotopes.—In general, the reaction rates of compounds which differ only in that they contain different isotopes of the same element are identical within experimental error. When, however, one of the lighter elements is involved, this need not be the fact. A compound which contains atoms of C^{14} (radioactive carbon) may react at a rate which differs appreciably (*e.g.*,

by 10%) from that of a compound identical except that it contains only normal carbon atoms. The rate of the reactions of compounds containing deuterium (heavy hydrogen) may, in certain cases, differ from those of the corresponding compounds of light hydrogen by a factor as large as eight. These large differences in rate, which may occur when a bond to a hydrogen atom is formed or broken, arise from an effect (zero-point vibrational energy) predicted by quantum mechanics (*q.v.*). Although a discussion of the theory of this effect is out of place here, the phenomenon is proving a most useful tool in investigations of reaction mechanisms.

The Collision Theory.—In the theory of reaction kinetics as so far presented, several difficulties have been noted. The present section is devoted to a discussion of these difficulties and the methods of avoiding them; a knowledge of physical chemistry on the part of the reader is assumed.

The ratio of the rates of a forward and of the corresponding reverse reactions gives an approximate expression for the equilibrium constant of the reaction in question, as shown for a special case by equation **(13).** In the more general case, an analogous treatment of the reaction

$$mA + nB + pC + \ldots \rightleftharpoons gR + hS + iT + \ldots \qquad (23)$$

leads to equation (24).

$$\frac{(R)^g(S)^h(T)^i\ldots}{(A)^m(B)^n(C)^p\ldots} = K_c \qquad (24)$$

The ratio of concentrations on the left side of equation (24) is obtained even if the kinetic equation for the reaction is a complex one. For example, if the reaction is catalyzed, the catalyst concentration appears in the expression for the rate of both the forward and the reverse reaction; it thus cancels out in equation (24). Careful inspection shows that other possible complexities are likewise of no effect on K,. But equation (24) is nevertheless not precisely correct. The true equilibrium expression (see THERMODYNAMICS) is defined in terms of the "activities," not the concentrations, of the reactants and reaction products. Although in dilute solutions the concentration of any substance closely approaches its activity, the two functions are by no means identical. (An analogous statement applies to gases at low pressure.) It is therefore clear that the law of Guldberg and Waage, although approximately correct, is not and cannot be uniformly valid.

The difficulty noted cannot be avoided by the assumption that reaction rates are proportional to activities rather than to concentrations; this assumption has been proved false by investigations of the rates of ionic reactions. The ratio of the activity of any substance to its concentration defines its activity coefficient. The activity coefficients of ions depend upon the ionic strength of the solution in which they occur (see SOLUTIONS, Solutions of Electrolytes). This ionic strength is a function of the concentrations and of the charges on all the ions present; in dilute solutions the activity coefficients of all ions decrease with increasing ionic strength, But the rates of reactions between two ions of like charge increase with increase of ionic strength; only for reactions between ions of opposite charge do the rates (like the activity coefficients) decrease with increasing ionic strength. Thus the rate of a reaction is not proportional to the "activities" of the reactants; it has already been shown that only as a first approximation is this rate proportional to the ionic concentrations.

The difficulty, at least insofar as ionic reactions are concerned, has been resolved by the assumption that reaction rates are proportional not to concentrations or activities, but to the number of collisions per second between the reacting ions. The number of collisions between charged particles should not be strictly proportional to the product of their concentrations. Let W be the ratio between the number of collisions among the reacting ions and the product of the ionic concentrations. Then, because of interionic effects, W should increase with increasing ionic strength for reactions between ions of like charge, and decrease with increasing ionic strength for reactions between ions of unlike charge. This predicted behaviour is in qualitative agreement with the anomaly in ionic reaction rates already cited.

J. A. Christiansen's calculation (1924) based on the theory of P. Debye and E. Hiickel, accounts quantitatively for the observed rates of ionic reactions in dilute solution. Further, although the forward and reverse rates, taken separately, are not proportional to the activities of the reactants and reaction products, the expression obtained by setting equal the rates of the forward and reverse reactions (corrected to account for interionic effects) yields the thermodynamic equilibrium expression in terms of activities, not concentrations. How this happens is made clearer in the consideration (see below) of the activated-complex theory of reaction velocity. In general, it has been assumed that consideration of the actual number of collisions always leads to corrections for the law of Guldberg and Waage, such that the dynamic and thermodynamic equilibrium constants become equal.

It should be pointed out that interionic and other forces not only affect the change in the number of collisions with change in concentration; they also affect the actual number of collisions per unit time. Thus, in a reaction between two positively charged ions, forces of electrostatic repulsion lower the number of collisions far below that computed from the kinetic molecular theory. Furthermore, it is not true that every collision between reactant particles moving, relative to one another, with a velocity greater than the critical one, u_0, leads to chemical change. There must also be a definite orientation of the molecules with respect to one another at the moment of collision. This consideration holds especially for complex molecules, which may be capable of reacting only at one end. The collision theory is thus considerably less precise than may at first have appeared.

Application of kinetic molecular theory to a simple bimolecular reaction (*e.g.,* the decomposition of hydrogen iodide) leads to equation (25), which relates the rate constant, k, with u_0 the minimal velocity at collision, necessary for reaction.

$$k = \frac{4N^2d^2}{c^2}\sqrt{\frac{\pi kT}{m}}\left(1+\frac{mu_0^2}{2kT}\right)e^{-mu_0^2/2kT} \qquad (25)[8]$$

$$\frac{1}{\mu} = \frac{1}{m_1} + \frac{1}{m_2} \qquad (26)$$

Here N molecules of effective diameter d and weight m are present at a concentration of c moles per litre and at an absolute temperature T. The symbol e is the base of the system of natural logarithms, and k is Boltzmann's constant, 1.38 X 10^{-16} ergs/degree. If the values of k are experimentally determined for a series of temperatures, the values of both u_0 (the minimal velocity of one molecule relative to another required for effective collisions) and of d (the effective diameter of the particles) can be determined. The difficulties previously discussed then appear as anomalously large or small values of d^2. That is to say, when the reacting particles attract each other, the cross sections of the molecules (proportional to d^2) which are "effective" for collisions, will be large compared to these cross sections as determined by other methods; conversely, when the particles repel one another, or when a preferred orientation is necessary for reaction, the "effective" cross section will be small. The latter condition holds (although not to a marked degree) for the hydrogen iodide reaction.

An alternative description of the reaction process may be obtained by computing a collision number on the basis of the best available estimates for molecular cross sections and by replacing equation (25) by (27), to which it is approximately equivalent.

$$k = PZe^{-Q/RT} \qquad (27)$$

Here Z is the "normal" collision factor, P is the "probability" factor defined by equation (27), and Q is the activation energy which does not differ greatly from $\frac{1}{2}Mu_0^2$, where M is the molecular weight of the substance in question. The difficulties of the collision theory are then contained in the factor P, and the problem of obtaining precise agreement between theory and experiment is reduced to that of computing P correctly.

One additional aspect of collision theory deserves attention. Some reactions (as previously stated) are of the first order. Such reactions would seem to be independent of collisions. In what way can these reactions be correlated with collision theory? Some first-order reactions probably cannot be so correlated. The disintegration of radium is strictly of the first order; the rate of the

[8] If the two molecules which react are not identical, this expression must he somewhat modified. Among other modifications, the reduced mass μ replaces m. If the masses of the two molecules in question are m_1 and m_2, then the reduced mass μ is defined by equation (&).

reaction depends upon changes in the radium nucleus, which are unaffected by collisions of the molecule as a whole. But in ordinary chemical, as opposed to nuclear, reactions, the energy necessary for reaction is probably acquired by the decomposing molecule through previous collisions.

The Activated-Complex Theory.—An alternative general theory of reaction kinetics is formulated in terms of the so-called "activated complex." (S. A. Arrhenius, J, N. Brönsted, N. Bjerrum, H. Eyring). In this theory, it is assumed that all the reactants are in pseudoequilibrium with an activated complex, X,

$$mA + nB + pC + \ldots\ldots \rightleftharpoons X \longrightarrow \text{products} \qquad (28)$$

which in turn decomposes to give the reaction products. The activated complex X is not a true molecule; it is merely a stage in the process by which the reactants become the reaction products. Hence, the activated complex is not in true equilibrium with the reactants. The activated-complex theory, however, is founded on the assumption that the concentration of the activated complex may be computed just as if it were a real, stable chemical compound. The rate of reaction is then the product of the concentration of X multiplied by the rate at which it decomposes. This rate can be computed by the general methods of quantum mechanics (*q.v.*); it is the same for all activated complexes, regardless of the materials out of which they have been formed. For a reaction such as (23), the activated-complex theory leads to equation (29)

$$v = \kappa \frac{kT}{h} K^*(A)^m(B)^n(C)^p \ldots\ldots \frac{\gamma_A{}^m \gamma_B{}^n \gamma_C{}^p}{\gamma_X} \qquad (29)$$

where k is the Boltzmann constant, h is Planck's constant, K* is the equilibrium constant for the formation of the activated complex (its decomposition into the reaction products being disregarded), and $\gamma_A, \gamma_B, \gamma_C, \ldots\ldots \gamma_X$ are respectively the activity coefficients of the reactants and of the activated complex. The constant κ is called the transmission coefficient; it is usually nearly unity. When the activated-complex theory is used to describe a reversible reaction, a distinction must be drawn between the activated complex formed from the reactants and that formed from the reaction products. The two complexes, although structurally the same, differ with respect to the materials from which they have been formed and into which they are decomposing. Unless the distinction in question is made, the theory is self-contradictory.

Equation (29) contains γ_X, the activity coefficient for the activated complex. Although this coefficient cannot be measured (since the activated complex is not a stable entity) it can be estimated for the complexes which occur in ionic reactions. The charge on the activated complex must be the sum of the charges on the reactants; furthermore, the charge on an ion, as a first approximation, determines its activity coefficient. Equation (29) correctly predicts the rates of ionic reactions; it leads to results identical with those obtained by Christiansen. Although in particular instances the collision theory may be more convenient to apply than is the activated complex theory, or vice versa, the two always lead to the same results; they are, in essence, two different languages in which the same phenomena may be described.

At equilibrium, the rates of the forward and reverse reactions are equal. When two rate expressions analogous to (29) are used, an equation (30) is obtained from which the activity coefficient of the activated complex and the transmission coefficients have been eliminated.

$$\frac{(R)^q(S)^h(T)^i \ldots\ldots (\gamma_R)^q(\gamma_S)^h(\gamma_T)^i \ldots\ldots\ldots\ldots}{(A)^m(B)^n(C)^p \ldots\ldots (\gamma_A)^m(\gamma_B)^n(\gamma_C)^p \ldots\ldots\ldots\ldots} = K \qquad (30)$$

Here K is the true thermodynamic equilibrium constant, expressed in terms of activities (concentrations multiplied by activity coefficients).

The pseudoequilibrium constant, K*, of equation (29) is related to the free energy of activation, AF*, the heat of activation AH*, and the entropy of activation ΔS^*, by equation (31).

$$-RT \log_e K^* = \Delta F^* = \Delta H^* - T\Delta S^* \qquad (31)$$

The heat of activation, ΔH^*, corresponds roughly with the energy of activation, Q, of the collision theory; the entropy of activation, ΔS^*, may be roughly related to the logarithm of the "probability" factor, P, of equation (27).

The thermodynamic concept of entropy has been interpreted, through statistical mechanics, in terms of molecular vibrations. Likewise, entropy of activation can often be interpreted in terms of the geometry and of the estimated vibrational frequencies of the activated complex.

The application of the activated-complex theory depends upon the computation of the pseudoequilibrium constant, K*. Thus, the kinetic problem is replaced by a thermodynamic one, and all the powerful tools of thermodynamics and of statistical mechanics become immediately available for its solution. It is possible in principle (always) and in practice (occasionally) to calculate the rate of a chemical reaction without the use of any experimentally determined kinetic data. The difficulties reside principally in the selection of appropriate constants for the activated complex. For the reaction between a hydrogen atom and a hydrogen molecule (which has been investigated by the use of ortho- and parahydrogen and of deuterium), the absolute reaction rate has been computed by methods related to the activated-complex theory (E. Wigner). Most reactions are, however, too complex for complete mathematical solution by methods now known.

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READE, CHARLES (1814–1884), English novelist and dramatist, the son of an Oxfordshire squire, was born at Ipsden, Oxfordshire, on June 8, 1814. He entered Magdalen college, Oxford, proceeded B.A. in 1835, and became a fellow of his college. He was subsequently dean of arts, and vice-president of Magdalen college, taking his degree of D.C.L. in 1847. His name was entered at Lincoln's Inn in 1836; he was elected Vinerian fellow in 1842, and was called to the bar in 1843. He kept his fellowship at Magdalen all his life, but after taking his degree he spent the greater part of his time in London. He began as a dramatist, and it was his own wish that "dramatist" should stand first in the description on his tombstone.

His first comedy, *The Ladies' Battle,* appeared at the Olympic theatre in May 1851. It was followed by *Angelo* (1851), *A Village Tale* (1852), *The Lost Husband* (1832) and *Gold* (1853). But Reade's reputation was made by the two-act comedy, *Masks and Faces,* in which he collaborated with Tom Taylor. It was produced in Nov. 1852, and later was expanded into three acts. By the advice of the actress, Laura Seymour, he turned the play into a prose story which appeared in 1853 as *Peg Woffington* as did also *Christie Johnstone,* a study of Scottish fisher folk. In 1854 he produced, with Tom Taylor, *Two Loves and a Life* and *The King's Rival;* and, unaided, *The Courier of Lyons*—well known under its later title, *The Lyons Mail*—and *Peregrine Pickle.* In 1855 appeared *Art,* afterward known as *Nance Oldfield.*

He made his name as a novelist in 1856, when he published *It's Never Too Late to Mend,* a novel written with the purpose of reforming abuses in prison discipline and the treatment of criminals. Five minor novels followed in quick succession—*The Course of True Love Never Did Run Smooth* (1857), *Jack of All Trades* (1858), *The Autobiography of a Thief* (1858), *Love Me Little, Love Me Long* (1859), and *White Lies* (1860), dramatized as *The Double Marriagz.* In 1861 his masterpiece, *The Cloister and the Hearth,* appeared, relating the adventures of the father of Erasmus. It is one of the finest historical novels in existence. Returning from the 15th century to modern English life, he produced another novel with a purpose, *Hard Cash* (1863), in which he directed attention to the abuses of private lunatic asylums. Three other novels "with a purpose" were *Foul Play* (1869), in which he exposed the iniquities of ship-knackers, and paved the way for the labours of Samuel Plimsoll; *Put Yourself in His Place* (1870), in which he grappled with the trade unions; and *A Woman-Hater* (1877), on the degrading conditions of village life. *The Wandering Heir* (1875), of which he also wrote a version for the stage, was suggested by the Tichborne trial.

Outside the line of these moral and occasional works Reade produced three elaborate studies of character—*Griffith Gaunt* (1866), *A* Terrible Temptation (1871). *A* Simpleton (1873). The first of these was in his own opinion the best of his novels. His greatest success as a dramatist attended his last attempt—Drink—an adaptation of Zola's *L'Assommoir,* produced in 1879. In that year his friend Laura Seymour, who had kept house for him since 1854, died. Reade's health failed from that time, and he died on April 11. 1884, leaving behind him a completed novel. *A* Perilous *Secret,* which showed no falling off in the arts of weaving a complicated plot and devising thrilling situations. Reade was an amateur of the violin, and among his works is an essay on Cremona violins with the title, *A* Lost Art Revived.

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READING, RUFUS DANIEL ISAACS, 1ST MARQUESS OF (1860–1935), British statesman. was born on Oct. 10, 1860, in London, the second son of Joseph Isaacs, merchant. He was educated at Cniversity College school, London, and abroad. At the age of 16 he went to sea, his parents believing that the discipline would be good for him. A subsequent venture on the stock exchange was a failure. He then read for the bar and was called in 1887; his legal career was unbroken and successful. He entered parliament as a Liberal Imperialist, winning a seat for his party at Reading in 1904, which he retained until he went to the house of lords. He became attorney general in 1910, and in 1912 was given a seat in the cabinet, which no attorney general had held before. On Oct. 22, 1913, he was made lord chief justice, and in Jan. 1914 was created Baron Reading of Erleigh. In this office he distinguished himself by humanity in the conduct of criminal cases and by the establishment of the principle that the court of criminal appeal should act as a real court of revision, upsetting verdicts or reducing sentences even of the individual high court judges.

After the outbreak of the war in Aug. 1914, he assisted in the drafting and the administration of those measures which saved England from financial ruin. In 1915 he was president of the Anglo-French Loan commission to the United States, where he succeeded in floating a great war loan. In 1917 he was appointed high commissioner and special envoy to the United States, and in November of that year was created an earl. In 1918 he was appointed high commissioner and special ambassador at Washington.

Lord Reading's term as viceroy of India began in 1921. At that time he was faced immediately by four acute problems. First, the dyarchy system of the Montagu-Chelmsford Government of India act, devised as a step in advance toward complete self-government, was definitely rejected by the leaders of the united Hindu and Mohammedan educated population, who in the movement known as *Swaraj* had resolved to make it unworkable. The second was the influence of Mahatma Gandhi, one of the most remarkable men of all time, who had inflamed millions of Indians to a boycott of the west by the east and a kind of gigantic movement of passive resistance, in which both British products and British government were to be alike rejected. The third was that the national temper of India had been aroused by prohibitions and indignities put upon Indians in other parts of the empire. The fourth, the story of the Punjab rebellion and the slaughter at Amritsar in 1919, with the support of Gen. Reginald Dyer's action there by the governing classes in England, had excited a feeling of such fierce resentment through the length and breadth of the peninsula as might have caused a general uprising. In dealing with the revolt against the dyarchy, he was compelled to imprison the two Mohammedan leaders, the brothers Ali. And although he was able to establish some kind of self-government in most of the local provinces and even something like friendly co-operation in the central legislative council, the constitution broke down in the Central Provinces and had to be suspended in Bengal, with a return to complete autocratic government. In the case of the boycott of the west the viceroy, after attempts at reconciliation with Gandhi, authorized his prosecution for inciting to mass civil disobedience.

Cpon Lord Reading's return to England in April 1926 he was created a marquess. the first commoner to be so created since the duke of Wellington. He was secretary of state for foreign affairs, Aug.–Nov. 1931, in Ramsay MacDonald's national government. He died Dec. 30, 1935. (See INDIA: History.)

READING, a county and parliamentary borough and the county town of Berkshire, Eng., 38 mi. W. of London by road. Pop (1961) 119,870. Area 14.2 sq.mi. Reading is an important junction of railways running west from London and south from the midlands, and the Kennet and Avon canal, to Bath and Bristol, and the Thames afford it connections by water. It lies on the Kennet river near where it joins the Thames. All the ancient churches are restored: Greyfriars church, formerly monastic, was completed early in the 14th century and after the dissolution of the monasteries served successively as a town hall, a workhouse and a jail, being restored to its proper use in 1864; St. Mary's was rebuilt in 1551 from the remains of a nunnery founded by Aelfthryth in expiation of the murder of her stepson Edward the Martyr; St. Laurence's is a Perpendicular building with Norman and Early English features; St. Giles's was much damaged during the siege of 1643 by the parliamentary forces and is almost wholly rebuilt. Public gardens occupy most of the site of the Benedictine abbey.

A University college was opened in 1892 and affiliated to Oxford; its success led to the gathering of an endo ment fund and it became an independent university with a charter in 1926. Its researches into agriculture, horticulture and dairying are of special importance. The National Institute of Research in Dairying, established in 1912, is part of the university. At the grammar school, founded in 1485 and now occupying modern buildings. Archbishop Laud (a native of Reading) was educated. There is also a bluecoat school (1656) now just outside the borough at Sonning. The municipal museum, besides an art gallery and other exhibits, includes Roman relics from Silchester (*q.v.*) and finds from the Thames.

Reading early became a place of importance. In 871 the Danes encamped there, and in 1006 it was burned by Sweyn. It consisted of only 30 houses at the time of the Domesday survey. It is thought that a fortification existed there before the Conquest, and Stephen built a masonry castle which Henry II destroyed. On the foundation of a Benedictine abbey in 1121, the town, hitherto demesne of the crown, was granted to the abbey by Henry I. Henry VIII converted the abbey, whose church was among the largest in the country, into a palace and it was destroyed during the Civil War. From the 12th until the 16th century, Reading's history was that of the struggle as to rights and privileges between the abbey and the merchants' guild. A 16th-century account of the merchants' guild shows that many trades were then carried on, but John Leland says the town "chiefly stondith by clothing." By the 17th century the trade had begun to decline; the bequest of the clothier John Kendrick (d. 1624) did little to revive it. and it was greatly injured by the Civil War. In the 18th century the chief trade was in malt.

The first town charter is that of Henry III (1253), confirmed and amplified by succeeding sovereigns. The governing charter until 1835 was that of Charles I (1639), incorporating the town under the title of the mayor, aldermen and burgesses. The market, chiefly held on Saturday, can be traced to the reign of Henry III; four fairs granted by the charter of 1562 are still held.

Reading is an agricultural centre with famous nursery gardens. Its biggest and best-known industry is biscuit manufacture, but there is much business in printing, iron foundries, engineering works, malting and brewing. The sale of corn, cattle and flour is carried on extensively, and there are pottery and brick works, together with riverside boatbuilding yards. The parliamentary borough. which used to return two members before the Reform act of 1885, regained that privilege in 1948.

READING, a city of southeastern Pennsylvania, U.S., the seat of Berks county, is located on the Schuylkill river, 58 mi. N.W. of Philadelphia.

The population in 1950 was 109,320 and decreased by 10.2% in 1960 to 98.177. However the population of the Reading standard metropolitan statistical area comprising Berks county increased from 255.740 in 1950 to 275,414 in 1960.

History.— In 1748 Reading was laid out and surveyed at the great ford on the Schuylkill. The plans were supervised by Thomas Penn, who insisted on the large open square, Penn common, for market purposes, as was common in England. He named the town for the seat of Berkshire. Eng., the ancestral home of the Penns. Four years later, when Berks county was created. Reading became the county seat. It was incorporated as a borough in 1783 with a population of 2,100 and was chartered as a city in 1847.

Though there were many Germans among the first settlers they were not politically minded and control of local affairs remained in the hands of the English. As a result of the Revolutionary War. the German element in Reading and elsewhere in Pennsylvania began to assert itself and eventually elected three governors from Reading and Berks county. As early as the spring of 17'75 two companies of infantry (mostly Germans) left the district for service under Gen. George Washington near Boston. Reading served as a depot for supplies, as a manufacturer of cannon and it maintained a prison camp for the Hessians captured at the battle of Trenton. The thrifty Pennsylvania Germans hired out some of the Hessian prisoners in their charge. During the American Civil War, Reading was the first to send a military unit to defend the national capital when Abraham Lincoln called for troops. The Ringgold light artillery, largely locally recruited, was later named the first defenders.

The local citizens are still proud of their predominantly Pennsylvania-German heritage, which they seek to keep alive at the widely attended annual Pennsylvania Dutch folk festival at nearby Kutztown.

Industrial Growth.--From the earliest days the making of iron and steel was important. In this area the first cold-blast furnace in America was set up and the first steel was commercially produced in Pennsylvania. At the middle of the 19th century Berks county had more iron and steel producing plants than any county in the U.S. The prosperity of Reading's primary iron and steel production continued until the upper Great Lakes ore replaced the use of Pennsylvania ore. Reading made the adjustment by shifting to the fabrication of iron and steel. The opening of the Schuylkill canal to Philadelphia in 1824 (abandoned in 1922), the Union canal to Lebanon and Middletown on the Susquehanna in 1828 (abandoned in 1880) and the building of the Philadelphia and Reading railroad in 1838 (extended to Pottsville in 1842) greatly stimulated industrial growth, as did the building of the Pennsylvania railroad to Reading in 1884.

An interesting feature of Reading's industrial history was the sudden mushrooming of safety-bicycle manufacturing to satisfy the fad of the 1890s. When the bicycle boom passed much hope was held out for automobile manufacturing. From 1900 to 1912 Charles E. Duryea manufactured a durable car that won a number of speed and endurance tests but did not sell well. The Reading Steamer produced from 1900 to 1903 was a novel machine that did not catch the fancy of the buying public.

The decline of primary iron and steel manufacturing and the blasted hopes of the bicycle and the automobile business were offset by the development of the textile and hosiery industry by two German technicians, Ferdinand Thun and Henry Janssen, around 1900. Other Germans built textile and hosiery factories and gave the city a national reputation.

Reading became an important retail and wholesale tradingcentre. It is located in the midst of a rich agricultural, dairy and industrial county and ranks third industrially in the state, with about 700 industrial establishments in the city and its suburbs. These include railway shops and plants producing builders hardware, foundry products, hosiery machinery, clothing, optical goods, chemicals, dairy products and pretzels. One of the largest full-fashioned hosiery mills in the world is located there, as are also an extensive single-unit foundry and a huge brick-burning kiln.

Skilled craftsmen form a large proportion of the population and union organizations are strong in the community, which has a tradition of unionism and socialism.

Reading was the second city in the U.S. to elect a socialist government. "Jim" Maurer was for many years nationally known as the leader of a moderate brand of socialism. (In contrast to the usual moderation, during the railroad strikes in 1877 ten men were killed and scores seriously wounded.)

The hosiery business, which once employed more than half the wage earners of Reading, has declined, but the city anticipated the slump and in the 1950s and 1960s stimulated new industries and the growth of old industries to take up the slack.

Education and Cultural Activities.— The public-school system comprises evening and summer schools in addition to the usual kindergarten through senior high school. A unique feature is the ownership by the school district of an extensive museum and art gallery, both of which are thoroughly integrated into the public school work at all levels. The butterfly collection and the collection of Carboniferous Age insects are nationally recognized. Pennsylvania State university, the University of Pennsylvania and Temple university maintain extension centres and institutes at Reading. Albright college (Evangelical United Brethren; founded in 1856), a four-year liberal arts college, is also located there. The county historical society has a valuable collection of ancient fire-fighting equipment. Both the symphony orchestra and the Ringgold band are among the oldest in America.

Parks and Historic Sites.—Mt. Penn, to the east of the city, rises to an elevation of 1,100 ft. and is the centre of a park system of more than 2.000 ac. The Duryea drive winds to the immense Chinese pagoda on the top. Penn common (50 ac.) is still a popular recreational area in the heart of the city. The anchor of the battleship "Maine" rests there.

Among the many historical landmarks in Reading and its environs are the Conrad Weiser farm, Hopewell Village National Historic site, Daniel Boone homestead and the sites of early forts and furnaces. (L. A. GR.)

READING is the mental process of securing and reacting to an author's message represented by written or printed symbols. To read, one must recognize words, know the meaning of the words, understand the ideas expressed by the author, sense the mood and tone of the selection, evaluate the accuracy of the ideas and use or apply them.

Children in the primary grades usually learn to read simple materials. These abilities are expanded and refined in the middle and upper grades. Many high schools in the United States began to teach reading between 1930 and 1950 and a number of colleges initiated courses to improve reading. By the 1950s many adult education courses included reading improvement classes, and some industrial concerns were offering reading courses to their employees. It is recognized that one learns to read, then reads to learn, and that the growth of these two abilities continues from childhood into adulthood.

Stages in Learning to Read.—Studies show that pupils' attainments in reading at various grade levels differ widely. Some at the end of first grade may be reading as well as the average of those in third grade. By the fourth grade a few pupils are reading at first-grade level, others at second, several at third and many at fourth. In addition, a number will attain scores at fifth, several at sixth and a few at seventh and eighth grades. Arthur I. Gates pointed out that all pupils go through the same stages in learning to read, but that individuals vary in the rate at which they master successive stages. Usually the stages are not clear-cut. but each merges gradually into the next.

The first stage is called reading readiness, or preparation for learning to read. Much of this preparation takes place in the home, but kindergarten is also an effective aid. Pupils who are not judged ready to read usually have additional preparation in first grade. Mental, social, emotional and language maturity appropriate to the average pupil of six years is considered optimal. An interest in books and in printed words is usually exhibited at this time.

The second stage is that of learning to read. During this period, children learn to recognize about 300 words by sight. In addition, their interest in reading increases, and they become thoughtful about what is read. Gradually, as this stage progresses. children learn to read simple books independently.

During the third stage there is considerable progress in learning to do good oral reading and rapid silent reading which is fully

understood. Sight vocabulary increases to 1.500–2,000 words. Concurrently, pupils learn the skills necessary to figure out independently the words in their speaking vocabulary. At this stage pupils begin to use reading as a tool in other school subjects, to satisfy their curiosity and for pleasure.

The fourth stage is characterized by the acquisition of more mature reading interests and tastes. During this period all of the previously learned abilities are refined and enhanced. Word recognition is gradually increased; knowledge of meanings is extended and precision of meaning is acquired. Understanding or ability to interpret grows as the reader secures a better background against which to evaluate what he reads. He is able to apply new knowledge acquired from his reading to assist him in adjusting his attitudes and behaviour. His reading interests become broader and. in worthwhile areas, more intensified. He begins to become what William S. Gray described as the mature reader.

Methods of Instruction. — One of the earlier methods of teaching reading in most parts of the western world was the so-called ABC method. Children first memorized the names of the letters. Then the letters were combined to form syllables and words. Words were combined to form sentences, and sentences to form paragraphs. Since saying the names of the letters in a word often bears little resemblance to the sound of the word when it is pronounced, learning was largely by memory and without much meaning. According to Nila B. Smith there was a vigorous protest against the ABC method between 1840 and 1850, although this method continued to be used long afterward.

However, experimentation turned in two directions. One involved learning words as units, since they have more meaning for young children than do letters. There were a staggering number of words for pupils to learn by sight without methods for attacking unfamiliar words. A second method developed in just the opposite direction. Instead of learning the names of letters, the sounds of the letters were taught. This was known as the phonetic method. Because some English letters have two or more sounds, a great deal more drill was required to learn all the combinations than was necessary in learning the names of the letters. However, the advantage of the phonetic method was that words could be built or dissected if the proper sounds were known. Several highly formalized phonetic systems were devised and used extensively.

Oral reading predominated during the early periods. Books were scarce and expensive, so reading was shared by many through listening. Early in the 20th century, scientific studies revealed that the processes of oral and silent reading were different. In the meantime, many educators criticized mord calling which was done without a knowledge of the meanings expressed. Beginning about 1920, emphasis was placed on silent reading and oral reading was not considered important. Standardized tests of reading had been devised and were used to appraise growth in reading by different methods. Furthermore, studies of learning revealed that young children tend to grasp ideas or units as a whole and later to identify the elements composing the unit. Based on this concept, a different method became prevalent.

The experience method begins when all of the pupils have an experience which is interesting and exciting to them. For example, they may visit a farm or a park or a zoo. Then, as the children talk about this experience, the teacher prints their story on the blackboard. Pupils take turns in reading back to the class the story they have composed. Thus. meaning is emphasized to a greater extent, and the words are viewed as carriers of meaning. Additional experiences use many of the same words and some new ones. Gradually, the sentences are divided into phrases, and finally nords per se are identified. After a sufficient number of words are learned in this fashion, children begin to read simple books called preprimers. New words are learned and pupils read their primers, first readers, etc. Subsequently, pupils are introduced to the most common sounds of the letters by being shown the similarity of familiar words which begin and end alike. In later stages, emphasis is placed on the phonetic elements and their application. The pupil is taught to guess what a new word might be to make sense in the story and then to check the sounds to be sure that he has identified the correct word. The names of the letters are learned in connection with spelling, and the order of the alphabet is learned when pupils must use the dictionary.

The experience method seems to appeal to children and most of them learn rapidly as soon as they are ready for this stage. If progress is not satisfactory, teachers may place greater emphasis on visual, auditory or kinesthetic clues to words. The first reading experiences are oral but silent reading is taught as soon as possible.

Recognition of words is basic to the other skills in reading, but it is useless unless the meanings of words are known. Thus in effective teaching word meanings, often called vocabulary, are taught throughout school. Not only in the reading period is this true. but teachers of all subjects in which reading is used teach the meanings of unfamiliar words. Best results are achieved when children and young people have direct rather than incidental instruction in word meanings. However, independence must be developed as pupils progress in school so that they may continue to expand their reading vocabularies throughout life.

Comprehension and interpretation of printed and written materials are taught from the early school levels on through high school, and sometimes in college. At first the materials used are simple and within the realm of experience of the pupils. Gradually, the materials become more difficult, less familiar and even abstract. A variety of adaptations must be made. For example, in literature a student may read one selection to get the general idea; another to sense the mood and tone of the author; another to study the characters and plot; and poetry may be read orally for the beauty of the language. Thus, comprehension and interpretation may include reading to get the main idea, details, to follow directions, to arrive at conclusions, to interpret the author's ideas and feelings, to evaluate for accuracy or bias or for the appreciation of the literary expression and content.

As word recognition, word meanings and comprehension improve, rate of reading usually increases accordingly. The first-grade pupil reads silently and orally at about the same rate. By third grade the average pupil begins to read silently at a rate more rapid than when he reads orally. Rate of reading for the mature adult should vary with the difficulty of the material and the purpose for reading it. For example, a person might read a novel for sheer pleasure at 300 words per minute. The same person might read an article dealing with politics at 200 words per minute. A technical article on the atom bomb might be read at 100 words per minute. Thus, the mature reader has many reading rates.

Teachers encourage pupils to read large amounts of materials of interest to them and at an appropriate level of difficulty. Thus, children learn to read widely for information, to solve problems and for pleasure. At the upper school levels, young people are guided by teachers and librarians to better literature and to sources designed to help them solve their personal and social problems'. It is the aim of schools and colleges to develop refined reading tastes and permanent reading interests.

Reading Interests. — Many studies of reading interests have been made of school children, young people and adults. The results show certain trends. In the primary grades, children are usually interested in familiar experiences and enjoy stories about other children of their ages and about animals. They prefer narrative to other types of materials.

In the preadolescent period, the majority of boys exhibit an interest in adventure, descriptions of "how-to-do-it," hero worship, hobbies and science. At the same period. girls' interests turn toward home and family life and fantasy and some interest is shown in adventure. It is significant that girls will often choose boys' books while boys do not like girls' books. Near the end of this period most pupils do more free reading than at any time in their school careers.

Adolescent boys are interested in reading about mysteries, sports and recreational activities. On the other hand, girls frequently turn to romance and stories of teen-age problems. The reading interests of adults are varied and complex. Douglas Waples and Ralph W. Tyler concluded that "international attitudes and problems" and "personal hygiene" were the only two

topics of interest to all the groups they studied. Otherwise, the reading interests of adults vary with sex, years of schooling, occupation, age and environment. Ease of securing reading materials is also related to interests. Newspapers and magazines are read more frequently than books.

Effects **of** Reading. — The emphasis on teaching and use of reading reflects the confidence that reading contributes to personal and social development, either positively or negatively. The widespread concern about reading crime and thrill comic books about the middle of the 20th century bears witness to the negative effects assigned to reading. On the positive side, studies summarized by William S. Gray revealed that reading influences the extent and accuracy of information, the attitudes, morale, beliefs, judgments and actions of readers.

Bibliotherapy, which is the personal interaction between the reader and literature, has been shown to be one method of therapy for some maladjusted persons. Librarians report progress in the adjustment of young people when books dealing with adolescent tasks are read and discussed.

Propaganda in reading materials has been shown to be an effective tool unless people learn to think critically about what they read and to evaluate sources carefully.

Reading Retardation. — Some pupils who grow physically and mentally at the same rate as their age mates make little or no progress in learning to read. Others move through one or more stages of growth and do not progress to the next stage. Such persons are known as retarded readers. Causes for reading retardation include visual difficulties, emotional disturbances, home and family problems, school methods improperly adapted to individuals and, in a few instances, other factors, according to Helen M. Robinson. In most cases, an examination of the retarded reader by a reading specialist results in charting a course for correcting the difficulty. Reading clinics or centres are staffed by persons especially qualified to prescribe and carry out the kind of instruction which results in adequate reading progress. In general, the methods are similar to those used to teach all children, but special adaptations are made for each learner.

Retarded readers are found in elementary schools, high schools, colleges and in adult life. While most of them are retarded in all aspects of reading, some have deficiencies in specific areas such as comprehension or rate of reading.

About the middle 1930s Guy T. Buswell and others demonstrated that many adults could increase their rates of reading without loss of comprehension. A widespread interest in rate improvement followed. Several manufacturers made instruments designed to increase reading rate. Practice has shown the value of the instruments when used wisely with the proper persons.

It seems quite likely that most adults can learn to read better and more rapidly if they want to do so. Reading is best improved by motivated practice with a purpose in mind and a strong desire to secure the information available on the printed page. There is no substitute for a teacher and for books.

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REAGAN, JOHN HENNINGER (1818–1905), U.S. politician, a member of the cabinet of the Confederate States of America and an advocate of conciliation in the post-Civil War period, was born in Sevier county, Tenn., on Oct. 8, 1818. He moved to Texas in 1839, was admitted to the bar in 1846, and in 1857–61 was a representative in congress. In 1861 he was appointed postmaster general in Pres. Jefferson Davis' cabinet and served in this capacity throughout the Civil War. Captured with the Davis party on May 10, 1865, he was imprisoned in Ft. Warren, Boston harbour, until the following October.

While in prison he wrote the "Fort Warren letter" (Aug. 11), in which he urged the people of Texas to recognize their defeat, grant civil rights to the freedmen and try to conciliate the North. From 1875 to 1887, when he entered the U.S. senate, he was again a representative in congress. In 1891, believing that his first duty was to his state, he resigned from the senate to accept the chairmanship of the newly established state railway commission. He retired from public service in 1901 and died at Palestine, Tex., on March 6, 1905.

REALGAR, a mineral species consisting of arsenic monosulfide and occurring as crystals of a bright red colour. usually occurs with ores of silver and lead in mineral veins. Realgar has been produced commercially in Europe and Asia and has been mined in small quantities in the United States. It has been used as a paint pigment and as a depilatory in tanning and for producing a brilliant white fire in pyrotechnics, but has largely been replaced by artificially prepared arsenic sulfide. The composition is AsS. It crystallizes in the monoclinic system and there is a perfect cleavage parallel to the plane of symmetry; hardness is 1.5–2, specific gravity 3.55. On exposure to light the crystals crumble to a yellow powder. The other native arsenic sulfide, As_2S_3, is known as orpiment (*q.v.*). (L. J. s.; X.)

REALISM (Latin res, "a thing"), a term used in several senses in various disciplines.

In metaphysics realism has two quite distinct meanings. First, in the history of scholasticism, it is used to designate the doctrine that universals (see UNIVERSAL) have real existence: extreme realism in this sense maintained that universals, such as goodness, justice, roundness, redness, humanity and so on, exist independently of the particular objects in which they are perceived, and that these objects are real only in so far as they participate in the universal; moderate or mitigated realism maintained that the universals really exist *in* the particular things in which they are perceived by the mind as forming their common nature. Conceptualism (*q.v.*), on the other hand, maintained that universals exist only in the mind, whereas nominalism (*q.v.*), in its extreme form, would deny universals altogether. The second metaphysical use of the term realism is to designate the contention that the objects of sense perception have real existence outside the perceiving mind, as opposed to idealism (*q.v.*). (See further KNOWLEDGE, THEORY OF.)

In ethics, realism is occasionally used to mean conduct based on considerations of practical advantage, without regard for ideal goodness or equity.

In literature, the term realism may be loosely applied to any writing that seeks to portray life exactly as it is (or, in histories and historical novels, is believed to have been), without embellishment or idealization. In a more restricted sense, it is applied to the style of such novelists as Gustave Flaubert (*q.v.;* and see NOVEL), in opposition both to romanticism and to naturalism; the latter tended eventually to emphasize the more sordid aspects of life that the realists had not gone out of their way to stress. See also Index references under "Realism" in vol. 24.

REAL PRESENCE: see TRANSUBSTANTIATION and EUCHARIST.

REAL PROPERTY AND CONVEYANCING: see LAWS OF REAL PROPERTY AND CONVEYANCING.

REAPING: see FARM MACHINERY; HARVESTING MACHINERY.

REAR VAULT: *see* ARCH AND VAULT.

RÉAUMUR, RENÉ ANTOINE FERCHAULT DE (1683–1757), French scientist who devised the Réaumur thermometric scale, was born on Feb. 28, 1683, at La Rochelle. In 1710 he was charged with the official description of the useful arts and manufactures of France, which led him to many practical researches. He examined and reported on the auriferous rivers, the turquoise mines, the forests and the fossil beds of France; devised a method of tinning iron and investigated the chemical composition of Chinese porcelain and the chemical differences between iron and steel.

Réaumur's thermometric scale (1730) was constructed on the principle of taking the freezing point of water as 0°, and graduating the tube of the thermometer into degrees each of which was one-thousandth of the volume contained by the bulb and tube up to the zero mark. It was an accident dependent on the coefficient

of expansion of the particular quality of alcohol employed which made the boiling point of water 80° R.; and mercurial thermometers the stems of ahich are graduated into 80 equal parts between the freezing and boiling points of water are Réaumur thermometers in name only. Réaumur wrote widely on natural history (see ENTOMOLOGY: *History* of *Entomology*), his best-known work on this subject being the *Mémoires pour* servir *à l'histoire* des insectes (6 vol., 1734–42). He died at La Bermondière, Maine, on Oct. 18, 1757.

REBATES, DEFERRED. A deferred rebate is a discount on the invoice price returned after a lapse of time to a trader, on certain conditions, as a means of maintaining monopoly and keeping out would-be competitors from the trade. In Great Britain the system consists in returning to the trader (merchant or retailer) at the end of every 6 or 12 months a rebate equal to perhaps 10% or 15% on his purchases, on condition that he shall not, during the period. have sold, displayed (or, it may be, offered) any of the kind of goods produced by the combination except those made by the combination. (J. H.; X.)

REBEC (REBECK), a medieval stringed instrument played with a bow, derived from the Oriental rebab, and sometimes regarded as the ancestor of the viol and violin. Like the rebab, the rebec assumed at first one of two forms—the pear-shaped body with a wide base, strung with three strings, or the long, narrow pear- or boat-shaped body with two strings and, in addition, the other oriental characteristics of the rebab, *i.e.,* the vaulted back, the absence of ribs, and pegs set in the back of the head. Except for the addition of a finger board. what is now recognized as the rebec underwent no structural development and never entered the domain of art, despite the wide favour which it enjoyed throughout the middle ages.

REBECCA RIOTS, the name given to some disturbances which occurred in 1843 in south Wales. The rioting was directed against the charges at the tollgates on the public roads, and the rioters took as their motto the words in Gen. xxiv, 60, "And they blessed Rebekah, and said to her, 'Our sister, be the mother of thousands of ten thousands; and may your descendants possess the gate of those who hate them!' " Many of the rioters were disguised as women and were on horseback; each band was led by a captain called "Rebecca," his followers being known as "her daughters." They destroyed not only the gates but also the tollhouses, the work being carried out suddenly and at night, but usually without violence to the tollkeepers, who were allowed to depart with their belongings. Emboldened by success, the Rebeccaites turned their attention to other grievances. The government dispatched soldiers and police to south Wales, and the disorder was auelled. South Wales was relieved from the burden of tollgates, while the few rioters who were captured were only lightly punished. The movement was separate from Chartism (*q.v.*), but was supported by the same class and arose from the same economic causes.

REBELLION, armed resistance for political purposes by nationals of a state against the government, usually resulting in insurrection, civil war or revolution. In lam, rebellion is the act of one who engages in such resistance and is therefore subject to prosecution for treason, sedition or rebellion. In British history, for example, supporters of the Old Pretender in 1715 and of the Young Pretender in 1745 were punished as rebels. In the U.S. Civil War the federal government regarded the Confederates as rebels although they had been recognized as belligerents by neutral states. A general amnesty after the war terminated prosecution against the leaders. In the South African war of 1899–1902 the supreme court of the Cape of Good Hope held that those who joined the burgher forces were liable for treason, although the burghers had been recognized as belligerents (Rex *v.* Louw, 21 C.G.H. Supreme Court Rep. 36, 1905). See TREASON; SEDITION.

For historic rebellions see titles of specific rebellions. For the status of rebellion in international law see BELLIGERENCY and INSURGENCY. For the usual justifications for rebellion, see DEMOCRACY; HUMAN RIGHTS; IMPERIALISM; NATIONALISM; SELF-DETERMINATION. (Q. W.)

REBIKOV, VLADIMIR (1866–1920), Russian composer, was born at Krasnoyarsk in 1866, and studied in Moscow. Berlin and Vienna. He then went to live at Odessa, where, in 1894, his first opera. The Thunderstorm, was produced. Other dramatic works are Tlze Christmas Tree (1903); Narcissus, Tlze Fables of *Krylov* (his best-known work); Przнce *Charming,* a fairy opera; and the pantomime *Snow-White* (1909). He also wrote suites for pianoforte, including the *Mélomimiques,* and mimetic vocal pieces. His music makes no appeal to the popular mind, and is difficult to grasp because of its harshness and lack of form. Rebikov's literary work includes a translation of Gevaert's *Traité d'Instrumentation* (1899) and La *musique* de 1960.

REBUS. A simple rebus is the representation of a word or part of a nord by a picture of a thing with a similar name. Several may be combined—in a single device. or successively—to make a phrase or sentence. Literary rebuses use letters, numbers, musical notes or specially placed uords to make sentences. Complex rebuses combine pictures and letters. As a means of communication, rebuses may convey direct meanings, especially to inform or instruct illiterate people; or they may deliberately conceal meanings to inform only the initiated or to puzzle and amuse.

An early form of rebus occurs in semiprimitive picture writings, where abstract words, difficult to portray. were represented by borrowing pictures of objects pronounced the same way. These are common in Egyptian hieroglyphs and early Chinese pictographs. Rebus pictures were used to convey names of to ns on Greek and Roman coins, or names of families in medieval heraldry (in the so-called canting arms). and they have often been used for instructional symbols in religious art and architecture. In the far east, especially in China and Korea, rebus symbols were commonly employed to carry auspicious wishes. Rebusmaking was long considered a specialty of Picardy, in France.

Elsewhere in Europe literary rebuses often appeared on family mottoes, personal seals, ciphers and bookplates and ultimately in games or riddles. A familiar English rebus is the debtor's I O U, for "I owe you."

Popular in the United States since the mid-19th century were rebus picture puzzles in which the indicated addition or subtraction of letters in illustrated words produced another word or a name. Hundreds of these were devised by the puzzlemaking genius Sam Loyd. Such picture riddles have been widely used in U.S. advertising, and, beginning in the 1930s, sequences of them were presented in newspaper contests designed to attract readers. Huge prizes were offered but the final problems were so difficult that only groups of experts could solve them. Attempts at solution became a nation-wide hobby in which hopes for material gain were usually disappointed, but many persons were led to further interest in self-education and research.

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(S. V. R. C.)

RECALL, a device, principally used in the United States, by which voters may remove a public official from office before the expiration of his regular term. Recall is based upon the principle that officials are mere agents of the popular will, and as such should be constantly subject to its control (see REPRESENTATION). Under the plan, if a specified percentage of the electorate are dissatisfied uith an official's conduct and sign a petition for his removal, the officer must face a general election to determine the majority opinion.

Though the general principle of the recall is simple, there are many variations in its practical application. Under some plans the question of removal may be decided in one election, and the question of a successor in a subsequent election, but for economy's sake the two are often combined in one election. The vote required to remove an official is usually a simple majority of those voting. The percentage of signatures required to force an election ranges widely, the average being about 25% of those who participated in the last general election in that electoral district. An officer elected at a recall election serves out the unexpired portion of the term of the office.

The recall is, in fact, infrequently resorted to and then almost

entirely for local officers. The recall found state-wide application in North Dakota in 1921 when the governor, attorney general and commissioner of agriculture were removed. At mid-20th century only a few instances of its being applied to judges were on record, all of them in minor courts. In its state-wide application it becomes too cumbersome to be resorted to frequently.

Recall originated in Switzerland where it was made applicable not only to individuals but to the entire legislature. It was suggested in the American Articles of Confederation and discussed in the Constitutional Convention of 1787, but its first practical application in the U.S. was in 1903 in the Los Angeles, Calif., city charter. It was soon adopted by many cities with the commission form of government as the most effective way to control the commissioners in whose hands large powers were placed. It was subsequently adopted in the following states: Oregon (1908), California (1911), Arizona, Idaho, Washington, Colorado and Nevada (1912), Michigan (1913) and Louisiana, North Dakota and Kansas (1914). Most of these states had many elective officers not subject to removal by the governor who were, in effect, beyond administrative control during their terms of office.

The term was also applied in the early 20th century to various proposed restraints on the judiciary. Under the slogan "recall of judicial decisions," the Progressive party under the leadership of former Pres. Theodore Roosevelt in 1912 advocated that "when an act, passed under the police power of the State, is held unconstitutional under the State Constitution, by the courts, the people . . . shall have an opportunity to vote on the question whether they desire the Act to become law, notwithstanding such decision." The 1912 proposal was not adopted, and in some states (Idaho, Louisiana, Michigan and Washington) the recall was not made applicable to judges on the ground that the judiciary should be independent of popular passions and political pressures.

A general increase in the size of electorates, plus a greater demonstration of responsibility on the part of executives and legislative bodies alike in the second half of the 20th century, tended to diminish use of the recall. Its effectiveness is perhaps not to be measured by its use, but by the restraining influence it may exercise. See also REFERENDUM AND INITIATIVE.

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RÉCAMIER, JEANNE FRANÇOISE JULIE ADÉLAÏDE (1777–1849), a famous Frenchwoman in the literary and political circles of the early 19th century, was born on Dec 4, 1777, at Lyons. Her maiden name was Bernard. She was married at 15 to the banker Jacques Récamier (d. 1830), who was more than old enough to be her father. From the early days of the consulate to almost the end of the July monarchy her salon in Paris was one of the chief resorts of literary and political society that pretended to fashion. The habitués of her house included many former royalists, with others, such as Bemadotte and General Moreau, more or less disaffected to the government. Through her friend Madame de Stael, Madame Récamier became acquainted with Benjamin Constant (*q.v.*). She was eventually exiled from Paris by Napoleon's orders. After a short stay at Lyons she proceeded to Rome, and finally to Naples, where she was on good terms with Murat and his wife, who were then intriguing with the Bourbons. She persuaded Constant to plead the claims of Murat in a memorandum addressed to the congress of Vienna, and also induced him definitely to oppose Napoleon during the Hundred Days. Her husband had sustained heavy losses in 1805, and she visited Madame de Stael at Coppet in Switzerland. In her later days she lost most of the rest of her fortune; but she continued to receive visitors at the Abbaye-aux-Bois, the old Paris convent to which she retired in 1814. There Chateaubriand was a constant visitor, and in a manner master of the house; but even in old age, ill-health and reduced circumstances Madame Récamier never lost her attraction. She numbered among her admirers Mathieu de Montmorency, Lucien Bonaparte, Prince Augustus of Prussia, Ballanche, J. J. Ampère and Constant, but none of them obtained over her so great an influence as did Chateaubriand, though she suffered much from his imperious temper. Her sincerest affection seems to have been for Prosper de Barante, whom she met at Coppet. She died in Paris on May 11, 1849.

RECEIVER, in English and U.S. law, a person appointed by a court to collect and conserve assets and income, making disbursements only as authorized by the court. He may or may not be entrusted with the active carrying on of a business. Receivers were traditionally appointed by courts of chancery in Great Britain. The Judicature act of 1873, however, conferred power to appoint receivers upon all divisions of the high court. In the United States receivers may be appointed by any court of general equity jurisdiction. State statutes have contributed to the development of the law of receiverships in various types of cases.

In theory a receivership is properly only incidental to the realization of another primary objective and is not recognized as an independent object of litigation. A receiver may be appropriate whenever the court finds a need to conserve property or to distribute funds in litigation. The receiver is deemed an "arm of the court," and the property which he takes into possession is said to come into the custody of the court. Unlike a trustee in bankruptcy in the U.S., he is not deemed to take "legal title."

Typically receivers are appointed on special or general creditors' bills. A court of equity, discharging a long recognized duty to furnish an effective remedy when the remedy at law is inadequate, will entertain a special creditor's bill to reach intangible or concealed property beyond the reach of execution or other legal process and to apply the proceeds to the complainant's claim. A general creditors' bill is particularly appropriate when a creditor can show the need for appointing a receiver to avert the liquidation of a going business enterprise with threatened loss to all concerned. An ensuing general equity receivership may lead to the reorganization of a business association. The receiver may be authorized to conduct the business during the litigation in hopes of effectuating a sale of the business as a going concern. The purchaser may be a business association, frequently a new corporation in which creditors and sometimes former proprietors have interests represented by new securities distributed under a plan of reorganization which has been negotiated by the parties and approved by the court. In the last third of the 19th century, a procedure for reorganizing insolvent railroad corporations was developed in the United States, substantially without statutory authorization, under the description of the "federal equity consent receivership." Certain United States district judges became expert in resuscitating insolvent railroad corporations. A few unsecured creditors of a failing railroad, citizens of some state or states other than that in which the railroad was incorporated, would file a general creditors' bill, showing the need of conserving the liquid assets of the road. A federal court would then have jurisdiction of the proceeding by reason of diversity of citizenship of the parties. Collusive proceedings were entertained in order to keep the railroad running under the protection of a federal court. A plan of reorganization could be negotiated, approved by the court and consummated through judicial sale, typically by the issuance of securities of a new corporation with a revised capital structure.

The equity receivership practice was elaborated and partly codified and reformed by sec. 77, added in 1933 to the U.S. Bankruptcy act of 1898. Initial experience with this statute led to substantial amendments in 1935. The court administers the property through an official called a trustee, but he has the powers of an equity receiver, as well as "legal title" as a statutory successor to the debtor, a concept developed with reference to trustees in strict bankruptcy.

Industrial and mercantile corporations may be reorganized under Chapter X of the Bankruptcy act. Statutory provisions for the intervention of the plans of reorganization make Chapter X proceedings elaborate and expensive affairs, transcending but still largely founded upon equity receivership practice.

In strict bankruptcy in the U.S., the receiver is merely a temporary conservator appointed when needed to serve until the trustee to liquidate the property can be elected by creditors. In Eng-

land, however, permanent officials designated receivers administer bankrupt estates, but they proceed more in the tradition of bankruptcy liquidation than that of receivers in chancery. The official receiver may take charge of the affairs of a company in compulsory winding up proceedings. Creditors or stockholders may. however, nominate liquidators other than the official receiver.

See also BANKRUPTCY. (J. A. MACL.)

English Practice.— In English law there is a clear distinction between a receiver appointed under an instrument (such as a debenture) and a receiver appointed by order of a court. The powers of a receiver appointed under an instrument depend upon the terms of that instrument and upon the general law of agency. Receivers appointed by a court are generally appointed under section 45 of the Judicature act, 1925. A court has power to appoint a receiver whenever this appears just and convenient, and the typical reason for such appointment is the protection of property for the benefit of interested persons as, for example, pending the trial of an action. Although all divisions of the high court, besides the court of appeal, have power to appoint a receiver, the chancery division most frequently does so. An appointment is as a rule only made in the queen's bench division by way of equitable execution. .Applications should be made in the probate, divorce and admiralty division when, for example, proceedings are pending to determine who shall administer a deceased person's estate, or when a wife entitled to alimony needs a receiver of her husband's interest under a settlement. Normally the court can only appoint a receiver when litigation is in process.

In English practice a named person is often made receiver .on the motion for an appointment, but if there is any difficulty or dispute the matter is referred to chambers. The court or the court of appeal will not interfere with the master's discretion in appointing unless he makes a mistake in principle. (W. T. Ws.)

RECHABITES (SONS OF RECHAB), a sort of religious order among the Israelites, analogous to the Nazirites (*q.v.*), with whom they shared the rule of abstinence from wine. They eschewed settled life and lived in tents, refusing to sow grain or to plant vineyards.

The Rechabites represented a protest against the contemporary civilization and a reaction toward simplicity of life. Their "father." or founder. was that Jehonadab (or Jonadab), son of Rechab. who encouraged Jehu to abolish the Tyrian Baal worship.

The "house of Rechab" fled for protection into Jerusalem at the approach of Nebuchadrezzar (Jer. xxxv), and Jeremiah promised them, as a reward of their adherence to the ordinance of Jehonadab. that they should never lack a man to represent them (as a priest) before Yahweh. Later Jewish tradition states that the Rechabites intermarried with the Levites.

RECHBERG-ROTHENLÖWEN, JOHANN BERNHARD, COUNT (1806–1899), Austrian statesman, was the second son of the Bavarian statesman Count Aloys von Rechberg-Rothenlöwen (1766–1839). Johann Bernhard was destined for the Bavarian public service, and he was educated at the universities of Strasbourg and Munich, but incurred the displeasure of King Louis I by the part he played as second in a duel, and in 1828 transferred to the Austrian diplomatic service. After being attached to embassies in Berlin, London and Brussels, he became envoy at Stockholm (1841) and at Rio de Janeiro (1843).

Returning to Europe in 1847, on the outbreak of the revolution of 1848 in Vienna he accompanied and assisted Prince Metternich in his flight to England. In July 1848 he was appointed Austrian plenipotentiary in the German federal diet at Frankfurt; in 1851 he became Austrian *internuncius* at Constantinople, and in 1853 Radetzky's civilian colleague in the government of Lombardo-Venetia.

In 1855 he returned to Frankfurt as Austrian representative and president of the federal diet. There his constant disputes with Bismarck, at that time Prussian envoy at the diet, were much sharpened by Rechberg's choleric temper, and on one occasion nearly led to a duel. Bismarck, however, always expressed a high appreciation of his character and abilities. In May 1859, on the eve of the war with Italy, he was appointed Austrian minister of foreign affairs and minister president, surrendering the latter post to the archduke Rainer the next year.

The five years during which Rechberg held the portfolio of foreign affairs covered the war with Italy and France, the insurrection in Poland, the attempted reform of the German confederation through the Frankfurt *fürstentag* and the Austro-Prussian war with Denmark. (See AUSTRIA, EMPIRE OF; EUROPE.)

Concerning the German question Rechberg's policy was one of compromise, and he generally advocated peaceful arrangement between Prussia and Austria as the indispensable preliminary to a reform of the confederation. In the Schleswig-Holstein question he was, however, consistently outwitted by Bismarck, and on Oct 27, 1864. Rechberg resigned He received the Golden Fleece from the emperor as a sign of special favour. He had been made a hereditary member of the upper house of the reichsrat in 1861, and as late as 1879 continued occasionally to take part in debates. Rechberg died near Vienna on Feb. 26, 1899.

RECIDIVISM. The term recidivism refers to chronic criminal behaviour which results in numerous arrests and incarcerations. Studies of the yearly intake of prisons, reformatories and jails in the United States show that from one-half to two-thirds of those imprisoned have served previous sentences in the same or other institutions. Statistics from European penal institutions come to a similar conclusion. This fact reveals two important facets of the crime problem: one is that the criminal population is made up largely of those for whom criminal behaviour has become habitual, or a way of life; the other indication is that penal institutions do little to change the basic behaviour patterns of their inmates.

Though the percentage of recidivists runs high for both felons and misdemeanants, for the latter group it is far greater. A veritable army of petty offenders appear as repeaters in courts of minor jurisdiction on charges of vagrancy, drunkenness, prostitution. disturbing the peace and other minor offenses. The short jail sentences they receive do nothing toward rehabilitation.

The most extensive and reliable studies of persistent criminal behaviour have been made by Sheldon and Eleanor T. Glueck in a series of research monographs of which the first was Five Hundred Criminal Careers (1930). These studies revealed the factors in the life situation of recidivists which differentiate them from other prisoners who make a good adjustment after their release from custody

Among the factors that are more prevalent with the recidivists are poor family situations, broken homes, mothers working outside the home, early onset of delinquency, truancy, poor economic status and adjustment, improper use of leisure and mental deficiency or other personality disorders. Similar factors abound among those offenders aho fail to succeed on probation or parole.

It is certain that longer sentences and existing penal methods are no solution to the problem of the chronic offender. Two improvements on current practice would seem to be necessary: one, the adoption of really indeterminate sentences that would enable authorities to keep recidivists in custody until their attitudes change for the better; another essential would be the equipment of penal institutions with personnel and facilities for more thoroughgoing work of rehabilitation. See also HABITUAL OFFENDERS; PRISON; PROBATION.

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RECIFE or PERNAMBUCO, a city and seaport of Brazil, capital of the state of Pernambuco. Pop. (1956 est.) 673,821, largely Negro and mulatto.

Located at the mouth of the Capiberibe river near the easternmost point of South America, the city is comprised of four separate parts (Recife, Santo Antonio, São José and Boa Vista) uhich are integrated by many bridges. Because of its numerous waterways the city is often referred to as the "Venice of America."

The district of Recife occupies the southern end of the Olinda peninsula and is the principal commercial centre of the city. In addition to warehouses and terminal facilities, there are the cus-

tomhouse, observatory, naval arsenal, government offices, several of the consulates and many of the more important banks, business houses and retail stores.

Santo Antonio is located on an island of the same name. Among the important institutions and public buildings in this part of the city are the government palace, the state treasury, the courthouse, the state museum, public library, several fine churches, including the city's famous church of São Francisco de Assís, the Santa Isabel theatre and many historic landmarks, including the Dutch fort of Cinco Pontas.

São José embraces a large district on the mainland and is chiefly residential. In this section of the city is Restoration square, which commemorates the end of Dutch domination.

Boa Vista, also on the mainland, is both a commercial and residential district and contains many of the educational institutions of Recife, including a normal school and schools of law, medicine, engineering, commerce and fine arts.

The hot, humid climate is mitigated somewhat by the southeast trade winds. July, the coolest month, has a mean temperature of 77°, whereas from December through March it is 82°. The total annual rainfall is 65 in., more than 80% of which falls from March through August.

The port of Recife is one of the most important of Brazil because of its proximity to Europe and its convenience for vessels passing around the east shoulder of the continent. Its harbour consists of a narrow body of water, about 2 mi. in length, which is sheltered on the east by a reef and breakwater. The latter extends about 3,600 ft. in a north and northeasterly direction from the reef—an ancient beach of firmly consolidated materials. A second breakwater (Olinda Mole), about 2,500 ft. in length, runs in a southeasterly direction from the mainland and forms the other wing of the entrance channel. The distance between the heads of these two breakwaters is about 900 ft. The northern part of the harbour is approximately 1,600 ft. in width and has been dredged to a low water depth of 32 ft. The southern part is considerably smaller and has been dredged to a depth of 25 ft. The quay is along the eastern margin of the peninsular district of Recife. The port is equipped with a modern coaling plant and grain conveyor, a sugar conveyor and more than 50 electric and steam cranes. Three sets of tracks, which connect with the Great Western of Brazil railway, serve the wharf and warehouses. There are several concrete warehouses, a cold storage warehouse, a warehouse for commodities which create a public hazard and tanks for petroleum products and alcohol. The terminal facilities are operated by a state *directoria* under the authority of the federal government. The principal imports of Recife are coal, petroleum and wheat. Exports consist largely of sugar, cotton and other agricultural products.

More than 1,600 mi. of railways serve the states of Pernambuco, Alagoas, Paraiba and Rio Grande do Norte, having outlet through Recife, and a well-developed system of surfaced roads provides additional transportation facilities. The city is served by several national and European air lines, has national and international cable connections and radio, telegraph and telephone communications.

Recife was settled about 1535, when Duarte Coelho Pereira landed there to take possession of the captaincy granted him by the Portuguese crown. The site of Coelho's capital was Olinda, but Recife remained its port and did not become an independent *villa* (town) until 1709.

Down to the close of the 18th century, when Rio de Janeiro became important, Recife was the second city of Brazil and for a time its most important port. It mas captured and plundered in 1595 by the English privateer James Lancaster. It was also captured by the Dutch in 1630 and remained in their possession till 1654, during which time the island of Santo Antonio was occupied and the town greatly improved. At the end of the Dutch war the capital was removed from Olinda to Recife, where it has since remained. (R. E. P.)

RECIPROCATING ENGINE: *see* STEAM; INTERNAL-COMBUSTION ENGINES.

RECIPROCITY, the condition or state of being reciprocal, *i.e.*, where there is give and take, mutual influence, or correspondence between two parties, persons or things (Lat. *reciprocus,* "returning back the same way," "alternating," probably from re "back" and *pro* "forward"). In a more particular sense, reciprocity refers to the commercial policy under which a country grants special tariff advantages to imports of another country in return for special tariff advantages granted to it by the other country. In American usage the terms "reciprocity" and "reciprocity agreements" have acquired a highly specialized meaning as a result of the tariff policy formerly pursued by the United States, particularly under the tariff acts of 1890 and 1897, in the negotiation of tariff agreements with other countries. In this specialized sense, a reciprocity agreement is one in which the contracting states grant to each other particular tariff concessions, in return for particular tariff concessions, without the intention or expectation that these concessions will be generalized, *i.e.*, extended to third countries. Reciprocity agreements are to be distinguished from reciprocal trade agreements concluded by the United States since 1934, in which the tariff reductions made by the United States (except in the Cuban agreement) have been generalized to all countries except those found to be discriminating against American trade. (H. F. G.)

RECKLINGHAUSEN, FRIEDRICH DANIEL VON (1833–1910), German pathologist, one of the numerous students of Rudolf Virchow, who contributed significantly in expanding the science of pathology carrying his researches into many fields. was born in Gütersloh, Westphalia, on Dec. 2, 1833. He received his degree in medicine at Berlin (1855) and spent the next six years as assistant to Virchow. This was the period of Germany's emergence as the centre of medical progress, marked by Virchow's *Cellular Pathology* (1858), which put forward the doctrine that formed the basis for modern knowledge of the nature of disease. Recklinghausen became professor of pathology at the University of Konigsberg in 1865, accepted the chair at Wiirzburg the following year and in 1872 became the first professor in that department at the University of Strasbourg.

Recklinghausen's name is familiar in medicine from the eponym associated with two diseases he described. Multiple neurofibromatosis, a condition in which there are numerous fibrous tumours of the skin distributed along the course of the cutaneous nerves, is called Recklinghausen's disease since his description of it in 1882. Similarly, Recklinghausen's disease of bone, a generalized fibrosis and cystic degeneration of the bony skeleton, now known to be caused by a hyperfunctioning tumour of the parathyroid gland, still bears his name. These are but a few of the many significant observations and discoveries made during his long career. He resigned his professorship at Strasbourg in 1906 and died on Aug. 26, 1910.

See H. Bailey and W. J. Bishop, *Notable Names in Medicine and Surgery (1959).* (L. M. Z.)

RECKLINGHAUSEN, a town in the province of North Rhine-Westphalia, Germany, 22 mi. N.W. of Dortmund. Pop. (1950) 104,791. The county of Recklinghausen belonged to the archbishopric of Cologne until 1803, when it passed to the duke of Arenberg. It was known as the West Recklinghausen. After 1815 the duke of Arenberg held it as a fief under Prussian sovereignty. In the neighbourhood of Recklinghausen are extensive coal-mines, iron and tin foundries and brick works, and the industries embrace the manufacture of linen, beer, spirits, cement, soap and ammonia.

RECLAMATION OF LAND: *see* LAND RECLAMATION.

RECLUS, ÉLISÉE (1830–1905), French geographer and anarchist who was awarded the gold medal of the Paris Geographical society in 1892 for *La Nouvelle Géographie universelle,* was born the second son of a Protestant pastor on March 15, 1830, at Sainte-Foy-la-Grande (Gironde). He was educated at the Protestant college of Montauban and studied geography under Karl Ritter in Berlin. Having identified himself with the republicans of 1848, he was obliged to leave France after the *coup d'état* of Dec. 1851. He spent the years 1852–57 visiting the British Isles, the United States, Central America and Colombia. Returning to France, he applied himself to geography, publishing La *Terre,*

description des phénomènes de la vie du globe, 2 vol. (1867–68; Eng trans . 4 vol., 1871–73) and *Histoire d'un ruisseau* (1869). During the siege of Paris (1870–71) he participated in A. Nadar's balloon ascents. Serving in the national guard in defense of the commune, he was taken prisoner in April 1871; but his sentence of transportation for life was commuted in Jan. 1872 to one of perpetual banishment after European scientists had appealed to the government on his behalf. After a visit to Italy, he settled at Clarens, Switz.

His great work, *La Nouvelle Géographie universelle, la terre et les hommes,* 19 vol (1875–94; Eng. trans.. *The Earth and Its Inhabitants,* 1878–94), is a stupendous compilation, profusely illustrated with maps, plans and engravings and characterized by the accuracy and brilliance of exposition that give his work permanent scientific value. His *Histoire d'une montagne* was published in 1880. Though benefiting under the amnesty of 1879, Reclus had meanwhile lost none of his revolutionary enthusiasm; and in 1882 he initiated the Anti-Marriage movement, in accordance with which he allowed his two daughters to marry without civil or religious sanction. When proceedings were instituted at Lyons against the International Workingmen's association, P. A. Kropotkin (*q.v.*) and Reclus were designated as leading promoters of anarchism; but Reclus. as domiciled in Switzerland, escaped imprisonment. In 1892 he was appointed professor of comparative geography in Brussels. He died at Thourout, near Bruges, on July 4, 1905. His other works include *L'Homme et la terre,* 6 vol. (1905–08) and several anarchist pamphlets.

RECOGNITION, DIPLOMATIC. This term may refer either to the procedure by uhich a new state is formally accepted by other states as a member of the international community, or to the procedure by which a new government of an existing state is accepted as the legal representative of that state. The two procedures, although frequently confused. raise distinct legal questions. The recognition of a new state involves the sovereignty of the state and its independent position in relation to other states; the recognition of a new government merely involves the determination of the particular organized group that is to be accepted as having the right to speak in the name of the state, without raising any issue of the legal personality of the state.

While the term "recognition" has been applied to states already enjoying independent existence but not maintaining diplomatic relations with the western powers, as in the case of Ethiopia until its admission into the League of Nations in 1923, its more normal application is to colonies or dependencies that have declared their independence of the mother country and have proved their ability to maintain their separate existence, as in the case of the recognition by the United States of the Latin American states beginning in 1822. The provisions of the United Nations Charter concerning "the self determination of peoples" and the administration of "nonself-governing territories" support such recognitions.

On occasion, political motives have led to the recognition of a new state before it actually proved its ability to maintain its independence, as in the case of the recognition of the United States by France in 1778. Recognition by the Netherlands came in 1782 on the eve of the treaty of peace. After that treaty, the United States was in due time recognized by other states, as by Sweden, Spain and Prussia in 1783, by Portugal in 1794 and by Russia as late as 1809. Premature recognition has regularly been regarded as an offense that the mother country might resent, as Mexico resented the recognition of Texas by the United States in 1837 and Colombia, that of Panamá in 1903.

During the 19th century the great powers gave collective recognition to certain new states before they had as yet won their independence by arms, as when Greece was recognized in 1827, Belgium in 1831, and Rumania, Serbia and Montenegro in 1878. Since the close of World War I recognition has frequently been given by voluntary act of the mother country or more recently by collective act of the members of the United Nations. Great Britain, for example, recognized the independence of Ireland in 1920, of Egypt in 1922, and of India and Pakistan in 1947. Recognition by other states followed promptly. Indonesia was recognized by the Netherlands as independent in 1949, and Ghana and Malaya by Great Britain in 1957, followed by their admission to the UN. New African nations (the republics of Cameroun, Congo and Togo, Federation of Mali, Malagasy Republic, Somalia and Nigeria) received or awaited recognition in the early 1960s.

The "Stimson doctrine" declared by the United States secretary of state in 1932, and subsequently supported by the League of Nations. asserted that recognition should not be extended to new states or to territorial changes effected by illegal use of armed force. In accordance with this doctrine the United States and the members of the League of Nations refused to recognize the Japanese-supported state of "Manchoukuo" and the United States refused to recognize the Italian conquest of Ethiopia (1936) and the German conquest of Austria (1938).

In the case of new governments the procedure of recognition is applied only when an existing *de jure* government is overthrown by revolution and it becomes necessary for the governments of other states to decide whether the new government has the stability required to justify holding it responsible for the obligations of the state and is entitled in turn to claim the rights of the state. Recognition in such cases raises no question of the legal personality of the state or of its place in the community of nations. but merely the question whether a particular group can properly speak in the name of the state. Governments actually in power are described as *de facto* until such time as recognition by other states makes them *de jure.*

In addition to stability. the condition has frequently been put that the new government must not have been established by immoral behaviour, such as assassination, and must manifest an intention to observe the rules of international law. Such political or subjective conditions of recognition have given rise to numerous controversies and conflicting practices, the new government being recognized by some states and not by others. The United States, for example, refused to recognize the government of Gen. Victoriano Huerta established in Mexico by assassination of President Madero in 1913, and, until 1933, the Soviet government of Russia established by revolution in 1917. The U.S. also refused to recognize the Communist government of China established in 1949 and recognized by many states but continued to recognize the Nationalist government of China on the Island of Formosa. The U.S., however, promptly recognized the government of Iraq established by assassination of King Faisal II in 1958. During World War II the United States and Great Britain refused to recognize the governments of the countries occupied by the German armies and continued to recognize the refugee governments.

Efforts have been made to establish rules of international law on the subject of recognition in addition to the prohibitions of "premature recognition" and "non-recognition of the forces of aggression," but the political element of recognition has dominated and states have been unwilling to accept a collective decision applying law on a matter on mhich diametrically opposite points of view may be taken with respect to the conduct that may be expected of the new government.

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(C. G. FE.)

RECOGNIZANCE, a term of common law usually employed to describe an obligation of record, entered into before some court or magistrate duly authorized, whereby the party bound acknowledges that he owes a personal debt to the Crown, with a defeasance, *i.e.,* subject to a condition that the obligation to pay shall be avoided if he shall do some particular act—as if he shall appear at the assizes, keep the peace, or the like. Recognizances are now used almost solely with reference to criminal proceedings. The security given by a receiver appointed by the High Court is still in the form of a recognizance acknowledging a debt to named officers of the court, and securing it on the real and personal estate of the receiver.

There is a general jurisdiction on conviction of misdemeanour both at common law and by statute to put the offender under recognizances to keep the peace and (or) be of good behaviour in addition to or in substitution for other punishment. On refusal

to enter into recognizances as above, the court may order imprisonment for the refusal, limited in cases within the Acts to 12 months, and in cases within the Act of 1879 to six months.

The recognizances above described may be described as a form of punishment or a judicial security for good conduct. Recognizances are, however, most used with reference to proceedings before conviction and judgment. In preliminary enquiries into indictable offences the enquiring justices take recognizances to ensure the attendance of the accused if liberated during any adjournment, and on committal for trial take the recognizances of the accused (if allowed bail) to attend the court of trial and take his trial, and of the prosecutor and the witnesses for the prosecution or defense to attend and prosecute or give evidence. Recognizances taken are returnable under penalty to the court of trial, which orders their estreat if the conditions are breached. Similar powers as to the recognizances of persons prosecuted summarily mere given by the Summary Jurisdiction acts, 1848 and 1879, amended by the Criminal Justice act, 1925.

By the Land Charges act, 1925, a recognizance, whether obtained or entered into on behalf of the crown or otherwise, did not operate as a charge on land or on any interest on land or on the unpaid purchase money for any land, unless a writ or order for the purpose of enforcing it was registered in the office of the land registry. This enactment was clearly applicable to receivers' recognizances; and on purchases of land search was made for registered recognizances and an official certificate could be obtained affirming or negativing the existence of a registered entry.

In the U.S.A., the states allow by either common law or statutes recognizances in much the same way as in England.

RECONNAISSANCE, a military term for reconnoitring or examination of an enemy's position or movements. A topographical reconnaissance is a survey of a tract of country or route by officers with small patrols, escorts or assistants. Strategical reconnaissance was formerly carried out by cavalry formations or squadrons. but it has now been taken over almost entirely by aircraft. Tactical reconnaissance falls to the lot of troops of all arms, whether in contact with the enemy or for self-protection. A reconnaissance by a large force of all arms with the idea of provoking an enemy into showing his hand, if necessary by fighting, is called a reconnaissance in force.

RECONSTRUCTION FINANCE CORPORATION. The Reconstruction Finance corporation in the United States was established by congress on Jan. 22. 1932, "to provide emergency financing facilities for financial institutions, to aid in financing agriculture, commerce and industry." After a few years of unprecedented depression and steady price declines, an institution was required which could pump dollars into financial institutions, railroads. etc., to enable them to meet their commitments. The RFC in turn was to obtain dollars from the federal government. In moderating the epidemic of bankruptcies in the 1930s, the RFC helped lay the groundwork of recovery.

The RFC was to operate as an independent agency, not subject to political influences. Every application would be considered on its merits, not on political considerations. It was also generally assumed that loans would be made on the condition that private financing was not available and that an important public interest would be served.

In the early years Jesse Jones, chairman of the board of directors, managed the institution without much interference. But as the functions of the RFC grew, and particularly as the RFC, even in the 1930s, began to assume responsibility for disbursing huge sums of money for other government agencies, without the delays incident to the voting of funds through the appropriation committees of the congress, the agency tended to become involved in politics.

By the 1940s the situation had become precarious. The Hoover commission in 1949 noted that "direct lending by the government to persons or enterprises opens up dangerous possibilities of waste and favoritism. . . . It invites political and private pressures, or even corruption" *(Report on Federal Business Enterprises,* March 31, 1949). As early as 1948 a congressional committee (Senate Committee Report no. 974 on the RFC act) had noted that attempts to influence the business judgments of RFC by the use of political influence. even though well intended, were a constant menace to sound administration. In a report in 1951, the senate banking and currency committee (Report no. 649) complained of the increasing practice of applicants seeking direct access to the directors of the RFC through members of the Democratic national committee; and many cases of corruption were aired.

Despite this, the Democratic majority of the banking and currency committee in 1951 proposed only to correct abuses, not to destroy the RFC, for the majority emphasized the important financing contributions of the RFC in a financial market that was imperfect at best. Once the Republicans came into power in 1953, however, they provided for a quick liquidation of the RFC (RFC Liquidation act, July 30, 1953). Effective June 30, 1957, the RFC was abolished and its remaining functions transferred to the Housing and Home Finance agency, the General Services administration, the Small Business administration and the treasury department.

During 21 years and 8 months of RFC lending, more than $12,000,000,000 was disbursed. When, in Sept, 1953, its lending authority was terminated, it had $800,000,000 outstanding in loans, securities and commitments. Aside from its peacetime activities, the RFC under legislation in 1940 and 1950 had assumed large military responsibilities; *e.g.,* purchases of strategic items, building of plant facilities. (S. E. H.)

RECORDER. The principal legal officer of an English city or borough having a court of quarter sessions. He must be a barrister of five years' standing, appointed by the crown. The recorder holds once in every quarter of a year, or oftener if he thinks fit. a court of quarter sessions in and for the borough He is sole judge of the court, "having cognizance of all crimes. offences, and matters cognizable by courts of quarter sessions for counties in England," except that he may not allow or levy any borough rate or grant licences (s. 165). He is not eligible to serve in parliament for the borough or to be an alderman or councillor, or stipendiary magistrate for the borough, though he is eligible to serve in parliament except for the borough. He may be appointed recorder for two or more boroughs conjointly. Appeals from the city and borough justices and under the Rating and Valuation act. 1925, are to the recorder as sole judge.

The recorder of London is judge of the lord mayor's court and one of the commissioners of the central criminal court. (See QUARTER SESSIONS, COURT OF.)

In the United States most of the states have county recorders elected by the voters of the county. In some of the states the duties of the recorder fall upon the clerk of one of the courts. In all of the states provision is made by constitution or statutes for some official to record deeds and other legal instruments. In New York the recorder is one of the criminal court judges.

RECORDER, FIPPLE FLUTE or ENGLISH FLUTE, a mediaeval flute, blown by means of a whistle mouthpiece and held vertically in front of the performer like a clarinet. It consisted of a wooden tube which was at first cylindrical or nearly so but became, as the instrument was developed and improved, an inverted cone.

Being very easy to play. the recorder enjoyed great popularity in all countries after the middle of the 18th century until the greater possibilities of the transverse flute turned the tide against it.

After 1800 a smaller variety, called the flageolet, played a certain role as an amateur instrument in England (where even double and triple flageolets were built). In the 20th century an increased interest in ancient music brought forth a renaissance of the recorder, produced in various sizes.

RECORDING, PHONOGRAPH: *see* PHONOGRAPH.

RECREATION. Recreation is easier to describe than to define. It has been variously characterized by different writers as any activity engaged in voluntarily just for the pleasure and satisfaction that it brings to the participant, whether through relaxation, refreshment of strength after toil, reneaal of spirit, the opportunity for self-expression, relief from boredom. release of emotional tension. the provision of an outlet for repressed impulses, the testing of one's powers, the attainment of a sense of achievement, the for-

getting of one's worries, sheer fun or the mere strengthening of the ego that comes from feelings of adequacy and self-esteem. Recreation is more than activity as such, however. It is activity plus an attitude on the part of the reacting individual and, of these two ingredients, the attitude of the individual is the more important.

Properly defined. the term recreation has an even broader meaning than implied thus far, for it can occur in the absence of any discernible activity. To virtually exhausted players, for example, the quiescent break that occurs between the periods of an athletic contest is likely to be recreative. Similarly, to one who bas long toiled without respite, a vacation with pay spent mainly at just resting could be highly recreative.

But inactivity is not always recreative. It is the total situation and how the individual feels with reference thereto that determines what is and what is not recreation. For example. a patient sitting in a dentist's waiting room who is scheduled to have a tooth extracted is not likely to find the period of waiting recreative. Similarly, during an economic depression, an individual long unemployed and eager to find profitable employment is likely to find his involuntary leisure not recreative but crushing. Thus. because the attitude of the individual concerned is so important, the same objective situation can be either recreative or quite the opposite.

Although recreation is sometimes defined as consisting of activities in which the individual engages just because he wants to, this statement has limitations. At certain times an individual may eat, sleep, etc., just because he wants to. Most people, however, would not regard such activities as recreation per se. But most of the remaining activities in the behaviour stream (when such reactions as eating, sleeping, etc.. are eliminated) in which the individual takes part of his own volition are considered his recreation.

Though not usually regarded as recreation, even eating and sleeping can provide a convivial background and even be essential parts of a gala occasion. This holds true, for example, for birthday parties, banquets, Christmas dinners and informal treats enjoyed with friends. At so-called "slumber parties," a popular pastime among teen-age girls in the United States, it is not the forty winks of sleep but the entire occasion that is recreative. Although we may identify one element as more prominent than another, it would be futile to try to analyze and isolate the specific elements that are recreative and those that are not. In such matters it is the total event that is recreative.

Although activities which are enjoyed by large numbers of people are usually labelled recreations, these activities are recreative only to individuals who find them so. Recreation, therefore, is more than a mere list of activities and festive occasions. Because of individual differences in tastes and preferences, no specific activity is recreative to everyone. On the other hand, under suitable circumstances such as might be found in dramatic play, for example, almost every conceivable human activity can be recreative to someone.

Recreation is sometimes defined as the physical recuperation of adults, and play as characteristic childish activity. These interpretations make a distinction between recreation and play largely because of the fact that small children often start to play immediately upon waking in the morning when they are not in need of physical recuperation. Despite the possible validity of this distinction, in order to avoid the monotonous repetition of any one word, the terms recreation, play, diversion and pastime will be employed interchangeably.

Because thousands play at what is work for professionals, it is impossible to make a sharp distinction between work and play. This fact is well illustrated by the endless amateur-professional controversy. Who is an amateur and who is not depends largely upon what game one plays, the country in which one plays it, and the decade during which it is played. Although various committees have attempted to specify who is and who is not an amateur, the definitions of all such committees have been arbitrary and unsatisfactory, and so have failed to gain general world-wide acceptance.

This discussion implies that, desirable though it might be from the view-point of the ardent behaviourist, recreation cannot be defined objectively in a way that gains general acceptance. It indicates also that it is impossible to make any accurate computation of the total time devoted to recreation or its total monetary cost. This is revealed by the great disparity in the estimates made. For example, one writer held that 5% of the money annually spent by U.S. consumers went for recreation, while another estimated that, broadly interpreted, not far from 25% of the entire U.S. national income was expended for play and recreation.

Obviously, such estimates are based on different definitions of the term recreation. The specific recreational activities engaged in by different individuals are determined by such factors as chronological age, sex, the social and geographic environment, the season of the year, economic status, the available facilities and equipment, fads and fashions and the skills and abilities of the participants.

Spectator Versus Active Participant **Activities.**—Recreations are sometimes divided into two general types: those which imply direct participation and those which involve looking on or listening to. The claim is sometimes made that witnessing games, viewing them on television or listening to radio accounts, is less beneficial than direct participation. Others challenge this allegation arguing that we misunderstand the nature of recreation when we try to impose our recreation values upon others. No one but the individual concerned is able to decide whether the role of spectator or that of active participant is more satisfying to him and hence more recreative. Relaxation, it has been argued, is one of the benefits to be obtained from recreation and it would be difficult to prove that, for those engaged in physical occupations, direct participation always provides more real relaxation from the strain of modern productive effort than does appreciative observation. Active participation is often not so much a form of recreation as an ordeal. Either because they are unqualified to perform skilfully or because they feel inadequate to play in a manner that enhances their opinions of themselves, millions are unable to enjoy direct participation, but this need not and should not preclude them from enjoying, as witnesses, the expert performances of others. Moreover, since no crustworthy method for measuring recreative values is available, the relative worth of active participation and of observation are matters of conjecture.

With reference to this entire subject, the Educational Policies commission of the National Education association maintained that it is idle to quarrel over the relative values of participation and observation. Both are important and both should be encouraged, for in the modern urban environment it is difficult to provide the space and the equipment for all who might wish to participate actively in certain kinds of activities. Therefore, many persons must engage in certain forms of recreation vicariously or not at all.

The Change in Attitude and Practice.— In earlier times the attitude of many persons was that play was wasteful and to some it was even wrong. This attitude was, in part, the product of religious convictions and was modified only gradually. The influences of Jean Jacques Rousseau, Friedrich Wilhelm Froehel, John Dewey and others were potent forces in effecting this change. By the beginning of the 20th century, the belief had gained wide acceptance that it is both undesirable and impossible to suppress either the need or the perfectly normal tendency to play; carefully planned leisure-time investment can be a direct and potent educational agent; and, if society does not provide opportunity for wholesome recreation and train the individual's capacity for seeking and finding it, the suppressed drives will frequently find various socially objectionable outlets.

It seems important, therefore, that efforts be made to enable both children and others to engage in those recreational activities which they will pursue whether they are instructed or uninstructed in them. In 1918 the National Education association adopted "worthy use of leisure" as one of seven cardinal principles of education, and in 1946, the Educational Policies commission of the National Education association stated that education for recreational pursuits is imperative. Modern schools, provide after-school and recess recreational opportunities for those of school age and by means of an expanding extracurricular program teach skills and interests that can be used by the pupils as recreation after gradua-

tion.

The legal function of the schools has been extended to include the right to provide facilities, purchase supplies and equipment and employ leaders for many kinds of community recreation. School auditoriums are supplied with stages for dramatics and portable school furniture is installed so that classrooms can readily be cleared for social occasions. In some communities classes in arts and crafts are provided for adults as well as for children, and neighbourhood clubs are permitted to use the school facilities for their recreational activities.

Churches came to assume favourable attitudes toward recreation, and some sponsor their own youth groups in which a social and recreational program receives major emphasis. Although its main purpose is religious, it is not uncommon for a church to own separate quarters that can be used for basketball, parties, dramatics, social dancing, etc. For many persons church work is a major social and recreational activity, and in some small communities and rural districts the church is the centre of the community's recreational life.

Recreation has assumed an increasingly vital role in the program of various churches, partly because it can be a powerful tool in developing church loyalty, partly because by promoting wholesome forms of recreation, the church can more effectively combat and lessen some of the depravities of civilization, and partly because of the general change in public opinion regarding man's basic need for recreation, including that of ecclesiastic authorities themselves.

Interrelations With Other Aspects of Living.—Recreation is so closely associated with other kinds of human endeavour that it is almost impossible to tell where it begins or ends. For example, most voluntary youth-serving organizations such as the Boy Scouts, the 4-H clubs and a host of others do not regard recreation as their main function. Nevertheless. it is an important feature in the program of all such groups, and it undoubtedly has much to do with their success in attracting and retaining members. This is true also for many adult organizations, such as women's clubs, fraternal orders, veterans' organizations and service clubs. The existence of numerous noonday luncheon clubs in the U.S. is probably due largely to a desire on the part of the members not merely to eat at regularly specified times but also to talk to congenial companions.

Wholesome recreation is a correlate of mental and physical health. For example, well-adjusted persons have more hobbies and they pursue them with more zest than do psychiatric patients. Although this correlation does not prove that good mental health is caused by recreational interests, many mental hygienists believe that such interests can help to direct troublesome feelings into socially approved channels and that they thus can be a valuable morale builder and a preventative of mental ill-health.

During World War II. both as a morale builder and for reasons of social hygiene, the special services division of the U.S. army, for example, provided recreation for 8,000,000 men scattered all over the world by means of movies, athletics, soldier shows, handicrafts, library service, post exchange services, games, clubs and rest camps.

Juvenile Delinquency and Recreation.—Research has shown that legally recognized delinquents differ from nondelinquents in their play behaviour, the delinquents participating more often in desultory, unguided and socially undesirable leisure-time pursuits. Although recreation is often heralded as a sovereign remedy for juvenile delinquency, it is a product of so many unfavourable causative factors that it probably cannot be eliminated by any one preventative measure. The case for recreation is sometimes hurt by overstatement of what it can do. Planned recreation can provide the opportunity for character development, but it cannot work miracles. Indeed, when the conditions are unfavourable, the participant in sports and games may learn not honesty but dishonesty.

Commercial Recreation.—Commercial recreations are those operated for monetary profit. Examples are the theatre, amusement parks, motion-picture theatres, radio and television, horse and dog races, prize fights, wrestling matches and professional sports. Although some fine programs are operated by commercial interests. the tawdry and even vicious nature of certain others resulted in nidespread criticism and popular demand for their more rigorous control. Activities and devices most often criticized are unregulated burlesque shows, pulp magazines. bingo games, fraudulent pinball machines which exploit the gullible, slot machines, sadistic comic books, roadhouses, taxi-dance halls and similar questionable resorts. Pool and billiards are sometimes condemned but chiefly because of the unsavory setting in which it is alleged they are played. When played under properly supervised conditions. such games of skill are unlikely to elicit objections.

The chief value of commercial recreation is that its promoters can provide equipment and facilities for specific types of recreation at a time when the call for them is still too slight to justify public expenditure. When public demand has increased and the need justifies the cost, public facilities can be provided. This has happened in the case of golf, tennis and several other recreations nhich are now offered in many communities by both commercial and public agencies.

Public Recreation.—Playgrounds were first established in the U.S. by philanthropic agencies to help keep underprivileged children off the streets. The Playground Association of America was organized in 1906 and renamed the National Recreation association in 1930. By means of its publications, field studies, consulting and advisory service and annual meetings, this organization led in the drive for a better understanding of community recreation systems, and also served as a public forum for the exchange of ideas and information regarding recreation in general. Any list of outstanding individual promoters of the U.S. play movement would have to include among others Henry S. Curtis, Luther Halsey Gulick, George E. Johnson and Joseph E. Lee.

Governmental responsibility for recreation was accepted in the United States on the national, state and local levels. Because leisure-time interests are far too numerous for any one agency to handle, about 35 different federal agencies rendered one or more types of recreational service in the 1950s, such as the preservation of areas of natural scenic beauty, the conservation, development and extension of fish and wildlife resources, the maintenance of national parks and forests and a host of others.

North Carolina, Vermont, Washington and California were the first states to accept recreation as a separate service of state government. Each of them created a state recreation commission empowered by law to aid local communities in developing their recreational resources. Practically every state passed enabling legislation permitting local communities to conduct recreational programs with public funds, and some states established game refuges and bird sanctuaries, as well as state parks and forests. Many also operate roadside parks and picnic areas, provide camping sites for tourists and furnish swimming, boating and other facilities.

Provisions for recreation in local communities throughout the U.S., many of which have continuous year-round, tax-supported programs, are implemented by means of municipal and school playgrounds, athletic fields, golf links, school gardens, field houses, community centres and, most important, the employment of trained leaders.

Outlook For the Future.—Modern industrial efficiency has provided man with a bewildering array of possibilities for entertaining himself, more income per family with which to pay the cost, more leisure time in which to play and more congested urban areas where children do not perform the daily chores that occupied their grandparents and where their opportunities for wholesome recreation are much curtailed. Although the machine has greatly increased man's free time, it cannot solve his problem of what to do with it. Therefore, leisure is not only an opportunity, but a social problem.

Recreation has become far more than mere diversion. It is an important social force. Its pattern is incredibly complex. It is, among other things, a big business. In many countries of Europe and in certain states of the United States the tourist or recreation business is among the most important economic assets. Recreation pulls in many directions. It merges with other things so gradually

that its boundaries are hard to locate. Perfectly respectable places of entertainment shade off imperceptibly into notorious subterfuges. This poses a problem in policing but government faces serious difficulties when it attempts to operate in the field of morals or of good taste.

Sports have long been considered useful in promoting social cohesion and as agencies for social direction. Since there probably will be even more leisure in the future, the modern community faces no more serious responsibility than that of making adequate provision for ways in which both children and adults can fill their free time with constructive and healthful recreational activities.

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PLAY THERAPY

Since play is the child's easiest and most natural medium of self-expression and an outlet for feelings which he cannot otherwise express, clinical psychologists have experimented extensively with play therapy as a method useful for diagnosing and treating children who have grave emotional problems and personality disturbances. In play therapy the ability of the preschool child to employ toys and dramatic play as a medium for expressing his fantasy life is utilized. For example, a play situation is arranged in which dolls represent the several members of the child's family. The child is asked to tell something about the dolls or to do something with them. Or he may be requested to complete a partly finished story pertaining to the dolls, or to interpret a picture.

The purpose here is to provide a means whereby the young child may indirectly and perhaps unwittingly reveal his real attitudes toward the members of his own family or toward others. In employing this technique, the therapist tries to create a permissive atmosphere which will encourage the child to express his deepest feelings, either by means of words or gestures, movements, clay modelling, finger painting, etc. The proponents of such therapy maintain that the child's play often gives insights into family situations which can be obtained by no other means. They report also that this psychotherapy often dissipates the child's unconscious conflicts and improves his self-expression, thus leading to better personal adjustment.

Play therapy has also been employed for understanding and helping children who have reading problems. Investigators even reported that, for children suffering from severe emotional conflicts, significant increases in intelligence test scores were obtained. The explanation offered for this increase was that the play therapy frees children from paralyzing inhibitions resulting from their emotional problems and that, as one result of this, the children are enabled to employ their capacities more freely and adequately. More research and analysis along these lines was needed in order that these claims might be further tested and verified.

See Virginia Mae Axline, *Play Therapy* (1947); Clark E. Moustakas, *Children in Play Therapy* (1953). (H. C. LN)

RECTIFIER, a device which converts one or more alternating-current waves into a unidirectional wave. It may be an electron tube (of either vacuum or gaseous type), vibrator, barrier-layer cell or mechanical device. Although they often serve the same purposes, rotary converters and motor-generator sets are not usually classified as rectifiers.

If an alternating-current wave is applied to the diode vacuum tube, the resulting output is a succession of pulses similar in shape to the positive portions of the input wave but separated from each other by an amount of time corresponding to the negative portions of the input wave. This is termed half-wave rectification.

Two diodes may be connected in such a manner that one will conduct when the other does not. This type of operation, called full-wave rectification, results in a continuous train of pulses.

Both the half-wave and full-wave rectifier outputs may be smoothed by inserting a capacitor across the output.

Gaseous tube operation in rectifier applications is quite similar to that of the vacuum tube but the power capabilities are much greater.

Copper-oxide rectifiers, consisting of a layer of cuprous oxide on a copper disk, and selenium rectifiers, consisting of a layer of selenium on iron, are examples of the barrier-layer types. In both cases, the boundary (barrier-layer) offers relatively low resistance to the passage of current in one direction but very high resistance to current in the other direction.

Regardless of the form it may take, the rectifier's fundamental property is one of unidirectional conductivity.

See also AMPLIFIER, ELECTRONIC. (A. L. SY.)

RECTOR, a title given to the bearers of certain ecclesiastical and academical offices. In the Roman empire, after Constantine, the title rector was borne by governors of provinces subordinate to the prefects or exarchs. In the middle ages it was given to certain secular officials (*e.g.*, the podestas of some Italian towns), but more especially to the heads of the universities, the representatives and rulers of the *universitas magistrorum et scholarium,* elected usually for a very short time. After the humanistic movement of the Renaissance the style rector was also given to the chief masters of schools containing several classes, and in some parts of modern Germany (*e.g.*, Saxony, Wiirttemberg) it continued to be used instead of the more modern title of director. Rector is also still the title of the heads of German universities, of Exeter and Lincoln colleges, Oxford, and of other institutions of higher education. As an ecclesiastical title, rector was once loosely used for rulers of the church generally, whether bishops, abbots or parish priests, but it was later confined, as in Poland and Spain, to a priest with a cure of souls, in England to the incumbent of a parish where the tithes are not impropriate and in the U.S. to the Protestant Episcopal clergyman in charge of a parish.

RECUSANT, the name given in the 16th and 17th centuries to persons, particularly to adherents of the Roman Catholic faith, who persisted in refusing to attend the services of the English Church and became thereby liable to prosecution and penalties.

REDBREAST or EUROPEAN ROBIN, *Erithacus rubecula* (Linnaeus), is the sole member of its genus, which is included in the thrush family of birds (Turdidae). The species is divided into a number of races in the Palaearctic region. The British race, *melophilus* Hartert, is famous for its close association with man and enjoys a unique place in affection and folklore. Hence British colonists overseas bestowed its name on various small redbreasted birds (*e.g.*, the American robin). Actually the breast is orange, which colour extends over the face, being divided from the olive-brown upper parts by a narrow blue-gray border. The underparts are white; the legs, bill and iris brown. The sexes are alike, and there is little difference in summer and winter. The juvenile plumage is speckled. The robin is originally a woodland bird and remains so on the European continent. Many British robins breed in woodland or its edge and winter near houses. Continental robins are migratory in the north of their range, partly so in the middle and resident in the south; in Great Britain many females, but few males, appear to migrate.

Both the biology and the folklore of the robin were intensively studied by David Lack in the period 1935–50 and his books, *The Life of the Robin* (rev. ed., London, 1947) and *Robin Redbreast* (Oxford, 1950) are standard works. Lack's technique of marking individual birds with coloured rings followed pioneer work by J. P. Burkitt in Northern Ireland. The robin shows highly developed territorial behaviour. In the breeding season each pair defends an area containing the nest against others of their own species; in winter each bird maintains a territory with equal rigidity, except in very severe weather. Robins are therefore extremely aggressive, and Lack, using stuffed dummies, was able to separate and analyze the complicated threat and courtship displays.

Robins usually nest from March to June. rearing two broods from clutches typically of five or six white, pink-spotted eggs. Nests in natural woodland sites are hard to find. but many are built in holes of walls, creepers, tins, nestboxes and various bizarre situations. Robins feed on invertebrate animals. especially worms, and on berries and food scraps.

The song is simple but melodious and can be heard almost throughout the year; after a break at midsummer it is resumed with a slightly changed quality. (B. C.)

REDBUD: *see* JUDAS TREE.

REDCAR, a municipal borough in the Cleveland parliamentary division of the North Riding of Yorkshire, Eng., on the northeast coast 8 mi. E.N.E. of Middlesbrough. Pop. (1951) 27,516. Area is 8.1 sq.mi. Lying midway along the continuous stretch of sand between the Tees estuary and Saltburn, it serves as residential town and holiday resort for the industrial population of south Tees-side. Incorporated in 1922, Redcar was growing rapidly in the 1950s. Huge industrial developments on its western boundaries include chemical works, a steel rolling mill and docks on the borough's frontage to the Tees river.

Kirkleatham hall, in the lovely village of Kirkleatham, was the home of the Turner family from the 17th century until 1948 after which it was demolished.

RED CEDAR: *see* JUNIPER.

RED CROSS, a national and international agency, was founded with the original purpose of protecting and caring for the sick and wounded of war. Later, the Red Cross extended its activities to include the prevention and alleviation of human suffering in peacetime as well as in war.

Origin of the Movement.— The Red Cross idea was born in 1859 on a battlefield in northern Italy. Henri Dunant, a young Swiss, came upon the scene of the bloody battle of Solferino. fought betneen the armies of France and Italy on one side and the Austrians on the other. About 40.000 men lay dead or dying on the battlefield. without adequate medical care. In the town of Castiglione nearby, thousands of wounded filled every available building—churches, schools and private homes—until the whole town became a temporary hosgital.

Dunant organized a corps of attendants from the people of the town, travelers, priests, housewives, anyone he could press into service, to bind wounds and to feed and comfort the injured. In 1862 Dunant published *L'n Souvenir de Solférino,* in Geneva, Switz., in which he described the horror of the plight of the thousands of wounded he had seen left without proper care.

For four years, Dunant carried on a persistent campaign throughout Europe to ensure better care for victims of war. "It should be possible," he said, "to form a society in every country when nations are at peace, in which men and women could be organized and trained so that they could give aid to the wounded in time of war." In 1863 a committee was formed, which later became the International Committee of the Red Cross, and this committee issued a call for a meeting later that year "to turn Dunant's inspiration into fact." Thirty-six delegates from 16 countries met at Geneva on Oct. 26 to 29 and there set forth the fundamental principles of the Red Cross.

A diplomatic conference was set for Aug. 8, 1864, in Geneva, at which representatives of 12 governments drew up the first international treaty whereby governments agreed to care for the wounded of war, whether friend or enemy. The outcome of this conference was the first Geneva convention (*q.v.*) to protect the wounded, the personnel caring for them and medical supplies for their use. A red cross on a uhite field was adopted as an emblem to be used so that hospitals, ambulances, doctors and nurses could be recognized on the battlefield. The International committee was urged to continue its work as guardian of the principles laid down in the convention and to promote the formation of national societies in all countries to develop the Red Cross movement and to organize aid for wounded soldiers.

As a result of experience in war. the original convention was later revised and new conventions adopted to extend protection to victims of warfare at sea (1907), to prisoners of war (1929) and to civilians in time of war (1949).

INTERNATIONAL COMMITTEE OF THE RED CROSS

The International Committee of the Red Cross (Comité International de la Croix-Rouge) is guardian of the principles of the Red Cross. Its purposes are to recognize new national Red Cross societies after verification of the basis upon which they are founded; to work for the observance and development of international humanitarian conventions (especially the Geneva conventions), to act as benevolent intermediary between governments and national Red Cross societies in time of international or civil war. In wartime it establishes information agencies concerning prisoners of war, visits the prisoners in their camps and uses all available influence to improve their material and moral conditions. Finally, in both war and peace, it acts as benevolent intermediary among governments, Red Cross societies and other relief organizations for the purpose of relieving or enabling others to relieve the suffering caused by war.

The International committee, with headquarters at Geneva, is comprised of 2j Swiss nationals, elected by the members themselves. Its activities are governed by the principles upon which the Red Cross was founded: absolute impartiality and independence, especially in political and religious matters, and equality of all the Red Cross national societies. A link between the committee and the national societies is provided by the *Bulletin international de la Croix-Rouge* (1864–) and the *Revue internationale de la Croix-Rouge* (1919–).

In 1928 the 13th International Red Cross conference, at The Hague, established the statutes of the International Red Cross, which includes the national societies. the International committee and the League of Red Cross societies. These three elements are the basis of the universal Red Cross movement, the assembly of which, the International conference, normally meets every four years.

The committee is entrusted by the International Red Cross conference with the distribution of Florence Nightingale medals, awarded periodically to the most deserving nurses of all countries. In 1917 and again in 1944 the committee was awarded the Nobel peace prize.

World War I.—At the outbreak of World War I, the committee opened the International Prisoners of War agency in Geneva with a staff of about 1.200 persons, mostly volunteers. Committee delegations visited internment camps, and facilities were obtained for the evacuation of civilians from the occupied regions of northern France, and the repatriation or accommodation in neutral countries of sick and wounded combatants and medical personnel. Committee work on the eastern front was delegated to the Danish Red Cross, which set up an extensive information bureau for this purpose in Copenhagen.

Between World Wars I and 11.—After World War I, the International committee organized the repatriation from Russia and central Europe of 450,000 prisoners of war of all nationalities. It also effected the exchange of hostages in Upper Silesia, the return of Bulgarians interned in Greece and the exchange of prisoners between Greece and Turkey. In medical relief and reconstruction work in war-stricken countries, the committee co-operated with a number of Red Cross societies and other organizations. World War I had revealed grave deficiencies in international law. notably with regard to the treatment of prisoners of war and civilian internees, and had shown the urgent need of protecting civilians. Ten years' intensive preparation led, in 1929, to the revised convention for the relief of sick and wounded combatants and the adoption of a new convention relative to the treatment of prisoners of war. Both the Gran Chaco War in the early 1930s and the Spanish civil mar (1936–39) called into action one of the International committee's most important humanitarian functions—to persuade belligerents not legally bound by conventions to accept their terms. Combatants and civilians were spared much suffering in these conflicts through the intervention of the committee's delegates. The committee also served during the wars in Ethiopia and China.

World War 11.—Under article 79 of the Prisoner of War convention, the committee opened the Central Prisoner of War agency in Geneva in Sept. 1939. The committee staff, almost half serving

without pay, maintained a card index on the location of millions of prisoners of war and internees, forwarded relief supplies, letters and telegrams to prisoners and aided in prisoner exchange. The committee's delegations made more than 11,000 visits to prisoner-of-war camps.

Relief for civilian war victims was the purpose of the Joint Relief commission of the International Red Cross, created in July 1941 by the International committee and the League of Red Cross societies. Foodstuffs, clothing and pharmaceutical supplies bought and dispatched by the commission were distributed in the war-stricken countries by national Red Cross societies and other welfare organizations in the presence, whenever possible, of a delegate of the committee. The chief countries helped were Belgium, France, Greece, Yugoslavia, the Netherlands, Norway and Poland. Relief for the famine-stricken Greek people during the winter of 1941–42 was carried out jointly by the Swedish government and the Swiss Red Cross society, with the assistance of the Turkish Red Crescent.

The strictness of the blockade and counterblockade during World War II, the scarcity of neutral shipping available and the vast extent of the relief scheme led to the creation of a Red Cross maritime transport system. The Foundation of the Organization of Red Cross Transports, set up by the committee in April 1942, had a fleet of 12 ships operating in the Atlantic, the Mediterranean and, later, in the North sea. These ships, sailing under neutral colours, were always accompanied by the committee's agents.

Special Problems.—Total warfare called into question the fundamental principles embodied in the Red Cross conventions and the international humanitarian agreements. Unforeseen problems and complex situations on a vast scale and of extreme urgency arose which had to be dealt with as they presented themselves. The committee made spontaneous appeals to belligerent governments in behalf of war victims. During World War II the committee's main task was to secure progressive improvement in implementing the conventions, especially regarding the treatment of prisoners of war. To this end, the committee made almost daily application to the detaining powers.

A convention, which had been drawn up at the 15th International Red Cross conference in Tokyo in 1934, paved the way for the protection of interned enemy aliens. However, the civilian populations subjected to evacuation, deportation and the rigours attending military occupation remained outside the scope of existing conventions. The committee had no legal basis whatever in international law for intervening in behalf of prisoners in concentration camps, which were regarded by the detaining authorities as a purely internal affair and were closed to the committee's delegates. In the autumn of 1943 the committee was able to send food parcels to civilian detainees whose exact addresses were known. But it was only during the last days of the war that several of the committee's delegates succeeded in entering certain concentration camps and saving the lives of many persons.

Two chief belligerents, the U.S.S.R. and Japan, had not ratified the Geneva Prisoner of War convention of 1929. Despite constant efforts before World War II, the committee was unable to secure agreements between Russia and Germany which would have allowed it to forward relief supplies to prisoners of war of either country. In the far east the greatest obstacles were raised to any systematic relief work by the committee, and its delegates had access only to a limited number of camps in Japan proper, Shanghai and Hong Kong.

After World War 11.—At mid-century the committee engaged in the following tasks: (1) aid and protection for many prisoners of war and civilian internees who were detained, despite the close of hostilities and steps taken for their repatriation; (2) aid to civilian populations suffering from the consequences of war; (3) preparatory work for the revision of the Geneva conventions and the establishment of a new convention for the protection of civilians in time of war. The Geneva conventions of Aug. 12, 1949, for the relief of sick and wounded members of the armed forces in the field and at sea, prisoners of war and civilians had been ratified in the mid-1950s by 52 states; (4) interventions in conflicts in Indochina, Indonesia, Kashmir, Greece, Palestine, Bengal and Korea.

LEAGUE OF RED CROSS SOCIETIES

The League of Red Cross Societies was formed in 1919, on the proposal of H. P. Davison, president of the War council of the American Red Cross, to organize an informal association of Red Cress societies to develop peacetime activities. The initial members were France, Great Britain, Italy, Japan and the United States. The foundation of the league preceded by a few weeks the signing of the covenant of the League of Nations, of which article 25 read as follows:

The Members of the League agree to encourage and promote the establishment and co-operation of duly authorized voluntary national Red Cross organizations having as purposes the improvement of health, the prevention of disease, and the mitigation of suffering throughout the world.

This was indicative of the widespread sentiment that caused the national Red Cross societies after World War I to extend their activities to relieving suffering wherever it was found.

The idea of an international movement that sought to protect mankind against its natural enemies in time of peace made an immediate appeal, and the most immediate result of the decision of the national societies and of the consequent activities of the League of Red Cross Societies was the extension of the Red Cross movement to many other countries. By the mid 1950s, the league included 74 national Red Cross societies with a total adult and junior membership of more than 105,000,000 persons. Its statutes defined among its duties the following:

To act as a permanent liaison agent between national Red Cross societies; to co-operate in all spheres of their work, especially for the improvement of health, the prevention of disease and the mitigation of suffering; to represent and to speak for the national societies on the international level in accord with resolutions adopted by the board of governors; to encourage and facilitate the establishment and the development of the activities of national societies; to be the guardian of the integrity and interests of the member societies.

The league has a board of governors comprising one representative from each member Red Cross society; and the board, when not in session, delegates its authority to an executive committee consisting of the chairman and vice-chairman of the board and representatives of 12 other societies designated by the board. The board meets biennially and the executive committee at least twice a year. The expenses of the league are met by the voluntary contributions of member societies.

The international activities of the league are supervised by the chairman of the board of governors and carried out by an international secretariat with headquarters at Geneva. In addition to the various branches of the secretary-general's office, there are technical divisions on disaster relief, health, nursing, social service and Junior Red Cross activities corresponding to the principal activities of member societies.

Among the most important functions of the league are the coordination of international relief in great natural disasters and the encouragement of interchange of technical material, experience and information on health and welfare programs by the various societies. Since the league secretariat is kept informed of all society programs, it can offer guidance to societies in developing and extending these programs. The secretariat also gives special attention to creating opportunities for frequent and regular contact between Red Cross representatives from different countries. In 1922 a program of study visits was begun under which delegates visit the headquarters of the league and of national societies to study Red Cross activities. This program is supplemented by regular visits by officers of the secretariat to the headquarters of the national societies.

The establishment of regional conferences, another important function of the league, began when the Red Cross societies of the far east were first brought together in conference in Bangkok, Thai., in 1922, and again at Tokyo in 1926. The first regional conference for central and eastern European societies was held in Warsaw, Pol., in 1923, the second in Vienna, Aus., two years later, and, after World War II, in Belgrade, Yugos., in 1947. Inter-American conferences started in Buenos Aires, Arg., in 1923, and one was held in Mexico City in 1951. These meetings facilitate

exchange of views and techniques concerned with problems common to the geographic, economic and social conditions of the respective countries and make possible collective action toward the solution of problems that transcend political boundaries.

The activities of the league in the technical fields of disaster relief, health, nursing, social service and Junior Red Cross have led to steady developments and to improved standards.

The Relief Bureau.—In 1924 the league established a relief organization to promote participation of national societies in international relief, especially in disaster. When recovery from a major disaster is beyond the resources of a government and its relief organizations, an international appeal is made and relief activities stemming from this appeal are co-ordinated by the league. After World War II the League of Red Cross Societies co-ordinated international relief in dozens of major catastrophes, through which a number of national societies provided food, clothing, medical supplies and shelter to victims of disasters in India, Pakistan, Greece, Italy, the Netherlands and other countries. For example, in 1953 the league appeal for victims of western European floods yielded relief consisting of commodities and money, contributed by 34 national societies.

The Health Bureau.—The health bureau of the league secretariat after World War II acted primarily in the promotion, extension and co-ordination of the medical and public health activities of the national societies and in providing materials for health education. In 1951 priority was given to first aid, accident prevention, blood banks, standardization of blood transfusion equipment, tuberculosis control, maternal and child health, mental health and the training of health teachers. Co-operative relations exist with the World Health organization of the United Nations, the United Nations Children's fund, the International Cnion Against Venereal Diseases, the International Blood Transfusion society. the International Union for Child Welfare and other governmental and intergovernmental agencies.

Nursing and Social Service Bureau.—The bureau, whose nursing activities are guided by an advisory committee composed of world leaders in the field, was set up originally in 1919 as a nursing bureau. In 1951 steps were taken to include a social service section. From its beginning, the bureau assisted national societies to develop public health and visiting nurse programs. Higher standards for the training of nurses were developed, and programs were extended to include instruction in home care of the sick. A significant contribution was the establishment by the league of an international nursing centre in London in 1920.

Under the auspices of the Florence Nightingale foundation, sponsored in part by the league and with the collaboration of the British Red Cross society, graduate nurses from all over the world were given supplementary training. In 1944 responsibility for the centre was transferred to the International Council of Nurses but with the league represented on the governing body.

The nursing and social service bureau set up an extensive information service, including documents collected or compiled for the use of national societies, and introduced a quarterly in English, French, German and Spanish. It also helps select candidates for Red Cross scholarships and study visit grants and helps arrange suitable training for accepted candidates. In 1951 priority was given to guidance in the organization of Red Cross nursing schools, in training nurses' aides, teaching home nursing and enrollment of qualified nursing personnel.

Junior Red Cross Bureau.—The bureau co-ordinates and promotes the work of Junior Red Cross sections in national societies throughout the world. By the early 1950s there were sections in 60 countries with more than 40,000,000 members. Many sections were in the elementary and secondary schools. In others, membership was maintained outside the schools. A newsletter published in four languages gives assistance in organizing Red Cross activities appropriate for the several age groups and suitable to the needs, resources and cultures of different countries, such as correspondence between school children, the making of albums, art exchanges and international training centres.

Co-operative Relationships.—The league maintains co-operative relationships with international governmental organizations with objectives related to Red Cross activities, such as the World Health organization, United Nations Educational. Scientific and Cultural organization, Food and Agriculture organization, International Refugee organization, Children's Fund, etc.

NATIONAL RED CROSS SOCIETIES

The national Red Cross societies were begun in most countries to support and assist the army and navy medical services in time of war. Charters granted them by governments, public demand and the absence of other resources to meet urgent social needs caused them to broaden their activities. To obtain international recognition, a national Red Cross society was required to fulfill the following conditions:

The government of its country must have adhered to the Geneva conventions; the society must have been recognized by its legal government as an auxiliary of the public authorities in the sense of the Geneva conventions; it must adopt the name and emblem of the Red Cross (except in Mohammedan countries the Red Crescent and in Iran the symbol of the Red Lion and Sun are used); its activity must extend throughout the country and its dependencies; its membership must be open to all citizens irrespective of sex, politics or religion; and, finally, it must undertake to maintain regular contact with the other national societies and with the International Committee of the Red Cross at Geneva. Only one national Red Cross society may be recognized in each country. Each national society is directed by a central committee and includes a suitable number of regional and local committees which assist the central committee and ensure co-operation from all sections of the country. In most cases there are general meetings once a year of delegates from each local branch.

National Red Cross societies are autonomous and independent within their own territory. The first national Red Cross societies came into existence in Europe immediately following the Geneva conference of 1863. There were in the mid-1950s 74 national societies in existence with headquarters in the capitals of their countries, except in Canada, the German Democratic Republic and Australia, where the headquarters are in Toronto, Dresden and Melbourne respectively. The first national societies were the French and the Italian, founded in 1864. Altogether 27 national Red Cross societies were founded before 1900 and an additional nine by the outbreak of World War I. Between that time and the beginning of World War II, another 24 national societies were founded. The remaining 14 were founded after World War II.

War Work.—National societies began early to discharge their primary duty as auxiliaries to the medical services of the armed forces. The first opportunity for the relief of the wounded by Red Cross societies occurred in the Dano-Prussian War of 1864. In the Seven Weeks' War of 1866, the Franco-German War of 1870–71, the Russo-Japanese War of 1904–05 and the Balkan Wars of 1912–13 the Red Cross societies of the belligerent countries provided ambulances, hospitals and medical and nursing personnel to the combatant forces.

World War I led to a vast expansion of Red Cross activity. The American Red Cross supplied ambulance service for the wounded, staffed and equipped base hospitals, maintained rest homes for convalescent soldiers and set up canteens for troops in transit. The British Red Cross, in collaboration with the Order of St. John of Jerusalem (*q.v.*) and the dominion societies, provided trained nurses, voluntary aid detachments, ambulances and hospitals wherever British forces were engaged. Motor ambulance convoys were organized by the British Red Cross for the evacuation of wounded, in addition to ambulance trains and (in Mesopotamia) motor ambulance launches.

Similar energy mas shown by the Red Cross societies of other belligerents, notably the French, German, Belgian, Italian, Austro-Hungarian, Russian, Serbian and Turkish societies. The Red Cross societies of such neutral countries as Switzerland: the Netherlands, Sweden, Denmark, Norway and Spain also provided assistance to prisoners of war, hospital facilities for the seriously sick and wounded and food for the occupied territories.

In World War II the work of the Red Cross societies again increased enormously. The United States armed forces, not the

American Red Cross as in World War I, operated their own hospitals and maintained their own nursing services. The American Red Cross, however, recruited and assigned 70,500 nurses to the military and established about 1,500 overseas clubs, many of which, in addition to recreation facilities, provided meals and billets. To meet military needs, the American people gave 13,000,000 pints of blood through the Red Cross blood bank program.

In World War II the British Red Cross and the Order of St. John of Jerusalem operated as a joint war organization, and their welfare workers served with British forces in all theatres of operation. Home services were adapted and increased. County committees met requests for comfort items for hospitalized sailors, soldiers and airmen. Hundreds of thousands of people were trained in first aid, many of whom joined the Air Raid Precaution organization. Although originally formed to relieve suffering among the sick and wounded of the fighting forces, the British Red Cross in 1940 extended many of its activities to civilian victims of the war. Outstanding among its many activities was packing parcels for prisoners of war who received them regularly. In all their services for prisoners of war the British Red Cross and the dominion societies worked through the International Committee of the Red Cross, in close co-operation with the American Red Cross and the societies of the Allied nations.

After World War 11.—Following World War II intergovernmental agencies financed by governments, such as the United Nations Relief and Rehabilitation administration, were formed to ease the suffering of millions of victims of war throughout the world. The Red Cross was, however, of assistance in locating families and friends separated through war and upheaval. Red Cross societies in all parts of the world co-operated in this humanitarian work. Red Cross societies, which had conducted vast civilian relief programs during and immediately following World War II, gradually limited their civilian relief work to victims of natural disasters. However, where conflicts created human needs that were not being met by intergovernmental action, Red Cross societies worked together with other agencies to extend relief. For example, in 1948 the United Nations asked the league, the International Committee of the Red Cross and the American Friends Service committee to organize a relief program to help thousands of refugees in Palestine, and in 1949 the league, working closely with the Red Cross and Red Crescent societies of Lebanon, Syria and Jordan, provided health and welfare services to more than 300,000 persons. The International committee took care of approximately the same number of refugees inside Palestine and the American Friends Service committee assumed responsibility for 212,000 in southern Palestine. The American Red Cross sent a four-man team to help conduct the relief program and furnished a large part of Red Cross supplies distributed.

In the 1950s in war-devastated Korea, about 30 national Red Cross societies provided welfare teams and supplies to help alleviate disease and poverty; in Vietnam, other Red Cross societies answered the appeal of the Vietnamese Red Cross for relief for the hundreds of thousands of refugees from the north.

Prisoner-of-War Relief.—In earlier conflicts the International Committee of the Red Cross arranged for the exchange of the sick and wounded and for the delivery of mail and food packages to prisoners of war, but during the Korean conflict, Communist authorities of China and North Korea refused to allow the committee to function in the area under Communist control. Various national Red Cross societies therefore took the initiative to provide relief to the prisoners. League activities were partly responsible for ending the stalemate over compulsory repatriation of war prisoners and for speeding exchange of sick and wounded prisoners after the Korean armistice. Red Cross societies of belligerents also provided personnel for joint teams that offered welfare services for prisoners as they were exchanged. Other prisoner exchanges effected through international Red Cross co-operation included return of Japanese prisoners of war and civil internees from China and the U.S.S.R., Greeks from Rumania, Hungary, Bulgaria and Czechoslovakia and Spaniards from Russia following World War II. Negotiations continue for return of war prisoners and civilians as long as they are detained.

Other Services.—In many national societies emphasis has been placed on the training of nurses' aides, visiting housekeepers and mothers' assistants. Red Cross programs often include public education in accident prevention, swimming and water safety and first aid, as well as beach and highway aid stations and ambulance service for emergencies. Maternal and child welfare centres and clinics, such as those of the Iranian Red Lion and Sun and the infants' clinics of the Guatemalan Red Cross, are maintained by many societies. The Indian Red Cross trains midwives. Some societies specialize in service for handicapped children; *e.g.,* the service of the Australian Red Cross to spastic children. School hygiene is emphasized by many. Summer colonies and preventoria are operated, and some societies also have homes for orphans and deserted children.

Members of the armed forces and their families are given financial aid, counseling services, referral, reporting and communications and other welfare services. Particularly in the American, Australian and Philippine societies, help for former servicemen and their dependents includes assistance in establishing veterans' claims for governmental benefits, retraining the disabled, financial assistance, supplying orthopedic appliances, etc.

Maintaining hospitals, clinics and dispensaries are the major programs of many societies, particularly in the Latin-American countries, where mobile clinics are often used for rural work. Nurses' training schools vary from the postgraduate training provided by the French Red Cross to those conducted by the British Red Cross for the training of voluntary auxiliary aides for civil defense. The training and enrollment of nurses and of personnel for ambulance, pharmaceutical, radiological, poliomyelitic and tuberculosis work are activities of many societies. Public health nursing is also a growing activity in many societies. Health education is likewise a part of Red Cross activities, including lectures and distribution of pamphlets, campaigns against tuberculosis, poliomyelitis, cancer and venereal diseases, and courses in the care of the sick and in household hygiene.

Procurement of blood for the treatment of the sick and wounded is yet another activity in many Red Cross societies. Some societies maintain blood banks; others limit their blood program to recruiting donors. Some furnish blood and blood derivatives to the armed forces as well as to civilians. Outstanding examples of comprehensive blood programs are those of the American and Canadian Red Cross societies.

Many societies, such as the Canadian Red Cross, have active international programs, including disaster relief, Junior Red Cross and co-operation with other societies.

Outpost work is featured by many societies in a variety of ways, such as the visiting housekeepers for isolated areas furnished by the Australian Red Cross, the first-aid posts and clinics of the South African society; the air ambulances of the Swedish Red Cross and those of the British Red Cross for service to the mines of Tanganyika, the east coast of Africa, Kenya and Uganda.

THE AMERICAN RED CROSS

The American Red Cross was organized in 1881 in Washington, D.C., largely through the efforts of Clara Barton, who had served as a volunteer welfare worker on the battlefields of the Civil War and had distributed relief supplies contributed by the people. While she was in Europe, regaining her health after the war, Miss Barton became familiar with the work of the Red Cross in Europe and did relief work during the Franco-German War. Returning to America, she placed all the force of her dynamic personality behind obtaining government adherence to the Geneva convention and gaining support for the Red Cross movement.

In 1881, anticipating government approval of the convention, the American Association of the Red Cross was organized with Clara Barton as its first president. That the Geneva convention was finally ratified in 1882 by the senate was largely the result of Miss Barton's writings, influence and persistent effort to have the United States join with other nations to see that proper care was given the wounded of war.

In 1900 the American Red Cross was reincorporated by congress and in 1905 was given a revised charter. The president of the

United States was to be its president and the war department, its auditor. The revised charter, largely the work of Mabel T. Boardman, in addition to recognizing the organization as the agency through which relief is extended to the armed forces in wartime, also called upon Red Cross to establish a system of national and international disaster relief.

During its first few years, Red Cross was primarily involved in helping in disaster. Time and again Red Cross was called upon to speed aid to disaster victims—to feed, clothe and shelter them and to care for the sick and injured. Besides this emergency aid, in order to help restore victims to normal living after a disaster, the organization developed a program which included repair, rebuilding and refurnishing of homes and re-establishment of small businesses on which the family depended. All help given by Red Cross is without cost to the victims, without any obligation to repay and is designed to meet family needs.

By the mid-1950s Red Cross engaged in an average of 300 disaster relief operations a year. The year 1955 was a record disaster year in Red Cross history; the organization spent $30,000,000 helping victims of 270 disasters. Emergency relief was given to 336,000 persons, and more than 36,000 families were aided through assistance in rebuilding, repairing and refurnishing homes; providing equipment and maintenance; meeting medical and hospital bills; and helping small businesses to recover. In addition to giving assistance to members of the armed services and ex-servicemen and their families, Red Cross operates a medically approved program of recreation and welfare services in military hospitals. In the mid-1950s the Red Cross spent approximately 40% of its annual budget to provide services for the armed forces, veterans and their families.

In addition to the Red Cross blood program under which, in the mid-1950s, about 165,000 volunteer donors each month gave blood to meet civilian and defense needs, the Red Cross conducts many other activities that contribute to the health, safety and well-being of the American people, including courses in home nursing, first aid and water safety, taught mostly by volunteer instructors. One of every 15 registered nurses in the country is enrolled in Red Cross for service—in disaster, epidemics and other emergencies, as well as in teaching home nursing, helping in mass X-ray programs, etc.

Each year an average of 1,500,000 volunteers serve their communities through more than 3,700 local Red Cross chapters. Red Cross volunteers work as Gray Ladies in hospitals and as nurses' aides in hospitals and clinics, drive patients to and from hospitals and clinics and provide recreation and entertainment for hospital patients and shut-ins. Other volunteers make bandages and compresses needed in hospitals; still others provide canteen service at embarkation points for servicemen, set up feeding operations in disaster areas and provide refreshments at blood centres. Nutritionists volunteer their services in activities related to food planning and budgets and nutrition education.

The American Junior Red Cross, the largest young people's organization operating in the schools, participates in a number of community and international services. Established during World War I, the organization had a membership by the mid-1950s of more than 21,000,000 enrolled through approximately 75,000 public, private and parochial schools. Among the programs promoting international understanding is the gift box program, through which each year about 200,000 gift boxes are packed by American school children and sent overseas to children in areas crippled by war or other disaster. In their communities junior members produce articles for persons in hospitals and homes for the aged, for orphans and for servicemen; serve as messengers in disaster; and take part in other service activities.

The American Red Cross has been active from the beginning in international relief work. Through the League of Red Cross Societies, the American Red Cross joins with other national societies to send supplies and other assistance to countries stricken by disaster. The American Red Cross also gives technical and advisory assistance to other societies, and has aided substantially in helping societies in war-crippled countries to re-establish and strengthen Red Cross services. It also works closely with other national societies in developing joint programs of assistance to prisoners of war.

Pioneer Work.—The American Red Cross has pioneered in a number of fields, in some of which the organization discontinued its work when tax-supported or other private agencies were created or expanded to take over meeting such needs. For example, Red Cross first launched the sale of Christmas seals to attack tuberculosis in the U.S. Later, in co-operation with the National Tuberculosis association, annual drives were carried on jointly until 1919, when Red Cross withdrew, turning the program over in its entirety to the National Tuberculosis association, together with a grant to help carry on the work. Similarly, Red Cross was the first organization to set up a national nutrition education program to teach better food habits through instruction in dietetics and household economics in 1908. Later, Red Cross joined with the U.S. department of agriculture to pioneer the school lunch program. In 1912 Red Cross began a public health nursing program, directed particularly toward providing nursing care in rural areas. Nurses, given special training through grants and loans by Red Cross, went out to rural and isolated communities as "town and country" nurses, teaching sanitation and hygiene, helping fight epidemics, counseling in proper diet, instructing in first aid, often providing the only available nursing care. As other agencies took over, Red Cross gradually withdrew from this field. By the time the program terminated in 1950, Red Cross had been responsible for establishing about 3,000 services in 3,700 chapters throughout the country. At their peak, these public health programs employed more than 2,000 nurses. In 1919 Red Cross began a national program to supply Braille books for blind servicemen. Thousands of volunteers in local chapters helped prepare the raised-image books. During the 1940s this program was taken over by the Library of Congress. Following World War I Red Cross pioneered in hospital recreation work and in medical and psychiatric social work in military and later in veterans' hospitals. Other fields in which Red Cross pioneered and in which the organization still participates are: disaster work; welfare services for the armed forces, veterans and their dependents; a nation-wide program of instruction in home nursing, first aid and water safety; a nation-wide blood program; and many others.

Red Cross is supported by voluntary contributions from the American public. Through its annual membership and fund campaign it seeks to enroll all citizens as members. In the mid-1950s, membership was about 44,000,000 including 21,000,000 junior members enrolled through the schools. The American Red Cross operates under a charter last amended by the U.S. congress in 1947. The governing body of the organization is a 50-member board of governors, 8 of whom are appointed by the president of the U.S.; 30 are elected by chapters and the remaining 12 by their fellow board members. The president of the U.S. is honorary chairman.

National headquarters are in Washington, D.C. There are four area offices—at Alexandria, Va., Atlanta, Ga., St. Louis, Mo., and San Francisco, Calif.; each has administrative responsibility for all Red Cross activities in the states under its jurisdiction.

Local chapters have a wide discretion in deciding on the Red Cross services they believe are needed in their communities. Each chapter, however, is required by charter to conduct a program of assistance to the armed forces and veterans and to engage in disaster activities. The work of each chapter is determined by a volunteer board of directors drawn from the community.

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(C. L. BT.)

RED DEER (Cervus elaphus), the male of which, the stag, par excellence, reaches a height of 4 ft. 6 in. at the shoulder. The antlers are rounded, possessing bez tines and in well-developed animals at least 12 points, the record number for a British wild specimen being 20, though an ancient Irish skull was found bearing 34 and a park specimen had 39. The tail is rather long and the coat is spotted in the young and occasionally even in the adult. The males. which alone bear antlers, often have a "mane" on the throat. and in the breeding season utter a roaring cry. There are numerous local races of the red deer, which inhabit Europe, northern Africa, Asia Minor and north Iran; the species has been successfully introduced into New Zealand. Typically a woodland animal, the red deer in Britain is now confined to open mountainsides in the highlands of Scotland, Exmoor and a few other localities, and to parks; as a result, there has been a decided decline in the size and condition of the Scottish animals, which cannot compare with those from the continent. (See DEER.)

REDDITCH, an urban district in the Bromsgrove parliamentary division of Worcestershire, Eng., 14 mi. S. of Birmingham by road. Pop. (1951) 29,183. Area 18.8 sq.mi. It is a centre for the manufacture of needles, fishhooks and fishing tackle and there is a large motorcycle and cycle works.

REDEMPTION, in religion, has both a larger association and a more limited biblical context. In the first sense it is broadly identified with salvation, atonement (*q.v.*), reconciliation and forgiveness. It refers to the action of God within history whereby mankind has been delivered from sin and death through the life, death and resurrection of Jesus Christ (see JESUS CHRIST). "In him we have redemption through his blood, the forgiveness of our trespasses according to the riches of his grace" (Eph. i, 7). The biblical metaphor is that of buying back a parcel of land or of purchasing someone from slavery. In the Old Testament redemption is usually described as deliverance from material disasters, but in Ps. cxxx it is promised that God "will redeem Israel from all his iniquities." Jesus' saying that "the Son of man also came not to be served but to serve, and to give his life as a ransom for many" (Mark x, 45) found its deepest expression in his crucifixion.

Emphasis has been placed on the voluntary and loving character of Christ's sacrificial act, on the costliness of this deliverance, on the representative and substitutionary activity of Christ in doing for men what they could not do for themselves, and on the needed response of men in faith, worship and newness of life to this initiative of God in Christ.

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REDEMPTORISTS (CONGREGATION OF THE MOST HOLY REDEEMER; CONGREGATIO SANCTISSIMI REDEMPTORIS; C.SS.R.), a religious congregation founded by St. Alfonso Maria de' Liguori (*q.v.*) at Scala, Italy, Nov. 9, 1732. Benedict XIV granted papal approbation Feb. 25. 1749. Neapolitan regalism was an obstacle to the congregation, and steps were taken to settle also in the papal states. In 1785 through St. Clement Hofbauer (*q.v.*) the congregation entered the transalpine world, and eventually secured foundations throughout Europe and, during the centenary year, 1832, the United States. The congregation now is established on the five continents. The purpose of the congregation is the sanctification of the members through the imitation of Jesus Christ and the preaching of the word of God, especially to the poor, through various means, particularly parish missions. The Redemptorists also conduct parishes and foreign missions.

The congregation, composed of priests, clerical students and lay brothers, is ruled by a superior-general, who is elected for life and resides in Rome at the general mother house. He is aided by general consultors who represent geographical areas. Provincials, vice-provincials and rectors are appointed by him. The Redemptorists number more than 8.000. There is also an order of Redemptorist nuns, founded by St. Alfonso Liguori in 1731 and approved in 1750.

See M. de Meulenieester, *Outline History of the Redemptorists* **(1956)**; G. Stebbing, *The Redemptorists* **(1924)**. (A. C. RU.)

REDFIELD, ROBERT (1897–1958). U.S. anthropologist, developed concepts that brought into a single purview preliterate tribes, folk peasantries and complex civilizations. Born Dec. 4, 1897, in Chicago, he was associated all of his life with The University of Chicago, as student, professor and dean. The son of a lanyer, Redfield married Margaret Park (daughter of the sociologist Robert E. Park) before graduating in law. A summer visit to Mexico turned him to anthropology. His Ph.D. dissertation (1928) reported field work in a community in Mexico; Tepoztlan received immediate attention as a pioneer study of the "folk" community as a way of life. After extended field work with his family in Yucatan, he showed through comparison of tribe, village, town and city how the growth of a small isolated community into a large heterogeneous society involves social disorganization and the substitution of formal institutions for a "moral order." Later, study of the civilizations of China and India, which he visited, suggested how the intellectual-aesthetic "great tradition" alters the character of small communities and their continuing "little traditions." Peasants are seen as living in small part-societies, somewhat tribal-like but affected by cities and the great tradition. Concerned with the good life as conceived by different groups, Redfield then traced continuities and changes in thought and values in the history of all mankind. In so doing he developed a new humanism in which careful and comparative methods are brought to problems that cannot escape questions of better-and-worse. The clarity of his thought and expression and the breadth of his conception greatly influenced men of affairs as he spoke for the free mind, the just society and the world united for peace. He died on Oct. 16, 1958, in Chicago.

Among his writings are Tepoztlan (1930); Chan Kom (1934); The Folk *Culture* of Yucatan (1941); *A* Village *That* Chose Progress (1950); *The* Primitive World and Its Transformations (1953); The Little Community (1955); Peasant Society and Culture (1956).

See Fay-Cooper Cole and Fred Eggan, "Robert Redfield," in *American Anthropologist,* vol. lxi, no. 4 (Aug. 1959), with full bibliography. (S. Tx.)

RED JACKET (Sagoyewatha—"he who keeps them awake") (c. 1751–1830) was a Seneca Indian chief born near Geneva, N.Y., about 1751. He was an eloquent orator—whence his Indian name—and possessed considerable influence over his people. He fought for the British during the Revolution and because of his ability as a runner was a favourite among the officers, one of whom presented him with a heavily embroidered red coat. This made him conspicuous among his people and he was henceforth known as Red Jacket. He first appeared as a conspicuous figure when he made a notable speech in opposition to the treaty which was signed at Ft. Stanwix in 1784 by the United States and the Six Nations. In 1792 he went to Philadelphia, then the capital, to conclude a treaty of friendship with the United States. Under his leadership the Senecas allied themselves with the Americans against the British in the War of 1812. Red Jacket understood the whites well and became more and more hostile to them as he realized their overwhelming power. "You are a kindhearted people, seeking your own advantages," he said in one of his speeches. He tried to consolidate his people and preserve their ancient ways and rites, but by his stand only lost his leadership. He died in Seneca village, N.Y., on Jan. 20, 1830.

REDLANDS, a city of San Bernardino county, Calif.. U.S., is situated at the foot of the San Bernardino mountains, 65 mi. E. of Los Angeles. (For comparative population figures see table in CALIFORNIA: Population.)

The city lies at the upper end of San Bernardino valley at an elevation of 1,200 to 2,100 ft , surrounded by peaks more than 10.000 ft. high. While the navel orange-growing area has been its basic economy, Redlands also provides homes for military and civilian personnel who work at nearby Norton and March air force bases and the local rocket company. Within easy commuting distance of Los Angeles, the nearby beaches, mountain resorts and desert playgrounds, with a mild sunny climate, Redlands is an ideal residential town.

The University of Redlands, affiliated with the American Baptist convention, was established in 1907. The Watchorn Lincoln memorial, the only one of its kind in the west, stands on the grounds of the public library. The San Bernardino *asistencia* is a link with the city's Spanish heritage, and the Redlands Music association provides weekly summer concerts in the Prosellis bowl.

The present city was founded in 1887 by New Englanders and incorporated in 1888. While retaining "Yankee" characteristics, it is representative of all areas of the country. A council-manager system of government was adopted in 1949.

(G. B. BE.)

REDLICH, JOSEPH (1869–1936), Austrian historian and politician, was born in Göding, Moravia, on June 18, 1869. He studied jurisprudence and history in Vienna, traveled extensively, especially in England, and in 1901 published his first work, *Die englische Lokalverwaltung (Local Government in England,* 1904). He afterward became professor at Vienna university, and sat in the Austrian parliament till 1911 as deputy for his birthplace. Both in the Austrian parliament in Vienna and the Moravian diet he did much to further the idea of an understanding between the German and Czech peoples. In 1905 he published another study of English political life: *Recht und Technik des englischen Parlamentarismus* (1905; Eng. trans., *The Procedure of the House* of *Commons,* 3 vol., 1907), a standard work on the subject and indispensable to the student. During World War I he was politically active, and in 1918 was appointed minister of finance in the Lammasch cabinet. He then retired from active politics, to produce *Das oesterreichische Staats- und Rechtsproblem* (vol. 1, 1920; vol. 2, 1926), a history of Austrian domestic policy from 1848 onward. His other works include *Das Wesen der oesterreichischen Kommunalverfassung* (1910); *The Common Law and the Case Method in American University Law Schools* (1914); *Oesterreichische Regierung und Verwaltung im Weltkriege* (English and German, 1925) and a biography, *Franz Joseph von Oesterreich* (1928). Redlich's attitude was usually rather that of a student of political theory and practice than of a pure historian, and his works were apt to be too voluminous to be easily read; but they were founded on encyclopaedic knowledge, carefully presented, and were exhaustive.

REDMAYNE, SIR RICHARD AUGUSTINE STUDDERT (1865–), K.C.B. (1914), was born at Gateshead-upon-Tyne, on July 22, 1865, and educated privately and at the Durham College of Science, Newcastle. In 1883 he became under-manager at a colliery firm in Durham, and eight years later went to South Africa. On his return in 1893 he was appointed manager of the Seaton Delaval collieries, Northumberland (1893–1902). He then obtained an appointment at Birmingham university as professor of mining. He acted as chairman on numerous government committees on questions affecting the mines, and in 1908 was appointed chief inspector of mines, a post which he held until 1920. He was chairman and governor of the Imperial Mineral Resources bureau (1918–25), and chairman of the advisory council on minerals to the Imperial institute (1925–35). His writings include *Men, Mines and Memories* (1942), *The Problem of the Coal Mines* (1945) and many official reports on mining.

REDMOND, JOHN EDWARD (1856–1918), Irish politician, son of W. A. Redmond, M.P., was born at Ballytrent. He was educated at Trinity college, Dublin, and was called to the bar at Gray's Inn in 1886, and subsequently to the Irish bar, though he never practised. He was a clerk in the vote office of the house of commons before he entered parliament in 1881 as member for New Ross. From 1883 to 1891 he represented North Wexford. As party whip he rendered great service to the Irish members by his thorough grasp of the procedure of the house. At the time of the rupture of the Irish party consequent on the Parnell scandals, Redmond was the most eloquent member of the minority who continued to recognize his leadership, and in 1891 he became the accredited leader of the Parnellites. In 1900 the two nationalist parties were amalgamated under his leadership. He contested Cork unsuccessfully in 1891, but was elected for Waterford. where he was re-elected in 1906. (For the political events under his leadership of the Irish parliamentary party up to 1910, *see* IRELAND: *History;* ENGLISH HISTORY, etc.)

Redmond obtained for the first time a position of real power in parliament after the general election in Jan. 1910. Though he had amalgamated the two Irish Nationalist parties under his own lead in 1900, he had never hitherto been able, because of the large Unionist majority of 1900 and the Liberal majority of 1906, to hold that balance of power in the house of commons which had proved such a formidable weapon in the hands first of O'Connell and then of Parnell. But the reduction of the Liberal forces in Jan. 1910 made if impossible that Asquith's government should long continue unless it found favour with Redmond.

The first use which he made of this new authority was to insist that Lloyd George's famous budget of 1909, on which the dissolution had turned, should be postponed till after the constitutional resolutions directed against the house of lords—his one object being to remove the veto of the upper house, which was the main barrier against home rule. This order of procedure was also demanded by the Labour party and by the Radicals; and the government complied. But Redmond pressed further for an assurance that the royal prerogative would be at the prime minister's disposal to overbear any rejection by the lords of the veto resolutions. He was impatient at the constitutional conference called in the summer at the beginning of King George's reign to endeavour to discover a solution by consent, and went to America to secure sympathy and funds. The conference having broken down, he conducted a strenuous campaign on behalf of the ministerial program for the second general election of the year, in spite of a harassing movement on his flank by a small party of independent Nationalists under O'Brien and Healy, who accused him of having sold the Irish vote to the government.

When the result of the polling had confirmed Redmond in his tenure of the balance of parliamentary power, he forwarded the progress of the Parliament bill in 1911 by the steady vote of his party. In the autumn he was regularly consulted on the details of the forthcoming Home Rule bill, and when the bill was introduced, in April 1912, he procured its enthusiastic acceptance from a nationalist convention in Ireland. His speeches during its passage through parliament were, on the whole, moderate; he disclaimed separation but denounced any attempt to take Ulster out of the bill as a mutilation of Ireland. In token of the union of feeling between Nationalists and Liberals, he attended the meeting of the National Liberal federation at Nottingham in Nov. 1912, and spoke for the first time on the same platform as Asquith. When the determined attitude of Ulster began to suggest to the Liberals the advisability of compromise. Redmond was very loth to agree, denouncing the Unionists and Ulster as engaged in "a gigantic game of bluff and blackmail." He insisted that Asquith's county option scheme was the extreme limit of concession. He was being pressed in Ireland by the rising power of Sinn Feiners and other extremists who had raised, in reply to Ulster, a great body of 100.000 nationalist volunteers, over whom Redmond only obtained control in June 1914 after a sharp struggle. Nevertheless he took part, at the end of July, in the abortive Buckingham Palace conference.

Then came World War I, and in the debate succeeding Sir E. Grey's famous declaration on bank holiday, Aug. 3, Redmond created a profound sensation by a speech in which he declared that the events of recent years had completely altered the nationalist feeling toward Great Britain. The government, he said, might withdraw its troops from Ireland, whose coasts would be defended by its own sons, nationalist volunteers joining with Ulster volunteers in the task. This attitude was met by the decision of the government to pass the Home Rule bill into law. suspending its operation till after the war. Redmond took an active part in promoting recruiting in Ireland, and stood on the platform in Dublin mansion house on Sept. 25 by the side of the prime minister and the lord lieutenant. Unfortunately, his efforts were only moderately successful, but he refused Asquith's offer to join the first coalition government. and he successfully opposed all attempts to apply conscription to Ireland. It was a stunning blow to him when the smouldering dissatisfaction of southern Ireland broke

out into a blaze in the Dublin rebellion of Easter 1916. He expressed his opposition in the house of commons, and lent his assistance to the attempt which was made by the government in the summer through Lloyd George to arrange an agreed settlement of the Irish question.

But the effort failed; Duke, a Unionist, was appointed chief secretary; and Redmond treated the whole transaction as a fresh outrage on Ireland, moving on Oct. 18 a resolution (which was rejected) charging ministers with maintaining a system of government in that country inconsistent with the principles for which the Allies were fighting in Europe. Next year he threatened a return of his party to the old obstructionist opposition; but when in May 1917 Lloyd George, as prime minister, suggested an Irish convention to produce a scheme of self-government, Redmond agreed; and in the convention he played a conciliatory part. During its sittings, however, his health failed, and he died in London on March 6, 1918.

See I. G. Redmond Howard, *John Redmond* (1910) ; *Home Rule: Speeches of John Redmond, M.P.,* ed. by R. Barry O'Brien (1919) ; S. Gwyn, *John Redmond's Last Years* (1919).

REDON, ODILON (1840–1916), French Symbolist painter, lithographer and etcher, was born in Bordeaux on April 20, 1840. An early friendship with the botanist Armand Clavaud stimulated his tastes in literature and philosophy and encouraged his love of drawing. He studied for a short time with Jean Léon Gérôme in Paris, but it was a meeting with the vagabond artist Rodolphe Bresdin in Bordeaux which had the greatest influence on him. During a life which was passed almost in retirement he produced 172 lithographs, 26 etchings and many paintings and drawings which are the testimonials of his sincerity, unalterable integrity and unselfish dedication to his art. The largest collection of his prints is in the Art Institute of Chicago. Due to his friendship with the poet Stéphane Mallarmé and the character of his work he is associated with the Symbolists. He died in Paris on July 6, 1916.

See André Mellério, *Odilon Redon* (1923). (H. Es.)

REDONDA: see ANTIGUA.

REDONDO BEACH, a resort city in Los Angeles county, Calif., U.S., is situated 19 mi. S.W. of Los Angeles on the Pacific ocean. Once seriously considered for the port of Los Angeles, Redondo Beach was developed in the 1880s with an iron pier and a narrow-gauge railroad. Though it mas a commercial port for some years while San Pedro was being developed, its wide beaches and sharp palisades were tourist attractions, and proinoters took advantage of its natural beauty by building fine hotels, a salt-water plunge, amusement facilities and an interurban rail line with Los Angeles. The city was incorporated in 1892 and adopted the city-manager form of municipal government in 1949. After 1945, the beach city also became a residential community for many people working in the oil refineries of Torrance, Wilmington and El Segundo. It has a public library, a symphony orchestra and a light-opera association. El Camino college (1948) and Loyola university (1911) are nearby. King harbour provides excellent boating facilities. For comparative population figures see table in CALIFORNIA : Population. (J. A. Sz.)

RED PEPPER: see CAPSICUM.

REDPOLL, the name given to several birds of the finch family (Fringillidae), allied to the linnet (*q.v.*), and possessing a reddish head. The best known is the lesser redpoll (Carduelis *linaria*). The mealy redpoll is a subspecies with a more northern range, visiting England in the winter. The type ranges over the north temperate zone. There are three additional subspecies in northern North America, but these rarely reach the U.S.

RED RIVER, sometimes called Red River of the South to distinguish it from the Red River of the North (*q.v.*), is formed in the high plains of the Texas panhandle. It flows generally eastward into Arkansas, where it turns southeast through Louisiana to its junction with the Old river, which connects the Mississippi with the Atchafalaya river. Though the Red is considered a tributary of the Mississippi, much of its normal discharge goes directly to the gulf by way of the Atchafalaya.

The Red is 1,018 mi. long; for about half this distance it serves as the Texas–Oklahoma boundary. Its drainage basin is approximately 81,300 sq.mi. Discharge at Shreveport, La., has varied from 1,500 to 260,000 cu.ft. per second. Among the many tributaries are the North Fork of the Red, Kiamichi, Little and Black (Ouachita) rivers.

Early navigation of the Red above Natchitoches, La., prior to 1832 was impeded by a jam of driftwood almost 160 mi. long. Capt. Henry M. Shreve cleared this "great raft" to Oklahoma by 1837. A later raft which formed above Shreveport was cleared in 1873. After removal of these rafts navigation prospered for a time, with Alexandria and Shreveport, La., being the chief beneficiaries. Though Fulton, Ark., 455 mi. upstream, is now considered the head of navigation, vessels drawing over four feet can reach it only a few months of the year. Most of the 1,000,000-ton annual traffic is in the lower 35 mi. portion.

In the early 1930s Denison dam was completed on the Red 726 mi. above the mouth. This multipurpose dam forms Lake Texoma, a 223-sq mi. lake with a storage capacity of over 5,500,000 ac.ft. (M. W. M.)

RED RIVER OF THE NORTH, formed by the juncture of the Bois de Sioux river from the south and the Otter Tail river from the east at the twin cities of Wahpeton, N.D., and Breckenridge, Minn. It flows north, forming the North Dakota–Minnesota boundary, then crosses the U.S.–Canadian border and enters Lake Winnipeg 40 mi. N. of Winnipeg, Man. The distance from its source to its mouth is 320 mi. but the river winds in such intricate curves over the flat plain of former glacial Lake Agassiz that the actual river mileage is 545 mi. It has cut a gorge 20 to 50 ft. deep through clay deposits throughout the greater part of its course. The principal tributaries from the west are the Assiniboine, Sheyenne, Wild Rice (of North Dakota) and Pembina rivers; from the east are the Otter Tail, Red Lake, Wild Rice (of Minnesota) and the Roseau rivers.

The river drains an agricultural region that is famous for the production of cereal grains, potatoes, sugar beets and livestock. Important recreation areas are found on the margins of the basin. The leading cities on the river are Winnipeg, and Fargo and Grand Forks, N.D. (B. L. W.)

RED RIVER SETTLEMENT, a Scottish colony founded in 1811 near the present city of Winnipeg by a philanthropic Scottish nobleman, Lord Selkirk, who at that time controlled the Hudson's Bay company and received from it a grant of 113,000 sq.mi. in the basin of the Assiniboine and Red rivers. Quarrels soon arose with the French and half-breed employees of the North-West Fur company, and were fostered by its officials. On June 19, 1816, in a fight between the rivals, Governor Semple of the Hudson's Bay company and 20 of his 27 attendants were killed, an affair known as the Battle of Seven Oaks. New settlers were sent by Selkirk and founded the village of Kildonan, now part of Winnipeg. In 1821 the rival companies united, and in 1836 repurchased from Selkirk's heirs all rights to the territory. In 1821 and in 1835 two forts, known as Lower and Upper Ft. Garry, were built to command the junction of the Red and Assiniboine rivers.

The purchase in 1869 of the territorial rights of the company by the dominion of Canada led to a rebellion and the setting up of a provisional government under Louis Riel, which was dispersed.

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RED SEA, a narrow strip of water extending south-southeast from Suez to the Strait of Bab el Mandeb in a nearly straight line, and separating the coasts of Saudi Arabia and Yemen from those of Egypt, Sudan and Eritrea. The Red sea was so named because of a free floating form of blue-green algae (*Trichodesmium* erythraeum) which has a red accessory pigment and occasionally gives a red colour to the surface waters. Its total length is about 1,200 mi., and its breadth varies from about 250 mi. in the southern half to 130 mi. in 27° 45' N., where it divides into two parts, the Gulf of Suez and the Gulf of Aqaba, separated from each other by the peninsula of Sinai. Structurally, the Red sea is part of a great rift-valley system forming one of the most

marked features of the earth's crust. The rift valley of the Jordan and the Dead sea is continued southward by the Wadi el Araba, and its submerged southern section gives the Gulf of Aqaba. This well-marked north-northeast to south-southwest line meets the north-northwest to south-southeast line, already marked in the Gulf of Suez, and together they form, to the south, the main basin of the Red sea. The rift may be traced still farther southward among the great African lakes.

This great structural depression is probably of Tertiary age, being let down between two ancient Archean blocks—Arabia and north Africa. Secondary and Tertiary deposits appear on both flanks in Egypt and Arabia, while Archean material appears at the surface in many places on the Red sea coast. These extensive earth movements were accompanied by much volcanic activity, traces of which are still evident. A group of volcanic islands occurs in 14° N., and on Jebel Teir, near 15° 30' N., jets of steam still appeared in the second half of the 20th century. The margin of the Red sea itself consists, on the Arabian side, of a strip of low plain backed by ranges of barren hills of coral and sand formation, and here and there by mountains up to 6,000 ft. and more in height. The greater elevations are for the most part formed of limestones, except in the south, where they are largely volcanic. The coasts of the Gulf of Aqaba are steep, with numerous coral reefs on both sides. On the African side there are, in the north, wide stretches of desert plain, which toward the south rise to elevated tablelands, and ultimately to the mountains of Abyssinia. The shores of the Red sea are little indented; good harbours are almost wanting in the desert regions of the north, while in the south the chief inlets are near 15° N. at Massaua, and at Kamaran, almost directly opposite. Coral formations are abundant; immense reefs, both barrier and fringing, skirt both coasts, often enclosing wide channels between the reef and the land.

Depths.—The mean depth of the Red sea is approximately 1.611 ft. and its area and volume are approximately 169,100 square miles, and 52,000 cubic miles respectively. The Gulf of Suez is shallow, with a maximum depth of about 210 ft., and outside its mouth the bottom in the Red sea slopes rather steeply to a depth of about 4,140 ft. at 27° 30′ N. The Gulf of Aqaba attains a depth of 4,200 ft. in 28° 39' N. and 34" 43' E. Its deeper waters are separated from the deep water of the Red sea by an entrance sill much of which is considerably less than 600 ft. below the surface. Along the mid-line of the Red sea an irregular trough about 30 mi. broad between the 3,000 ft. depth contours extends from 27° 30' N. to 17° N. where it is interrupted by a transverse submarine ridge rising to within 1,200 ft. of the surface. Between 25" N. and 17° N. mid-channel depths occasionally exceed 7,200 ft., with a maximum of over 9,000 ft. reported near 20° N., whereas to the south the maximum depth is about 4,020 ft. and the channel shoals to about 300 ft. off Hanish Island in crossing the entrance sill which separates the deeper basin of the Red sea from that of the Gulf of Aden. From the north end of the Red sea to the banks of Suakin and Farasan in 20° N. the 600-ft. line keeps to a belt of coral reef close inshore, but in lower latitudes the shallow coral region, 300 mi, long and 70 to 80 mi. across, extends farther and farther seaward until at 15° N., off Hodeida, the part of the channel that is deeper than 600 ft. is only 20 mi. broad, all the rest of the area being dangerous to navigation even for small vessels. The Strait of Bab el Mandeb, the southern entrance to the Red sea, is divided by Perim Island into two channels. The eastern channel is 1.7 mi. broad between the 30 ft. curves and has a maximum depth of 96 ft. The western channel preferred for navigation, is 1,020 ft. in mid-channel and is 10.4 mi. wide between Perim Island and the islands near the African coast.

Meteorology.—In the northern part, down to almost 19° N., the prevailing winds are north and northwest. The middle region, to 14°–16° N., has variable winds in an area of low barometric pressure, while in the southern Red sea southeast and east winds prevail. From June to August the northwest wind blows over the entire area; in September it retreats again as far as 16° N., south of which the winds are for a time variable. In the Gulf of Suez the prevailing wind is northerly or northwesterly, but the westerly or "Egyptian" wind occurs occasionally during winter, sometimes blowing with violence, and generally accompanied by fog and clouds of dust. Strong north-northeast winds prevail in the Gulf of Aqaba during the greater part of the year; they are weakest in April and May, sometimes giving place at that season to southerly breezes. The mean monthly air temperature ranges from 71° F. at Suez to 86° at Massaua. Rainfall is light, generally less than an inch a year along the northern shores, and nowhere exceeding about ten inches. At some points a year may pass without a trace of rain. The high temperature and great relative humidity in summer make it a difficult region for active life.

Water Temperature.—The mean annual surface temperature of the waters varies from about 75° F. near the head to 80° F. in about 22" N., to 84° in 16° N., and drops again to 82° at the Strait of Bab el Mandeb. Temperatures in February are about 5° below and in August 5° above the annual mean. Temperature is, on the whole, higher near the Arabian than the Egyptian side. During summer the temperature decreases rapidly, dropping as much as 10° in the upper 150 ft. and then decreasing more slo ly to about 70.7°, in water at depths of 600 to 1,200 ft.; this latter temperature is constant throughout the sea and the year. In winter as a consequence of increased density caused by rapid evaporation and cooling, sinking of surface water apparently occurs north of about 22° N., and the temperature changes but slightly with depth. In the southern part of the area, however, the temperature still decreases with increasing depth, but because of surface cooling the drop is less pronounced than in summer. In the Gulf of Suez temperatures are relatively low, ranging from about 64° in February to 79° in August, and decreasing quite rapidly from south to north. The waters in the Gulf of Aqaba are reportedly warmer toward the Arabian than the Sinai coast, but here as well as in the Red sea proper temperatures will vary locally in response to wind and circulation patterns; a uniform temperature of 70.2° is observed in the deeper water.

Salinity.—The salinity of the waters is very high compared to that found in the open ocean, the surface values being highest, $41^0/_{00}$ (per mille), in the Gulf of Suez, and decreasing to about $36.5^0/_{00}$ near Perim Island at the southern entrance. Below a depth of 600 ft. the salinity ranges between $41^0/_{00}$ in the north and $40.5^0/_{00}$ in the south. South of about 20° N. the salinity increases with depth, the increase being particularly rapid between 300 and 600 ft., whereas in the north, there is little change from top to bottom. In general the surface salinity is somewhat greater on the western than the eastern side. In the Gulf of Aqaba the salinity is quite uniform averaging about $40^0/_{00}$. Salinities of $50^0/_{00}$ to $55^0/_{00}$ are encountered in the Bitter lakes section of the Suez canal, but the prevailing current carries most of this water toward the Mediterranean.

Circulation.—The movements of the waters are of great irregularity and complexity, rendering navigation difficult and dangerous. Two features stand out with special distinctness; the exchange of water between the Red sea and the Indian ocean, and the tidal streams of the Gulf of Suez. During the north-northwest winds of summer surface water and a layer of highly saline bottom water flows from the Red sea to the Gulf of Aden, and between these layers a contrary current of Indian ocean water sets into the Red sea. In winter surface waters enter the Red sea from the Gulf of Aden but Red sea water continues to discharge at depth. The water carried by the bottom current was formed and sank in the northern part of the Red sea in winter and has a high salinity and temperature and a low concentration of dissolved oxygen. Through these characteristics it has been traced at intermediate depths in the Indian ocean south past the equator. In the Gulfs of Suez and Aqaba, almost the only part of the Red sea in which tidal phenomena are well developed, a sharply defined tidal circulation is found. Elsewhere, the surface movements at least are controlled by the prevailing winds, which give rise in places to complex transverse currents, and near the coast are modified by the channels enclosed by the coral reefs. During the prevalence of the north and northwest winds the surface level of the northern part is depressed by as much as two feet.

The Red sea was important in Egyptian maritime commerce at least as early as the 2nd millennium B.C. and it had associations

with India early in the 1st millennium B.C. Under the Arabs the Red sea was an important highway of trade with connections to India, Persia and east Africa. This sea helped to keep Islam in touch with the thinkers of the east and with the glories of the ancient world during the dark ages in the west; with the revolutions in shipping and movement by sea that followed the age of discovery the Red sea seemed to retreat into the background; but with the cutting of the Suez canal (1869) and the shortening of the route to India, Australia and the east, the Red sea not only recovered its former importance but became one of the greatest commercial highways in the world.

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REDSHANK, the name of a bird, Tringa *totanus*, so called from the colour of its long legs. In suitable localities it is abundant throughout the greater part of Europe and Asia, retiring southward for the winter, though a considerable number remain along the coasts of some of the more northern countries. The body of the redshank is as big as a snipe's, but its longer neck, wings and legs make it appear larger. Above. the general colour is grayish drab, freckled with black, except the lower part of the back and a conspicuous band on each wing. which are white, while the flight quills are black. The bird nests in inland localities as well as by the sea. The males in spring have a beautiful song-flight, rising and falling with quivering wings, and a striking courtship on the ground. They are very pugnacious, fights often continuing for over an hour. The redshank is very wary, and is disliked by shore gunners for giving the alarm to other species. The nest is generally concealed in a tuft of rushes or grass in the swamp whence the bird gets its sustenance, and contains four eggs of a warmly tinted brown with blackish spots or blotches.

The black, dusky or spotted redshank (T. erythropus) is a larger and less common bird, and in the greater part of Europe it only occurs on its passage to or from its breeding grounds, which are south of the Arctic circle. The spot chosen for the nest is nearly always in forests and at some distance from water. In breeding dress the head. neck. shoulders and lower parts are black, the back and rump white, while the legs become crimson. At other times of the year the plumage is similar to that of the common redshank and the legs are of the same light orange-red.

REDSTART (FIRETAIL), *Phoenicurus phoenicurus*, a small bird which is a summer visitor to Europe, where it haunts gardens, orchards and old buildings. Its habit of flirting its red tail, and the white forehead, black throat, and bay breast of the cock are distinguishing features; the hen is more plainly coloured, but the characteristic colouring and action of the tail pertain to her equally as to her mate. The nest is almost always placed in a hole of a tree or building, and contains from five to seven eggs of a delicate greenish blue, occasionally sprinkled with faint red spots. The young on assuming their feathers present a great resemblance to those of the redbreast (*q.v.*) at the same age; but the red tail, though of a duller hue than in the adult. forms even at this early age an easy means of distinguishing them. The redstart breeds regularly in all the counties of England and Wales. It also reaches the extreme north of Scotland; but in Ireland it is very rare. It appears throughout the whole of Europe in summer, and is known to winter in the interior of Africa. Several very nearly allied forms occur in Asia; one, P. aurorea, is found in Japan. The black redstart (P. ochrurus) is darker than the preceding, with a more southerly range. Like the last. however, it winters in Africa. It often haunts the vicinity of houses. The males of the black redstart seem to be more than one year in acquiring their full plumage. Allied to the redstarts are the bluethroats (*q.v.*). These groups belong to the subfamily Turdinae of the thrushes. The American redstart (Setophaga *ruticilla*) belongs to the purely new world family Mniotiltidae, and ranges from Canada (in summer) to Bolivia, but is rare on the Pacific coast. The salmon of the breast, wings, and tail of the male are replaced by yellow in the female. The painted redstart (*S.* picta) has a deep-red breast and belly. It inhabits the Mexican plateau, extending north to Arizona and New Mexico.

REDUCTION: see OXIDATION AND REDUCTION.

REDWING, a species of thrush (*q.v.*), *Turdus musicus*, a winter visitor to the British Isles, arriving in autumn about the same time as the fieldfare (*q.v.*). It is very similar to the song thrush, but it has a white streak over the eye, and the sides of its body, inner wing coverts and axillaries are reddish orange. The redwing breeds in colonies in woods in subarctic Europe and Asia to Lake Baikal. In winter it migrates as far south as north Africa and the Himalayas. Its song has often been praised, but is disappointing in comparison with that of the song thrush or blackbird. In its winter quarters it often gives a peculiar inward song in early spring, while still in flocks. Its nest and eggs resemble those of the blackbird.

REDWOOD (Sequoia sempervirens), a valuable, gigantic, coniferous tree extending along the Pacific coastal forests from southern Oregon to near Santa Barbara. Calif. The largest specimen upon which accurate measurements have been made is 364 ft. tall, 12 ft. 7 in. in diameter at breast height and about 18 ft. in maximum diameter. It is seldom found more than 3½ mi. inland or above 3,000 ft. in elevation. An unusual feature of this magnificent tree is its ability to develop thrifty, vigorous, stump sprouts which attain commercial proportions in a relatively short time. While coppice sprouts of this sort are a common feature of broad-leaved species, their occurrence among conifers is relatively rare. The allied big tree, Sequoia *gigantea* (syn. *Sequoia*dendron *giganteum*), also of California (discovered in 1850 in the Sierra Nevada), develops a much more massive bole but not quite the stature of coastal species (see SEQCOIA).

REDWOOD CITY, a city and the seat of San Mateo county, Calif., U.S., is located about 27 mi. S.E. of San Francisco on the San Francisco peninsula. Situated near the mouth of Redwood creek, it has the southernmost deep-water port on San Francisco bay. used since Spanish-Californian days when the town was on El Camino Real (historic mission trail, now a federal highway) and known as Embarcadero. Once the site of an early shipbuilding industry that served a flourishing lumber and shingle trade, the port is used mainly for the shipment of oil, cement and salt. It was first plotted in 1854 on sections of the old Rancho de las Pulgas, largest Spanish land grant in the area, dating back to 1795. Originally named Mezesville after S. M. Mezes. its Mexican founder, the town became known by its present name because of its redwood lumber business long before it was incorporated in 1867. It has been council-manager governed since 1929.

Redwood City is a residential and industrial community. The port has always attracted some industry and the number of industrial establishments grew steadily after World War II. Some of the largest electronics firms, which have made the San Francisco peninsula a centre of this industry, are located there. Redwood City's population increased by 81.1% from 1940 to 1960. For comparative population figures see table in CALIFORNIA: Population. (S. B. KN.)

REED, JOSEPH (1741–1785), U.S. politician, was born in Trenton. N.J., on Aug. 27, 1741. He graduated at Princeton in 1757, studied law in 1763–65 at the Middle Temple, London and then practised in Trenton until he moved to Philadelphia in 1770. He was aide-de-camp and military secretary to General Washington in 1775–76, and mas adjutant general in 1776–77. In 1777–78 he was a delegate to the Continental congress. From 1778 to 1781 he was president of the state executive council. During his administration the proprietary rights of the Penn family were abrogated (1779), and provision was made for the gradual abolition of slavery (1780). Reed was elected to congress in 1784, but died in Philadelphia on March 5, 1785.

The Life and Correspondence of Joseph Reed (1874), by his grandson William B. Reed is based upon the family papers.

His grandson WILLIAM BRADFORD REED (1806–76) graduated at the Pennsylvania university in 1822. He was professor of American history in the University of Pennsylvania in 1850–56, United

States minister to China in 1857–58, and in 1858 negotiated a treaty with China, proclaimed in 1860.

REED, THOMAS BRACKETT (1839–1902), U.S. statesman who as speaker of the house of representatives introduced a number of changes in the procedure of that body, was born in Portland. Me.. on Oct. 18, 1839, and graduated from Bowdoin college in 1860. Admitted to the bar in 1865, he began to practise law in Portland, and was elected to the state's house of representatives in 1868 and to the senate in 1870. From 1874 to 1877 he was city solicitor of Portland. In 1877 he was elected to the U.S. house of representatives on the Republican ticket and served continuously until 1899.

Reed's knowledge of parliamentary law and executive ability made him the leader of his party in the house, 1886–89 and speaker, 1889–91 and 1895–99. He mas a "strong" speaker in his control over proceedings; developing a committee system, he made the majority of the rules committee consist of the speaker and the chairmen of the ways and means and appropriations committees. The Reed rules, drawn by him, William McKinley and Joseph G. Cannon (*qq.v.*) were adopted Feb. 14, 1890; they provided that every member must vote unless financially interested in a measure, that members present and not voting be counted for a quorum and that no dilatory motions be entertained by the speaker. His dictatorial methods were bitterly attacked by the opposition; he was called "Czar" Reed. Nevertheless his rules and methods were adopted by the Democratic leadership in 1891–95 and the powers of the rules committee were increased. Reed's name is not associated with any particular legislation, but he exercised a powerful influence in guiding bills through congress. He vigorously opposed free silver and advocated protective tariffs. He opposed the McKinley administration on the outcome of the Spanish-American War and as a result resigned in 1899 and began the practice of law in New York city. Reed was a student, reading French literature for relaxation, and a powerful orator with a ready wit. His good humour led to many stories about him. While opinion varied as to his conduct as speaker, he was respected and admired by Republicans and Democrats as a man of rugged honesty and intense loyalty. He died in Washington, D.C., on Dec. 7, 1902. For subsequent developments in the office of speaker of the house *see* SPEAKER.

See William Robinson, *Thomas B. Reed, Parliamentarian (1930).*

(H. F. TT.)

REED, WALTER (1851–1902), U.S. bacteriologist, head of the U.S. army Yellow Fever commission, was born in Gloucester county, Va., on Sept. 13. 1851, and was educated at the University of Virginia and Bellevue Medical school (M.D., 1870). In 1875 he entered the medical corps of the U.S. army as assistant surgeon, with rank of lieutenant. In 1893 he was promoted to surgeon, with rank of major, and was made professor of bacteriology and clinical microscopy in the newly organized Army Medical school at Washington, D.C. When the Spanish-American War began, Reed was appointed chairman of a committee to investigate the causation and mode of propagation of typhoid fever, an epidemic of which had broken out among the soldiers. The committee's *Report on the Origin and Spread of Typhoid Fever in C.S. Military Camps* (published in 1904, after Reed's death) revealed a number of points concerning the disease not before known, and emphasized others that had been little appreciated.

In 1897 Reed and an associate proved erroneous the theory of Giuseppe Sanarelli that the *Bacillus icteroides* mas the specific cause of yellow fever. In 1900, when the disease broke out among U.S. troops in Cuba, Reed was made chairman of a commission to investigate its cause and method of transmission. The other members were James Carroll, Jesse W. Lazear (*q.v.*) and Aristides Agramonte. Reed's observation of many cases led him to discount the then prevalent idea that the disease was transmitted by fomites in bedding, clothing, etc., of patients suffering from yellow fever, and to revive the discarded notion of Carlos Juan Finlay that the yellow fever parasite was carried only by mosquitoes. Since the disease was not acquired by animals there was no method of proof except by experiment upon human beings. By a thorough set of experiments, in which some of his co-workers sacrificed their lives, Reed proved to a skeptical world that the yellow fever parasite was carried only by the mosquito then called *Stegomyia fasciata* (later classified as *Aedes aegypti)* and that the bite of this mosquito caused the disease only under certain conditions. Possessed of this knowledge, U.S. sanitary engineers eradicated yellow fever from Cuba (there was not one case in 1902), and it has since been largely eliminated from those parts of the world where scientific public health procedures are carried on. Reed returned in 1901 to Washington, where he died on Nov. 23, 1902. The army general hospital in Washington was named in his honour.

See H. A. Kelly, *Walter Reed and Yellow Fever* **(1923).**

REED, a term applied to several distinct species of large. water-loving grasses. The common or water reed, *Phragmites communis,* occurs along the margins of lakes, fens, marshes and placid streams, not only throughout Great Britain and the United States, but widely distributed in arctic and also in temperate regions extending into the tropics. Another very important species is *Ammophila arenaria* (also known as *Psamma arenaria),* the sea reed or marram grass, a native of the sandy shores of Europe and north Africa. Both species have been of notable geological importance, the former binding the soil and so impeding denudation, and actually converting swamp into dry land, largely by the aid of its tall (five to ten feet) close-set stems. The latter species, of which the branching rootstocks may be traced 30 or even 40 ft., is of still greater importance in holding sand dunes against the sea, and for this purpose has not only been long protected by law, but has been extensively planted on the coasts of Norfolk, Eng., the Netherlands, Gascony, etc. Other reeds are *Calamagrostis* (various species), *Gynerium argenteum* (pampas grass), etc., also *Arundo donax,* the largest European grass (6 to 12 ft. high), which is abundant in Europe. Reeds have been used from the earliest times in thatching and in other branches of construction, and also for arrows, the pipes of musical instruments, etc. Reed pens are still used in the east. Plants belonging to other orders occasionally share the name, especially the bur reed *(Sparganium)* and the reed mace *(Typha),* both belonging to the family Typhaceae. The bulrushes *(Scirpus),* belonging to the family Cyperaceae are also to be distinguished.

See also GRASSES.

REEDBUCK, a yellowish-red African antelope *(Redunca redunca),* about 30 in. high at the shoulder, with a bushy tail, a bare gland patch behind the ear, and in the male short, black, ridged horns which curve upward and outward and bend forward at the tip. There are several other African species of the genus *Redunca* to which the name of reedbuck is also applied. *See* also ANTELOPE.

REED INSTRUMENTS: *see* WIND INSTRUMENTS.

REESE, LIZETTE WOODWORTH (1856–1935), **U.S.** poet whose poetry is largely based on the rural simplicities of her childhood, was born in Baltimore county, Md., Jan. 9, 1856, and died in Baltimore, Dec. 17, 1935. She spent her childhood on the York road, near what became the village of Waverly, in what was then the outskirts of Baltimore. Educated privately, she began to teach in St. John's parish school in Waverly in 1873, and continued teaching in the public schools of Baltimore until her retirement in 1921.

Her lyric talent was strikingly evident even in her first book, *A Branch of May* (1887). and her reputation grew slowly. Her condensed form and sincerity of emotion broke with 19th-century conventional sentimentality and foreshadowed the tone and temper of 20th-century lyricism. The sonnet "Tears," published in 1891 in her fourth collection, A *Wayside Lute,* became deservedly well known. *Selected Poems* (1926) was followed by several other volumes of verse: *Little Henrietta* (1927), *White April* (1930) and *Pastures* (1933); and two books of reminiscences: A *Victorian Village* (1929) and *The York Road* (1931). (LE. BN.)

REEVE, CLARA (1729–1807), English novelist, was born at Ipswich, Suffolk. in 1729. She was an industrious writer and produced many works in prose and verse, including a history of fiction, the *Progress of Romance* (1785). Her only eminent success, however, was the novel *The Old English Baron* (1777), originally published under the title of *The Champion of Virtue.*

She died at Ipswich on Dec. 3, 1807.

REEVE, HENRY (1813–1895), English writer, an influential though inconspicuous figure in early Victorian politics, was born at Norwich, Eng., on Sept, 9, 1813, and educated at Geneva, Munich and Paris. In 1835 he translated Alexis de Tocqueville's *Démocratie en Amérique*.

In 1837 he was nominated head of the legal department of the privy council office, a post he held for 50 years. From 1840 to 1855 he wrote leading articles for the *Times*, and practically guided its foreign policy; friendships with Lords Clarendon and Granville, and with Guizot and Thiers (*qq.v.*), and his trenchant style gave his articles weight. From 1855 he edited the Edinburgh Review, contributing most of the articles on foreign affairs himself. His edition of the Memoirs of C. C. F. Greville (*q.v.*), in three series (1874, 1885 and 1887), though carefully expurgated, gave much offense. Reeve died near Bournemouth on Oct. 21, 1895.

See J. K. Laughton, **Memoirs** of . . . Henry ***Reeve***, 2 vol. (1898).

(M. R. D. F.)

REEVE, a bailiff, steward or business agent; in early English history, one entrusted with the administration of a division of a country; also the chief magistrate of a town or district. The name survives in Canada for the president of a village or town council and in the United States, in composition, as port-reeve, town-reeve, etc.

REFECTORY, the dining hall of a monastery, convent. etc. There frequently was a sort of ambo (*q.v.*), approached by steps, from which to read the lives of the saints, etc., during meals. The refectory was generally situated by the side of the south cloister (*q.v.*), so as to be removed from the church but contiguous to the kitchen.

The word is also sometimes applied to any large hall used for community meals. as in a college, school, etc.

REFEREE, a person to whom anything is referred; an arbitrator. The court of referees in England was a court to which the house of commons committed the decision of all questions as to the right of petitioners to be heard in opposition to private bills. The court was charged with the duty, as defined by a standing order, to decide upon all petitions against private bills, or against provisional orders or provisional certificates, as to the rights of the petitioners to be heard upon such petitions. In the high court of justice, under the Judicature act of 1873, cases might be submitted to three official referees, for trial, inquiry and report, or assessment of damages. Inquiry and report might be directed in any case. trial only by consent of the parties, or in any matter requiring any prolonged examination of documents or accounts, or any investigation which could not be tried in the ordinary way.

United States. — The term referee is commonly applied to persons to whom a court sends a cause or some question therein for determination or for the purpose of taking evidence and reporting upon the same. In this connection it is synonymous with such terms as auditor, commissioner, arbitrator, assessor, etc.

In some states the term is applied to a master, who is appointed in equity suits pursuant to statute as distinguished from masters appointed pursuant to the old equity practice. (See EQUITY.)

REFERENDUM AND INITIATIVE, two methods by which the wishes of the electorate may be expressed with regard to proposed legislation. They exist in a variety of forms. The referendum may be obligatory or optional. Under the former type certain classes of actions by a legislature are required, ordinarily by constitutional provision, to be referred to a popular vote for approval or rejection. Amendments to constitutions proposed by legislatures are subject in most states of the United States, for example, to an obligatory referendum. Under the optional (or facultative) referendum a specified number of voters by petition may demand a popular vote on a law passed by a legislative body. By this means the actions of a legislature may be overruled.

The referendum may also be constitutional or legislative depending on the nature of the matter referred. In the United States questions subject to the obligatory referendum are mostly constitutional while those subject to the optional referendum are invariably legislative. The obligatory and optional forms are to be distinguished from the submission by legislative bodies of particular questions to a referendum or plebiscite, the effect of which may be determinative of the issue or only advisory to the legislature.

By the initiative a specified number of voters may invoke a popular vote on a proposed state or local law or a proposal to amend the state constitution. In its direct form a proposal supported by the requisite number of voters is submitted directly to a popular vote for decision. Under the indirect form the legislature has an opportunity to enact such a proposal. If rejected, the proposition is submitted to a popular vote, in some instances with an alternative proposal by the legislature or with a statement of its reasons for rejection.

The initiative and referendum came into common use in Switzerland in the liberal reaction after the Paris revolution of 1830. In 1831 St. Gall first adopted the facultative referendum (then and for some time after called the veto), and its example was followed by several cantons before 1848. The obligatory referendum appears first in 1852 and 1854 respectively in the Valais and the Grisons, when the older system was reformed. but in its modern form it was first adopted in 1863 by the canton of rural Basel. The initiative was first adopted in 1845 by Vaud. In the cases both of the facultative referendum and of the initiative, each canton fixes the number of citizens who have a right to exercise this power. Both institutions have been used freely in federal and cantonal matters.

Suiss experience with the devices of direct legislation was influential in the'adoption of the initiative and the optional referendum in U.S. states and municipalities.

The United States. — The obligatory referendum on amendments to state constitutions proposed by state legislatures, first adopted by Connecticut in 1818, was in the second half of the 20th century the prevailing method for the amendment of state constitutions. In some states a referendum is obligatory on bond issues and a like rule is widespread in local government for bond issues, tax questions and related matters. Because of the detailed nature of state constitutions and the necessity for their frequent amendment many issues not of a nature to arouse great interest among the voters are referred to them for amendment.

In U.S. usage, the terms initiative and referendum or direct legislation refer not to the obligatory referendum but to the optional referendum on legislation and to the initiation of laws or constitutional amendments by the voters (with the assumption that a popular vote or referendum on the initiated measure will follow). These devices were adopted in the U.S. under the leadership of groups hostile to machine rule, distrustful of legislatures and with a deep faith in democracy. The belief was that by granting the people a means to overrule legislative action and to initiate popular votes on legislation, abuses at the time characteristic of state legislatures might be prevented. Conservative groups were hostile to the adoption of the institution of direct legislation. The chief resort to direct legislation was in the western states, principally in California and Oregon. It did not, however, fulfill the hopes of its advocates or the fears of its opponents. In practice the referendum is used by groups that consider themselves aggrieved by an action of the legislature and feel that they might persuade a majority of the electorate to support them in their demand that the law not go into effect. The initiative tends to be used by groups which have been unable to induce the legislature to enact a desired law. The initiative and referendum proved much less important than the obligatory referendum in bringing issues to the voters. In the legislative process as a whole the initiative and referendum are comparatively unimportant insofar as the volume of legislation directly affected is concerned. The devices may be regarded, in the words of Woodrow Wilson, as a "gun behind the door" to be used when abuses arise in the legislative body.

See also **RECALL.**

British Commonwealth. — Australia. — The Australian commonwealth constitution provides for neither the initiative nor the optional referendum, but the obligatory referendum exists with

respect to amendments to the constitution proposed by parliament. In fact the Australian electorate proved surprisingly hostile to constitutional innovation. In the first half-century of the commonwealth's life only 12 amendments were submitted to the people by referendum and of these only four were carried. The first in 1906 altered the date of senate elections, the second in 1910 enabled the commonwealth to take over state debts, the third in 1927 set up a Loan council and the fourth in 1946 confirmed the commonwealth's power to legislate upon certain social services. Proposals rejected included conscription for overseas service in 1916 and 1917, federal rent and price control in 1948, and anti-Communist legislation in 1951. The referendum was also used by the state governments.

New Zealand used the machinery of the referendum in repeated endeavours to secure the passage of prohibition — always without success. In 1949 proposals to amend the licensing laws were rejected, but off-the-course betting and the introduction of conscription were both carried by referendum.

Canada has no such obligatory referendum as Australia and in fact used the device on a national scale on only two occasions, in 1898 on the temperance issue and in 1942 when the government sought and obtained release from its pledge not to introduce conscription for service overseas. At the provincial and municipal level the referendum was much used for securing decisions on the control of liquor, resulting first in the imposition and later in the removal of prohibition in the western provinces; in local government for the submission of bylaws to the electorate. In Newfoundland in 1948 the voters were polled on the constitutional question of whether they wished to continue under commission government, or regain dominion status, or confederate with Canada. They chose the last-named course.

Ireland. — The Irish Free State constitution of 1922 made a referendum mandatory in cases of constitutional amendment and allowed for referendums on nonconstitutional issues in certain circumstances. There was also a provision for an optional initiative. In 1928 the constitutional referendum was suspended, and the optional referendum and initiative mere abolished. The 1937 constitution, however (itself ratified by plebiscite), restored the referendum (though not the initiative) in its 1922 form.

European Countries. — Formal adherence to democratic doctrines in drafting new constitutions in various European countries after World War I led to frequent provision for use of the initiative and referendum. Thus Germany's Weimar constitution of 1919 made generous provision for referenda in certain contingencies, although in fact they were little employed. The same was true of Austria. Less enthusiasm for direct democracy was felt by constitution makers after World War II, but some use of the referendum was provided for. In France the constitution originally proposed for the French republic was rejected by referendum in 1946 and its successor accepted five months later. The constitution later adopted required that any amendment must be submitted to the people unless it has obtained a two-thirds majority of the lower house of the French parliament or a three-fifths majority of both houses. In Italy the post-World War II constitution provided that 50,000 electors may present a proposal to the legislature, and, if 500,000 voters or five regional councils request it, a referendum must be held on the question of abrogating a law. Provision was also made for using the referendum as part of the amending process. Neither in France nor in Italy, however, had any of these provisions been put to the test of use by the latter 1950s.

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(V. O. K.; H. G. N.; X.)

REFLECTION. When waves of any kind traveling in one medium arrive at another in which their velocity is different, part of their energy is, in general, turned back into the first medium. This is termed reflection. If the surface of separation is smooth, *i.e.,* if the irregularities in it are small compared with the wave length of the incident disturbance, the reflection is regular; if the surface is rough each facet reflects the rays incident upon it in accordance with the laws of regular reflection *(see* OPTICS) and the reflection, as a whole, is irregular or diffuse. Consider, for example, the reflection of light at smooth and ruffled water surfaces. From the ruffled surface rays enter the eye after reflection from suitably inclined facets distributed over a wide area on the surface and a diffuse band of light is seen, while from the smooth surface only those rays reflected at the requisite angle from a small area on the surface can reach the eye. In the first case the optical system of the eye focuses the water surface on the retina just as it does all other rough surfaces. In the latter the rays appear to come from a laterally inverted replica of the luminous source situated as far below the surface as the source itself is above, and it is this image which is then focused on the retina. The diffusion of light by matt surfaces in general is an example of the same phenomenon differing only in the number and size of the facets which scatter the light. Echoes and reverberations are caused by the reflection of sound (see SOUND: *Reflection and Refraction of Sound)* and the "fading" of wireless signals (in part) by variations in the conditions under which the electromagnetic waves are reflected by the Heaviside layer in the upper atmosphere. *See* RADIO; see also references under "Reflection" in the Index volume.

REFLEX. Reflex actions consist of comparatively simple segments of behaviour in which the reactions usually occur as direct and immediate responses to particular stimuli uniquely correlated with them. Reflex actions may be regarded as universal forms of behaviour because of their widespread occurrence among all complex animals. For this reason, as well as for the fact that all psychological actions are at the same time biological events, it is essential to distinguish between psychological and purely biological reflexes.

Biological and Psychological Reflexes. — The basic criterion for distinguishing between these is that the former consist primarily of the functioning of organic structures, whereas psychological reflexes are definite interbehaviours with stimulus objects. A convincing illustration of this distinction is the contrast between unconditioned salivating reflexes and similar responses conditioned by being associated with stimulus objects other than those originally stimulating them.

Plainly, psychological reflexes are built-up adjustments to particular internal or external objects. Such conditioning processes were popularized by I. P. Pavlov (*q.v.*) and his co-workers. Pavlov. while investigating digestion, incidentally discovered that salivation occurred in dogs not only when food or acid was placed in the mouth, but also when a bell previously paired with food was sounded. What makes this a typical psychological interaction is the observable building up of co-ordinate stimulus and response functions in a unique system.

Biological reflexes and the biologist's approach to reflex actions are both exemplified by the reflex tests of the physician. When the neurologist elicits the knee jerk with his hammer stroke or the pupil-closing reflex by directing light to the eye, he is attempting to ascertain whether the organism's biological mechanisms are working properly. For this reason the stimuli may be regarded as simple energy releasers.

Development of Reflex Theory. — The notion of reflex action originally developed in a philosophical rather than scientific atmosphere. For example, René Descartes. who first elaborated the notion of reflex action, did so to distinguish between the automatic action of soulless animals and the voluntary and rational behaviour of human beings. When anatomy and physiology developed in the early 19th century. interest became centred on anatomical and physiological processes of behaviour mechanisms. Although notions of psychic or mental processes were not given up, both biologists and psychologists sought for precise biological locations of

"centres" for the production and control of actions. Actions involving mentality or consciousness were regarded as requiring brain centres, while reflex or mechanical actions were presumed to operate on the basis of isolated neural arcs located on various spinal cord levels.

Toward the end of the 19th century and the beginning of the 20th, however, the idea that animals act in parts gave way somewhat to the organismic notion that they act as units and that, therefore, the brain plays a significant part in all actions, including reflexes. In 1906 C. S. Sherrington published researches demonstrating that reflexes are very different from the traditional isolated arcs they were thought to be. Sherrington declared that the familiar diagrams of localized biological reflexes mere fictitious and insisted that they must be regarded as integrated actions of the total organism, even though they are simpler than actions classified as voluntary or rational. He also suggested that the stimuli for reflex actions were not simple energy releasers but definite environmental conditions to which the organism adjusted.

With the spread of evolutionary doctrine in the 20th century, reflex theory developed rapidly. The oversimplified notions of isolated neural mechanisms, and even the organismic concept, gave way in great part to the facts of embryological development and ecological adjustment. Important here was the work of C. J. Herrick, C. M. Child and G. E. Coghill, who showed that even simple reflexes are specialized environmental adaptations developed from original mass behaviours. The capstone of biological progress was the enlargement of the notion of reflexes to include ecologically based behaviour conditioned not only to one substitute object but to several.

Current reflex theory, then, envisages all animal behaviour, and not only reflexes, as continuous ecological evolutions. This does not in any way minimize the importance of the separate cells. tissues and organs with their normal or pathological participation in adjustments or maladjustments to environmental circumstances. The great importance of this achievement is that both biologists and psychologists are now able to describe all varieties of behaviour, from the simplest to the most complex, without invoking any vitalistic or psychic principles.

Reflexes **and** Psychological Theory. — Because of the close interrelationship of psychology and biology, the development of reflex theory exerted a great influence on psychological thinking. Especially those psychologists striving for a naturalistic evolution of their science followed the development of reflex notions and were so deeply impressed with the conditioned reflex as model that reflexology became assimilated to psychology. Early behaviourists, such as Pavlov, Karl Lashley and others, who wanted to construct laws of psychological action free from any psychic powers, overstressed the organism and hoped to trace conditioned reflex arcs through the cortex. J. B. Watson, however, advised against an invalid organism-centred viewpoint.

Later behaviourists (E. R. Guthrie, Clark Hull, E. C. Tolman, B. F. Skinner) reacted against a restricted reflexological viewpoint and stressed the conditioning process, which allowed stimulus objects and stimulating circumstances their place in the behaviour field along with the reacting organism. Conditioning became synonymous with learning. In various theories they proposed principles (contiguity of response and stimulus, the manner of stimulus reinforcement, and the effect of stimulation in reducing organic needs) to explain psychological actions. Despite the limitations of behaviouristic psychology, however, its attempt to dispense with psychic notions aided an objective psychology to emerge with broader interests than conditioned reflexes. See also CONDITIONING; ANIMAL BEHAVIOUR; BEHAVIOURISM.

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REFORMATION. This word, like "Catholic," is in itself a question-begging term; but both are adopted. if only under protest, in modern speech. By "Reformation," then, is meant that religious revolution of the 16th century which divided western Christendom into two camps — Catholic and Protestant. This was in itself a complex movement for a multiplicity of causes.

Moral Causes. — These were the most important of all, for they lay at the very root. From St. Bernard at the beginning of the 12th century to Bishop Fox, nho founded Corpus Christi college at Oxford in 1516. there is no generation from which we cannot choose orthodox and distinguished churchmen who urged the crying need for Church reform in language which might seem harsh from the pen of a modern Protestant. From Innocent III. in 1215 to Leo X. in 1512, nine great world-councils were held, with Church reform in the forefront of their programme; yet each in turn confessed the failure of its predecessors, and the Council of Trent (1545) testified to the impotence of them all.

The attempt to saddle the Black Death (1348–50) with this state of things is grossly unhistorical. Two of the greatest cardinals of the 13th century, St. Bonaventura (d. 1274) and Hugues de St. Cher (d. 1260) were among the most outspoken of all our witnesses against the clerical morals of their day. Even plainer is the testimony of another very distinguished bishop, Guillaume Durand, who was consulted for the Council of Vienne (1311). In his long memorial, he drew a terrible picture of the reigning and growing abuses, and concluded that the thing most needful was "a reformation in head and in members," that is, from the pope and his court downwards; and this became a watchword not only at succeeding councils, not only among outside critics, but sometimes of popes. It is acknowledged on all hands that the abuses emphasized at the council of 1215 were in many respects even more rampant in 1512, and that the discipline so often demanded was never realized until after the Council of Trent had completed its long work (1564).

The celibacy of the clergy had presented great and continual difficulties. (See CELIBACY.) Even so energetic a reformer as St. Anselm was practically compelled to abandon his design of separating the English clergy from their partners.

It is rare to find any mediaeval author who, if he generalizes about monks, friars and nuns at all, fails to complain of the immoral example which they too frequently set.[1] St. Bernardino of Siena (d. 1444) tells us that "very many" men of his day had no belief in Heaven, and looked upon the Christian scriptures as merely interesting figments, because of the evil lives of cloisterers and other clergy. Pope Gregory X. had said the same at the Council of Lyons (1274), and by about 1500 it had become a commonplace that the lives of the clergy were mainly responsible for the increase of heresy. And some of the most distinguished mediaeval witnesses, such as Cardinal Hugues de St. Cher (d. 1260) and St Catharine of Siena (d. 1380) point out that clerical vices were naturally reflected and even exaggerated in the laity. Again, long before Luther's appearance, orthodox Catholics were emphasizing the abusive side of many Church ceremonies' and practices; the sale of indulgences (*q.v.*), the multiplication of holy-days and the vice and riot which often marked these festivals; the abuse of the mass and of the consecrated oils for witchcraft; and the extent to which clerical immunities encouraged crimes. The laity of the later middle ages, with all their faults, were improving far more rapidly than the clergy; and this gave a proportionately increasing impetus to criticism.

Doctrine. — Here the clergy had once been supreme, and would probably have had little difficulty in maintaining their authority if they had kept unquestionable moral superiority. Few people are really interested in pushing theological enquiries very far, and, as long as men's conduct corresponds to their doctrine, the vast majority of mankind are willing to accept this at least as a working theory. and are under no temptation to question the speculative basis of practices which they approve. So long as there was no deep gulf between what the clergy actually were and what the people had a right to expect of them, free-thought was mainly limited to a few philosophers here and there, to a few weavers at their loom or cobblers at their bench, and to that dead weight of indifference, of resistance against idealism of any kind, which

[1] More than 100 orthodox witnesses are cited on pp. 379–419 of G. G. Coulton's *Five Centuries of Religion,* vol. ii.

has prevailed in every generation among the masses who need to concentrate so much of their thoughts and their labour upon the elementary problems of daily bread. We have abundant proof that the majority of the mediaeval population were not actively religious; but for a long time the enthusiastic churchman had generally nothing worse to struggle with than inertia and complacent ignorance. About the year A.D. 1000, there came a revival comparable almost to that which we call the Renaissance. With this revival we also find signs of free-thought and religious friction; an ice-bound world was now thawing; therefore it moved less regularly and under less strict control than might have been desired. Many features of the then existing dogmatic scheme had been created less by profound philosophy than by popular feeling or by comparatively unreflecting impulses. All men, for instance, had gradually grown to assume that we must take that text "many are called, but few are chosen," in its most baldly literal sense. Even in the 13th century, and in a philosopher so remarkable for balance and moderation as St. Thomas Aquinas, we find that the "feu," who shall be saved are directly contrasted with the "very many" who shall go to hell. His contemporary, the Franciscan Berthold of Regensburg, whom Roger Bacon singles out as the greatest preacher of the day, actually commits himself in one passage to a rough numerical calculation; only about one in 100,000 shall be saved; and fe mediaeval theologians put it more favourably than one in 1,000.

Moreover, they exerted all their imagination and their rhetoric to impress upon their hearers the terrible significance of this separation between the sheep and the goats. All was to depend upon the last moment of life; and, even there, it must depend mainly upon the faith in which the sinner died. Berthold asks his hearers to imagine themselves writhing white-hot within a white-hot universe until the day of judgment, when the pains will be greatly increased. Let them imagine this continuing for as many years as all the hairs that have grown upon all the beasts in this world since the creation; and, even then, the sinner will be only at the beginning of his torments. Yet Berthold was one of the kindliest of men; if he defended the current dogma with this ferociously implacable logic, it was because he had inherited it as part of the deposit of faith, and because he now found himself faced by an opposition which no student of the Reformation can afford to ignore.

Heresy. — The first half of the 12th century had witnessed the rise of several powerful heretical sects, which even the eloquence and influence of men like St. Bernard could not extinguish, though the leaders could be taken and slain. All these sects were more or less antisacerdotal; and more than one held among its chief tenets that the personal unworthiness of the priest impairs or destroys the value of the sacrament which he administers, a doctrine to which some colour had been lent by the very methods taken to combat clerical concubinage by the great pope Gregory VII. (d. 1085).

Towards the end of the century, these popular and comparatively unlearned revolts were succeeded by others of very different intellectual weight. The Waldensians [1175] took their stand upon the Bible; this they read in the vernacular, and committed to memory with a diligence which, as even their persecutors complained, ought to have shamed the orthodox out of their ignorance.

About the same time, the complete works of Aristotle began to filter into the University of Paris through translations from the Arabic, and, a little later, through more accurate versions made by orthodox scholars. The Bible led the Waldensians to deny any essential distinction between clergy and laity; but they long persisted in regarding themselves as orthodox Catholics. The new Aristotle, and especially his Arabic translators and commentators, led a certain number of Paris teachers to adopt the teaching of Averroes (*q.v.*), and thus to deny such fundamental doctrines as the personality of God, the creation, and the immortality of the soul.

But stern measures of repression, first by bishops and clergy and then by the Inquisition (*q.v.*), prevented the general diffusion of these doctrines. In southern France, indeed, about 1200, it was complained that the heretics outnumbered the Catholics; but Innocent III. exterminated them in a merciless crusade; and the new orders of friars, instituted soon afterwards, did almost as much as the sword and the Inquisition to crush movements which were necessarily sporadic and disorganized, since there was no chance of bringing that side of university scholarship into quiet and steady co-operation with the less articulate impulses of the multitudes. Moreover, from the very first, there was naturally a good deal of base leaven in these revolts; and even the Waldensians, whose original tenets resembled modern Quakerism in a good many respects, were gradually compelled, under persecution, to make common cause with other rebels whom they had begun by opposing.

Orthodoxy. — Society as a mass was not ripe for revolution; the nonconformists had too little of a positive programme to substitute for that of the conformists. For the orthodox had gradually set themselves to systematize the theology which they had inherited. Peter Lombard, bishop of Paris (d. 1164) compiled his *Sentences, i.e.*, texts from the Bible and from the fathers, arranged with comments so as to present a fairly consistent foundation upon which most of later mediaeval theology was built. St. Thomas Aquinas (d. 1274) built up a powerful constructive plea for Christianity in his *Summa contra Gentiles* and a wonderfully complete synthesis of Christian tradition with Aristotelian philosophy in his *Summa totius Theologiae.*

From the mid 13th century onwards, there was a tendency in official circles to look upon the intellectual and social equilibrium as complete; philosophers were less concerned to advance than to hold the positions already gained and to strengthen the outworks from generation to generation. Roger Bacon, the slightly older contemporary of Aquinas, might indeed criticize this imposing philosophical structure in terms which almost anticipate Huxley; it rested (he said) upon a Bible misunderstood. and an Aristotle misunderstood, and upon an almost total neglect of the physical and mathematical sciences. But Bacon exaggerates so far as Aristotle is concerned; and he, like those few who thought with him, had no chance in face of the Inquisition; therefore, though a great deal of Averroism survived at the universities, and we have evidence throughout the later middle ages for groups of "intellectuals" who treated Christianity as an outworn superstition. it was improbable that these men would ever have led a revolt. The academic tendency was rather to evade serious issues under shelter of the theory of "double truth"; things (they said) might be theologically true even while they were philosophically false. Far more important was the gradual change of thought among the masses. These, as zealous teachers complained, had always looked too grossly for tangible and immediate results. Saints' images which refused to work expected miracles might be scorned or maltreated; the failure of St. Louis' crusade led common folk to say "nowadays, Mohammed is stronger than Christ." The Black Death inflicted a terrible shock, from which. all vital things recovered rapidly, but which shook all mere conventions to their base; to that extent, it must certainly be counted among the hastening factors of the Reformation.

The popes, by their voluntary desertion of Rome for Avignon, did much to impair their prestige, especially in England. where they seemed necessarily partisans of France in the Hundred Years' War. This was expressed in popular rhymes: "The pope is a Frenchman now, but Jesus is English; let us see who will do most, Jesus or the pope!" Then came the Great Schism, with 39 years of struggle between rival popes upon whose claims, though historians are mostly in agreement, the Roman church has never pronounced so clearly and unequivocally as to render it a question settled for all time. Among contemporaries, St. Catharine of Siena was certain that Urban was true pope, and Clement a pretender. But the Spaniard, St. Vincent Ferrer, proves with every reinforcement of scholastic logic, not only that Clement is true pope, but that no man who, having heard the pleas in his favour, decides for Urban, can hope for heaven. The effect of this upon the masses can scarcely be exaggerated; it mas the schism, perhaps, which lent its greatest force to the heresy of Wycliffe. For, at the same time, popular devotions and a popular theology were growing up under the wing of the Church,

yet in considerable independence of the priesthood.

Piers Plowman is only one of many books which show how pious and thoughtful folk, outside the hierarchy, were exercised by such problems as predestination, or the damnation of virtuous non-Christians, or the papal doctrine of indulgences (*q.v.*). The multiplication of books of popular piety in the last generations before the Reformation is enormous. For good or for evil, the people were beginning to outgrow clerical tutelage. Even in the foundation of schools and hospitals, the laity were beginning not only to pay their money, as they had done for long past, but to demand control of their own foundations. There was new life everywhere about 1500; but the gains were far more secular than sacerdotal.

Economic Causes.—During the later centuries of the middle ages, clerical possessions were enormous; churchmen owned a proportion which has been variously estimated at one-fifth or one-third of the whole landed property; yet they claimed to be free of taxation by the state. This naturally led to extreme friction; the preamble of Boniface VIII.'s celebrated bull *Clericis Laicos* (1296), in which he strongly asserted this claim for immunity, runs: "That the laity are bitterly hostile to the clergy is a matter of ancient tradition which is also plainly confirmed by the experience of modern times."

Equal friction arose from the farther claim, which had gradually grown up and was finally fixed by John XXII. (1316–34), that all Church benefices belong to the pope, who may appoint whom he will. This naturally led to a systematic trade in benefices at the Roman court: "Nothing is to be had at Rome without money," wrote Aeneas Silvius, the future pope Pius II. (1458–64). The popes took from each bishop half of his year's income (annates), and proportionately from abbots of great monasteries. Justice was sold in all the Church courts even more frequently than by secular judges; from at least the 12th century onwards, it was notorious that the archdeacons derived a large proportion of their income from bribes. These economic causes for reformation are most pithily summed up in the *Hundred Grievances* of *the German Nation,* laid before Adrian VI. (1522–23) by the German princes.

The Inquisition.—Moreover, the Inquisition itself, by its very constitution, had become a terrible economic burden. It had always paid its way by wholesale confiscations; even "reconciled" heretics must lose their goods. Therefore, when heresy had been nearly stamped out among rich and conspicuous folk, and the few that remained were such as had procured some sort of illegal protection, then (as we are frankly told by the Inquisitor Eymeric, writing about 1350) princes ceased to take an interest in the Inquisition, and it languished for want of funds.

In the later middle ages, the Inquisition directed much of its energies to the suppression of witchcraft; for an enormous number of heathen customs still survived, especially among the peasantry, who formed the overwhelming majority of the population. Many peasants, said Berthold of Regensburg (1250), and especially many peasant women, cannot take any step in life without having recourse to witchcraft. Therefore, easy though it was to raise an outcry against some unpopular individual, any general enforcement of severe measures against witchcraft must have been extremely unpopular. The enormous multiplication of witch-hunts during the 15th century—for on this side Joan of Arc's fate is quite typical—was both symptom and cause of a deep gulf between the ignorant multitude and the theology of leaders like Aquinas. "Every Inquisitor whom [the Church] commissioned to suppress witchcraft was an active missionary who scattered the seeds of the belief ever more widely" (Lea). A bull of Innocent VIII. in 1484 had the practical effect that thenceforward to question the reality of witchcraft was to question the utterance of the vicar of Christ, "Thus the Inquisition in its decrepitude had a temporary resumption of activity" (Lea). Here again, however, we are to some extent anticipating; for the Inquisition was not only an economic but also a political force.

But, before quitting the economic factors, we must remember that they brought as much weakness as strength into the Reformation movement. It is evident that an economically irreproachable Church would have been as impregnable as the earliest Christian society had been; but it is equally true that the purity of reform was very early tainted by greed; so that, when force was used on both sides, there was little or no moral difference between a defensive commercialized hierarchy and an aggressive squirearchy eager for plunder.

Political Causes.—The political factor, though by itself it might never have led to actual revolt, came in at the last stage with decisive effect. It was the struggle with Protestantism which evolved the half-way principle of *cuius regio, eius religio;* "the ruler's choice determines the established religion of his territory"; and this in turn has led to our modern toleration of all creeds. But the mediaeval ideal had been one empire with one religion; and the actual conditions cannot be better described than in the words of the jurist-historian F. W. Maitland *(Canon Law in the Ch. of England, p.* 100), "We could frame no acceptable definition of a State which would not comprehend the [mediaeval] Church. What has it not that a State should have? It has laws, law-givers, law-courts, lawyers. It uses physical force to compel men to obey the laws. It keeps prisons. In the 13th century, though with squeamish phrases, it pronounced sentence of death. It is no voluntary society; if people are not born into it they are baptized into it when they cannot help themselves. If they attempt to leave they are guilty of *crimen laesae maiestatis,* and are likely to be burned. It is supported by involuntary contributions, by tithe and by tax. And, it may be added, it claims to ovemde, all the world over, the power of the secular State."

Much of this power came to the Church by a process as legitimate as that which could be claimed by most of the civil Governments. The Church had consciously modelled her organization on that of the Roman empire; and she survived when the empire went to wreck. At first there was no question of serious rivalry with the earthly state. Gregory I., in face of an imperial edict or law which he might have been excused for interpreting as a trespass upon Church privileges, had no doubt about his duty of publishing the edict as he was commanded, even while he protested against it; "What am I," he wrote to the imperial council, "but dust and a worm? . . . a man set under authority."

It was only by degrees, and not without many reactions, even under Charles's weak successors, that the popes reached a position which rendered possible the claims of Gregory VII., a man of commanding genius and rare courage. Starting from Augustine's theory of the City of God, founded by Christ, in its contrast with the earthly city, founded by Cain, Gregory insists that the papal power of binding and loosing places him above all earthly sovereigns. It enables him to annul all oaths made contrary to God's will (of which the pope is interpreter) and to absolve all subjects from allegiance to an emperor whom the pope has deposed. Innocent III. (d. 1216) reasserted these claims both in theory and in practice; and at the death of the Emperor Frederick II. in 1250 the long struggle between papacy and empire was virtually decided in favour of the former.

National Spirit.—Yet the papacy now found a more formidable rival in the growing spirit of nationalism, which, no less than imperialism, must necessarily find itself in conflict with a non-national authority claiming moral dictatorship, and therefore political dominion, over the whole western world. It has sometimes been asserted that nationalism was unknown to the middle ages; that the one Church, with one Latin tongue for all educated Europe, effaced merely national divisions. This, however, is a very superficial view. In proportion as the heterogeneous mediaeval populations consolidated into nations, they developed also the consciousness of nationality; divisions became fewer than in the dark ages, but deeper; we may say that the papacy and the Latin tongue had scarcely more to do with the ending of the Hundred Years' War than with its outbreak; and Marsilius of Padua (1324) was on unassailable historical ground when he asserted that popes had very frequently been the authors of European wars.

France was the greatest nation in the 14th century; therefore she was nationally one of the most self-conscious; and it is she who came into directest conflict with the papacy. Boniface VIII.

(d. 1302) attempted to forbid taxation of the clergy by the State; again, he claimed that "all law is enclosed in the casket of the pope's breast." In his bull *Unam Sanctam*, he proclaimed to the world: "We declare that all human beings are subject to the pontiff of Rome; and we assert, define and pronounce this tenet to be essential and necessary to salvation." This attitude led to a conflict with Philippe-le-Bel of France, in which Boniface was humbled; this, again was a prelude to the transference from Rome to Avignon, where the popes in fact, though not in pretension, became virtually subjects of the French king. Even in England, where it might be argued that the clergy themselves were becoming more papalist than ever, and where Archbishop Arundel could proclaim that it was heresy to dispute any papal decretal (1408), yet king and parliament were putting very definite limits to papal control by their Statutes of Provisors and of Praemunire. Other sovereigns presently protected themselves by similar measures.

Publicists. — For, meanwhile, in the first half of the 14th century, publicists like Marsilius of Padua and William of Ockham (see OCCAM) enunciated theories which probably represented what a good many thinkers had long since been saying confidentially to each other in universities like Paris, and in great self-governing cities like Padua. For Marsilius and Ockham, the Bible is the great rule of life for Christendom; the supreme power resides in a council of the whole Church, to which Ockham, apparently, was ready to admit women, and which may judge the pope. Indeed, Ockham is ready to conceive a Christendom without the pope; true, there are certain functions which it would be difficult to arrange otherwise, but the papacy is not essential to the Church of Christ. These speculations formed a fitting prelude to the conciliar epoch (1414–57) during which, mainly at Constance (*q.v.*) and Basel, the Church attempted to put definite constitutional limits to papal autocracy. Both councils decreed, and compelled popes practically to admit, that a general council may judge and depose even a supreme pontiff, and that the pope cannot legislate without conciliar approval.

It is true that the constitutionalists here, as in the England of 1642, over-reached themselves, and the later mediaeval papacy profited by a reaction which rendered it despotic again within the Church. But the laity never forgot; and temporal princes grew more and more accustomed to maintain their own interests in open conflict with the pope.

Two factors contributed farther to this political independence. The monastic reforms decreed by the councils of Constance and Basel, in so far as they were carried out at all, owed much of their success to the secular authorities; in this field, at any rate, it became increasingly plain that the Church was not likely to reform herself merely from within. Again, the later mediaeval popes were predominantly politicians. The papacy had become an Italian principate; the pontiffs constantly involved themselves in those civil wars which made Italy a "hostelry of pain" (Dante); and they showed no less selfishness and duplicity than the princes with whom they were contending. They were ready to go any lengths to secure a little more authority or a few more square miles of territory; as when Clement V. (1309) decreed that the resisting Venetians should be sold into slavery, and Gregory XI. and Sixtus IV. decreed the same for the Florentines and Julius II. for both Florence and Bologna. The bull by which Nicholas V. (1442) encouraged Portugal to what became the organized trade in negro slaves did not immediately show these disastrous results; but when, in 1538, Paul III. decreed slavery against all Englishmen who should dare to support Henry VIII. against the pope, nobody was deceived as to the selfishness of this political move. (For evidence on these points see articles SLAVERY and INQUISITION; also T. Brecht, *Kirche* und *Sklaverei*, p. 156.) A quarrel with this spiritual autocrat, however moral or religious might be the original cause of difference, became *ipso* facto a political quarrel. Therefore, in 1500, any spark might have kindled a general conflagration.

Martin Luther. — This spark, when it came, was in fact moral and religious; but it at once kindled the mass of inflammable politico-economic material. The pope was working his indulgences to an excess which strained loyalty to the breaking-point. Berthold of Regensburg, long ago [1250], had complained that "many thousands" went to hell because they thought themselves to have bought absolution from these "penny-preachers." Gascoigne, the great Oxford chancellor [1450], wrote ever. more strongly, in proportion to the growing evil: "Sinners say nowadays 'I care not how many or what evils I do in God's sight; for I can easily and quickly get plenary remission of all guilt and penalty by an absolution and indulgence granted me by the pope, whose written grant I have bought for 4d or 6d, or have won as a stake for a game of tennis.' " (Lib. Veritatum, p. 86; full translation in G. G. Coulton, Social Life in Britain, p. 204.)

Then, in 1517, the rupture came. A scandalous archbishop of Mainz promised Leo X. 10,000 ducats as a bribe for permission to hold three archbishoprics at the same time. This money was to be paid in part from the sums which here, as everywhere else, were being raised by the sale of indulgences for the building of St. Peter's at Rome. An Augustinian friar and university professor of Wittenberg, Martin Luther, expressed the general indignation by drafting 95 theses on the indulgence system, on which he challenged dispute with all comers.

We may say "the general indignation," for Germany was thoroughly prepared for this revolt. She had many flourishing cities, and a high general level of education for that time; the printing press had long been active; several editions of the vernacular Bible had been published. and very many little books of popular piety. The Greek and Latin classics were being studied busily, and in a far less pagan spirit than in Italy. The Inquisition, again, was comparatively inoperative in Germany; there was little chance of its nipping any doctrine in the bud before it had time to gain popular support. And, lastly, the weakness of the central Government was favourable to Luther; it was the patronage of a few local princes that sheltered his movement in its first stages.

GERMANY

The political complications were here very great; the empire contained more than 300 separate states, small and great, which often rendered little more than nominal obedience to the emperor. Luther was first summoned to Rome and then commanded to present himself before the papal legate at Augsburg (Oct. 1518). Finding that the legate practically demanded submission without discussion, Luther published his account of the interview as an appeal to the German people (Actn *Augustana*). Leo X. then sent an envoy, Miltitz, who was so tactful that a reconciliation might conceivably have been effected but for the Leipzig disputation on the papal primacy and supremacy (June 1519), to which Luther was challenged by the Dominican friar Johann Eck. Luther, in his months of preparation for this debate, discovered how many forgeries there were among the documents which seemed to tell most against him; and Eck, by driving him to the admission that not all the tenets of the Hussite heretics were wrong, widened the breach still farther. The younger university teachers were now on Luther's side; and, encouraged by the growing approbation of all classes among the laity, he began to appeal unhesitatingly and unceasingly through the pulpit and the press.

In three great treatises (1520) he took up a position from which he never after retreated on any essential point. For he had a positive programme; a national Church, free from papal interference; inspection of monasteries; limitation of holy-days and pilgrimages, and marriage for the priesthood as the best remedy for the standing disgrace of concubinage.

Leo X. met this programme with a bull (*Exsurge Domine*, June 1520) in which he condemned 41 propositions attributed to Luther. One of these is all the more significant because the condemnation was repeated in other papa1 letters: Luther had said "It is against the will of the [Holy] Spirit that heretics should be burned." The pope condemns even the least harmful of these 41 propositions as "scandalous or offensive to pious ears or calculated to lead simple minds astray": those who hold or preach any of them are henceforward excommunicate and liable, unless they repent, to all the pains and penalties of heresy. This bull was entrusted to Luther's enemy Eck; but it overshot the mark Universities and bishops would not or dared not publish it, and

Luther received encouragement from many quarters.

He was now excommunicate, and his writings were solemnly burned; he retaliated by burning the papal decretals with equal publicity. Luther had great virtues and great faults; but at this crisis even his faults had a value for the world; for his courage and self-assertion precipitated the crystallization of a thousand thoughts and impulses with which society had gradually become saturated, but which had remained in solution until now.

This Church quarrel now became the most burning question in all German politics. The young Emperor Charles V. was crowned in Oct. 1520, and fixed January for his first Diet, at Worms. He had followed the fight, and was determined to uphold the traditions of his ancestors. The princes insisted that Luther should not be placed under the ban of the empire without being heard in his defence; he was therefore summoned under a safe conduct. He decided to go, "even though there were as many devils at Worms as tiles on the house-roofs." Nearly 2,000 people came out from the city to welcome him. He was brought before the Diet (April 17) and asked whether he would retract his books and their contents; he requested a day to consider his answer. His reply on the 18th was clear and decided: "The duty that I owe to my Germany will not allow me to recant." Pressed still farther: "It is impossible for me to recant unless I am proved to be in the wrong by the testimony of Scripture or by evident reasoning." Pressed farther again, while the torches began burning down to their sockets, as to the infallibility of general councils (the infallibility of the pope was not yet a necessary article of faith) he replied that these had sometimes erred by contradicting Holy Scripture, and he could prove it. At this, the emperor made a sign to break up the meeting.

The Credo of Charles. — Next day Charles read to the diet his own profession of faith; he stressed the authority not of popes but of councils; and upon that he was firm; here is a single friar now setting up his private judgment against 1,000 years of Catholicism, and "I have therefore resolved to stake upon this cause all my kingdoms and lordships, my friends, my body and my blood, my life and my soul." He called upon the diet to help him in this crusade; but "many turned paler than death." For the antagonism was here clearly stated; Luther was ready to stake all upon his own personal convictions, and the emperor upon his own loyalty to tradition. Here, then, was the clear parting of the ways. Both sides relied, fundamentally, upon the Bible. St. Thomas Aquinas had been as convinced as any later Protestant theologian that the Bible was inerrant not only in its spiritual teaching but even on matters of historical fact.

Authority and Judgment. — The real question which had gradually grown up during the Christian centuries, and which had now come to a point, was not as to the infallibility of the Bible but as to the methods of interpretation: was the book sufficient in itself, with no light beyond God's grace and the earnest searcher's conscience, or could it be rightly interpreted only in the light of ancient tradition, and by certain divinely-constituted teachers who, whenever they met in solemn conclave, were inerrant? Luther, in asserting that general councils had sometimes contradicted the Bible, had thrown down the gauntlet; at that point the emperor had naturally dissolved the assembly but only to take up the gauntlet solemnly next day; if the princes then turned pale, it was because they saw war imminent, and knew neither where it would end nor even (in most cases) on which side they must range themselves. To many, it seemed impossible to accept the existing constitution of Church and society as sacrosanct, to the extent of condemning all radical reform as sacrilegious, and all radical reformers as faggots for the stake.

Yet, on the other hand, they saw how intimately this treatment of nonconformity as heresy, this distrust of free discussion, and these methods of physical coercion, had grown into the whole social fabric, and therefore how great was the fear lest the edifice should collapse if once a friar were allowed to publish his own biblical interpretations against those of the councils, and to persuade the community that the burning of heretics is against the will of the Holy Spirit. Therefore, in the struggle that now follows, all other auestions, however important in themselves, are subordinate to this one fundamental antithesis between authority and private judgment. Did the princes desire a world in which the deposit of faith might safely be entrusted to the reason and religious feeling and good sense of the majority, or must physical force be held over men's heads everywhere and always as a menace, and be very frequently employed in fact? Were most men so firmly assured of the fundamentals that all contrary pleas of a small minority might be mainly left to work out their own confusion (as in More's *Utopia)* or was orthodox assurance so wavering that the centre of gravity might shift under the shock of a friar's contradictions, and the Church might turn upside down, and the State with it? The risk was plainly enormous; here was Luther, willing to take that risk for himself and for the world; but few of the politicians could have faced the crisis without serious misgivings.

The Wartburg. — No compromise between Luther and the emperor was now possible; on the 26th, it was announced that his safe-conduct would expire in 21 days. He left Worms; but he was seized by the advice and with the connivance of the elector of Saxony, and carried off to the elector's castle of the Wartburg near Eisenach. The emperor signed Luther's condemnation as a pestilent heretic (May 26); but his secretary wrote to a friend in Spain: "I am persuaded this is not the end, but the beginning. . . . Since [the Emperor's edict]. Luther's books are sold with impunity at every step and corner of the streets and market places."

Luther spent nearly ten months in hiding at the castle of the Wartburg, his "Patmos," as he afterwards called it. Here his pen was unceasingly busy with controversial pamphlets and his translation of the New Testament. But his body suffered from want of exercise, and his mind from natural doubts; could so many past generations and so many estimable contemporaries have been wrong, while he, the mere friar, was right as against them all? Might he not be dragging thousands down to hell with himself? Yet his convictions constantly returned more strongly than ever; and, by a natural reaction, he felt increasing confidence in his divine commission; to doubt of this, or to remain treacherously silent, would be to incur damnation. The gulf between authority and private judgment was thenceforward too wide to be bridged; and Luther emerged from the Wartburg as a determined revolutionary. Yet he was a conservative revolutionary; and this it was which brought him out of his retirement.

His doctrines had been spreading widely; the statistics of the German press are most eloquent here; in 1517 only 37 vernacular books were printed; in 1518 there were 71, and by 1523 the number had risen to 498, of which 180 were by Luther himself. For here was a population which, far beyond all others in Europe, had already been gaining a certain familiarity with the Bible in the vernacular. Fourteen editions in High German, and four in Low German, had appeared before 1518; and, though these editions were doubtless limited and therefore expensive, yet they must have done something to permeate popular thought. Most of the great cities were becoming Lutheran; the new doctrines spread, naturally enough, in Luther's own religious order (the Austin Friars) and in his University of Wittenberg.

Here, in fact, things went too fast. One of the Wittenberg professors, Andrew Bodenstein (Carlstadt), pushed matters to extremes; he lectured and preached and wrote against almost all the traditional ceremonies.

Momentum. — At the same time, and only 60 miles away, the populous weaving centre of Zwickau was in still greater religious commotion; three of the Zwickau enthusiasts came to Wittenberg, and Carlstadt persuaded the magistrates to publish an epoch-making ordinance, which practically transferred the whole direction of Church affairs to the laity, who at the same time undertook the poor relief and the moral discipline of the city. Carlstadt went even farther, and started an iconoclastic crusade. Luther's friend and colleague Melanchthon (*q.v.*) disapproved strongly, but could do nothing. The elector also was seriously troubled; other princes were taking the Wittenberg disturbances as a text for armed intervention; and Luther risked his own personal safety to return and restore order. He preached at Wittenberg on eight

successive days: "I will preach reform, I will talk about it, I will write about it, but I will not use force or compulsion with any one. . . . The word will drop into one heart to-day, and to-morrow into another, and so will work that each will forsake the mass."

A new pope came to the throne in 1522, Adrian VI., a pious man sincerely anxious for reform. At the diet of the empire held at Nuremberg (1522–3) his nuncio pressed that serious measures should be taken against Luther, since Charles V.'s decree, however decisively worded, was practically a dead letter. The members of the diet answered by presenting a list of 100 grievances against the Church; the nuncio reported to the pope that "among a thousand men scarcely one could be found untainted by Lutheran teaching." Then Adrian died suddenly, and was succeeded by Clement VII., a Medici by birth and by nature interested less in reform than in papal prestige. His legate, Campeggio, though a most dexterous diplomatist, could effect very little. The Diet of Speyer (1524) began to plan a Church council for Germany, which would have separated from Rome and anticipated England in the formation of a national Church.

The Peasants' War.—It is from this moment that we must date "the beginning of the separation of Germany into two opposite camps of Protestant and Roman Catholic, although the real parting of the ways actually occurred after the Peasants' War" (T. M. Lindsay). That war, though precipitated by the Lutheran revolt, was essentially a mere coctinuation of the struggles described above. Luther's message was democratic; his language displayed the defects of his qualities; its extraordinary force and directness constantly tempted him into exaggeration, and added fuel to the social discontent which had smouldered for generations side by side with anti-clericalism.

Seven years after Luther's attack on the indulgence system, the peasants' revolt broke suddenly out (June 1524). It began on the upper Rhine, encouraged doubtless by the successful assertion of freedom by the Swiss. In a few weeks the conflagration spread as far north as the Harz, and eastward to Tirol and Styria; cities, knights, and even princes made terms with the insurgents or joined their ranks. But the want of efficient leadership and discipline soon made itself felt; other princes and knights, with trained soldiers at their back, beat the insurgents in one battle after another, and the main revolt was subdued before the end of 1525, leaving the peasants in a worse plight than before, though the Tirolese held out longer and gained real concessions. Luther at first had sympathized with the insurgents and protested against harsh measures; he even risked his life by going among them and preaching peace and moderation.

But soon their excesses angered and dismayed him; his tract *Against the murdering, thieving hordes of peasants* breathed fire and slaughter. Its pitiless tone may be explained, though never excused, by the disastrous reaction of this social revolt upon Luther's own revolution; the more so, since the rebels had in nearly all cases claimed religious sanctions for the movement. It was thenceforth evident that the Reformation was bound to emphasize political and social differences. Hitherto it might have been called a national movement in Germany, but henceforward it was a party-question in every sense of the word.

A Religion of State.—The story is complicated by the multiplicity and kaleidoscopic changes of these 300 German States, and especially by the confusion between the two Saxonys. Catholicism and Protestantism were exposed to all the gusts of party politics. In Luther himself the prophet often gave way to the politician; and he, who in 1525 had at first insisted that the peasants must be met not with blows but with reasons, was soon ready to call upon secular princes to draw the sword against all enemies of the Reformation. He had begun by insisting on responsibility to God alone; but now with most of the Reformers, he ended by subordinating Church to State. In July 1525, a league of Catholic princes was being formed to quench the Reformation in blood; in October, the landgrave Philip of Hesse began to frame a defensive league of Protestant princes. This support could be bought only by abandoning absolute freedom of private judgment and by allowing many ecclesiastical endowments to be secularized. In order to avoid offending the landgrave, Luther, Melanchthon and Bucer agreed in allowing him to commit bigamy; a concession which may be paralleled by a few similar licences from popes, but which, coming from these Reformers, justly scandalized the public more than the papal actions. On both sides, Catholic and Protestant, self-interest now played a very great part.

The ups and downs may be very briefly summarized. The Diet of Augsburg (Dec. 1525) did little. That of Speyer (June 1526) refused to execute the edict of Worms, and procured the decision that each prince should so act in matters of faith as to be able to answer for his conduct to God and the emperor. This gave the Reformers a most valuable breathing space, but the Catholic States were presently provoked into organizing persecution against heretical subjects; the emperor, having now made up his private quarrel with the pope, was determined to fight the innovators, and a diet at Speyer (1529) altered the tolerant decree of 1526. Six princes and 14 cities read a solemn protest at the diet against this vote; and the action of this small minority gave to the party that name of Protestant by which it has ever since been known.

Schmalkalden.—For the Diet of Augsburg (June 1530) Melanchthon drew up a confession, which minimized the differences between Lutherans and Catholics, and exaggerated those which separated Luther from the more radical Swiss reformer Zwingli. The emperor granted a respite till April 15, 1531. By that date, eight princes and 11 cities had formed at Schmalkalden a defensive league for six years. The emperor, more and more hampered by the Turkish peril, finally granted the Peace of Nuremberg (July 1532) which guaranteed the Protestants from molestation until the next general council of the Church. But Clement VII. was in no haste to call such a council; he feared the emperor's encroachments scarcely less than Luther's heresy; and, meanwhile, Protestantism gained much ground, though in Switzerland it had received a check in the death of Zwingli. When at last the general council, in spite of dissensions among the orthodox, seemed imminent, the Protestant princes refused to attend it; they renewed the Schmalkaldic League (1537) and were joined by fresh allies. The emperor formed a counter-league (Nuremberg, 1538) and war seemed imminent, when a compromise was arranged at the Diet of Frankfort (1539).

A series of conferences, from 1540 onwards, produced no real agreement. In 1544 the Peace of Nuremberg was formally prolonged for another five years; but the continual spread of Protestantism, not always without a violence equal to that which their enemies were prepared to exercise, precipitated a struggle. The long-delayed council of the Church had at last met (Trent, 1542); but the Protestants refused to attend it. The emperor declared war; the Protestants were beaten at Miihlberg (1547), and promised to send representatives to Trent, but were freed from that undertaking by Catholic dissensions. At the Diet of Augsburg (1548), Charles drew up on his own responsibility a sort of compromise, the *Interim;* and in 1551 the Protestants sent representatives to Trent.

But the Interim was naturally unpopular on both sides; and, next year, Maurice of Saxony took advantage of the emperor's twofold embarrassments with France and Turkey to turn suddenly against him; he almost succeeded in taking him prisoner. Charles, foreseeing defeat and shrinking from the humiliation, soon transferred to his brother Ferdinand of Austria the direction of German affairs (1554). Maurice was killed in the moment of victory at Sievershausen; John Frederick of Saxony died soon afterwards; but Protestantism was too deeply rooted to be shaken.

"Cuius regio, eius religio."—While the Diet of Augsburg was hesitating to grant religious peace, a rival assembly at Naumburg was attended by more princes than the diet itself, and decided to abide by the confession of Augsburg (155j). *(See* AUGSBURG, CONFESSION OF.) The diet, after many struggles, agreed to one of those compromises which leave seeds for future war. It consecrated the principle *cuius regio, eius religio;* each prince might choose for himself between Catholicism and Protestantism; his subjects must submit to that choice unless they preferred to emigrate. We must here end the story of the Reformation in Germany. The mere fact that Catholicism had been compelled, over and over again, to negotiate with Protestantism on something

like equal terms, was a death-blow to the mediaeval conception of the Church. Now, by this Peace of Augsburg, Protestantism was actually legalized for about half the population of Germany; and this proportion has since maintained itself with little alteration.

SWITZERLAND

Switzerland had broken loose from the empire in 1499; and here was plenty of fuel for Luther's spark. Ulrich Zwingli (b. 1484) was ordained priest in 1506 and soon distinguished himself as an opponent of moral abuses both in the Church and among the laity. In 1518 he succeeded in expelling the indulgence-seller of St. Peter's from the canton of Schwyz; and was promoted to the great minster of Zurich. Here his learning and zeal, aided by the strongly democratic tendencies of this city of Ziirich, made him into a combination of prophet, priest and politician. The burghers of Zurich had long exercised a disciplinary control over their clergy which was far from usual; and here also was an important printing press. Zwingli, in his campaign against the wholesale enlistment of young Switzers as mercenaries for foreign countries, was bold enough to preach also "that it is no sin to eat flesh on a fast day, though it is a great sin to sell human flesh for slaughter." This brought him into conflict with the bishop of his diocese (Constance). In 1522, by a custom general among the Swiss clergy, he contracted a connection with the widow of a citizen, and joined with ten other priests in a petition to the bishop against the law of celibacy, on the ground that this was commonly broken in Switzerland. In April 1524 he married her publicly, in defiance of the Church.

Meanwhile the magistrates had arranged a public disputation between orthodox and innovators (Jan. 1523). More than 600 clergy and representative laity attended, and the magistrates decided in Zwingli's favour. In consequence of a second disputation in the autumn, all church pictures and images were abolished; presently the monasteries were disendowed, and their funds devoted to schools and the poor. The neighbouring canton of Lucerne sent to warn Zurich against its heresies; threats were added, and Ziirich began to prepare for war. In 1525 a new form of liturgy was prescribed, severely puritanical; and in 1529 the Catholic worship was forbidden.

Division. — Meanwhile the revolt spread to other cantons. At a disputation at Baden (May 1526), which Zwingli refused to attend, 82 clerical representatives voted for the conservative side, as against 20 reformers. Yet the movement went rapidly forward, in spite of Zwingli's quarrel with the more conservative Luther, and of the set-back which followed here, as in Germany, upon the Peasants' Revolt. The forest cantons, with their comparatively primitive and scattered peasantry, were naturally on the conservative side; they had formed an anti-heretical league (April 1524); and in Zwingli the prophet became more and more overshadowed by the politician. Between 1527 and 1530 Zürich succeeded in creating a league of the greater Protestant towns, to which the five forest cantons replied by a "Christian Union" (April 1529). Each party was ready to ally itself with the foreigner; Ziirich with France, the Union with Austria. The Swiss confederacy was thus broken up into two opposing camps. The Catholics were unable to accept the full principle of mutual tolerance; and Zurich also was aggressive and intolerant. The two armies faced each other at Kappel, but peace was patched up (June 1529). This was only a truce; they met again at Kappel, where Zwingli was defeated and slain (1531). The peace now made granted to each canton the choice of its own religion, and did much also to protect minorities. The country soon settled into much the same division which still obtains: Catholicism reigned mainly in the mountains and Protestantism in the more fertile lands and in the great cities.

Geneva. — Geneva (not yet in Switzerland) deserves separate mention: it owed everything to its neutral position and to the personality of John Calvin (*q.v.*). The Genevese had lived for centuries under a prince-bishop, though with a good deal of democracy in their civic constitution; thus State and Church were more closely interwoven here than in most other cities.

In 1530 the city rebelled against its bishop; in 1534 it entered into a contract for joint citizenship with Protestant Berne; in 1536 it formally committed itself to Protestantism, and two months later Calvin settled in the city. He was a man of precociously wide and exact scholarship, bred in the law, and touched with inspiration from Erasmus and Luther at the age of 24 (1533).

Calvin's "Institution."—Next year he fled from France; in 1535 he was at Basel, where he wrote in Latin his *Institution of Christian Religion,* which he afterwards turned into French. This epoch-making book has often been misrepresented. Calvin's insistence upon the torments of hell is merely the orthodox mediaeval doctrine, in a far milder form than we find it (for instance) in St. Bernardino of Siena. His insistence upon predestination does not go far beyond St. Thomas Aquinas, whose actual words are often softened down by his modern exponents. The great value of Calvin's book was that it gave a clear and logical structure to a hitherto formless and disorganized Protestant thought, much as St. Thomas and his fellows had constructed a logical synthesis from the heterogeneous mass of Catholic traditions.

In July of 1536 Calvin passed through Geneva, where the reformer Guillaume Farel persuaded him to stay. He introduced into the city, now an independent republic, a discipline which, like his *Institution,* may easily be misunderstood. His supervision of morals and expenses and amusements was no new thing; there is practically no detail in that field which had not been insisted upon by orthodox mediaeval theologians for centuries past, and written in town statute-books, and sometimes even enforced in practice. Here, Calvin's innovation was to substitute stern regularity for impulse and caprice. For the matter was now in the hands of business men; the bishop having been driven out, this enforcement of discipline devolved upon the town council as wielders both of ecclesiastical and of secular authority.

And behind that was another revival from the past. Anxious as Calvin was to revert to the Christianity of the earliest days, and finding as he did in the Lord's Supper the central Christian rite, he insisted on the rejection of unworthy communicants. This regulation proved too stringent for many others besides the "libertines"; and Calvin, with his two chief colleagues, was banished in 1538. The city recalled him in 1541, and he obeyed, most unwillingly, for the sake of what he regarded as a great public work. His *Ecclesiastical Ordinances* and his institution of the *Consistory,* became in one sense the parents of Presbyterianism (*q.v.*). The discipline which had always been advocated was now actually enforced; and nonconformists were punished, sometimes even to the death; the world will never forget how this rebel Calvin burned the Unitarian Servetus. But he saw that a Protestant ministry could never hold its ground without solid learning; therefore he wrote a catechism which should teach even children to give reasons for their faith; moreover, he founded a grammar-school and an academy which attracted able men from all lands, and which sent missionaries out in all directions.

FRANCE

In France, as in Switzerland, the germ of the Reformation is pre-Lutheran. The concordat of 1516 had put the French Church practically under royal authority; the Renaissance (*q.v.*) was rapidly sapping mediaeval conventions; and one very remarkable man devoted himself with equal enthusiasm to religious reform and to learning. This was Jacques Lefhvre (Faber Stapulensis), who in 1512, at the age of about 55, published a Latin translation of the Pauline epistles, with a commentary which roughly anticipated Luther's theory of grace and his denial of transubstantiation. In 1524 Lefhvre revised a French translation of the New Testament, as a foretaste of the whole Bible. He was now under the protection of his old pupil Briçonnet, bishop of Meaux, who had set his heart on the reformation of morals and religion within that diocese. With the help of other pupils, such as Guillaume Farel, Lefhvre created a whole school of students and evangelical preachers.

Meanwhile Luther's doctrines were spreading in France and had been formally condemned (1521); and in 1523 the bishop of

Meaux found himself obliged to fulminate against Luther by name, and against certain doctrines held by Farel and other extremists. Then the *parlement* took strong measures against the innovators: Lefèvre's Testament was burned, while he and his friends found safety in flight. Heresy spread rapidly, and Francis I. favoured or punished it according to the changes of the political weathercock. At the end of 1533 he decreed instant burning against any man convicted by two witnesses of being a Lutheran; but the next January he signed a secret treaty with the Protestant princes of Germany.

Then the excesses of the wilder reformers, who placarded Paris with an offensive broadside against the mass and the priests, caused a natural reaction among the people and at court. In two months, nearly 200 heretics were in the Paris prisons, and eight had been burned. When Lefèvre died (1536) "partly from the timidity of the leaders and partly from the rashness of the rank and file, the first or Evangelical phase of Protestantism in France had failed to bring about a reform of the Church" (A. A. Tilley in *Camb. Mod. Hist.*, vol. II.).

In that same year Calvin published his *Institution*, with which the second, or Calvinistic, phase began. The book supplied the Protestants with a clear and detailed theory of religion; on the other hand, it involved a considerable recoil from two most important principles: it set definite limits both to free enquiry and to individualism. Thenceforward French reformers shared the strength and the weakness of institutionalism. More truly in France than in any other great country, Geneva now became "the Protestant Rome."

The Waldensians.—After a lull, persecution became more severe again (1538–40). The theological faculty of Paris drew up 26 articles of faith in answer to the *Institution*, which Calvin had now published in French, and which was solemnly burned in 1544; meanwhile, many Calvinists were burned here and there. In 1530, the Waldensians (Vaudois) who had survived from mediaeval persecutions in a group of 30 remote mountain villages along the Durance, affiliated themselves to the Lutherans; therefore in 1545, after varying negotiations, an army was sent against them without warning; 22 villages were burned and 3,000 men, women and children were killed.

A still deeper impression was made by the *auto-da-fé* of Meaux (1546) because this was a solemn and judicial act. Sixty persons were here arrested for the crime of having celebrated the Lord's Supper in Protestant fashion; all but ten were punished; 14 were tortured and burned. Even this did not drive the new doctrines altogether underground; other executions took place elsewhere; but meanwhile missionaries and pedlars were secretly preaching and distributing forbidden pamphlets in every province except far-off Brittany. After ten years of this, Francis I. died, and Henry II. sharpened the persecution, by creating an anti-heretical committee of .the *parlement* of Paris, which became known as the *chambre ardente*. This condemned at least 100 persons to death in 3 years; and the provincial *parlements* followed suit.

Yet Protestantism still grew; and in 1555 it began to organize itself; churches were founded on the model which Calvin had framed for Strassburg, and in 1559 a General Synod met, representing from 40 to 50 churches. The Government now procured papal approbation for an Inquisition after the Spanish model; but the Paris *parlement* was not prepared to go so far. Meanwhile the new doctrines were taken up by some of the higher nobility; they thus acquired the advantage and the disadvantage of becoming both fashionable and political. The execution of a distinguished member of the *parlement*, Anne du Bourg, for merely protesting against persecution (1559), could be described by an eyewitness as "doing more harm to the Catholic Church than 100 ministers could have done." But the "tumult of Amboise," next year, redressed the balance. The Government, during the boyhood of Francis II., had fallen into the hands of the Guise family; and a number of Protestant nobles conspired at Amboise to arrest and imprison these unpopular rulers. The plot failed and brought natural discredit upon the religious cause.

A Political Party.— Protestantism was now becoming almost as definitely a political party in France as Catholicism: therefore, a council was held at Poissy, virtually representing the whole nation, to find a *modus vivendi* on the basis of mutual toleration. The Protestants were represented by 12 ministers and 20 laymen; the Catholics by six cardinals and 64 prelates or doctors; the king presided, with the queen mother and princes of the blood. The conference failed to effect a compromise between irreconcilable doctrines; but it was followed by an edict granting liberty of conscience within certain definite limitations. This, however, without fully satisfying the Protestants, was enough to exasperate the Catholics.

In March 1562, the former were holding a religious service in a barn at Vassy, in spite of the edict which forbade their worship in any walled town. The duke of Guise, passing through the town, sent his men to expel them. They resisted, and the soldiers stormed the barn, killing 63 of the worshippers and wounding 100 or more. The example of this "massacre of Vassy" was followed in many other places; henceforward the Wars of Religion begin, and we can no longer treat the French Reformation as a purely spiritual movement The massacre of St. Bartholomew was a natural sequel to the tumult of Amboise and the massacre of Vassy. But, before quitting this subject, we must note that the "Presbyterian" constitution owes even more, directly, to the French Protestants than to any other source. Their "confession of faith" and their "book of discipline," though founded essentially upon Calvin, have more directly influenced the Dutch, Scottish and American churches, than Calvin's own constitution at Geneva.

THE NETHERLANDS

When we have followed the German, Swiss and French Reformations, we find little that is new in other Continental countries. The Netherlands were well prepared for Protestantism by their busy civic life, their early welcome of the printing press, their vernacular translation of the Bible (1477), and the educational work of the *Brethren of the Common Life* or *Common Lot (see* BRETHREN OF THE COMMON LIFE; GROOT, GERHARD). Luther's writings were welcomed at once; and the Bible was frequently printed in Dutch, Flemish and French between 1513 and 1531.

Charles V. began with public burnings of Lutheran books *en masse*, and then established the Inquisition (1522). Burnings for heresy began early; but the emperor's edicts, though severe and frequently repeated, were difficult to enforce in face of the growing opposition. Special severity and peculiar tortures were reserved for the Anabaptists, who were intercepted and slaughtered in large numbers even when they attempted to emigrate. At last, in 1534, they were provoked to strike back, but with the natural result of severer persecution. Under Philip II., political and religious oppression were intertwined. When, in 1565, he insisted on the publication of the decrees of the Council of Trent, not in the pope's name but in his own, Holland and Brabant protested against this as an infringement of their constitutional liberties. Next year, a confederacy of nobles and leading citizens pledged themselves to resist the Inquisition, and adopted the nickname of *Gueux* (*q.v.*) which the courtiers had fastened upon them.

In July, Philip promised to withdraw the Inquisition and grant such tolerance as his conscience would permit; but the secret archives of Simancas show that he wrote simultaneously to the pope and explained this promise as a mere ruse to gain time. At that point, a series of iconoclastic outrages by the Protestant mob gave a legitimate handle to the Catholics. The duke of Alva was then made vicegerent by Philip II.; he proclaimed heresy as high treason and inaugurated a reign of terror (1567); from that time forth the struggle became political; religious discussion was merged in civil war.

DENMARK AND SWEDEN

In Scandinavia the revolution was comparatively bloodless. King Christian II. of Denmark imported a Lutheran preacher in 1519, and would have welcomed Luther himself; he published new codes of law which no pope could approve. But he became unpopular, fled from his kingdom in 1523, and was reconciled to the

pope in 1529. Meanwhile Frederick I., proclaimed as his successor, made peace with the clergy; but Lutheran doctrines still spread; and, Frederick believing himself to have been tricked by the pope in the matter of the archbishopric of Lund, was confirmed in his own growing inclinations towards Protestantism.

His son Christian and his son-in-law Albert of Brandenburg had already declared themselves and in 1527 Frederick met the solemn remonstrances of the bishops with the reply that faith is free, and that each man must follow his own conscience. In 1530, 21 Lutheran preachers, accused of heresy, offered to dispute publicly in Danish against the accusing bishops, who, however, refused to discuss religious questions in the vernacular. Frederick's son Christian III., in 1536, abolished the bishops' authority, seized their possessions, and imported a disciple of Luther, Bugenhagen, as his chief ecclesiastical adviser. Much of the ancient ritual was preserved; and, though there was inevitable friction between the two parties, this systematic and authoritative change of official religion avoided civil war, and brought Denmark higher in commerce and in learning than she had ever stood before. Frederick and Christian made corresponding changes in their subject lands of Norway and Iceland; but here the ancient abuses had been less crying; the people were less ready for change; so that the revolution thus forced upon them from above caused perhaps as much evil as that which it professed to remedy.

In Sweden also the royal initiative secured a bloodless change. Gustavus Vasa (1523–60) had made the acquaintance of Lutheran preachers before his accession; and political necessities led him to look towards disendowment of the Church. A public disputation in the king's palace (1524) went in favour of the reformers; between 1526 and 1541 the whole Bible was published in the vernacular; and men could henceforth judge better for themselves between the rival claims. The diet of 1527 decided in favour of Lutheranism and disendowment. The next king showed some preference for Calvinism; and John III. (1568–92) proposed reunion with Rome. John's son had adopted Catholicism; therefore the people resolved to secure themselves before his formal accession. A synod of lay folk and clergy was held at Uppsala; it decided to accept the Bible as the supreme authority, adopted the Augsburg confession, and restored Luther's catechism as the foundation of all religious teaching.

ITALY AND SPAIN

In Southern Europe, in Italy and Spain, Protestantism enjoyed no princely protection of any importance, nor (perhaps on that account) did it ever spread far enough to gain a hold upon the people. Here, as elsewhere, orthodox reformers constantly fell under suspicion because orthodoxy and radical reform were so difficult to reconcile in practice. The celebrated *Counsel for Amendment of the Church*, drawn up in 1537 by a papal commission of cardinals and other distinguished theologians, insisted that dispensations from Church law should not be so frequent, and should never be given for money. Yet one of these same cardinals, Caraffa, when raised to the papacy as Paul IV., condemned the document in 1559 to his Index of Prohibited Books, while three of the other cardinals (Sadoleto, Contarini and Pole) fell under suspicion of unorthodoxy in later years. Many Italian reformers were thus driven over the line; others protested their loyalty to the last.

The Triumph of Orthodoxy. — The Inquisition, in both countries, was a deciding factor. Into Italy it was reintroduced in 1542 by Cardinal Caraffa, who, when raised to the papacy, worked it with increasing severity. Although Naples and Venice refused to grant it full powers, yet, even there, it was strong enough to prevent any real organization of Protestantism; while in the principalities of Ferrara, Modena and elsewhere heresy was always struck down before it could mature; at Modena 14 persons were burned in the single year 1568 Many fled abroad; in Switzerland there grew up a considerable Italian community; some of these, persecuted by Calvin for their extreme radicalism, fled into Poland and contributed to the spread of Unitarianism.

In Spain, orthodoxy triumphed still more easily. Cardinal Ximenes (d. 1517) had, by the most drastic disciplinary action, raised the Spanish clergy far above the general European level of morals and learning: consequently there was a strong party which could accuse even Erasmus of wild exaggeration in his attack upon Church abuses; distinguished men were condemned for favouring "Erasmic" propositions. Secret communities of Protestants gradually formed at Seville (where we are told of nearly 1,000 members) and at Valladolid. But two *autos da fé* (1559–60) burned 24 men and women at Seville; two others (1559) burned 27 at Valladolid; there were other sporadic executions, and the Spanish non-conformists, like the Italian, could find safety only in flight. In Portugal, where the Inquisition was even more rigorous, we can scarcely guess what might have been the result if anything like private judgment had been possible for the people; what actually happened was that the country prodyced very few Protestants.

GREAT BRITAIN AND IRELAND

The English story is peculiar in one most important particular. In its beginnings, the Reformation was strongly political, yet not anti-Catholic; Henry VIII.'s ideal was "the papacy without the pope."

Here, as in Germany, the ground was well prepared. Lollardy had been driven underground; but it was still very far from complete extinction. The clergy were, on the whole, unpopular, especially in London. The bishop of London wrote to Wolsey in 1515: "Assured am I, if my chancellor be tried by any [jury of] 12 men in London, they be so maliciously set in favour of heretical pravity that they will cast and condemn any cleric, though he were as innocent as Abel." And Charles V.'s envoy, Chapuys, reported to his master from London in 1529: "Nearly all the people here hate the priests." Here. therefore, as in many other parts of Europe, the mediaeval concordat between Church and State was already breaking down.

And here also the Renaissance had already begun to undermine the old fabric. In 1516, More told Erasmus that the *Epistolae Obscurorum Virorum*, a bitter satire upon the monks and the traditional philosophy, was "read everywhere" in England. Erasmus's own writings had enjoyed great popularity; and Colet, dean of St. Paul's, supported the new learning against tradition with a boldness which naturally started other men upon still bolder courses; moreover, More's *Utopia*, published in 1516, was almost as revolutionary on the theological as on the social and political side. All religions are tolerated in Utopia, and almost all religious discussion. For in this country "nothing is seen or heard in the churches, but that which seemeth to agree indifferently with them all. If there be a distinct kind of sacrifice peculiar to any several sect, that they execute at home in their own houses." Wider knowledge of the universe was beginning to break down that mediaeval condemnation of all non-Christians to hell; and this breakdown must, sooner or later, involve a break with yet other mediaevai tenets.

The "Defender of the Faith." — Therefore, when Luther came forward, his works found an early welcome in England; and in 1521 Henry wrote a Latin treatise against the heresiarch which earned him from the pope the solemn title of "Defender of the Faith." Heretical books were burned in St. Paul's churchyard, and four heretics were burned in the diocese of Lincoln, while 50 more abjured their creed. But Lutheran groups began to form at the two universities, especially at Cambridge; which produced eight leaders of the new movement. Here, in 1525, the prior of the Austin Friars, Dr. Barnes, preached a sermon which caused his prosecution for heresy; he was compelled to abjure at St. Paul's, in company with four German merchants. But, a year later, the king was planning a divorce and remarriage, since it was politically necessary for him to have a definite heir to the throne.

This has often been represented as a mere piece of sensuality; but the facts speak plainly to the contrary. There was nothing to prevent Henry, if he had wished it, from keeping a harem like those of his contemporary Francis I. in France and his successor Charles II. in England. Moreover, before the question of Catharine's divorce came up, Henry was already taking very strong measures in another direction; he heaped honours upon his one

known illegitimate son, Henry Fitzroy, and planned, with the advice of his council, the proclamation of this six-year-old boy as heir to the throne. But the plan broke down and Henry's attachment to Anne Boleyn now contributed to suggest the other expedient of a divorce from Catharine. (In the strict technical sense it was not a *divorce,* but a *decree* of *nullity;* however, the briefer term was very commonly used then, as since.)

This complicated story may be reduced to a few simple issues. In the minds of all the principal actors except Catharine, the problem was mainly or wholly political. The king needed a male heir; he and his counsellors augured disaster to the kingdom from a female or a disputed succession. So also with Rome; Clement VII. himself was long in making up his mind as to the Catharine case; and, most significant of all, he actually suggested in 1530 that the problem might be solved without divorce, by allowing Henry two wives at once. (A. F. Pollard, *Henry VIII.* [1905], p. 207.) Even if, as some of Henry's advisers suggested, this was merely a diplomatic feint, it is no less significant in this present connection. Henry had thought of the proposal seriously at an earlier stage, and based it upon Old Testament precedents. As Pollard points out, Eugenius IV. had actually granted similar licence to Henry IV. of Castile, for similar political reasons, in 1437. For the pope's real difficulty was not in the moral problem of the Boleyn marriage but in the political problem of the divorce, since Catharine was aunt to the most powerful sovereign in Europe, and the one from whom Clement had most to fear personally. Therefore the pope evaded all definite decisions, shifting in response to the shifting political situation, for three years (1527–29), when at last he transferred the case to Rome.

Then, at Cranmer's advice, Henry appealed to the universities, and, apart from Oxford and Cambridge, eight of the greatest in Europe decided for him (Paris, Orléans, Bourges, Toulouse, Bologna, Ferrara, Pavia and Padua). However much we may discount these verdicts by royal pressure and other evidence which suggests bribery by both parties, yet on the whole '(these opinions must stand for the general opinion of the learned, unless the divines of France and Italy were more generally venal than is commonly supposed" (H. M. Gwatkin).

Supreme Head.—Already in 1529 Henry had begun to permit the circulation of anti-papal German pamphlets as a threat to the pope; and had even allowed his envoy to hint at further Lutheran developments. Next year, the bishop of Norwich complained of the impossibility of destroying heretical books so long as many folk believed the king to favour them. But at that very moment Henry was taking public measures against heresy, burning Tyndale's New Testament, and forbidding all English Bibles until a version should be made "by great, learned and Catholic persons." This last (as More confessed about the same time) was a great desideratum; yet no such orthodox version was made, or even attempted until long after England had broken finally with Rome (1582–1609).

Already, in 1529, Henry had begun an attack upon the clergy, probably upon the advice of his new minister, the adventurer Thomas Cromwell. Taking advantage of their notorious unpopularity, Henry considerably curtailed the clerical exactions of which lay folk were complaining, and restricted the evils of plurality and non-residence. It was made a penal offense to evade this statute by seeking dispensation from Rome.

Next year, came a still plainer step. Henry, under form of law and without real justice, condemned the clergy of England for having allowed the papal legate to set up his court in England, in violation of the Statute of Praemunire. He extorted not only an enormous fine, but also an acknowledgment in the convocation of Canterbury that the king is "only and supreme lord [of the clergy], and, as far as the law of Christ allows, even supreme head." But this weapon rested in its sheath until the parliament of 1532.

In this parliament, by means which cannot be palliated except on the plea that they were usual in the politics of that day, and that his adversaries were not more scrupulous, Henry first forced convocation, the parliament of the clergy, to accept three articles which definitely submitted Church to State in England. He then procured from parliament a statute abolishing "annates," one of the most lucrative sources of papal revenue from England: this, however, he held in his hand at first only as a menace to Rome, until he had procured papal bulls of approval for the election of Cranmer as archbishop of Canterbury. Next, he procured a statute declaring the king supreme head of Church and State, and forbidding all appeals to Rome. Then, by a capitulation even more humiliating than the previous "submission of the clergy," convocation, at Henry's demand, declared the nullity of Catharine's marriage. There was a mock-trial of the case at Dunstable, and Henry, who had already secretly married Anne Boleyn, was now free to make her his queen. How he then succeeded in defying papal excommunication, and in preventing any papal crusade being launched against him by the Catholic princes of Europe, is a purely political story. Before parliament dissolved. it passed a statute forbidding all further payments of any kind to "the bishop of Rome," and "an act for the submission of the clergy to the king's majesty."

The rest of Henry's reign was spent in ruthless warfare against heretics who believed in mediaeval Catholicism less than he did, and against others who believed more than he. His "six articles" of 1539 rehearsed nearly all the main points of the mediaeval creed; to deny transubstantiation was made heresy, and therefore punishable with burning; to deny any of the other five was felony. Consequently the king was burning heretics on the one hand, while on the other he was enforcing obedience to the royal supremacy by beheading Fisher and More.

The Monasteries.—Three causes led him to strike at the monasteries. They were pro-papal. wealthy, and not popular enough to find many defenders. Among the few points of importance upon which historians on both sides are agreed, are two which concern us here: that the monasteries necessarily considered their own cause bound up with the pope's and that one of the most remarkable features of Henry's despotic reign is the absence of organized or determined resistance on the part of the clergy, whether cloistered or not. Henry was extravagant; he wanted money; and here was a comparatively easy prey. Everywhere else in Europe, the civil authority had already been obliged to interfere in the cause of monastic reform.

The ardcles of reform for English monasteries, which Cromwell issued by Henry's orders, do not deserve the blame which has sometimes been cast upon them. Not only the majority of them, but the most important, were taken straight from the Benedictine rule or from the decrees of popes and other orthodox reformers in the past. When, for instance, Cromwell prescribes "that no monk, or brother of this monastery, by any means go forth of the precinct of the same," he is here only summarizing the plain prohibition in chapter 66 of St. Benedict's rule. When, again, he goes on to command that "women, of what state or condition soever they be, be utterly excluded," this is one of the most time-honoured and frequently repeated of monastic statutes. The only real novelties in this Cromwellian document are the command to accept and preach royal supremacy, and the freedom given to subject monks to complain against superiors who neglect or contravene any of this long list of injunctions.

But Cromwell's visitation of the monasteries is open to far more serious criticism. He chose base agents, who did their work in a base and hasty fashion. It is quite possible that they invented much of their evidence; yet we have irrefragable orthodox testimony to the fact that this unfavourable evidence did not violate probability. The spoils of the monasteries were devoted partly to public purposes, but mainly to pay Henry's courtiers: here England compares very unfavourably with Scotland and some of the German states, where the money went in a large measure to education. Yet, apart from all this which must be said against Henry's unjust and wasteful methods, his dissolution of the monasteries is justified by the experience of other European countries, all of whom, sooner or later, have been compelled to do the same. In Italy and Spain, where Protestantism has been virtually non-existent; in France, where Louis XIV. drove out thousands of Huguenots, and the pastor François Rochette was condemned and hanged in 1761 for exercising his pastoral office; in Austria, where

the small minority of Protestants was either driven into exile or submitted to the same leaden, crushing tyranny which England exercised over the Irish Catholics; in all these countries there has been a wholesale dissolution and disendowment.

The Tudor monasteries were probably in much the same state as that Oxford which Gibbon describes in his autobiography: and, if the universities of Gibbon's day had been entrenched behind all sorts of extra-legal privileges; if the students had been as numerous as the Tudor Religious were; and if they had successfully resisted, for at least three centuries, all serious efforts for reform, then we can hardly doubt that they also would have been disestablished and disendowed before now. The dissolution was one oi many causes for a rising in Lincolnshire, and for the "Pilgrimage of Grace," in the north, where the people were poorest and least educated, and the monasteries would most be missed. Henry showed himself a perfidious negotiator and took a cruel vengeance; but his cause had been supported by many of the higher nobility; and he had no difficulty in getting the shire levies oi the south to march against the northern rebels (1536).

Edward VI.—Under Edward VI. religious changes came far more rapidly. Henry VIII. had ended by not only permitting but enjoining the popular study of the vernacular Bible (1536–38) and, though the permission mas limited in 1543 to the higher classes of society, even this implied a freedom of private judgment quite incompatible with mediaeval tradition, and gave an enormous, if not intentional, impetus to Protestantism. Politics, however, played almost more of a part in the Reformation under Edward VI. than under his father. Reiormers were dominant on the council of regency which Henry had appointed; Edward's two tutors, Cheke and Cox, had both been reiormers. Under the protector Somerset the chantries were suppressed and confiscated; many of them had also been scholastic ioundations in a small way; and thus, though mediaeval England had never possessed an educational system in the modern sense, Edward VI. did iar more harm to the schools than he atoned for by a few ioundations of his own (1545).

Then, in 1548, came deliberate iconoclasm. The party which looked upon images as a hindrance to true religion was stronger now than those who found them edifying, and much regrettable violence was exercised; yet, when we take a wide view, we find that the Orthodox Catholic Montalembert is right in pointing out that a larger proportion of mediaeval Gothic architecture has survived in England than in France. Edward VI. introduced an English liturgy and a Protestant confession of faith in 42 articles (since reduced to 39); and he permitted marriage to the clergy.

A Return to Rome.— His early death put the Catholic Mary upon the throne, while the country in general was still halting between the rival creeds. She communicated immediately with Rome; Cardinal Pole was sent as papal legate; and both houses of parliament answered affirmatively to Mary's question whether they would return to papal obedience. They next rescinded all the anti-papal legislation of Henry VIII. and Edward VI., and revived the statutes against heresy. Mary was now free for all violent measures.

She had promised, and perhaps intended, leniency; but here was a death-struggle between two incompatible ideals, and, in an age when scarcely anybody believed in toleration, Mary had only one choice. She executed 210 Protestants in her last three years; and, at her death, this rate was rather rising than falling. This was fatal; her very first victim, John Rogers, had been so heartily cheered by the London crowd "that he seemed to be going to his marriage," so wrote the French ambassador to his master. This sympathy, strong from the first, grew in proportion as the queen's desperate efforts intensified. Moreover, a new generation was growing up which was far more widely educated than its ancestors; and this was especially noteworthy with the women.

Elizabeth.— The country welcomed Elizabeth; and, though she was not tolerant in the modern sense, she and her ministers carried through one of the most successful compromises in history, the "Reformation settlement." Elizabeth herself would possibly have preferred a moderate form oi non-papal Catholicism, though one of her earliest acts mas very significact; she forbade the bishop who said mass in her presence to elevate the Host, and went out of the chapel when he disobeyed. Many of her subjects were convinced and determined Catholics. But she recognized that Protestantism had come to stay; and she so managed that it should have far more freedom than in any Catholic land, while the Catholics, on the other hand, had as much liberty as the Protestant non-conformists.

Death mas the legal penalty for obstinate refusal to take the oath of royal supremacy; but in fact no Catholic who refrained from political plots needed to fear more than a shilling fine for each refusal to attend Sunday service, until after the pope had excommunicated her and decreed her deposition. Scarcely one-fiftieth of the Marian clergy were deprived of their livings for refusing the oath. Therefore the nation settled down rapidly; and the result was a more rapid national advance in learning, in literature and in commerce than at any period since the Conquest. One set of figures may be quoted as typical of the rest. The religious quarrels told very heavily upon the universities. The number oi degrees fell sadly at Oxford under Henry VIII, and rose again under Mary to the mediaeval average; at Cambridge, however, they fell under Mary. From 1555 to 1558 they averaged only 28 a year; but in 1570 they had risen to 170, and in 1583 to 277, or three times the mediaeval average.

Scotland and Ireland.— The Scottish Reformation went on side by side with the English; each assisted the other. John Knox and Elizabeth were far from complete agreement; but they had sufficient sense and self-control to work together. This religious Concordat went far to obliterate ancient enmities; "Knox included in his liturgy a prayer that there might nevermore be war between Scotland and England; and that prayer has been fulfilled" (F. W. Maitland in *Camb. Mod. Hist.*, vol. II). In 1560 the Scottish parliament did what the English had done a year before; mass and papal authority were formally rejected. Knox's *Book of Discipline*, founded mainly on Calvin's *Institution* and on the organization already adopted by French Protestantism, fixed Scotland in "presbyterianism."

The democratic character of the Scottish Reiormation, and Knox's own zeal for education, go far to explain the subsequent love of learning and the high level of general education in Scotland; though the greed of the barons irustrated the hope of endowing a whole system oi schools and colleges from confiscated Church property.

England's treatment of Ireland is a black page in Reformation history. The country was conquered, and the conquerors dealt with it aiter the brutal fashion of that time. Few Catholics lost their lives for religion pure and simple, as apart from political revolts; hut a series of unjust penal statutes were enacted, and these, although seldom enforced in their full theoretical strictness, were relaxed far too slowly in the face of advancing civilization; instead of weakening, they strengthened the attachment of the Irish to their religion.

GENERAL RESULTS

It has sometimes been argued that .the present religious equilibrium, or something better, might have been obtained without revolution. But this contention seems scarcely reconcilable either with previous or with subsequent history.

R e have seen how long this revolution had been brewing. It would be difficult to find any institution which has been so severely criticized by so many of its most devoted adherents, through so many centuries, as the mediaeval Church. At the very beginning of the 12th century, St. Bernard had emphasized weaknesses which, if not remedied, must necessarily bring disaster; yet orthodox churchmen of 1500 frequently quote St. Bernard's actual words as exactly applicable to the Church of their own day. Some scandals had been abated; but others were even more rampant. Such improvements as had taken place were mainly due to pressure from the laity; and friction between clergy and their flocks seemed increasing rather than decreasing.

Subsequent history, again, seems to point even more decisively in this same direction. We have seen that the real question at issue was that of private judgment. Nearly all reiormers had two fundamental points in common with the orthodox; they wanted to save souls and they believed in the inerrancy of the Bible. But on one fundamental point they differed; is the Bible to be interpreted by the individual for his own soul's sake, or by the Church for the individual's soul's sake? The reformers acted on the former principle; and this opened the floodgates ior the rest; so, although the full claim of private judgment was not the basis on which the reformers consciously took their stand, yet it was implicit in their original theories and actions.

Private Judgment.— Between authority and private judgment, no agreement seems possible except the agreement to differ; yet even that was essentially impossible under the mediaeval regime. To differ publicly irom any solemn pronouncement of the Church mas a crime; obstinately to differ was a capital crime. Therefore no orthodox mediaeval churchman could grant to others the right of nonconformity, or could really escape from the responsibility (however much he might personally shrink from it) of denouncing and punishing all dissenters. Yet, by 1500 at least, it was becoming quite obvious that considerable numbers oi Christians were trusting more to private judgment, confessedly or implicitly, than to the traditional teaching of their priests.

The Inquisition had driven the nonconformists underground for nearly three centuries, very much as early Christianity had been driven underground for nearly three centuries by imperial persecution; but it was now emerging with irresistible iorce. The pope could not now do what Constantine had done in 324, reversing at a single stroke the policy of his predecessors. To Constantine, this religious question had been only one of many debatable issues, and he may even have looked upon it as one of the least important of his political problems; therefore, a reversal at that point need not in the least imply reversal of the whole imperial machine. To the pope, on the other hand, this question of private judgment was absolutely fundamental.

Moreover, even the strongest of popes was always far more at the mercy of his predecessors' traditional policy, of his court and of his officials, than a strong emperor. The pope had no means of coming to terms with Protestantism but by accepting the basic tenet of Protestantism; the Protestants, again, could have come to terms only by abandoning a tenet which, implicitly at least, was absolutely necessary to their position. And the fact that, aiter a century of striie, Christendom was, and has since remained, pretty equally divided between these two irreconcilable principles, mould seem to prove that no human ingenuity could ,have kept the parties permanently within one fold.

And, indeed, this division of parties seems to have worked more

than any other factor towards that tolerance which is one of the greatest gains of modern civilization. The general mass of European society had improved greatly, in many important respects, between 1100 and 1500; but in this one matter of toleration there had been painful and continual retrogression. The Reformers, again, at their earliest stage, were compelled to plead for impunity; but, once in power, they probed as untrue to this principle as the Christian Church had proved when the emperors raised it from a persecuted minority to a persecuting majority.

Mutual Toleration.—Lord Acton, in one of his most plain-spoken essays', has insisted on the wickedness of this *volte-face,* and has pointed out that the innovators Martin Luther and John Calvin lacked that palliation which may be pleaded for persecutors who had persecuted in defense of tradition. But, whether we agree or disagree with him in condemning the individual persecuting Protestant more severely than the individual Catholic, the fact remains that the principle of private judgment is logically inseparable from the principle of toleration, and that no institution can survive, in the face of a powerful enemy, if it acts in public and systematic and continual violation of its own fundamental principle. There is a painful truth in the contention that both sides have learned toleration only under outside pressure; yet that pressure itself has resulted from the assertion of a principle irreconcilable with mediaeval theory and practice.

Private judgment brought half of Europe into conflict with the traditions of centuries; the resultant wars were indecisive; it became evident that neither side could exterminate the other; thenceforward both were obliged to seek some way of living together in the same world. The one party has never granted the individual's right to interpret Scripture otherwise than it was interpreted by the mediaeval hierarchy. Even Protestantism, for many generations, did not advance from the claim for individual interpretation of the Bible to the wider modern claim of rejecting, when necessary, some things that are plainly written in the Bible. But Catholics and Protestants and men of many other creeds live together in modern times in far less discord than that which often reigned in the middle ages among professing Catholics.

The Reformation thus becomes one of the most remarkable episodes in world history, whether we regard it in bulk or in detail. It is rich in striking incidents and in display of human character, both on the Catholic and on the Protestant side; we may find here the loftiest heroism and the lowest depths of turpitude. It exemplifies all the problems of daily life, magnified in proportion to the greatness of the issues here invoked. And from the heat of this conflict between two irreconcilable ideals one principle has slowly emerged, theoretically repudiated by one side and too often violated by the other in practice, yet finally victorious through the mere force of circumstances; the principle of religious toleration. The experience of centuries has now suggested that the main differences which separate many minds from the teaching of the mediaeval Church are rooted in human nature itself; and that, however near the two parties may dram to each other in the distant future, no such *modus vivendi* was possible in 1517.

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REFORMATORY, an institution for the treatment, training and rehabilitation of youthful offenders. Institutions commonly referred to as reformatories for youth are basically of two types: (1) training schools for youths under 16 or 18 years; and (2) institutions for youthful offenders between the ages of 16 and 25 who have been convicted of criminal acts. Modern penologists have largely abandoned the term "reformatory" and replaced it with the more descriptive title of correctional training schools.

Viewed historically, institutions for the young offender were originally conceived of as "houses of refuge." The earliest institution of this nature was established in New York city in 1825. Neglected children as well as delinquents were detained there. On the other hand: the first reformatory for older youths was established in Elmira, N.Y., in 1876. In Great Britain the reformatory movement led to the establishment in 1908 of the Borstal system (*q.v.*).

Reformatories made a significant contribution to modern penology by introducing the indeterminate sentence concept whereby the length of incarceration is based upon individual needs rather than upon a fixed sentence. However, their rehabilitation programs were not successful.

Significant changes in treatment programs and architecture have occurred in individual states and in certain European countries. Whereas traditional training school programs accented rigid discipline and large-scale training and education, the leading youth correctional institutions are providing an increasing amount of individual treatment including psychotherapy. Such institutions are found in Sweden, Norway. England and Denmark and in California, New Jersey. Michigan. Ohio, New York and Minnesota, and in the U.S. federal youth correctional system.

While some progress has been made, the anachronistic reformatory programs of the early 1900s persist in most U.S. states and in many other parts of the world. Public apathy, lack of legislative support and uninspired administrative direction have perpetuated these conditions in youth training programs and impeded their development.

UNITED STATES

On any given day, approximately 40.000 minors are detained in more than 130 state and federal youth training schools and about 20 reformatories. Studies indicate the average youth remains in these institutions for approximately ten months and a significant proportion later continue their delinquent careers. This is attributable to two factors: (1) reformatory and correctional training schools, by and large, have failed to meet rehabilitation treatment needs; and (2) generally the more seriously involved. less amenable youthful offenders are committed to such institutions.

Experts largely agree that traditional reform school programs have not fulfilled their rehabilitative objectives, and that institutional programs, to be successful, must provide the following. (1) diagnosis and classification for each inmate: (2) an institutional program focused upon the individual with the ultimate objective of preparing him for return to the community; (3) a discipline program which develops self-control; (4) an academic and vocational training program which is adaptable to the needs of the inmates and which teaches healthful work habits and attitudes; and (5) postinstitutional or parole supervision which strengthens the child, his family and their community relationships

The leading correctional training programs in the United States and Canada and in Europe provide both institutional and aftercare services which meet these criteria in part. For example, in California where such institutions are under the administrative direction of the California Youth authority, a diversified institutional and parole program is offered. There are two reception-classification institutions where all newly admitted delinquent children are studied and processed. Following the completion of the diagnostic summary, each youth is then sent to an appropriate institution or forestry camp where individual and group counseling programs are provided under the direction of treatment specialists as well as academic. vocational training and religious programs. These programs are studied scientifically by trained social researchers. Following the minor's release, trained parole officers provide supervision, counseling and treatment to the child and his parents.

In New Jersey the Highfield School for Boys, a small institution housing 25 children, also provides intensive treatment and group counseling. Similar progressive programs can be found in several other states.

EUROPEAN PROGRAMS

Several European nations have also pioneered unique institutional treatment programs. Sweden has a program for deeply disturbed delinquent children at the Children's village near Stockholm, where an extremely permissive therapeutic environment is combined with intensive, individual psychotherapy. England's Borstal system has focused increasing emphasis upon treatment in small groups. Other experimental treatment programs are emerging in Norway and the Netherlands. However. the majority of European correctional schools, like those in most U.S. states. are generally deficient in basic psychiatric treatment programs for the disturbed child. Instead. they provide programs of vocational training and remedial teaching.

In summary, reformatories have not fulfilled the enthusiastic

promise responsible for their establishment in correctional systems. The most respected correctional specialists consider them junior prisons which are often secondary schools for crime. Discipline in most reformatories is excessively rigid and little treatment is provided.

Slowly a new type of correctional training school for youths is emerging. These are small institutions which have a fairly adequate clinical staff for treating delinquents, and which focus their rehabilitative programs upon meeting the delinquent's individual needs. Additional empirical research on the new institution awaits completion, but these changes in program emphases coupled with casework supervision of wards granted probation in lieu of confinement and also of those released from institutions hold greater promise for reducing recidivism.

See also CHILDREN'S COURT; JUVENILE DELINQUENCY; PRISON; PROBATION.

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REFORMED CHURCHES, THE, are those European churches which during the Reformation undertook to reform their faith and life, as they declared, "according to the Word of God," under the leadership of such men as Huldreich Zwingli, Martin Bucer, John Calvin, Heinrich Bullinger and John Oecolampadius. The movement first began in German-speaking Switzerland and in the Rhineland, spreading quickly to French-speaking Switzerland, France, the Netherlands, Hungary and other European countries. The churches are now world-wide in distribution. The Presbyterian Churches of Great Britain share, in part, these same origins, but are also distinctly British in other ways. The Presbyterians, however, classify themselves as Reformed Churches because of the common heritage. The Reformed Churches call their ecclesiastical polity the "presbyterian" system. The name "Reformed" was originally used by all the Reformation churches, as were the names "Evangelical" (*i.e.*, based on the Evangel, the Gospel) and "Lutheran." Only after the serious controversy over the Lord's Supper (after 1529) did the followers of Martin Luther become known distinctly as the Lutherans and the non-Lutheran Reformation bodies as the Reformed.

Though the term "Calvinistic Churches" has become synonymous with the name "Reformed Churches." John Calvin of Geneva was not the original leader of this phase of the Reformation. Rather he. coming after the first great leaders. Zwingli. Bucer, Oecolampadius, etc., took up their ideas, systematized them, adapted them and improved upon them. He is. therefore, the greatest figure in the history of these churches. Not all his distinctive ideas were adopted by all the Reformed Churches.

Switzerland. — The Reformation in Switzerland may properly be said to have been begun by Zwingli in 1519 at Zurich. Zwingli had been deeply influenced by Desiderius Erasmus, and stood closer to Renaissance Humanism than did any of the other great Reformation leaders. His outright break with the Roman Church did not come until 1522. It came then in a form which was to become virtually standard for the entire Swiss Reformation and which was to have consequences of the utmost importance. Switzerland had become a federation of cantons each of which had almost total autonomy in internal affairs. A democratically elected council, or other body, controlled all matters. Ecclesiastically episcopal authority had become vague in most cantons.

When controversy broke out between the reforming preachers and the Roman priests, the council of Ziirich assumed jurisdiction. Zwingli demanded that a public disputation be held between the reformers and the Roman clergy, and that thereafter the people themselves, through their officers, should decide which religion to follow. This pattern of debate followed by a vote of the people was used in almost every Swiss city or canton which became Evangelical (Protestant). The civil authorities were established in this manner as the heads of the churches, though they had actually controlled church affairs in great measure before. This control once established came to have serious consequences.

Zurich became fully Evangelical after a series of major disputations, 1523–25. Basle, following a similar pattern, led by Wolfgang Capito, Oecolampadius and Guillaume Farel, voted in the Evangelical faith the same year. Berne. the most powerful of all the cantons. followed suit in 1528. St Gallen, Biel and others also made the change in the same manner. Opposition from those cantons which remained Roman Catholic grew, and Zurich and Berne led in the formation of the Christian Civic league in defense of the Evangelical Reformation. Eventually even German cities such as Strasbourg joined, and Hesse and Wurttemberg became interested. The Roman forces now joined in the Christian union. In the t o wars which followed, the Evangelical forces were finally defeated, Zwingli was killed, and the Evangelical advance all but permanently halted. Moreover, political leadership in Swiss Protestantism passed from Zurich to Berne (1531). Evangelical and Roman groups agreed to recognize the right of the other to exist. Heinrich Bullinger succeeded Zwingli at Zurich.

Meanwhile, the controversy over the Lord's Supper (after 1529) had broken the Swiss reformers away from the German reformers led by Luther and had brought the Strasbourg reformers led by Bucer into the role of unsuccessful mediators. After Zwingli's death, Bullinger and the other Swiss reformers came to an understanding with Bucer and even with Philipp Melanchthon, but could not do so with Luther. Henceforth no one theological mind dominated the Reformation of the Swiss-German Rhineland, and a great area of tacit agreement came into existence. These reformers remained more Humanistic than Luther was or than Calvin was to be (though he was to be deeply influenced by them).

Berne took over and pushed the policy laid out by Zurich of advancing the Reformation by open debate and elections. In the furtherance of this policy it had as agents a number of Evangelical preachers who went everywhere, protected by Berne, preaching and debating in Roman Catholic areas. Guillaume Farel was one of the leaders of these preachers. So successful were their efforts that in 1532 it was possible to call a synod of 230 Evangelical preachers at Berne. Bucer was present as an adviser.

Farel turned his attention to Geneva in 1532 but found progress slow and hard Only after riots and threats of force by both Catholic and Protestant cantons did Geneva finally agree to hold a public disputation in 1532. The Catholic forces led by the prince-bishop besieged Geneva. Berne by coming into the war saved Geneva and crushed the house of Savoy's forces. This brought Geneva somewhat under Berne's tutelage, with Farel as the religious leader. Farel was unable to get an Evangelical church life established in any real measure at Geneva the first year.

Farel saved the situation by persuading John Calvin, a young French Evangelical refugee. to become his assistant. Calvin had been associated with the "group of Meaux," and perhaps also with the Strasbourg reformers. He had, in addition to great theological and pastoral gifts, unusual organizing abilities. Geneva had become Evangelical for political reasons and wished to do as Berne, Zurich and other Swiss cities had; namely, control, and use, the church. Calvin and the other Genevan pastors demanded independence for the church in religious matters and the right to criticize, on moral and religious grounds. the acts of the government and the moral life of the city. The church was, however, to have no authority in civil matters. After three years Farel and Calvin were dismissed by the civil authorities from their pastorates because of this clash of ideas (1538). Calvin became a pastor in Strasbourg.

Geneva dared not return to Roman Catholicism because it would mean the loss of its independence to the prince-bishop of the house of Savoy. Yet, religiously and politically the situation in the city deteriorated. The second year Calvin nas asked to return, but he refused. In 1541 Calvin's friends persuaded him to come back. He returned as pastor and teacher.

Work was now begun on the reforming of the church in Geneva. Calvin desired a church based on the Gospel and free to conduct its own affairs, including the right to discipline its members, if need

be, by excommunication. Also, he desired no civil office, but the right to preach and teach on civic issues. No civil officer was to have any hold on the church. The government, however, wished still to control, and to use, the church. In the end, the government temporized, leaving the pulpit free, with no civic office for ministers; but the government of the city constituted the government of the church, thus controlling it in the final analysis. Thus, the civil authorities hired the ministers also, whereas Calvin had wished the people to have this right. Because Geneva did have certain serious moral problems, the authorities gave the church large disciplinary power backed by civil penalties as well as religious. The mediaeval "blue laws" and many other regulations were imposed at once in order to reform the city.

Civil and religious authorities worked together well for a time. However, when the church attempted to discipline members of the upper, ruling class trouble came from the civil authorities. Also, Calvin's insistence upon making Geneva a centre for Evangelical refugees caused great resentment among the "old Genevese" party which resented the coming in of these "foreigners." The group in the city for which the religious change from Catholicism to Evangelicalism had been essentially a part of the move for civic independence made common cause with those who resented religious reform. In 1553 Calvin's cause seemed defeated.

Michael Servetus appeared in Geneva at that very time. He had just escaped from the Inquisition at Lyons, Fr., where he had been condemned for Unitarian views. He was an able and well-known freethinker. In Geneva he was arrested for heresy and tried before the civil authorities. At once this became the test case of the whole struggle between Calvin and his opponents. The trial lasted more than a month. Servetus eventually demanded that he be acquitted and that Calvin be put to death and Calvin's property awarded to himself. As other issues were interjected into the case, Calvin and several other ministers resigned and prepared to leave the city. The authorities now temporized and decided to circularize a number of other European churches asking for advice. The mediaeval idea that heretics were disrupters of society and dangerous prevailed, and all these churches recommended death for Servetus. The opposition now not only lost the Servetus test case but was in a hopeless strategic position. The city authorities burned Servetus, though Calvin and others urged a less cruel death.

Two years later (1555) the civil authorities gave up all control over the internal life of the church, but still held out on the issue of the refugees. When the leaders of the opposition to Calvin uere found to be in secret negotiations with the French king their whole cause collapsed. Calvin was then free to settle church affairs, found the University of Geneva. train refugee ministers for service all over Europe and make Geneva the Evangelical centre of Europe. He held no office other than that of pastor of the church, though his influence was enormous. Gradually leadership of the various Reformed Churches passed to Geneva. Calvin died in 1564, and his successor, Theodore Beza, was the acknowledged leader of French Protestantism. Under his successors Genevan leadership declined wholly. By the 18th century Geneva was dominated by the Enlightenment. German Switzerland came to greater prominence. French Reformed leadership was never again great.

During the Reformation most Swiss cantons had each its own state church. This pattern has never been dropped. During the 20th century most of the churches were disestablished in greater or lesser measure, without losing their character of national churches. The presbyterian form of government in general prevails in these churches. No particular creed is used by any of them, though, in general, they follow the Reformed tradition.

Switzerland has become the international cectre of world Protestantism, and the Reformed Churches have contributed much to this ecumenical work. During World Wars I and II the Swiss Churches did much to hold together Evangelical Churches in the warring world. In 1948 the Swiss Reformed Churches formed a federation which included roughly three-fifths the population of Switzerland.

Germany. — Matthew Zell, who had been influenced by Zwingli, began preaching Evangelical doctrine in Strassbourg as early as 1521. Soon he was joined by Capito from Basle, and others. Martin Bucer, who had become an Erasmian reformer, met Luther in 1518 and became an Evangelical. In 1524 he went to Strasbourg and shortly was made pastor. Subject now to influences from Ziirich, Basle and France. he gradually moved away from Luther. At the Diet of Augsburg, 1530, he led a small group of Germans and others who sought a middle ground between Luther's and Zwingli's groups. From then on he followed a policy of mediation, first between the various reforming groups, and then between the Reformed groups and the Roman groups. When the Interim was forced on Germany (1548), Strasbourg was compelled to become Roman Catholic, and the Reformed leaders were exiled. Bucer and others went to England, and some went to Switzerland. When the Interim was lifted Strasbourg was made exclusively Lutheran until 1789.

The course of the Reformed system in Strasbourg was, therefore, limited to the period 1521–49. However, during that period some decisive things took place. Strasbourg became the centre, within Germany, of Swiss Reformation thought. All down the Rhine valley Swiss-Strasbourg influences moved, even into the Netherlands. Calvin found refuge in Strasbourg 1538–41, and both gave and received lasting contributions. English Puritans before, during and after the "Marian exile" were permanently affected by this theology of the Rhineland, and Bucer eventually went to England. Without Strasbourg's role as a channel the influence of Zurich, Basle and Geneva upon the outside world might well have been rather small. The so-called Reformed Churches might have been limited to Switzerland and France.

Francis Lambert of Avignon, who had been at both Wittenberg and Strasbourg, led a brief attempt at a Reformed Church in Hesse. At the Synod of Homberg in 1526 the Reformed plan of pastors, elders and deacons elected by the people had been projected. The church soon became Lutheran, but the ideas set in motion by the synod continued to permeate other regions.

The city of Emden became Evangelical under Reformed leadership in 1526–29. Difficulties abounded until a Polish noble, Jan Laski the younger, who had become a Reformed minister took charge in 1542. He introduced a system which blended German Swiss-Rhineland views with those of Calvin. This form of Reformed thought had a wide influence, since Laski was twice a refugee pastor in England and later settled in the Rhineland.

Elector Frederick III of the Palatinate was, in many ways, the one who really gave the German Reformed Church its great opportunity. During the later years of Melanchthon's life, and for some time thereafter, grievous controversy raged among Lutherans between an ultra-Lutheran faction and a more moderate group of Melanchthon's followers. The latter were continually accused of being Calvinists, and Melanchthon was friendly toward Calvin and the Reformed groups. The violence of the controversy turned many minds toward Calvinism, or the Reformed views.

Frederick made Heidelberg university a centre of Reformed thought, bringing to it men such as Zacharias Ursinus and Kaspar Olevianus. Ursinus had been first a Melanchthonian Lutheran and had later come under Peter Martyr and Farel. Frederick commissioned these men to draft a constitution for the Palatinate which would more nearly express the Reformed views. The Heidelberg Catechism (1563) which they drew up quickly became the catechism (in many ways the creed) of all the Reformed Churches. In clarity, depth, simplicity and warmth it excelled any other Reformed confession or catechism. Theologically it was an able harmony of all current Reformed thought. Moreover, while it was not based on the then rising Federal theology, with which Olevianus was shortly to side, it could be fitted into that scheme. In view of its many virtues it is not surprising that it replaced, in time, all other Reformed catechisms.

Ursinus and Olevianus prepared also a directory for public worship for the Palatinate. It was definitely Reformed, being a guide to the right ordering of public worship and not a stated, required liturgy whose forms must be used. Altars and vestments were dispensed with, and the communion table was brought in. The pulpit became the focus of the church's public worship, because

from it the Gospel was proclaimed.

The Heidelberg Catechism was attacked fiercely by the ultra-Lutherans. Soon it was being asserted that those who held its views had no right to toleration under the terms laid down in the Peace of Augsburg, 1555. Frederick fought the issue to a successful conclusion at the Diet of Augsburg, 1566, thus gaining a clear-cut admission that the Reformed Churches had the right to exist parallel to the Lutheran Churches allowed by the diet of 1555. With a persuasive statement of faith, a great university, the legal right to exist and a powerful elector as their champion, the Reformed Churches enjoyed a period of growth and success.

Despite temporary or local losses, or both, the Reformed Churches spread down the Rhine. The Wetterau counties became Reformed, and at Herborn a famous Reformed university was founded. Bremen also became Reformed, and then Brandenburg (1613) with its capita1 Berlin. Other smaller areas scattered over the German states also became Reformed.

The Thirty Years' War brought the Reformed territories almost to ruin, and at the Peace of Prague, 1635, the Reformed groups were so wholly betrayed that the war was resumed. The Peace of Westphalia, 1648, recognized explicitly the Reformed Churches and restored the lands of the Reformed nobles. It also recognized Switzerland's independence of the empire. The war, therefore, had been an important event for the Reformed Churches. The revocation of the Edict of Nantes (1685) brought into Germany about 60,000 Huguenot refugees. These greatly strengthened the Reformed Churches. During this same period the French ravaged the Palatinate and greatly reduced the Reformed Churches, which were saved only by the intervention of Brandenburg. Yet, until 1802 serious hardship was their fate.

During the 18th century Pietism, coupled with the Federal theology, gained almost total allegiance among the German Reformed Churches. The form of Pietism was that of the Dutch Churches, and drew these two Reformed groups closer together. Pietism, in turn, was followed by the Enlightenment. (F. D. E. Schleiermacher was of the Reformed Church.)

Beginning in 1817, Prussia united, by three stages, the Reformed and Lutheran Churches in its territories. The first stage was federation, the second (1830) a common liturgy, and the third (1834) allowed each congregation the right to use whichever creed and liturgy it wished (Reformed or Lutheran). The territories were those where the Reformed groups had their greatest strength, Brandenburg. Prussia, Pomerania, Silesia, Posen, Westphalia and the Rhine provinces. Those provinces which joined Prussia after 1817, Hanover, Nassau and electoral Hesse, were not compelled to unite their churches, although Nassau had done so previously at its own order. Small local unions were made in these areas, however. Nonunion Reformed Churches remained in Bremen, Lippe, Alsace-Lorraine, Lower Saxony, etc. Generally speaking the Reformed tradition was overshadowed by the Lutheran in the union.

In 1861 Reformed leaders began to revive, but within the various union agreements, a greater appreciation for the Reformed tradition and ethic. Inner mission work among the poor, sick, etc., also was pushed, as were foreign missions, youth work, etc. A vigorous literature on the Reformed ideals began to appear. World War I and the years immediately following wrought havoc on all German Churches. Old cultural patterns disappeared, and the industrialized, modem secular society emerged. The close connections of all the churches with the German state had become a hindrance. and disestablishment under the Weimar republic was in itself good. However, it came when the churches could least afford the financial and other losses which it entailed.

Beginning in 1918–21 a vigorous theological renewal took place in Germany. The Reformed federation, led by August Lang, brought Karl Barth to Gottingen university. He quickly became the leading Reformed theologian of modern times. As the nazi regime took over, Barth and Otto Weber of the Reformed federation became leaders in the struggle of the German Churches against Hitler and neopaganism.

World War II brought serious losses to the Reformed Churches. Those regions of Germany where they were strongest fell into the soviet zone of occupation. Moreover, many Lutherans, pressed by the remembrance of the nazi persecutions, demanded unqualified adherence to (Lutheran) traditional creeds as a guarantee of future strength for the church. This meant the denunciation of the union in fact if not in law. In Hesse, the Ruhr and other regions of west Germany the Reformed Churches recovered slowly after the war, aided by United States Presbyterian and Reformed Churches.

Prior to World War I the German Protestant Churches, working through numerous missionary societies, had a vast foreign missionary work. After 1918 it was necessary, for financial reasons, that churches in other nations take over this work.

During the height of Germany's power, German Reformed groups spread out over a large part of Europe and also into Russia. Sizeable churches were established in Austria (Vienna), Yugoslavia, and Slovakia; smaller bodies were found among the German settlers in Russia, Lithuania and Latvia. In the territories which were alternately Polish and German in the 19th and 20th centuries there were large Reformed groups. The status of all these groups deteriorated seriously after World War II.

The Netherlands.--Reforming interest emerged in the Netherlands early in the Reformation era. Erasmus did much of his best work at Rotterdam. Moreover, the Brethren of the Common Life and other mystical groups had been active in these areas. From 1513 to 1531 about 25 different translations of the Bible, or parts of it, into Dutch, Flemish or French were published in the Netherlands. Much of the early English Reformation literature also was printed in the Low Countries.

Erasmian and mystical types of reform were soon followed by Zwinglian and Lutheran influences. Communications, and other interests also, bound the Rhineland and the Netherlands together. Hence the Swiss-Rhineland type of reform came to predominate. The Anabaptists and the other reform movements seldom if ever merged, and their influences were felt more at a later period. Charles V, who controlled the Ketherlands, instituted the Inquisition there against the Reformation as early as 1522.

The struggle for freedom from Spain was begun by the Dutch as a protest in demand of greater liberties, especially religious, within Charles's empire. Charles was determined to wipe out all heresy. and, while frustrated in Germany, he gave himself to the task in his own hereditary provinces, the Ketherlands, with the more fanatic zeal. Eventually, the Dutch nobles (c. 1566), led by William the Silent of Orange. turned against him. When he finally abdicated in defeat and despair, Philip II took over his father's crusade against heresy, but with even fewer prospects of success. One of Philip's generals, the duke of Alva, became a notorious symbol of blind and merciless despotism, William was murdered by a hired assassin in 1584, but by that time the Spanish-Roman Catholic cause had been defeated. The Netherlands became free, and the Reformed Church was established.

During the long struggle the religious situation had also become clarified. The leaders in the war for freedom had been deeply influenced by French Huguenot-Calvinist political and religious thought. Lutheran and Erasmian ideas had given way to a theology blended from Rhineland, Genevan Calvinist and French Huguenot influences and ideas drawn from Jan Laski's work. The Belgic Confession of 1561 became the standard creed. Church organization was patterned most nearly after the forms of Laski and the Huguenots, two forms of Calvinistic presbyterian polity. However, the church was not a national church. The Ketherlands was a federation of states with great local autonomy in each state. Each had its own church over which the local authorities had almost complete powers. National synods were provided for in the church's system but were seldom allowed by the various states.

Civic peace had scarcely been achieved before a theological revolution took place in the Dutch Church. Calvinists, in their controversies with Lutherans and Catholics, had carried their philosophical development of Calvin's religious view of predestination (which he shared with Luther) to great lengths. Some Reformed thinkers began to object, among them a Dutch theologian named Jacobus Arminius. Other issues also were involved. especially Dutch political issues. The leader of the ultrapredestinarian Calvinists in the Dutch Reformed Churches was Franz Gomarus.

To solve the issue a synod of representatives of Reformed Churches in all lands was called by the civil authorities. Representatives came from several European countries. James I of England took peculiar interest in the synod and sent representatives from the Church of England. The synod met at Dort in 1618, condemned Arminius' mild views, rejected Gomarus' extreme views and stated in more or less classical form the quasi-Calvinistic view which had become the badge of Calvinists in their poleniics with other theologians. The term "Arminianism" became a very broad designation in Europe for any deviation from any essential aspect of Calvinistic orthodoxy, whether or not connected with Arminius' followers or with the original points of controversy.

Though scholastic Calvinistic orthodoxy won the struggle with Arminius it failed to nurture the life of the Reformed Church. Dutch Pietism (anterior to and more churchly and theological than German Pietism) and the Federal theology soon dominated the Dutch scene. In these movements the Canons of Dort were always honoured but also made harmless in practice.

By the 19th century the extreme orthodox groups in the Dutch Church were disaffected by the influences of the Enlightenment upon the church. A series of schisms took place which eventually gave Holland three Reformed Churches, each professing to be the successor of historic Reformed Christianity in the Netherlands. The original church bears the name the Netherland Reformed Church. Two early secessionist groups were the Christian Reformed Church (1834) and the Low German Mourning Reformed Church (1886). These merged in 1892 as the Reformed Churches in the Netherlands. A minority of the early secession, however, constituted itself the Christian Reformed Church (Restored). None of these three churches is now a state church, although the original body is still regarded, in some measure, as the national church. During World War II and the German occupation of the Netherlands much progress was made toward healing these old schisms. After the peace most of this gain was lost.

On all matters of Dutch colonial policy the old original church became a leader of enlightened opinion in postwar times. Political parties and labour unions usually follow confessional lines in the Netherlands. Accordingly the various Reformed Churches have their corresponding political parties and labour unions. This structure has tended to fix the distance between the church and all degrees and forms of left-wing thought.

The Netherland Reformed Church had (in 1948) 1,500,000 members, 1,400 congregations and 2,500 additional preaching points, 1,550 ministers, 4,500 elders and 169 missionaries at 65 stations in the Netherlands Indies and Malaya.

The Reformed Churches in the Netherlands had (in 1948) 324,621 members, 810 congregations and 801 ministers. Missionary work was being done in the Netherlands Indies.

The Christian Reformed Church (Restored) had (in 1948) approximately 35,000 members.

The Dutch Churches followed the colonial expansion of the Netherlands. In the Union of South Africa they became the principal Christian Churches. This, together with the Dutch tendency to have political parties follow confessional lines, threw upon these churches a very large responsibility. With few exceptions, these churches reflected the views of the Dutch South Africans. The post-World War II premier, Daniel Malan, who led the campaign for the total segregation of the population and areas of South Africa on racial and colour lines, was an ordained Reformed minister. The South African Reformed Churches officially approved his policy.

Controversy over doctrinal issues divided the church in South Africa also. There were five distinct bodies in South Africa (in 1948) with an aggregate (white) membership of approximately 895,000 members. A mission church for nonwhite missionary converts had (in 1948) a membership of 132,096.

The Netherlands Indies, prior to its independence, had a Dutch Church of about 300.000 members.

France.— From the beginning the Reformation made slow progress in France. And yet, reforming movements within the Roman Catholic Church had been early in appearing. Before Luther had emerged as a reformer, French Humanists had created much interest in biblical studies and had aroused a concern for a purer type of Christianity. In time Marguerite d'Angoulême, the sister of Francis I, became the centre of a Humanistic group known as the "group of Meaux." While this group never broke with the Roman Church, and never became outright Evangelical, it did create great interest in reform. Also, members of it, such as Jacobus Faber, contributed much by their writings to biblical and theological studies which the Evangelicals could and did use. Again, a number of the group—Nicolas Cop, Guillaume Farel, etc.—as individuals, left the group and became outright Evangelicals. Moreover, because of her position and her influence, Marguerite was often of aid to all degrees of reforming interests.

Not until 1555 was any real attempt made to organize Evangelical congregations in France. Until that time some had hoped for reform from within the Roman Church, others had looked to the group of Meaux and others had thought the Evangelical cause too weak to organize. Calvin, Farel and Beza, all Frenchmen then active in Geneva, had maintained a deep interest in the French Reform movement. Hundreds of students had been sent from Geneva to evangelize France. By 1560 it was estimated that there were about 300,000 Evangelicals in France, and there were at least 49 organized congregations.

Geneva had indeed been the spiritual guide of these churches, but not their ruler. When, in 1559, these churches moved to draw up a confession of faith, Calvin had demurred, thinking the move too hasty. Nonetheless they proceeded, and informed him that they had used his brief confession of 1557 as a basis, although they had altered it somewhat. This pattern of relationships was to continue to the bitter end: Calvin urging patience, the French Reformed Churches (called the Huguenots) impetuous and often violent. In general the Huguenots followed Calvin's views, yet on many critical matters they made such changes as they wished and when they wished.

The Huguenot alterations on Calvin which became of greatest significance were two: in political theory and in church polity. Calvin had been resolute but cautious on the right of revolution against a civil government. He believed that when a tyrannical king or government attempted to force men to live contrary to the will of God, then, and then only, men might resist—but only through the next lowest, willing, legally constituted, official body or group (*i.e.*, usually a parliament against a king, or a league of cities against a king, etc.). The Huguenots urged that when men felt oppressed in any serious regard by a king, they might individually, or collectively in extralegally constituted groups, resist, revolt and even use tyrannicide.

The second alteration on Calvin's views made by the Huguenots was in the realm of church polity, or government. Calvin's adaptation of presbyterian church government had been worked out for the church of a small city-state. The Huguenots adapted it quite successfully to a national scale. The local congregation elected its minister and a body of elders and deacons who, with the pastor, formed the consistory. These consistories then constituted the provincial synod by electing members to it. The provincial synods again constituted by elected representatives the national synod. Nearly all subsequent forms of presbyterian church organization—European, British, U.S., etc., are directly or indirectly modelled on this Huguenot adaptation of Calvin's Genevan system (which in turn had not been original with Calvin).

Frances I had been no friend of the Huguenots, but under Frances II the Guises and their Roman Catholic followers harried the Huguenots. They in turn leaned, to their great loss, upon certain high nobles. Finally, against Calvin's objections, they organized as a political and military force. In a long series of civil wars (1562–94) which followed, they gained and lost as the fortunes of war came and went. Finally peace came when the Huguenot leader, Henry of Navarre, became King Henry IV of France as a Roman Catholic. This satisfied the Roman Catholic groups, and Henry promulgated the Edict of Nantes, 1598, which guaranteed the Huguenots virtual freedom of religion. During this era of strife had occurred the greatest horror of the Reformation, the massacre of thousands of Huguenots throughout France on St.

Bartholomew's night, 1572.

The French Reformed Churches recovered in great measure from these frightful persecutions after 1598. However, the Edict of Nantes was revoked in 1685. Untold sufferings preceded and succeeded this act by Louis XIV. Despite laws against emigration, more than 250,000 Huguenots fled to Germany, the Netherlands. England, Switzerland and the new world. Those who remained persisted as a virtual underground movement and did not regain their full rights until the Revolution of 1789.

Since the Revolution France as a nation has been quite indifferent to all religions. The French Reformed Churches have grown slowly under great handicaps. The theological upheavals of the 19th century broke these churches into two main bodies, the National Union of Evangelical Reformed Churches (conservative) and the National Union of Reformed Churches in France (liberal). In addition, the Reformed Churches of Alsace-Lorraine were grouped separately under that name. A union of the conservative and liberal unions was achieved in 1939, the Reformed Church of France. The churches of Alsace-Lorraine remained distinct and enjoyed state support, whereas the churches of France proper did not after 1905. A small group of the old conservative union continued under its old name.

The Reformed Church of France had (in 1948) approximately 150,000 members, 528 congregations, 600 ministers and 5,000 elders; missionary work was done through interdenominational bodies rather than through exclusive confessional agencies.

The Reformed Church of Alsace-Lorraine had (in 1948) 22,073 members, 50 congregations, 84 additional preaching points, 47 ministers and 280 elders; missionary work done as by the Reformed Church of France.

Hungary. — The influence of the Reformation was felt early in Hungary. A synod at Erdod adopted the Augsburg Confession in 1545. By 1567 Reformed views had become so well known that the Synod of Debrecen adopted the Heidelberg Catechism and the Second Helvetic Confession, thus becoming a Reformed Church. Except for minor reverses the Evangelicals made progress in Hungary until 1677. The Magyars had become almost all Reformed. The Counter Reformation era was one of severe persecution for all Evangelicals. Not until Joseph II promulgated the Edict of Toleration in 1781 did respite come. Nevertheless, the Reformed Church had not been destroyed by the persecution. Within the old Austro-Hungarian empire the Reformed Church was of two wings, the Magyar (the larger) and the German. The Magyar people spread rather widely through the old empire, carrying their church with them. Theologically the Reformed Churches were much influenced by German theological scholarship. Within the empire they built up a very large system of schools, elementary to university, and did much for Hungarian cultural life. Through state aid and through other sources the church became possessed of much landed property which was used for income purposes (a familiar pattern in Hungarian life).

World War I broke up the old Austria-Hungary, and the nation of Hungary which emerged after the peace of Versailles was approximately one-third the size of the old Hungary. The Hungarian Reformed Church was now shattered. Within the new nation of Hungary there remained about one-half the church. The other half was now minority groups in unfriendly or even hostile countries. The largest segment, 780,000 in Rumania, suffered grievously for both religious and cultural reasons. The 210,000 in Slovakia suffered less. The small group of 40,000 in Yugoslavia had a precarious existence.

The effect of this dismemberment in Hungary was to foster an extreme type of nationalism, to which the church in part fell prey also. Many of the upper middle class, the professional, the government and the military leaders were in the Reformed Church, Adm. Nicholas Horthy de Nagybanya among them. World War II brought a terrible defeat to Hungary and to all hopes of reuniting the Magyar people and their church. Moreover, it brought about a changed outlook among Reformed leaders. When the Communist government nationalized all church lands (Evangelical and Catholic), Reformed leaders urged that land reform must not be resisted; the church must give up its old privileges, etc. So, also, the church gave up its schools without strife wnen all church schools were nationalized. This reaction away from its pre-World War II upper-class nationalism and toward a better understanding with, and vigorous evangelism among, the Communist-controlled working classes caused much international comment. The war losses of the church in life and property were severe.

The Reformed Church in Hungary had (in 1948) 973,393 members, 1,203 congregations and 2,016 additional preaching points, 1,850 ministers (100 of whom were women) and 22,000 elders.

The Reformed Church in Rumania (Hungarian Magyar) had (in 1948) 380,000 members, 719 congregations, 686 ministers and 10,200 elders.

The Reformed Church in Slovakia (Hungarian Magyar) had (in 1948) 20,000 members, 31 congregations and 23 additional preaching points, 31 ministers and 588 elders.

Yugoslavia had approximately 40,000 Magyar Reformed Christians in 1948.

Czechoslovakia. — The Reformed Churches of Czechoslovakia are, as the nation itself, of varied origins. The Czech Reformed body is the Evangelical Church of Bohemian Brethren. The Slovak Reformed body is a wing of the Hungarian Magyar Reformed family (see above under Hungary).

John Huss's attempt at reforming the church ended at the stake in 1415. His followers were crushed in 1434, but underground the cause persisted. During the 16th-century reforming movement the Bohemian Brethren emerged again to flourish for a brief period. In 1547 they were again suppressed, and the Jesuits were given charge of religious affairs in Bohemia. A Bohemian revolt in 1618 began the Thirty Years' War in Europe, and thereafter the house of Habsburg and the Counter Reformation held sway in Bohemia. Thousands of Evangelicals fled the country, and the patriot and the Evangelical leaders were executed. During this Thirty Years' War the population of Bohemia was reduced from 3,000,000 to 800,000 by the frightful excesses of the conquest.

Not until 1781 were Evangelical groups again tolerated in Bohemia. Then only bodies holding either of the two German Protestant symbols (Augsburg or Heidelberg) were tolerated. The old native Czech Bohemian Church was still banned. It remained in existence, however, underground. Moreover, the cause of Czech independence and of the Bohemian Church became intertwined.

When the nation of Czechoslovakia was created by the peace of Versailles the Evangelical Church of Czech Brethren was freed. It became the leading Evangelical, or Protestant, Church in the nation. Its leadership in theological education, social work, etc., was marked. During the crises preceding World War II, Czech patriotism and the Bohemian Brethren again made common cause. When the nazi army seized Czechoslovakia the consequences for this Reformed Church were severe. Many of its leaders, Joseph Hromadka among them, had to flee. After the war the nation came under a Communist government and the church faced a new crisis. The church had been predominantly middle and upper class, with no great hold on the classes now influenced by communism. Under the leadership of Hromadka the church strove to come to an understanding with the government and with the proletariat in an effort to overcome its previous social stratification and isolation. Considerable criticism was directed at this move from other nations.

The church had (in 1948) 90,000 members, 218 congregations and 296 additional preaching points, 186 ministers and 2,616 elders.

Other European Countries. — Small Reformed Churches, often only a few scattered congregations, are found in Belgium, the Scandinavian countries, Greece, Spain and Portugal. Also, the ancient Waldensian Churches of Italy, together with their branches in Uruguay and Paraguay, have come within the orbit of the Reformed Churches, though preserving their own character.

United States. — The Reformed Church in America. — Dutch settlers were brought to the New York area in 1624 by the Dutch West India company. The first church was founded, subject to the church of the homeland, in 1628. When the English conquered the colony in 1664 they allowed the church of the Netherlands to continue in the area In 1629 a slight amount of power was granted by the home church to a local governing body of churches called a "classis."

Early in the 18th century new movements came, colonial self-

consciousness, the "Great Awakening" revival of religion, etc. The Dutch Church was divided into two groups, one favouring great freedom from the home church, supporting the revival, a local college and the free use of the English language. The other group was extremely conservative and wished to remain a part of the Dutch culture. The colonial group grew more rapidly, and founded Queen's college (later Rutgers university) in 1766.

The two factions reunited in 1771 under a plan which left ultimate authority in the Netherlands but gave great local autonomy. After the Revolutionary War the church became wholly independent under a constitution drafted 1784–92. By 1820 the Dutch language had ceased to be in use. The name Reformed Protestant Dutch Church was changed in 1867 to the Reformed Church in America.

A large migration of Dutch people into the United States about the middle of the 19th century added greatly to the church. Most of these settled in Michigan and other midwestern areas. The church had, therefore, two integrally related though rather distinct groups, one centred in New York and New Jersey, the other in Michigan.

The church had (in 1948) 181,299 members, 743 congregations, 899 ministers and 114 missionaries in Arabia, China, India, Japan and Mesopotamia.

The Christian Reformed Church. — *In* 1822 a small group withdrew from the Reformed Protestant Dutch Church because of doctrinal disagreements. When the mid-century migrations brought many Hollanders who were members of the Christian Reformed Church of the Netherlands into the United States, these united to form the Christian Reformed Church in America. A new secession from the Retormed Church in America in 1882 brought added strength.

The church had (in 1948) 74,778 members, 312 congregations, 268 ministers and 28 missionaries in China.

The Evangelical and Refornzed Church. — *(This* body was formed in 1934 by the union of the Reformed [German] Church in the United States, and the Evangelical Synod of North America. It maintains contact officially with the other Reformed Churches in the United States and elsewhere, although by the union it became both Lutheran and Reformed.)

Palatinate Germans, driven out by the wars between France and Germany, came to the American colonies early in the 18th century. The Reformed Church in the Netherlands aided them for a time. They settled in Pennsylvania and in the Valley of Virginia. Attempts to unite them to the Dutch Church and to the Presbyterian Church failed. Gradually they emerged as a self-sustaining church, 1791–93.

During the 19th-century migrations and the expansion of the American west, new German Reformed bodies arose only loosely connected with the eastern parent body. In 1863 these united in one. Efforts to unite with the Dutch Reformed Churches failed in 1891. Later attempts to unite with the Presbyterian Church in the U.S.A. failed also. Union with the Evangelical Church was achieved in 1934. In 1961 the church was united with the Congregational Christian Churches to form the United Church of Christ. *See* also CALVIN, JOHN; PRESBYTERIAN; REFORMATION.

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REFORMED EPISCOPAL CHURCH, a Protestant community in the United States, dating from Dec. 1873. The influence of the Tractarian movement began to be felt at an early date in the Episcopal Church of the United States, and the ordination of Arthur Carey in New York, July 1843, a clergyman who denied that there was any difference in points of faith between the Anglican and the Roman Churches and considered the Reformation an unjustifiable act, brought into relief the antagonism between the evangelical Protestant clergy and those who sympathized with the position of Carey. The struggle went on for a generation and with increasing bitterness. The climax was reached when George D. Cummins (1822–76), assistant bishop of Kentucky, was angrily attacked for officiating at the united communion service held at the meeting of the sixth General Conference of the Evangelical Alliance in New York, Oct. 1873. This prelate resigned his charge in the Episcopal Church on Nov. 11, and a month later, with seven other clergymen and a score of laymen, constituted the Reformed Episcopal Church, and consecrated Charles E. Cheney (1836–1916), rector of Christ church, Chicago, Ill., to be bishop.

The church recognizes no "orders" of ministry; the episcopate is an office, not an order, the bishop being the chief presbyter, *primus inter pares. See* also ENGLAND. CHURCH OF.

REFORM MOVEMENT, the name given in history to that movement toward parliamentary electoral reform, active in England between 1769 and 1832, and in France between 1832 and 1848. Different as the two movements were in character, time (the principal phase of the English struggle was over in 1832, when the movement in France was, strictly, only beginning) and result (the ultimate desideratum of manhood suffrage was achieved in France in 1848 and in England only in 1918), the march of events in either country had a profound effect upon the movement in the other. The following article sketches the course of the movement in the two countries. (X.)

THE MOVEMENT IN ENGLAND

The ultimate, if long delayed, success of "reform," embodied in the great act of 1832 was due to an unanalysable blend of political theory and the logic of concrete fact. The political, social and economic structure of Great Britain had, in short, been revolutionized between 1780 and 1830 before the revolution was expressed in a decisive formative statute. The act of 1832 did not so much impose the new system of an ardent minority on an unprepared country as it translated into the organization of self-government the appropriate machinery for achieving what a majority had already accepted as inevitable.

The System in 1714.—The system of representation existing in 1714 was, like every other major organ of the national life, the deposit of a prolonged historic development of at least eight centuries. The House of Commons in 1714 consisted of 558 members, of whom 513 represented England and Wales and 45 represented Scotland. Ireland (with 100 members) was not included until the Act of Union of 1800, which abolished the separate Irish legislature. The Scottish representation had only been introduced in 1707 by the Act of Union. Of the 513 English representatives 94 represented counties, 415 boroughs and four the two universities of Oxford and Cambridge; 30 members represented Scottish counties and 15 Scottish boroughs. The English franchises for the counties, and the boroughs differed fundamentally. The county franchise, with trifling exceptions, was based on a 40s. freehold, assessed to the land tax. The borough franchise was amazingly varied and defied reduction to a single principle. Four groups can broadly be distinguished: (i.) The "Scot and lot" and "pot walloper" boroughs, where the voters, roughly, were residents rated to Church and poor rate; (ii.) the boroughs where every freeman, *i.e.,* enjoying the freedom of the borough, had a vote; (iii.) the burgage-boroughs with the franchise attaching to a certain holding or burgage, and (iv.) the corporation-boroughs, where a close corporation was the privileged electoral organ.

The county franchise dated back to 1430. The borough franchise was the haphazard result of five centuries of piecemeal development. The electoral map of 1714 emphasized the enormous preponderance of voting power in the borough representatives. The distribution of the boroughs roughly represented the distribution of population at the end of the 16th century. But by 1650 this distribution had altered, and since then had been altering rapidly, even before the radical redistribution and growth caused by the "Industrial Revolution" (*q.v.*). The "Reform of Parliament" embodied in "The Instrument of Government" of the Cromwellian period (1654), demonstrated very clearly by its redistribution the admitted hiatus between the existing system and the actual facts. The elaborate analyses made by the "Reformers" of the 18th century revealed these bewildering anomalies. Apart from the contradictions of the borough franchise, which allowed a vote in one borough that was denied in another, custom degenerating into caprice, or avowed manipulation, the distribution of seats resulted in the most astonishing paradoxes. Cornwall, for example, paying 16 out of 513 parts of the land-tax, returned 42 members (two county, 40 borough members); Lancashire, paying ten times as much, returned 14 (two county and 12 borough members). The City of London returned four, as did, also, the united boroughs of Weymouth and Melcombe Regis, with neither landed nor economic interests. In Yorkshire, York city and 13 boroughs, with a total of 7,000 voters, returned 28, while the county, with a total of 16,000 voters, returned two members.

The disabilities imposed by law severely restricted both the electors and the elected. Apart from women, children, lunatics, paupers or convicted criminals, the Nonconformists, the Roman

Catholics, the Quakers, the Jews and agnostics could neither vote nor be elected. In the counties neither leaseholders nor copyholders, however wealthy, could vote. Prosperous cities such as Birmingham or Manchester, which had come into existence since 1600, had no representation, while Old Sarum with seven, or Dunwich, half under the sea, with 14 voters, returned respectively two members apiece. Even in 1714 it was abundantly clear that members of parliament did not represent their constituencies, and that the constituencies still more did not represent the nation. It was estimated in 1793 that, with a population of some eight and a half millions, 257 members (*i.e.,* a majority of the House of Commons) were returned by 11,075 electors; that in 51 constituencies there were less than 50 voters, and that 130 boroughs had less than 300 electors apiece; and that whereas 92 county members were returned by 130,000 voters, 84,000 electors in the boroughs had 421 representatives. "The rotten boroughs," *i.e.,* those which were completely under the control of the Crown or a patron, were admittedly the most indefensible parts of this parody of principles and facts.

The Society of the Friends of the People undertook, in 1793, to prove that the lords of the Treasury, 71 peers and 82 commoners could together nominate 306 out of 558 members, *i.e.,* make a decisive majority. The influence of the Crown, *i.e.,* of the Government — through the patronage of the navy, army, Church, judiciary, civil and colonial services — was enormous, and secured the steady voting support in the Commons without which no administration considered itself safe or even possible. In 1770 there were 192 place-holders in the Commons. "Vested interests" in the whole system, indeed, were so strong and deeply-rooted that nothing short of a complete organic change in the social and economic structure could compel a House of Commons to accept "reform" which meant the extirpation of a half of those who sat in it, with the lucrative possibilities that membership offered. It follows from this brief summary that the would-be "reformer" of the 18th century, with so large and easy a target to attack, but which covered such a variety of interests, had really to prove that the "system" resulted in bad government, and that in the major issues of the national life the welfare of the unrepresented was more important than the welfare of the minority and was being continually sacrificed to it. Before the political theory of Locke, Blackstone and Burke could be dissolved a new political theory had to be created and absorbed. The Reform movement had by 1830 produced such a new theory, with a re-interpretation both of the ends and methods of popular government and civil society under a limited monarchy — but it was not until 1790 when Whiggism had been dissolved once and for all by the corrosive acids of the Industrial and French Revolutions that the school of Godwin, Priestley and Price, above all of Adam Smith and Bentham, had captured the best minds alike of the old gentry and the new individualists. In 1832 a true revolution was accomplished with less bloodshed and disturbance than "the glorious revolution" of 1688, and as in 1688 so in 1832, the monarchy entered on a new lease of life, influence and prestige.

The First Phase **(1714–65).**—In the Walpole and Bolingbroke era (1714–40) "reform" was the cry of the broken and discredited Tories or the schismatic Whigs, who denounced the corruption by which they asserted Walpole maintained his power, or who demanded the repeal of the Septennial Act and a return of the Triennial Act', or even to the annual parliaments of a "golden middle-age." The agitation, which had no support outside Westminster, had no effect on the general acquiescence in parliaments with a legal duration of seven years, and resulted only in a very limited Place bill, disfranchising a few hundreds of place-men. The elder Pitt gave a new life and a new power to the Reform movement, due to his prestige, his disinterestedness, the splendour of his achievements, and his criticism of effete or flabby government. But Pitt was neither a consistent political thinker nor a practical and constructive administrator, capable of creating and leading a party with a coherent and thought-out programme of internal reform. He accepted the Whig view that "representation was not of persons but of property," and that "the share of national burdens (*i.e.,* taxation of ***property)*** should decide the weight it ought to have in the political balance." He accepted "the rotten boroughs" (for one of which he had sat) as "the natural infirmity of the Constitution." "Amputation might be death." Pitt's sole remedy for "the corruption of the people and the ambition of the Crown" was to add a third member to the county representation, "the purest part of the system," and to revert to triennial parliaments. Neither of these remedies was seriously pressed, though they became a traditional formula for the Chathamite and Rockingham Whigs.

Cartwright, 1763–80.—John Wilkes, demagogue and the popular hero of the struggle against general warrants, for the rights of the electors in the Middlesex election and for the right to report debates in parliament, with John Cartwright, the brother of the inventor of the power-loom, were, in 1776, the joint but independent "fathers" of the real Reform movement, *i.e.,* a demand not merely to eliminate the rotten elements, but by an extension of the franchise and a redistribution of seats to secure "a just and equal representation of the people." Wilkes and Cartwright pinned reform down to these points-disfranchisement, enfranchisement and redistribution — on the basis of two democratic principles, that government was for the good of the governed and that rich and poor alike had equal rights and an equal interest in determining laws and government affecting their lives, fortunes and happiness. The Reform Act of 1832 was thus foreshadowed in embryo in 1776, the year of the Declaration of American Independence, of Adam Smith's Wealth of Nations, and Bentham's Fragment *on* Government. Cartwright, also, by founding The Society of the Supporters of the Bill of Rights was the parent of a new political method, the organized league for propaganda, education and consolidation of a group with a defined and agreed programme. Radicalism, in short, as a theory of political life and a constructive political machine, was born in 1776. Cartwright's society was the fruitful mother of many leagues, societies and federations down to the Free Trade League of 1837, the "Birmingham Caucus" of 1878, and the party organizations of to-day.

The Whigs and Economic Reform. — The Whigs, under the influence of Dowdeswell and of Burke, would have none of either Wilkes' and Cartwright's principles, or of "demagogic" methods. The genius of Burke, reverencing the Constitution as almost a Divine gift to a chosen people, dreading organic change as the betrayal of a mighty heritage, and already, in 1780, scenting in the political theory of the American rebels and of the English Radicals the Jacobinical poison which the French Revolution was to let loose, saw in "economic reform" the supreme remedy for purging a sound organism afflicted by a temporary but paralysing disease in the corrupting influence of the Crown. The Yorkshire Association and the famous Yorkshire Petition of 1780 were methods borrowed from the Radicals, but "the economic reform" for which they pressed kept clear of the Radical demand for organic reconstruction of the representative system. Burke and the Rockingham Whigs succeeded in disfranchising contractors and revenue officers, in abolishing sinecures and in reducing places and a swollen pension list, but in accomplishing this valuable result they had shot their bolt. They had not attempted to deal either with the legal disabilities which excluded whole classes from representation, or with the rotten boroughs which were far more demoralizing and far-reaching in their control of parliament than the "corrupt influence" of the Crown.

The Younger Pitt **(1780–1785).**—The mantle of Chatham fell, and the hopes of Radicalism concentrated on Chatham's son, the younger Pitt, who, in 1781, moved for "a Committee to enquire into the Present State of the Representation" and was defeated only by 20 votes — the best division the Reformers had between 1780 and 1831. As prime minister, in 1785, Pitt endeavoured to introduce a Reform bill, his intention being to disfranchise 36 rotten boroughs, establish a fund of £1,000,000 for compensating the owners of borough "property," and assign the 72 seats set free by the disfranchised 36 boroughs to the counties, London, Westminster and the chief unrepresented towns. "Leave to introduce" was, however, refused by a majority of 79 votes. Henceforward Pitt was lost to the Reform movement. It was his first and his

last effort as a constructive Reformer and the French Revolution shortly converted him into an obstinate antagonist to all or any change.

The Fourth Phase (1785–1807).—The movement really gained in the long run by this set-back. Had Pitt's milk-and-water proposals been carried the old system would have been given a new lease of existence. Pitt, equally with Burke, accepted the inherited past, and his acceptance of the rotten boroughs as a form of property, the disfranchisement of which required compensation, was rightly rejected as immoral and indefensible on any theory of national representation, by the Reformers of 1831. The Whigs had never really believed in reform, and it now became the monopoly of the "doctrinaire Radicals." For seven years the stars in their courses fought for Radicalism. The American War had given an immense stimulus to political thinking and a new school of political philosophy came into existence; the Industrial Revolution was steadily sapping the bases of 18th century society and of the economic fabric. In 1788 the centenary of 1688 was celebrated by the ardent Radicals and the young minds of the country outside politics. In 1789 the outbreak of the French Revolution galvanized all these currents into enthusiastic activity, and The London Revolution Society—the leading organization of the Reformers, of which Price and Godwin were vigorous members--entered into direct connection with the National Assembly in France and the Constitutional Revolutionists in Paris.

Fox, who hailed the French Revolution with joy, professed to be a Reformer, but he was in reality too deeply saturated with the old Whiggism to accept with conviction the new Radicalism. The real leaders in parliament were the young Charles Grey (the Earl Grey who carried the Reform Act in 1832) and Erskine. But all the ardent aspirations of 1789–91 were doomed to disastrous extinction, for which four main causes were responsible. First, the September massacres, the execution of Louis XVI. and Marie Antoinette, and the Reign of Terror not only paralyzed the moderate Reformers with a chill of disillusionment, but sent a series of waves of panic through Great Britain. Reform was promptly identified with revolution on the French model. Secondly, once Great Britain was at war with France (1793), reform was regarded as sedition and treason. Even the mildest critic of existing institutions was denounced as a Jacobin and a traitor. Thirdly, the opposition to reform found in Burke a thinker of genius whose "Reflections on the French Revolution" became the Bible, not only of Toryism, but of three-fourths of thinking or unthinking England. To Burke the new democratic philosophy of Price, Goodwin and Paine, even of Bentham and Mackintosh, was anathema, and the "Rights of Man" were exposed as the pseudo-scientific basis of a creed which would logically end in the downfall of the monarchy, a Jacobin Reign of Terror and a military dictatorship on the French model. The extremists on the Left of the Reform movement, with the bravado that extremists enjoy, were powerful allies of reaction. For 15 years Great Britain lived in the hurricane of a European convulsion, and Wyndham's phrase as to the folly "of repairing your house in the hurricane season," for all its shallowness, correctly summed up the mood of three-fourths of Great Britain, shown in the "loyalist" riots at Birmingham, Manchester and other industrial centres. Fourthly, the irreparable breach between Burke and Fox not only split the parliamentary opposition but drove one-half of the Whigs into coalition with Pitt and the Tory Party.

The war at first was popular; prosecutions for sedition followed, and the judiciary, especially in Scotland, where a great awakening of political activity had followed the French Revolution. were readv to strain the law of treason and to lav it down from the Bench that all criticism of existing institutions was calculated to bring the Government into contempt, and was, therefore, seditious treason. The proposal to hold at Edinburgh a British convention for the discussion of reform whetted the panic of the Government and the convention was dissolved. The trials and condemnation of "the Scottish martyrs," such as Tytler, Stewart, Callender, Muir, Palmer, Margarot, Gerrald, Watt and Downie, and, in England, of Frend, Frost, Eaton and Winterbotham, make a soiled page in the history of British law. Thanks to Erskine's splendid advocacy, the acquittal of Hardy and Horne Tooke brought some sanity into the supercharged atmosphere of indiscriminate terror and proscription. But until 1799 liberty of opinion ceased to exist in Great Britain, and in this valley of black shadows the numerous political societies, the chief of which were *The London Corresponding Society* and the *Society of United Scotsmen,* withered at the roots and were easily and finally suppressed by governmental action (1794–98). There would have been general and resentful astonishment could the memorial to "the Scottish Martyrs," on the Calton hill, at Edinburgh, erected by public subscription have been foreseen in 1800. Muir's "blasphemous" prediction that "the cause would ultimately prevail" was accepted as a platitude by a reformed and grateful Great Britain in 1844.

It "prevailed" for three reasons. First, the existing system of parliamentary representation provided its own condemnation when men could once more use their eyes, unblurred by panic and war. fever. Secondly, every five years of the changes made by "the Industrial Revolution" threw up a new and unrepresented population, creating a new wealth which paid three-fourths of the taxes but, under the old system, was not "property" with any political rights. Thirdly, the real Reformers retained their faith, and the new and abhorred creed of "democracy" was being hammered out by powerful minds, and could be proved to have a better scientific basis for the theory of a reborn, civilized and progressive society than the philosophy of Burke. To the England of 1807 and onwards the old Whig creed of 1688 was not to be regarded as a climax and a terminus, but simply a stage in an inexhaustible development.

The Fifth Phase (1807–1815).—A new point of departure was made in 1807. The Westminster election of that year brought Sir Francis Burdett, a wealthy and ardent Reformer, into the House of Commons to be the fearless and effective champion of the new Radicalism. The indefatigable Cartwright, who lived until 1824 and saw the dawn of the new day, was ready to join with Cobbett, "orator Hunt," Bentham, the stubborn and aristocratic Whig, Coke of Holkam, the "King of Norfolk," of whose respectability and place in the great gentry there could be no doubt. Reform had, in fact, its increasing adherents alike in the peerage, the intelligentsia and "the people." It only needed now two further acquisitions—the conversion of the official Whig Opposition and a first-rate organizer. The latter was found in Francis Place, the tailor of Charing Cross, whose career and gifts make a fascinating chapter in the history of British politics. Place, if any man, was the "organizer of victory." The conversion of the Whigs, led by Grey (who had succeeded to the earldom in 1807) was accomplished in 1820, when Lord Russell definitely associated the Whig party with the cause. Russell was ably supported by Brougham, and even more effectively by the aristocratic Radical, Lambton (later Lord Durham of the "Durham report"). Cartwright, in 1823, predicted that reform would "come suddenly." He did not live to see the passing of the Konconformist Emancipation Act in 1828, of Roman Catholic emancipation by a Tory minister in 1829, or the triumphant passage of the Reform **Act** of 1832, nine years after his prediction. It was, indeed, in the irony of history that the French Revolution of 1789 should have shattered "the cause," and that a second revolution in France in 1830 should convert Great Britain to enthusiastic support of the Whig Reform bill of 1831.

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THE MOVEMENT IN FRANCE

If the political history of France be compared with that of England, it will be seen that the political system of both countries underwent similar changes, and arrived at approximately the same result—the main features of which were a responsible ministry and popular suffrage.

The political organization which was created both in France and in England was based on three essential elements: (1) an elected assembly capable of imposing an effective limitation on the power of the monarch; (2) a council of ministers subject to the control of the assembly; (3) an electorate capable of maintaining the control of the nation over the assembly. Three things were thus necessary in order to establish responsible government: the arbitrary power of the king must be restricted by an assembly independent of the court; the assembly must obtain effective control of the Government by transforming the king's ministers into agents for carrying out the will of the assembly; and the electoral system must be such as to ensure that the members of the assembly were representative of the will of the people.

In France the power of the king was so great that the people, who possessed no institutions through which they could exercise their action, were unable to impose any limitation on his authority. At a period when Great Britain already had a government responsible to an elected parliament, France had no political assembly, no franchise, and no check on the arbitrary power of ministers. The latter were simply the instruments through which the king exercised his personal authority.

It was impossible to modify this system, as had been done in England, by introducing successive improvements in the method of government, because there was no machinery in France through which control could be exercised. The change was made, without transition, by revolution; the old system of government was destroyed, and a new one had to be improvised. In devising a new system of government in this way it was of course necessary to proceed according to a general plan and to apply uniform rules of a legal and abstract character, whereas the British constitution was rather in the nature of a body of customs built up by a series of historical precedents. The difference in the method followed in the two countries has generally been attributed to a difference of national temperament, the Englishman being more phlegmatic, conservative and practical, and the Frenchman more passionate, revolutionary and fond of abstract ideas. It may however be more naturally explained by the different conditions under which the transformation of the political system was effected in the two countries. England already possessed an elected parliament which tended by gradual development to establish its control over the ministry; all that the English had to do was to reform their archaic electoral system. The French nation had to improvise an entire political system, and could only do so by the application of general rules.

The Revolution.—The French Revolution was initiated by the action of the royal Government itself in calling a meeting of the States General for the purpose of voting money. The meeting of the States General was not however, like the English parliament, an institution with the force of tradition behind it. The meeting called in 1789 under the old name of the States General was in reality a new assembly, summoned by a procedure created expressly for it.

Thus the question of the electoral system, which was the last to be settled in England, was in France the one which arose earliest. The system adopted was uniform for the whole country, and thus more logical than that of England. Voting was by secret ballot and by absolute majority. As the Government had extended the right to vote to all tax-payers, including the very numerous peasant class, the election of the deputies of the Third Estate was carried out by indirect suffrage. A system of indirect suffrage of two degrees, with a secret ballot and absolute majority, was applied to all elections of legislative bodies throughout the Revolution period.

The assembly, converted into a "National Assembly," declared that it would not separate until it had given France a Constitution; the royal power was thus limited by an elected body representing the nation as a whole. After the fall of Louis XVI. it became necessary to vest all powers in a single body, which was given the name of the Convention, a term borrowed from the United States. When the Convention desired to restore a regular political order conforming to the doctrine of the separation of powers, all that it could do was to replace the king by an executive Directory.

The third question, that of the qualifications and functions of ministers, had been settled under the pressure of practical necessities in 1789, when it had had to be decided whether ministers might also be members of the Assembly. The Constituent Assembly had been apprehensive of the influence which ministers might exercise over the legislative body; it feared the ambition of one of its members, Mirabeau. Ministers, as members of the executive, were therefore forbidden to be at the same time members of the Legislative Assembly; and this made it impossible to establish a system of responsible government in France.

The Restoration.—The institutions created by the Revolution were abolished by Napoleon, who reduced assemblies, elections and ministers to the position of instruments through which the absolute authority of the emperor was exercised. At the Restoration, however, a fresh attempt was made to create an organized political system. Louis XVIII. accepted the limitation of the royal power by a constitution and its control by an assembly. The three questions which had had to be considered in 1789 thus arose again in 1814; this time they were settled on lines directly copied from Great Britain.

Under the imperial regime there had been two chambers; Louis XVIII. maintained them under different names. The senate became a hereditary chamber of peers; the Legislative Assembly became the chamber of deputies, and the king had power to dissolve it, as in England. The chamber adopted a number of the practices of the British parliament, such as the King's speech, the voting of the Address, and the procedure for voting on ways and means.

The method of selecting ministers was not regulated by the Charter of 1814, just as there were no formal rules on the subject in England. Ministers were responsible, but only in the case of action contrary to the constitution, when they were liable to a procedure copied from the English system of impeachment. Thus France did not yet enjoy responsible government in the sense in which the term is understood in English-speaking countries at the present day. Louis XVIII. however generally followed the practice of forming the ministry in agreement with the majority of the chamber, and when Charles X., in 1829, appointed ministers who were definitely unpopular, the majority made an official protest, the "address of the 221," in which it enunciated the theory of responsible government.

The dispute led to an insurrection in Paris, and the Revolution of 1830 was the result. The new king, Louis Philippe, formally recognized the sovereign rights of the nation, and accordingly did not contest the principle of the responsibility of ministers to the Chamber. France thus adopted the principle of the political responsibility of ministers, according to which a minister is obliged to resign as soon as he is in disagreement with the elected Chamber.

"The Reform Movement."—The electoral system in France had been a constant subject of party controversy from 1814 onwards. The practice of holding elections had been introduced as a new departure in 1789; it was not a long-standing tradition as it was in England, and it had not struck deep root in the political life of the nation. The Charter of 1814, which was hastily drafted, only contained a single provision dealing with the electoral system; no one was entitled to vote unless he paid not less than 300 francs in direct taxes. This represented a much more limited franchise than that in force in England, and the result was to deprive the elections of their popular character.

It was not until later that legislation was adopted fixing the minimum tax payment constituting the electoral qualification and the procedure for elections. The act of 1831, which was passed after the Revolution, merely lowered the electoral qualification from 300 to 200 francs. This resulted in increasing the number

of electors from 87,000 to 166,000; a maximum of 249,000 was reached in 1847

One section of opinion in France regarded this reform as insufficient, since the large majority of citizens were still excluded from political life. Demands for the extension of the franchise were therefore put forward. At the time when in England the reform movement which had been initiated 60 years earlier was at last achieving success in the Reform Acts of 1832, agitation for the same object in France was only beginning. It is to the movement of 1832–48 that the term "reform" is applied in France.

Neither in France nor in England were the supporters of an extended franchise able to agree on the scope of the desired reform. Universal suffrage, which had been advocated in England as early as 1780, was not at first proposed in France except by a few isolated republicans. The *Société des Droits de l'Homme,* an association consisting mainly of young Parisian students and workmen, referred to universal suffrage in its manifesto of 1833 as an instrument for bringing about social revolution and improving the position of the proletariat; this attitude corresponded to that of the English Chartists.

The supporters of a less radical measure of reform put forward their demand for an extended franchise in the form of petitions to parliament, as had been done in England. The movement did not attain real political importance until 1838, when the National Guard of Paris, in which nearly the whole of the lower middle class population was enrolled, organized a petition asking that all members of the National Guard should be given the right to vote. A committee of deputies was formed to direct operations in the provinces; public manifestations were arranged, in which the National Guards marched in procession to greet the deputy with cries of "Vive la Réforme." The same cry was raised on June 14, 1840 at a review of the National Guard by Louis Philippe. The petition obtained about 240,000 signatures.

The opposition accused the Government of corrupting those deputies who were in the Government service by promises of promotion and the electors by granting them personal favours. As a remedy for the "corruption" of deputies it demanded "parliamentary reform," *i.e* , that civil servants should be forbidden to sit in the chamber. As a remedy for "electoral corruption" it demanded "electoral reform." These were the terms which had been employed in England in the time of George III.

Cniversal suffrage was at no time demanded by more than a very small minority, much less numerous than the Chartists in England. Almost its only champion in the chamber was the lawyer A. A. Ledru-Rollin. nho founded a journal entitled *La Réforme* in 1843, Ledru-Rollin represented political reform as a necessary condition for social reform. La *Réforme,* however, did not have a circulation of more than 2,000.

The campaign for reform was carried on in the chamber principally by the party nhich was opposed to the dynasty. For some years the question formed the subject of debates which led to no practical result. François Guizot, the virtual head of the ministry, always replied that the introduction of reform measures was inexpedient. Louis Philippe himself took part in the dispute. "There will be no reform." he said in Jan. 1848; "I will not have it If the Chamber of Deputies votes for it. I have the Chamber of Peers to reject it. Even if the Chamber of Peers adopted it. I have my veto."

The restrictions imposed on the press by the legislation of 1835 made it difficult for the opposition to state its views in the newspapers. A means of expression was found in the organization of a series of public dinners by opposition deputies and journalists; about 70 such dinners were held in 1847 and 1848, and toasts were drunk in honour of reform. The Government. by prohibiting a public dinner in Paris, provoked the revolt which led to the Paris insurrection of Feb. 23 and the overthrow of the monarchy. The provisional Government, composed of deputies representing the small republican minority, at once introduced universal male suffrage. Thus electoral reform, which was only begun in England after half a century of agitation, was consummated in France in a few days in its most radical form. (C. SE.)

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REFRACTION. When waves of any kind traveling in one medium enter another, in nhich their velocity is difierent. their direction is. in general, changed, the rays, i.e , the lines perpendicular to the wave surfaces (in isotropic media) along nhich the energy travels, being bent or refracted at their point of incidence on the second medium. The change in direction is such that the sine of the angle formed by the incident ray and the normal to the surface of separation bears the same ratio to the sine of the angle formed by the refracted ray and this normal. as the velocity of the waves in the first medium to their velocity in the second. This ratio, known as the refractive index, may depend on the frequency of the wave vibrations If such be the case, each frequency in the incident disturbance gives rise to a separate refracted ray—a phenomenon known as dispersion. (*See* OPTICS.)

Mirage is due to the refraction of light by layers of air of gradually varying temperature and density. A similar variation. due to convection currents, is responsible for the flickering appearance seen above asphalt and sand on a hot day, and also for the twinkling of the stars. The refraction of rays of light entering the earth's atmosphere from heavenly bodies is knonn as astronomical refraction; it has the effect of making such bodies appear higher above the horizon than they really are. See REFRACTORIETER. *See* also Index references under "Refraction" in vol. 24.

REFRACTOMETER, an optical instrument for measuring refractive index. The refractive index, n, of a substance is equal to the speed of light. V_m, in that substance divided into the speed, V_s, in a standard medium: $n = V_s/V_m$. The standard medium is usually air or, in the case of gases. vacuum. Each pure substance has a unique value of n under standard conditions of temperature. pressure and wave length.

Refractometers are generally either of the deviation type or interference type, depending on the utilized change in light waves passing from one medium into another. These changes are caused by the different speeds of light in the two media and consist of: (1) a change in direction when the light strikes the boundary surface obliquely; and (2) a change in the phase of vibration of the light wave. A third. less common, type of refractometer makes use of the ratio between the intensities of light reflected and incident on an interface between two media. Sensitive photoelectric cells allow the rapid detection of small changes in refractive index by the photometric method.

A number of variables must be accurately controlled in precision refractometry. These are mainly temperature. nave length of light. and optical alignment of parts. An increase in temperature of 1° C. causes, for most liquids, a decrease in n by several units in the fourth decimal. The refractive index of a colourless substance measured with red light may be as much as several units in the second decimal smaller than when measured with violet light. The most widely used monochromatic light source is the sodium lamp; unless otherwise stated. values of n refer to the average wave length of the yellow sodium spectral lines (5.893 Å) Electric-discharge tubes containing such elements as helium, hydrogen, cadmium or mercury provide a series of well-defined wave lengths that are often used to determine optical dispersion.

Instruments designed to give fourth- or fifth-decimal accuracy require the highest quality workmanship in their optical and mechanical construction and adjustment. Reliable refractometric measurements require frequent calibrations of the instrument with known standards. The greatest accuracy is obtained by a direct comparison of the unknown with a similar knonn substance. The critical-angle and interference-type refractometers allow this kind of technique. knonn as the differential method. Easily purified liquids. such as water. serve as convenient standards of comparison; glass test plates are also used. In 1944 the U.S. National Bureau of Standards made available a series of pure hydrocarbons with refractive indices certified to the fifth decimal.

Deviation-Type Instruments. — Optical Principles. — Basic to

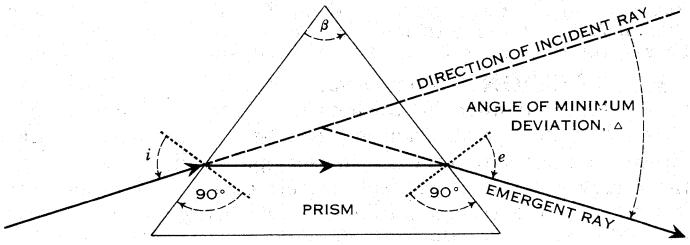


FIG. 1.— PRINCIPLE OF MINIMUM DEVIATION. USED WITH SPECTROMETER TO DETERMINE REFRACTIVE INDEX n OF PRISM: $n = \text{SIN } [(\beta + \Delta)/2] / \text{SIN } (\beta/2)$

all such instruments is Snell's law of refraction: $n = \sin i / \sin r$. The angle of incidence i and the angle of refraction r are the angles made with the normal, *i.e.*, perpendicular, to the boundary surface by the rays in the first and second media, respectively. The angles i and r are usually found indirectly from the deviations of rays which traverse not only the sample but one or more prisms and lenses of the refractometer as well. In the spectrometer type of instrument the incident rays come from a narrow slit so that, with a proper lens system, the refracted rays can be located precisely with the aid of a telescope. The spectrometer is ordinarily used with the principle of minimum deviation, which states that the angle between incident and emergent rays (fig. 1) can be made a minimum, Δ, by a unique orientation of the prism. Under these conditions, $i = e$, and the refractive index of the prism is $n = \sin \frac{1}{2}(\beta + \Delta) / \sin \frac{1}{2} \beta$, where β is the angle between the refracting faces of the prism.

Critical-angle refractometers make use of particular incident and refracted rays. The critical angle of refraction, C, is the greatest value of r which can be attained by any ray passing from a less to a more refracting medium (fig. 2). According to Snell's law, C corresponds to an incident ray that grazes the intersurface between the two media ($i = 90°$). All other refracted rays come closer than C to the normal direction. In critical-angle refractometers a prism of known refractive index n_p is used as the more refracting medium. A beam of nonparallel rays passes through the sample into the prism. On viewing the light refracted through the prism by means of a telescope, one finds a sharp critical boundary between a dark and a light region (fig 2) which very precisely defines the rays having the angles $i = 90°$ and $r = C$. The refractive index of the sample is given by the equation $n = n_p \sin C$.

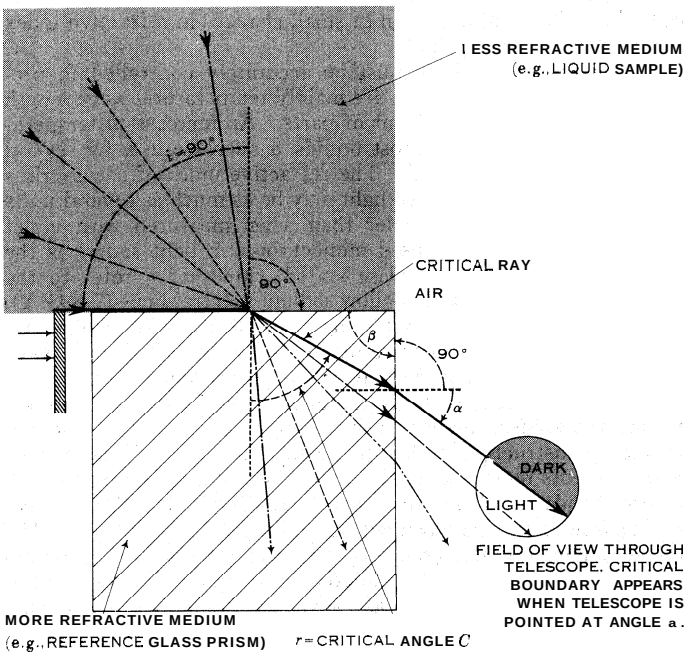


FIG. 2.— CRITICAL ANGLE OF REFRACTION. RAYS HAVING AN ANGLE OF INCIDENCE OF EXACTLY 90° APPEAR IN THE VIEWING TELESCOPE AT THE SHARP BOUNDARY BETWEEN A LIGHT AND A DARK REGION. HENCE THEIR ANGLE OF REFRACTION CAN BE MEASURED ACCURATELY

Abbe *Refractometer*.—This instrument is perhaps the most widely used critical-angle instrument. The ordinary model is rugged, compact (about the size of a microscope) and is capable of fourth-decimal accuracy. Only a few drops of a liquid sample are required, and a determination may be completed in less than five minutes. Liquid samples are confined to a thin film between the surfaces of the refracting prism P (fig. 3), $\beta = 60°$, and an adjacent auxiliary prism P'. The latter prism serves to send light into the sample in the direction required for the critical boundary. If white light is used, the critical boundary is not sharp because of the different refraction of rays of different wave length.

Most Abbe models are provided with a pair of compensating prisms, mounted in the barrel of the telescope, which remove nearly all of the boundary colour and sharpen the boundary. The amount of rotation of one compensating prism relative to the other, required to achromatize the boundary, provides a rough measure of the dispersion of the sample. The compensating system is designed to give refractive indices corresponding to a wave length near that of the sodium lines. The prisms holding the sample can be rotated with respect to the telescope about an axis passing through the point R (fig. 3). With a solid or liquid sample on the lower face of the prism P, the critical boundary can be made to coincide with the cross hairs in the telescope by rotating the prism by means of the alidade arm and a slow-motion screw. A pointer attached to the arm indicates the degree of rotation on a circular scale attached to the telescope. The scale may read directly in terms of refractive index n or, as desired, in terms of concentration of some solute. The range of each instrument is limited by the refractive index of the prism. Usually refractive indices from 1.3 to 1.7 can be covered.

Dipping *or* Immersion *Refractometer*.—This instrument resembles the Abbe instrument without the auxiliary prism P'. The refracting P is directly immersed in liquid samples, and the critical boundary is located with respect to a movable eyepiece scale. The dipping refractometer is widely used to check the concentration of solutions. The use of interchangeable prisms gives it a greater range than the Abbe type.

Other Types.— Deviation-type instruments, such as spectrometers, cover an unlimited range of refractive indices and, when appropriately designed, can be used with ultraviolet or infrared light. The material under investigation must be in the form of an accurately shaped prism. Liquid samples are placed in a prismatic cell. Monc-hromatic or polychromatic light from a narrow slit is made parallel by a collimating lens before traversing the prism. For each wave length an image of the slit is located by means of a telescope mounted on a graduated circle. The many necessary careful adjustments make the spectrometer inconvenient for routine use. Its principle is employed, however, in a number of simplified image-displacement refractometers. Some of these'are designed for rapid measurement of small liquid samples. The sample is made into a tiny prism by placing a drop between a pair of glass surfaces. If an illuminated slit is viewed through such a prism, its apparent position is shifted from its true position by an amount that depends on the refractive index of the sample and the angle of the prism. The amount of image displacement can be observed on a scale mounted behind the prism. A variation of this principle is found in the Nichols refractometer, which uses a microscope to observe the image displacement. The ordinary microscope can be adapted for use as a simple refractometer of this type.

Interference-Type Instruments.— Interference refractometers are indispensable for finding the refractive indices of gases; they can also be used for liquids and some solids. The interferometric method offers the most convenient means for determining the concentration of a substance in an extremely dilute solution.

Differences in refractive index of one part in a million may be detected easily, and still higher sensitivities have been attained. Such small differences may be of practical importance, as in the industrial analysis of air. Portable interference refractometers have been used to detect traces (0.1%) of methane (marsh gas) in coal-mine air as a means of preventing explosions.

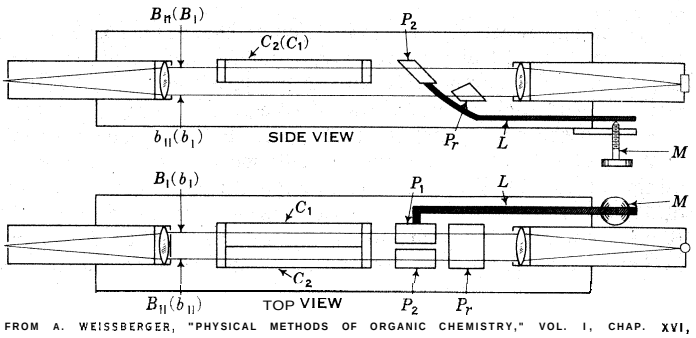
Optical Principles.—In the interference-type refractometer a set of interference bands is produced by the superposition of two light beams originating at the same slit source. When a transparent substance having a refractive index n is placed in the path of one of the beams while the other beam travels a comparable distance in a material of index n_o, there is a displacement of the interference bands that depends on the difference n − n,.

The relation between refractive index and band displacement can be understood by considering the superposition of two converging trains of wave fronts. If they originate at the same slit source, there is a series of locations along the wave fronts where the waves are in the same phase of vibration and reinforce each other to produce a maximum light intensity. At intervening places the waves will be out of phase and tend to annul each other. One then sees alternately bright and dark areas in the field of view. These interference bands usually appear as narrow vertical fringes. If one of the wave trains is slowed down somewhat by passing through a more refracting medium than the other, the locations of the maxima and minima will be displaced laterally.

A relative retardation by one wave length causes the bands to shift laterally by one fringe interval. The band displacement, in number of fringe intervals N, is consequently related to the refractive index n by the formula $n - n_o = \lambda N/t$, where λ is the wave length of the light and t is the thickness of the interposed sample.

Rayleigh *Refractometer.*—The basic elements of the Rayleigh interference refractometer (fig. 4) are two achromatic lenses of long focal length, the first for obtaining parallel rays from a narrow slit source, the second for bringing together two beams, B_I and B_{II}, emerging from two broad slits in front of the first lens. The resulting interference bands are' observed with the aid of a cylindrical lens focused on the focal plane of the second achromatic lens. Adjacent cells C_1 and C_2, each in the path of one of the beams B_I and $B_{,,}$. contain the reference substance and the sample.

Commercial instruments are usually of the Rayleigh-Haber-Löwe type (fig. 4), which uses the Jamin method of determining the band displacement. B_I and B_{II} are so divided that there are actually four beams: B_I, B_{II}, b_I and b_{II}. The lower beams, b_I and b_{II}, pass through air and the lifting prism (Pr). The upper beams, B_I and B_{II}, pass through cells C_1 and C_2 and movable plate P_1 and fixed plate P_2, respectively. Instead of counting the bands, the path in the glass is increased by tilting the plate P_1 to produce a retardation just equal to that produced by the sample in the other beam. The effective thickness of P_1 is adjusted by the tilting lever L and a graduated micrometer screw. The micrometer scale may be calibrated to read values of $n - n_o$. The screw M is turned until the central interference band is brought back into the position it had before the sample was introduced. The central band in white light can be recognized because it is the only one having a pure white colour. See also INTERFEROMETER; LIGHT; OPTICS.



FROM A. WEISSBERGER, "PHYSICAL METHODS OF ORGANIC CHEMISTRY," VOL. I, CHAP. XVI, FIG. 18, INTERSCIENCE PUBLISHERS INC., NEW YORK, 1945

FIG. 4.— SCHEMATIC DIAGRAM OF RAYLEIGH-HABER-LÖWE INTERFERENCE REFRACTOMETER

Automatic recording refractometers. Instruments of this nature show promise of wide application in science and industry as a means of detecting small changes in flowing gases and liquids. Any of the types of refractometers may be adapted to automatic recording by substituting a photoelectric cell for the human eye. The current through the cell provides a measure of the intensity of light falling on the cell at a definite location.

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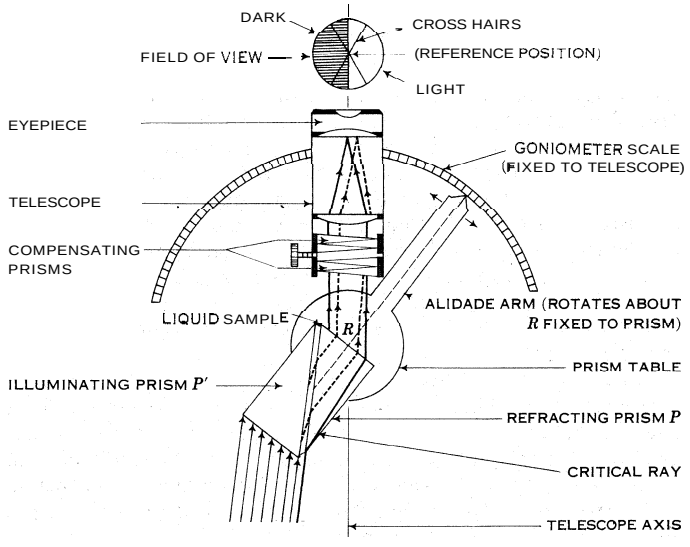

FIG. 3.— SCHEMATIC DIAGRAM OF ABBE REFRACTOMETER

REFRIGERATION. Refrigeration is the process of extracting heat from the interior of an insulated enclosure and rejecting it to the surroundings or some other external medium of higher temperature, thereby lowering the temperature inside the enclosure. Heat will not flow spontaneously from a region of low temperature to one of higher temperature, and so mechanical work or heat energy from an external source must be expended to move the heat from the enclosure to be refrigerated.

In the following article the applications of refrigeration are treated first. Then follow discussions of the working principles of refrigeration systems, the mechanical compression and absorption systems of refrigeration, and the history of liquefaction of gases.

APPLICATIONS OF REFRIGERATION

Household Refrigerators and **Freezers.**—With the achievement of reliability in modern, hermetic, mechanical refrigeration systems of fractional horsepower size, the main emphasis in household refrigerators was placed on improved appearance, utility and convenience.

The greatly increased use of frozen foods resulted in the need for refrigerators with much larger and colder frozen-food storage compartments. In a variety of models the freezing compartments run the full width across the top or bottom of the food compartment. The evaporator is operated at the low temperatures required for proper food storage but at the same time maintains temperatures above freezing in the regular food storage compartment, an insulated baffle being placed beneath the evaporator. Some manufacturers provide separate cooling for the freezer and the food storage compartments with separate evaporators. In larger refrigerators a two-door design is introduced, where the freezer and food storage compartments are completely separated from each other and each has its own exterior door. The volume of the frozen-food compartment may vary from 20% to 100% of the food storage compartment volume. Those in the latter category are normally classified as combination refrigerator-

freezers.

The trend toward specialized interior designs has become a common practice. Meat storage compartments maintained at temperatures slightly above freezing, with relative humidities around 90%, special high-humidity compartments for leafy vegetables, shelves on the inner panel of the door for storage of small bottles, containers, eggs, etc., and compartments with provisions for maintaining butter at suitable spreading temperatures are common. Another important feature in modern household refrigerators is the rapid automatic defrosting of the evaporator. With defrosting cycles ranging from 5 to 30 minutes in duration no substantial rise occurs in the frozen-food temperature or in the normal food compartment temperature.

The use of household freezers in urban homes and on farms can be considered to have assumed commercial importance in 1937, and their acceptance and use have been constantly increasing since that year. The functions of the household freezer are to provide a storage space at a temperature of 0° F. or below and a fast-freezing zone where limited quantities of fresh food may be frozen in a reasonably short time with minimum disturbance of the stored load temperature. Modern freezer cabinets are made in two general styles, namely, the upright freezer and the chest-type freezer. Upright freezers have followed the pattern of household refrigerators, with interior locker doors used to reduce air spillage and to form convenient loading shelves when the main door is opened. Tests comparing chest and upright types indicate no significant difference in operating costs with a door-opening frequency of two per day. The frost accumulation in the upright type may become objectionable when more frequent door openings are necessary, but in household use this objection is not experienced.

Cold-Storage Warehouses.— Cold-storage warehouses vary in capacity from 1,000,000 to 6,000,000 or more cubic feet of storage space devoted, on the average, two-thirds to freezer space and one-third to cooler space. Unless special provisions are made for quick freezing, the minimum temperatures maintained in these spaces usually are: sharp freezers, −15° to −10° F.; carrying freezers, −10° to 0° F.; and coolers, 30" F. The actual refrigeration capacity necessary to take care of a cold-storage warehouse is not always easy to estimate as the load requirements vary appreciably with the nature of products stored and many other operating variables, including the size of the plant. To give an idea of the order of magnitude involved. one can say that an average cold-storage warehouse of 6,000,000 cu ft. storage capacity requires the installation of the order of 300 tons of refrigeration.

The cooling systems used in cold-storage applications come under three main classifications, namely: (1) the direct application, where the refrigerant proper circulates in pipe coils in the space to be cooled; (2) the indirect application, where the refrigerant cools a brine (a solution of water and calcium chloride or sodium chloride having a freezing point temperature as low as −60" F., depending on the salt concentration) in a heat exchanger, and the cold brine circulates in pipe coils in the space to be refrigerated; (3) the indirect application, where air, cooled either by a brine spray or direct expansion coils, is circulated through diffusers in the refrigerated space. Of the three methods mentioned, the brine and the forced-air circulation methods are the most extensively used because of their greater flexibility and safety features. It is common practice to use several refrigeration compressors to handle the total load of a cold-storage installation, a number of the units supplying refrigeration for the freezer rooms and others for the coolers, with at least one unit kept as a stand-by or spare to be used in the event one of the operating units breaks down.

Another type of installation somewhat similar to the cold-storage warehouse but much smaller in capacity and more specialized in function is the frozen-food locker plant, where foods are frozen and held in storage for families and other groups of a community.

Refrigerated Food Transportation.— *Trucks and Trailers.*— The distribution of refrigerated foods from major storage centres to retailers and even the long-distance hauling from farms and food processing centres to cities is handled to a large extent by refrigerated trucks and trailers. In the main, two types of truck bodies are constructed: those maintaining 35° to 40° F. for carrying fresh meat, vegetables and dairy products; and those holding about 0° F. for ice cream and frozen foods. Numerous types of mechanical refrigeration systems are used in both trucks and trailers, the source of power being obtained either by a separate internal-combustion engine or from the truck engine itself. either by a crankshaft extension at the front end or by a power take-off from the transmission. Besides mechanical refrigeration, water ice and dry ice (solid carbon dioxide) are extensively used in refrigerated transportation, where these are charged in conveniently located bunkers either at the end or near the ceiling of the truck body, and air is circulated past them and through the body by means of a small blower. The use of dry ice in refrigerated transportation (truck, trailer and rail) was steadily increasing in the 1960s despite its much higher cost per pound. Because of its low temperature it is ideal for frozen-food transportation. When dry ice is used in the shipment of fresh foods, the carbon dioxide gas in the atmosphere immediately surrounding the product serves as a means of reducing the oxygen content of the air, thus minimizing possible deterioration resulting from oxidation. Also, it inhibits the growth and development of bacteria and various molds which cause spoilage. It is often the practice to precool the interior of the truck, as well as the fresh produce, prior to or at the time of loading.

Refrigerated Railway Cars.— Despite the tremendous volume of perishables transported by trucks and trailers and their increasing competition nith the railways, the main bulk of long-distance refrigerated transportation was handled by rail in the 1960s. The earliest known use of refrigeration by the railroads was in July 1851. when several tons of butter were shipped from Ogdensburg, N.Y., to Boston, Mass., in a wooden boxcar insulated with sawdust and stocked with ice. More than a century later, water ice was still more or less the universal cooling medium in refrigerated freight and express cars. The modern standard refrigerator car in the U.S. is 40 ft. long and of the end-bunker type, equipped with fans and having about 4 in. insulation. Some cars, 50 ft. long and with 6 in, insulation, using 30% by weight sodium chloride salt with water ice giving a bunker temperaturt of −3° F., are used in the transportation of frozen foods. The use of mechanical refrigeration on railways was still more or less in the developmental stage in the early 1960s. Considerations of high first cost and high maintenance costs were expected to delay wide-scale mechanical installations. The few mechanically refrigerated freight cars in operation were mostly equipped with Freon-12 compressors run by diesel-electric drives. Each of these cars had a refrigeration capacity of about seven tons, and they were used mainly by the frozen-food and frozen-concentrate industry.

Marine Refrigeration.— The early history of mechanical refrigeration as applied to food transportation finds its origin in marine refrigeration. In the summer of 1880 the steamer "Strathleven" brought to England the first successfully carried refrigerated meat cargo. Early shipboard installations were equipped with dense-air machines, later being replaced by carbon dioxide and ammonia systems. In modern installations Freon refrigerants are used extensively. Design conditions and other basic principles are not greatly different in marine refrigeration from those in cold-storage warehouse practice. All equipment and installations must be specified as complying with the rules and regulations of the classification societies (American Bureau of Shipping or Lloyd's Register or both, etc.).

Manufacture of Water Ice.— Despite the tremendous increase in the use of fractional-horsepower mechanical refrigeration units for household and other commercial refrigeration uses, the manufacture of water ice remained a major industry. The method most extensively used is the can method, using treated or untreated raw (tap) water. Galvanized steel ice cans, usually of about 320 lb. capacity, 11 x 12 in. at the top and 50 in. in depth, with an overall taper of $\frac{1}{4}$ in, in their length. are submerged in a well-insulated (10 to 12 in. granulated cork) tank in which cold brine is circulated. Tank depths are usually about 52 in. for 320-lb. ice cans, and width and length seldom exceed 40 and 120 ft. The brine is cooled by direct-expansion evaporator coils normally placed be-

tween rows of cans. The velocity of the brine flowing past the cans and the brine temperature determine the time required for freezing. Brine velocities should not exceed about 35 ft. per minute, and variations of temperature should be kept less than 1° F. For a given brine velocity, the time required to freeze a given thickness of ice is determined first by the brine temperature. As most raw waters, treated or untreated, crack upon freezing at temperatures below 10° F., the freezing temperatures are in general somewhat above this figure. The rate of freezing drops rapidly as the ice becomes thicker. An 11 x 12-in. can holding 320 lb. of water in 12° F. brine takes 24 hours to freeze the first 280 lb. of ice and requires an additional 14 hours to freeze the last 40 lb. When raw water is used in the manufacture of ice it is necessary to agitate the water in the cans during freezing to obtain clear ice. This is done by bubbling dry air, usually at about 15 to 18 lb. per square inch (p.s.i.) gauge pressure, at the centre of each can, thus rejecting most of the dissolved minerals into the unfrozen centre core. Near the completion of freezing, the concentrated core, consisting of about three to four gallons, is sucked out and replaced with chilled fresh water to complete the freezing of the complete block. The refrigeration reauired to manufacture ice depends on many factors, such as initial water temperature, brine temperature, insulation of brine tank, efficiency of refrigeration compressors, size of plant, etc. A good figure for a well-constructed plant of 30- to 50-ton daily ice capacity using 60° F. water and 12° F. brine is 1.52 tons of refrigeration per ton of ice.

Despite the large amount of ice consumption in all countries of the world, the methods for handling and processing ice have not changed significantly over the years. Only in the decade following World War II did mechanization of ice making become widespread. There was then a definite trend toward increased sales of ice in small sizes (cubed, crushed and sized and shaved) aside from the manufacture of block ice. Installation of scoring machines, cubing machines, sizing machines and packing machines for automatic vending stations expanded rapidly.

Comfort Air Conditioning. — In its strictest definition, comfort air conditioning must incorporate the following features: control of temperature, humidity, air distribution (ventilation), odour, air cleanliness and in some instances air sterilization. All comfort conditioning applications are functionally similar whether the space under consideration be a residential dwelling, large building, hotel or restaurant. In large installations, involving sometimes 1,000 or more tons of refrigeration capacity, the central system design is adapted. However, the majority of installations run in sizes starting from ½ ton for window air-conditioning units to 5, 10 or 25 tons for small retail shops, restaurants, etc. *(See* AIR CONDITIONING.)

Other Applications. — The following constitutes only a partial illustrative list of the many diverse applications where refrigeration is used extensively: food processing and manufacturing: dairy products (butter, ice cream, cheese), beverages (beer, wine and other alcoholic and carbonated beverages), bakery goods, etc.; industrial and engineering applications: liquefied storage and transportation of industrial gases (oxygen, nitrogen, hydrogen), manufacture of dry ice, textile industry (synthetic and natural yarn processing and weaving), petroleum refining and chemical processes, metallurgical processes, engineering construction (freezing of sliding silty soils in the construction of dams, tunnels, shaft sinking, curing of large masses of poured concrete), low-temperature testing facilities, wind-tunnel cooling. etc.; industrial air conditioning: printing and paper manufacture, precision machining and assembly of metal machine parts, confectionery processing, deep-mine cooling, preservation of valuable books, paintings, tapestries, etc., in libraries and museums, etc. See also AIR CONDITIONING; HEATIKG AKD VENTILATION.

WORKING PRINCIPLES OF REFRIGERATION SYSTEMS

Refrigeration technology draws its basic knowledge from three interrelated yet distinct areas of science, namely, thermodynamics, heat transfer and fluid flow. In the following sections the underlying principles of operation of major refrigeration systems are discussed, drawing on the basic sciences only to the extent necessary to achieve understanding and clarity.

In all refrigeration systems the working fluid used to carry away the heat from the region to be cooled is known as the refrigerant. The boiling temperature of refrigerants, as that of any other liquid, depends on the pressure at which the boiling takes place, the boiling temperature decreasing with decreasing pressure. This boiling temperature *v.* pressure characteristic of refrigerants is used to advantage in all refrigeration systems and can be said to constitute the main principle of operation. Fig. 1 illustrates the boiling temperature v. pressure characteristics of some commonly used refrigerants. It is to be noted that, at a given pressure, the phenomena of boiling and condensation take place at the same temperature, one process being the reverse of the other.

MECHANICAL COMPRESSION REFRIGERATION SYSTEMS

The most widely used refrigeration cycle is the mechanical compression refrigeration cycle which is schematically illustrated in fig. 2. Referring to fig. 2, high-pressure refrigerant vapour is discharged from the compressor (point 1) in a superheated state (a

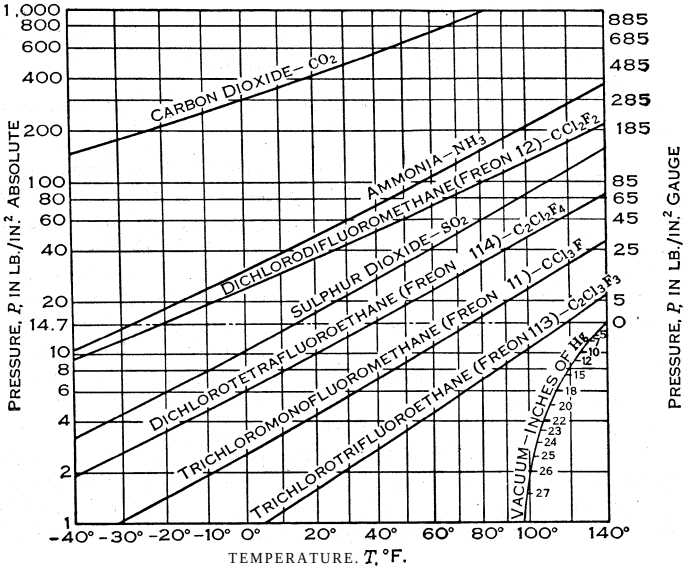

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FIG. 1. — PRESSURE AND TEMPERATURE RELATIONSHIP OF SOME REFRIGERANTS

state having a temperature higher than the boiling temperature at that pressure) and enters a heat exchanger known as the condenser. In the condenser the refrigerant vapour is condensed, essentially at constant pressure, by giving up its latent heat to the cooling water flowing through coils or tubes, as shown in the figure. or to the surrounding atmosphere, as is often the case in small-sized machines. The saturated liquid refrigerant (liquid at the boiling temperature corresponding to the condensing pressure) is collected into a receiver tank which in the case of water-cooled condensers may consist of the lower portion of the condenser shell itself as indicated in fig. 2. At point 2 the saturated liquid refrigerant at high pressure enters the expansion valve, also known as the throttling valve or reducing valve, and its pressure is reduced to a much lower value at point 3. Simultaneous with the reduction in pressure an associated reduction in temperature takes place, the new temperature corresponding to the boiling temperature at this lower pressure. The actual mechanism which accounts for this lowering of the liquid refrigerant temperature consists of the flashing into vapour of a portion of the liquid, and as there exists no external source of heat, the energy for this evaporation is supplied by the liquid refrigerant itself, thus causing its temperature to drop. At point 3 in fig. 2 the low-temperature liquid refrigerant, with a small fraction of its vapour, is admitted to a heat exchanger known as the evaporator. Within the evaporator (which may be constructed in a variety of designs) the liquid

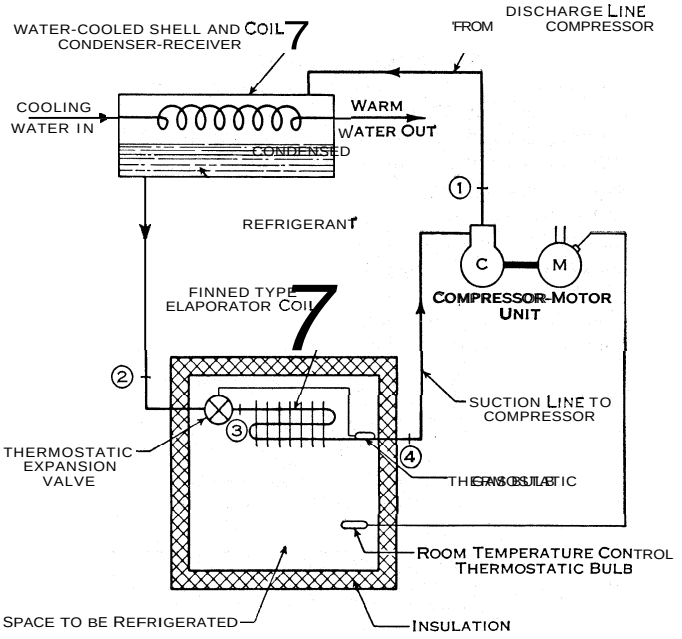

FIG. 2.— SCHEMATIC FLOW DIAGRAM OF A MECHANICAL REFRIGERATION SYSTEM

refrigerant is evaporated by heat transferred to it from the comparatively warmer space to be refrigerated. The flow rate of the refrigerant is so adjusted by the thermostatic expansion valve that at the exit of the evaporator, at point 4 in the system, all the liquid refrigerant is in the saturated vapour state (vapour at the boiling temperature corresponding to the evaporator pressure). The vapour leaving the evaporator enters the suction side of the compressor and is compressed to a higher pressure. The work *of compression raises both the pressure and temperature of the refrigerant vapour* which *is discharged in the superheated vapour state and ready to repeat the entire cycle over again.*

A cycle of the type described above is known as a steady flow thermodynamic cycle because at any one point in the cycle refrigerant conditions (i.e., flow rate, temperature, pressure, etc.) do not change with *time,* while *heat and* work *are received by the refrigerant in the evaporator and compressor, respectively, and heat is rejected in the condenser. It is to be noted that the cycle discussed above operates between* two *levels of pressure and* two *corresponding levels of* temperature. *The high-pressure half of the cycle extends from the dis rge of the compressor to the inlet of the expansion valve, and the low-pressure side extends from the discharge of the expansion valve to the inlet of the compressor.*

Thermodynamic Analysis of Compression Refrigeration Cycles.— The evaluation of the performance of the various components of the refrigeration cycle discussed above requires a knowledge of some of the laws of thermodynamics which govern the interconversion of heat and work *and enable the calculation of the thermal properties of substances. It sufficesto state here that extensive tables of thermodynamic properties of all commonly used refrigerants have been prepared and are available in tabular or graphical form readily usable in engineering calculations (see* HEAT; THERMODYNAMICS).

From the principle of conservation of energy it can be stated that for a fluid *in steady flow the summation of all its energy* quantities *(its total energy) entering a system (compressor, heat exchanger, etc.) must be equal to the summation of all its energy quantities leaving the system. For a unit mass* flowing *in and out of a system per unit time this principle can be written in symbolic form as:*

$$u_1 + A(P_1v_1) + A(V_1^2/2g) + AZ_1 + {}_1Q_2 = u_2 + A(P_2v_2) + A(V_2^2/2g) + AZ_2 + A({}_1Wk_2) \quad (1)$$

In the above relation subscripts 1 and 2 refer, respectively, to the magnitudes of the various quantities as the fluid enters and leaves the system. The magnitude of the various quantities can be expressed in any consistent set of units such as the British system of engineering units employed here. The above symbols are defined as follows: u = internal energy of the fluid, its value depending on the temperature and pressure of the fluid, expressed in the units of B.T.U. per pound (one B.T.U. [British thermal unit] is the quantity of heat required to raise the temperature of one pound of water by one degree Fahrenheit [from 63° F. to 64" F.]); P = pressure of the fluid, in pounds per square foot; v = specific volume of fluid, in cubic feet per pound; V = velocity of the fluid, in feet per second; Z = elevation of the inlet to the system measured from an arbitrary reference level, in feet; ${}_1Q_2$ = heat transferred to or away from the fluid from the time it enters to the time it leaves the system, in B.T.U. per pound of fluid flowing (by convention, ${}_1Q_2$ is taken as positive if the fluid receives heat and negative if it gives up heat); ${}_1Wk_2$ = external work done by the fluid or on the fluid from the time it enters to the time it leaves the system, in foot-pounds per pound of fluid flowing (by convention, ${}_1Wk_2$ is taken as positive if it is performed *by the fluid and negative if it is performed on the fluid); g = gravitational acceleration whose standard value is 32.2 ft. per square second; A = the mechanical equivalent of heat, a universal constant used to convert units of work into units of heat and vice versa ($A = \frac{1}{778}$ ft.-lb. per B.T.U.).*

Examining equation (1) further, the term (Pv), the product of the pressure by the volume, represents the magnitude of the flow work necessary to set the fluid in motion; the term $V^2/2g$ represents the kinetic energy caused by motion; and Z represents the potential energy of the moving fluid measured above a given arbitrary reference datum plane. In thermodynamics, because of the frequent simultaneous occurrence of the terms u and (Pv), a new *term called enthalpy is defined as $h = u + Pv$. Hence, the quantity $(u_1 + AP_1v_1)$ can be written as h_1 and $(u_2 + AP_2v_2)$ as h_2. Making these substitutions and transposing some of the terms, equation (1) can be rewritten in the form*

$$(h_2 - h_1) = {}_1Q_2 - A({}_1Wk_2) + A(V_1^2 - V_2^2)/2g + A(Z_1 - Z_2) \quad (2)$$

Equations (1) and (2), which are identical, are known as the general energy equations for steady flow and are used extensively in engineering calculations involving the interchange of heat and work. *For reasons of simplicity, in the analysis of refrigeration cycles it is common practice to neglect the last two terms on the right-hand side of equation (2), since their magnitude is either zero or negligible compared with the others. Indeed, the difference in elevation between the inlet and outlet openings or the difference in velocity between the inlet and outlet of compressors or heat exchangers is either nil or negligible. On the basis of this simplifying assumption equation (2) reduces to the form*

$$(hz - h_1) = {}_1Q_2 - A({}_1Wk_2) \quad (3)$$

Equation (3) may be applied to any one of the components that make up the refrigeration system shown in fig. 2. Considering the condenser, the refrigerant receives no external or shaft work *and delivers none as it enters and leaves this equipment, and only heat is exchanged between the condensing refrigerant and the cooling water. Therefore in equation (3) the quantity ${}_1Wk_2$ is zero, and the decrease in enthalpy of the refrigerant $(h_2 - h_1)$ is equal to the heat it rejects to the cooling water, ${}_1Q_2$. The evaporator is a similar piece of equipment and again there is no work involved; therefore, the heat absorbed from the space to be refrigerated is equal to the increase of enthalpy of the evaporating refrigerant, ${}_3Q_4 = (h_4 - h_3)$. The* flow *through the expansion valve involves neither the exchange of heat nor work, hence, in this instance, equation (3) yields the result $h_3 - h_2 = 0$, indicating that the refrigerant undergoes no change of enthalpy. In the case of the compressor a definite amount of work, ${}_4Wk_1$, is delivered to the refrigerant vapour being compressed.* While *some heat, ${}_4Q_1$, is dissipated from the compressor* cylinder *head to the surrounding atmosphere by convection and radiation, this quantity is usually a small fraction of the total* work *input and may be neglected in most instances without causing serious error. Where more exact*

calculations are desired or, in the case of jacketed water-cooled compressors, where the heat loss from the compressor cylinder is appreciable, in applying equation (3) either the quantity ${}_4Q_1$ must be known or a different expression should be used to evaluate the work required for compression. Such an expression has the general form

$$Wk_{comp.} = [n/(n-1)]P_4v_4[1 - (P_1/P_4)^{(n-1)/n}] \quad (4)$$

where all symbols are as defined before and n is a constant which depends on the nature of the refrigerant, the type of compression (the extent of heat loss during compression) and the pressure range over which the compression takes place. Values of n are determined experimentally and are reported in reference works on refrigeration. An important observation to be made in equation (4) is the fact that the work of compression depends primarily on the pressure ratio of compression and not on the absolute values of the inlet or discharge pressures.

The Thermodynamic Diagram. — In the solution of refrigeration problems it is most helpful to trace the processes the refrigerant undergoes on a chart of thermodynamic properties of the refrigerant. Such a chart most frequently used in refrigeration work is the pressure v. enthalpy chart shown in skeletal form in fig. 3, where the interrelationship between three of the most frequently

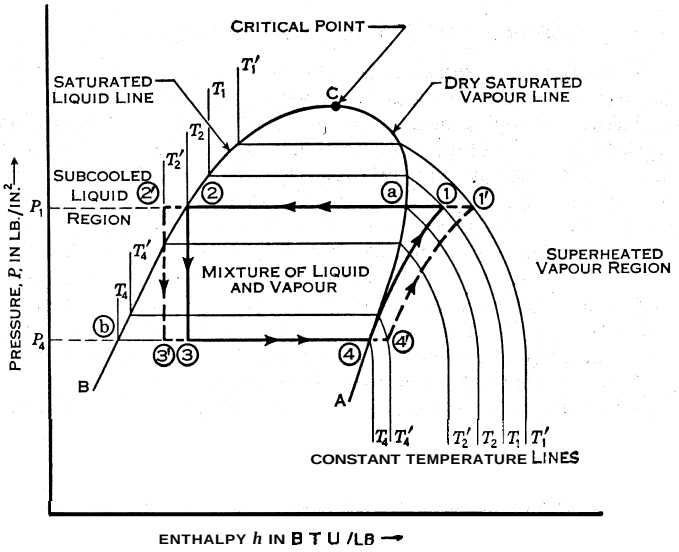

FIG. 3.— SKELETAL THERMODYNAMIC DIAGRAM ILLUSTRATING THE REFRIGERANT CYCLE FOR THE SYSTEM SHOWN IN FIG. 2 (NUMBERS CORRESPOND TO POINTS IN FIG. 2)

used properties of refrigerants (pressure, enthalpy and temperature) is graphically depicted. The properties pressure and enthalpy are chosen as the co-ordinates for the figure, and their variation with temperature is represented by the family of constant temperature lines T_4, T_4', T_2', T_2, T_1, T_1', in order of increasing temperature. The dome A-C-B is known as the saturation dome. Points along the curve A-C represent states of dry saturated vapour and along B-C states of saturated liquid. The saturated vapour and saturated liquid curves meet at point C, which is known as the critical point. At this unique temperature and pressure the liquid and vapour phases of the refrigerant are indistinguishable and therefore possess identical properties known as the critical properties of the refrigerant. The region to the right of the saturated vapour curve A-C represents states of superheated vapour and that to the left of the saturated liquid curve B-C represents states of subcooled (or compressed) liquid (liquid at a temperature lower than the condensation temperature corresponding to the same pressure). The region within the dome A-C-B (wet vapour region) represents states of mixtures of liquid and vapour refrigerant. The per cent*by weight of vapour in the mixture at any point within the dome is obtained by taking the ratio of the horizontal distance between the saturated liquid curve and the point in question to the total distance between the two saturation curves (measured at the same pressure). For example, at point 3 (fig. 3) the per cent of vapour in the mixture is given by the ratio of distances (b to 3)/(b to 4) or $(h_3 - h_b)/(h_4 - h_b)$. This fraction is called the quality of the wet vapour and is designated by the symbol x. On this basis, the vapour at point 4 on the saturated vapour curve would have a quality x = 100%. At a given pressure or temperature, the difference in enthalpies between the saturated vapour and saturated liquid is known as the latent heat of evaporation (or condensation) representing the quantity of heat required to evaporate completely a unit mass of refrigerant from the saturated liquid state to saturated vapour state (at constant temperature and pressure). It should be noted that within the saturation dome A-C-B the constant temperature lines are horizontal and coincide with the corresponding saturation constant pressure lines.

The Thermodynamic Cycle. — The cycle of the refrigerant corresponding to the simple refrigeration system of fig. 2 is traced on this thermodynamic chart, with corresponding points on the flow diagram being labeled by matching numbers on fig. 3. Referring to fig. 3, the trace 1–2–3–4 represents this cycle. At point 1 the compressed and superheated refrigerant vapour (at temperature T_1 and pressure P_1) leaves the compressor and enters the condenser. As heat is transferred in the condenser to the cooling water the superheated vapour is cooled at constant pressure and its temperature drops from T_1 to T_2 (same as T_a). At point a the saturated vapour begins to condense and upon further heat transfer condensation continues between points a and 2, the vapour giving up its latent heat of condensation until at point 2 all of the vapour is completely liquefied and is collected in the lower part of the condenser (or a receiver) as saturated liquid. At point 2 the saturated liquid refrigerant enters the expansion valve and its pressure is reduced from P_1 (same as P_2) to P_3 $(P_3 = P_4)$. As shown earlier, the enthalpy of the refrigerant entering and leaving the expansion valve is the same; *i.e.*, $h_2 = h_3$. As a result of this pressure drop the temperature of the refrigerant is reduced to T_3 (same as T_4) at the expense of some of the liquid flashing into vapour. The fraction of the liquid flashed (the quality) is given by the ratio $x_3 = (h_3 - h_b)/(h_4 - h_3)$. At point 3 the refrigerant (mixture of liquid and vapour) enters the evaporator and as it absorbs heat from the refrigerated space and its contents it continues to evaporate at constant pressure and temperature until at point 4 all of the refrigerant is completely evaporated and leaves the evaporator as saturated vapour. The dry saturated vapour enters the compressor at point 4, and by means of external work it is compressed along the path 4–1 and is discharged at 1 to repeat the cycle. The cycle just described is known as the simple saturation ideal cycle because the refrigerant entering the expansion valve and the compressor consists of saturated liquid and saturated vapour, respectively. It is called ideal because of the simplifying assumption that no pressure drop takes place in any of the piping, the heat exchangers, or at the inlet and outlet of the compressor.

In actual practice it is nearly always the case that the liquid refrigerant leaving the condenser is somewhat subcooled and the vapour leaving the evaporator is somewhat superheated. Such a cycle is shown in fig. 3 by the trace 1'–2'–3'–4'. All other things being the same, the effect of subcooling is to increase the refrigeration effect per pound of refrigerant circulated in the system and is therefore desirable. On the other hand, superheating of the vapour entering the compressor increases the work of compression and should be kept to a minimum.. A slight amount of superheating is encouraged in practice as a safety measure to protect the compressor by preventing any liquid from entering the compressor cylinder.

All previous discussion and analysis have been based on one pound of refrigerant circulating in the system. In the design and analysis of actual systems certain information and requirements are given the engineer at the outset. For instance, the refrigeration load (demand) is specified, and the temperature at which this refrigeration effect is desired is stated. The temperature of the available condenser cooling water (or ambient air) is also specified. Starting with this information, the first step is to determine the condensation and evaporation temperatures and pres-

sures for the refrigeration cycle. In practice, it is customary to assume an average temperature difference between the cooling medium and the condensing refrigerant of the order of 10° F. A similar figure is taken for the temperature difierence between the evaporating refrigerant and the refrigerated medium. The smaller the temperature differential, the larger becomes the required size of the heat exchanger needed to accomplish a given heat transfer. Hence. the actual selection of temperature differentials to be used is based on both engineering and economic considerations. In general, therefore, one can write

$$T_c = (T_{c.w})_{av.} + (\Delta T)_c \text{ and } T_e = T_r - (\Delta T)_e \qquad (5)$$

where T_c, T, and T_r are the temperatures of the condensing and evaporating refrigerants and refrigerated medium, respectively; (T, ₃)$_{av}$ is the average cooling nater or air temperature; (AT), and (AT), are the design temperature differentials between the cooling water and condensing refrigerant and between the refrigerated medium and evaporating refrigerant, respectively, all temperatures being expressed in degrees F.

At this point the choice of a refrigerant must be made. The proper refrigerant selection is dependent primarily on the condenser and evaporator temperatures. A desirable refrigerant should not give rise to either unduly high condenser pressures or very low evaporator pressures. Some of the characteristics of refrigerants are discussed in a later section. Having decided on the refrigerant to be used and having determined the condensing and evaporating temperatures, the respective pressures are directly obtained by looking up the saturation pressures corresponding to these two temperatures. The next step in the analysis is the determination of the flow rate of refrigerant necessary to provide the desired refrigeration. Refrigeration load is commonly expressed in the unit of tons of refrigeration. In the U.S., 1 ton of refrigeration is equal to a cooling rate of 288,000 B.T.U. per 24-hour day or 200 B.T.U. per minute. The ton as the unit of refrigeration derives its name from the fact that to freeze 1 ton of water per day (1 U.S. ton equals 2,000 lb.) from 32° F. liquid to 32° F. solid requires approximately 288,000 B.T.U. In Great Britain and Europe the ton of refrigeration is sometimes defined either on the basis of the long ton (2.240 lb.) or taken equal to a cooling rate of one kilocalorie per second. These units are larger than the C.S. ton by 12% and 18.8%, respectively. Referring to the cycle 1–2–3–4 of fig. 3, the refrigeration performed per pound of refrigerant is given by $(h_4 - h_3)$, in B.T.U. per pound; hence, the required refrigerant flow rate, w, is

$$w = (\textit{tons of refrigeration})\ 200/(h_4 - hs),\ \textit{pounds per minute}$$

The work necessary for compression is obtained from the relation

$$Wk_{comp.} = w(h_1 - h_4)/42.42,\ \text{h.p.}$$

where 42.42 is a conversion factor between heat units and horsepower (1 h.p. = 42.42 B.T.U. per minute).

A final quantity of interest in the analysis of refrigeration cycles is the efficiency of performance of the cycle. The efficiency of refrigeration cycles. which is known as the coefficient of performance (C.O.P.), is defined as the ratio of the refrigeration effect produced in the evaporator to the compressor work necessary to bring about this refrigeration effect. In symbolic form this may be expressed as

$$\text{C.O.P.} = w(h_4 - h_3)/w(h_1 - h_4) = (h_4 - h_3)/(h_1 - h_4)$$

The C.O.P. of all mechanical refrigeration cycles is greater than 1. Since the magnitude of the C.O.P. is not directly indicative of the degree of perfection attained by an actual refrigeration system, it is often compared with the C.O.P. of an ideal cycle operating between the same condensing and evaporating temperatures. Such an ideal cycle is the Carnot cycle, named after its originator, Nicolas Léonhard Sadi Carnot, the French engineer. It can be shown in thermodynamics that a refrigeration system operating on the Carnot cycle requires the least amount of work per unit of refrigeration. It can further be shown that the C.O.P. of the Carnot cycle is independent of the type of refrigerant used and is fixed solely by the two temperatures at which heat is rejected and received. The C.O.P. of the Carnot cycle is defined as

$$(\text{C.O.P.})_{\text{Carnot}} = T_c/(T_c - T_e) \qquad (6)$$

where T, and T_c are the evaporation and condensation temperatures. respectively, expressed in degrees Rankine. Temperatures in degrees Rankine are obtained by adding 460 to Fahrenheit degrees (see THERMOMETRY).

Properties of Refrigerants.—Since the early days of mechanical refrigeration the number of available refrigerants has increased steadily as a result of the consistent efforts of chemists and physical chemists searching for new fluids possessing suitable thermal, physical and chemical characteristics to meet demands of new applications and equipment design. The most striking example of such research is the development of the series of refrigerants known under the trade name of Freons. With rapid advances in the understanding of the structure of matter it has become possible to synthesize almost any type of refrigerant suitable for a specific application. However, even scientific progress has not been able to produce the ideal refrigerant having simultaneously optimum thermodynamic. physical and chemical properties. Therefore, in the final analysis. refrigerant suitability for a specific application is determined as a result of both engineering and economic considerations, and compromises must be made among the most important factors involved in a particular situation.

ABSORPTION REFRIGERATION SYSTEMS

Absorption refrigeration systems use heat energy directly through the medium of a generator-absorber-pump circuit which replaces the complex mechanical compressor. In some absorption refrigerators a small liquid pump constitutes the only moving part in the entire system, and in others even this is eliminated, resulting in a system with no moving parts whatsoever. Two of the most prominent types of absorption systems are discussed below.

The Ammonia-Water Absorption Refrigeration Cycle.— The most common absorption system is the two-fluid, water-ammonia (also known as aqua-ammonia) system. The operation of this system is based on the particular relationship between the temperature, pressure and concentration of a mixture of two fluids, such as ammonia and water, while it undergoes a change of phase. When a mixture of ammonia and water boils at a given pressure, the vapour phase is much richer in ammonia (the more volatile of the two components) than the liquid phase in contact with it. Conversely, when condensing a mixture of ammonia and water vapour the condensate is poorer in ammonia than the vapour mixture in contact with it. It is also observed that at a given pressure the boiling point temperature of the mixture decreases with increasing concentration of ammonia. This behaviour can be interpreted to mean that at low temperatures the mixture can hold more ammonia in solution than at high temperatures Increasing the pressure on the mixture at constant temperature has the same effect. Finally, as is the case with single-component liquids, at a given concentration the boiling temperature of the mixture increases with increasing pressure. These basic behaviour characteristics of binary (two-component) mixtures will help in the understanding of the operation of the absorption system schematically shown in fig. 4 (see SOLUTIONS). Liquid ammonia (point 2) at about 85° F. and 160 p.s.i. is expanded through the expansion valve to about 22 p.s.i. and 15° F. and enters the evaporator where it evaporates, absorbing heat from the space to be refrigerated. This ammonia vapour is discharged into the absorber (point 3), where it meets a shower (point 8) of weak liquor (about 30% ammonia), which absorbs the ammonia vapour into solution as it trickles down successive trays, thus forming a solution stronger in ammonia (about 38%). This strong liquor is pumped from the absorber to the top of the analyzer (point 5), being partly heated on its way as it passes through the heat exchanger. In the analyzer this strong liquor trickles down trays against a current of vapour of ammonia and water rising from the boiling solution in the generator below it. The heater (electric, gas or low-pressure condensing steam) boils the ammonia-water liquor, and the hot vapour (about 220° F.) rises up the analyzer counterflow to the cold strong liquor. As a result of this distilla-

tion process the vapour at the top of the analyzer (point 9) reaches a concentration of about 94%. This concentration is further increased as the vapour continues its way through the rectifier, where partial condensation takes place, and the vapour is enriched

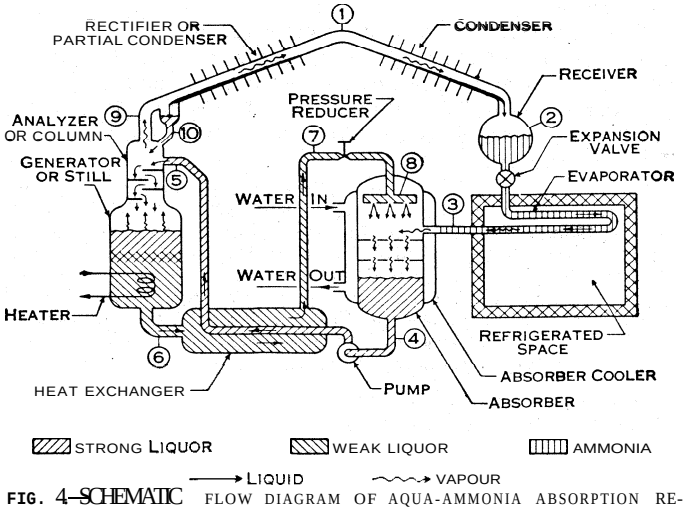

FIG. 4.—SCHEMATIC FLOW DIAGRAM OF AQUA-AMMONIA ABSORPTION REFRIGERATION CYCLE

to about 99.5% ammonia as it enters the condenser at about 125° F. (point 1). The small amount of condensate (about 60% ammonia) formed in the rectifier flows back to the top of the analyzer (point 10). As the liquor boils in the generator the part weak in ammonia gravitates to the bottom of the generator, from where it is taken to the absorber through a pressure reducer (point 7). On its way to the absorber this weak liquor is partly cooled in the heat exchanger as it heats up the strong liquor. The C.O.P. of absorption systems is much lower than that of mechanical refrigeration systems (about 0.5); however, this disadvantage is offset by the fact that they can be made to operate on inexpensive, low-grade energy. Also, the fact that they have no major moving parts makes for quiet and vibration-free operation, a feature desirable in some applications.

Electrolux Absorption Refrigeration System.—An ingenious modification of the absorption cycle shown in fig. 4 is the Electrolux absorption system in which the refrigerant is taken around the refrigeration cycle without employing any machinery with moving parts. This system was invented by two Swedish engineers, Carl Munters and Baltzar von Platen, while they were still undergraduates at the Royal Institute of Technology in Stockholm. The Electrolux system is in all respects identical to the ammonia-water absorption system with the exception that the strong-liquor pump, the expansion valve and the pressure-reducer valve are all eliminated. In the Electrolux system the ammonia is transported from the absorber to the generator by going into solution in water and the aqua ammonia being circulated by gravity and thermal siphon effect. The functions of the expansion and pressure-reducer valves are performed by an inert atmosphere of hydrogen gas (insoluble in water or ammonia) which circulates between the evaporator and the absorber, transporting the ammonia vapour with it. Heat is supplied to the generator. forcing slugs of strong aqua-ammonia solution and its vapour into the standpipe and lifting the liquid in the same way a coffee percolator operates. As this stream discharges into the top of the generator the liquid and vapour separate and the concentrated ammonia vapour enters the rectifier, where the concentration is increased by partial liquefaction prior to entering the condenser. The small amount of condensate formed in the rectifier returns to the top of the generator. The ammonia vapour is liquefied in the condenser and is discharged as a liquid into a flash chamber at the head of the evaporator. Hydrogen gas released in the absorber also enters the evaporator at this point, and as a result ammonia evaporates into this hydrogen, thus undergoing a drop in temperature. The evaporation of the ammonia is caused by its drop in pressure, say, from 180 p.s.i. in the condenser to a partial pressure of 30 p.s.i. in the evaporator. This is explained by a physical law discovered by John Dalton which states that the total pressure of a mixture of gases is equal to the sum of the pressures that each gas in the same volume and at the same temperature would exert if the other gases were absent. Therefore, when the ammonia which is liquefied at 180 p.s.i. in the condenser enters the evaporator, where the partial pressure of the hydrogen is only 150 p.s.i., it evaporates at a rate to make up the difference between the two pressures; *i.e.*, 30 p.s.i. The mixture of hydrogen gas and ammonia vapour leaves the evaporator and enters the absorber where it meets a spray of weak aqua ammonia. Within the absorber the ammonia vapour is readily absorbed into solution by the weak aqua ammonia as it trickles down successive perforated trays and leaves the absorber at the bottom as strong liquor while the inert hydrogen gas free of ammonia vapour rises up the absorber and leaves at the top to repeat its cycle. An absorber cooling jacket, in which water is circulated, is provided to remove the heat of solution generated by the absorption of ammonia vapour by the weak liquor. The strong liquor leaving the absorber proceeds to the generator, being partially heated on its way in the heat exchanger by the hot weak liquor coming from the generator on its way to the absorber. It is seen that in this system the total pressure in all its parts is the same (except for minor friction losses). While the partial pressure of the refrigerant varies from a minimum in the evaporator to a maximum in the condenser, a compensating variation in the partial pressure of the hydrogen gas enables the maintenance of the same total pressure throughout.

HISTORY OF LIQUEFACTION OF GASES

The exact date of the conception to liquefy gases is not known; however, Antoine L. Lavoisier certainly seems to have expressed this idea concerning the Earth's atmosphere, but it remained to his associates Gaspard Monge and Louis Clouet to first liquefy sulfur dioxide in a glass tube cooled with a mixture of ice and salt. About the same time, Van Marum and Paets van Troostwyk (1790) compressed ammonia to corroborate the validity of Boyle's law and found that when a certain pressure was reached drops of liquid ammonia appeared.

In 1799 Louis Guyton de Morveau also liquefied gaseous ammonia by cooling it to the temperature of a mixture of ice and salt. In 1805 Northmore compressed a number of gases mechanically and seems to have succeeded in liquefying chlorine.

In 1823 Sir Humphry Davy and his assistant Michael Faraday presented papers before the Royal society, describing experiments conducted at the Royal institution on chlorine and sulfureted hydrogen. Davy's paper is of historical importance because it shows that in 1823 he had already installed apparatus for the compression liquefaction of gases.

In 1834 Thilorier developed a method already in vogue for the manufacture of soda water and applied it to the condensation of carbon dioxide in large quantity. In his experiments Thilorier observed that a snowlike solid was formed when the liquid was allowed to escape through an orifice into a well-insulated chamber. His observation that solid carbon dioxide mixed with ether was a much more efficient refrigerant than the solid alone was a valuable contribution to the experimental side of the subject.

The first to apply Thilorier's work to scientific investigations was Faraday, who by using carbon dioxide and ether in the presence of vacuum was able to obtain a temperature of −166° F. Faraday then took up the work of Davy in the determination of the vapour pressure of all the gases which could be liquefied at temperatures above −166° F. and at pressures up to 50 atmospheres.

Faraday was unable to liquefy hydrogen, oxygen, nitrogen, nitric oxide and carbonic oxide, and the failure of others to succeed by using even higher pressures gave rise to the idea that these gases were permanent, the term being still used, with recognized qualifications.

Among the many investigators who attempted, but failed, to liquefy the so-called permanent gases was Thomas Andrews, who

in 1860 repeated in more extended form the nearly forgotten work of Cagniard de la Tour performed as early as 1822. Andrews discovered that for each gas there exists a critical temperature above which it cannot be liquefied. This discovery threw considerable light on the general problem of the liquefaction of gases and explained the reason for his own failures and those of Faraday and other investigators to liquefy the permanent gases.

Andrews' studies gave rise to a number of theoretical investigations and important contributions to the understanding of the liquid-vapour relationship of substances. Among those who contributed in a major way between 1850 and 1916 were: William Thomson (Lord Kelvin), Johannes D. van der Waals, Heike Kamerlingh Onnes, Rudolf Clausius, P. E. Marcelin Berthelot, Witkowski and Conrad Dieterici.

The next experimental work of importance following the work of Andrews is that of Louis Cailletet. He first partially liquefied acetylene and then nitrous oxide by means of compression followed by expansion through a jet, thus obtaining a liquid mist. Following his success, Cailletet proceeded to attack the problem of liquefying the so-called permanent gases. Methane, carbon monoxide and oxygen were in turn compressed to 300 atmospheres, cooled to −20° F. in a bath of sulfur dioxide boiling under reduced pressure and then allowed to expand by releasing the pressure. In each case a dense mist was observed, indicating that liquefaction had taken place although no liquid was actually collected in static condition.

Almost simultaneously with Cailletet, Raoul Pictet was also able to obtain a jet of liquid oxygen, surrounded by a white mist, by allowing compressed and cooled oxygen to expand through an expansion valve.

In 1883 Zygmunt Wroblemski and Olszewski repeated Cailletet's experiments in a much improved manner and attained not only the lowest temperature (−213° F.) until then obtained but were the first to produce liquid oxygen in a static condition. Two years later they were able to reach a temperature of −242° F., and both nitrogen and carbon monoxide were liquefied. Improving his apparatus even further, in 1885 Olszewski reached a temperature of −373° F., the lowest temperature recorded until much later, and liquefied much larger quantities of oxygen, nitrogen, carbon monoxide and small amounts of hydrogen.

It was not until 1886 that James Dewar obtained liquid oxygen under static conditions. At this point it is worth while to note that perhaps Demar's greatest contribution to the field of low-temperature production was his invention of the method of vacuum insulation which constitutes the basis for design of all low-temperature systems. The Dewar flask or bottle (popularly known as the Thermos bottle) is named in his honour.

The work of Olszewski was followed in rapid succession by major achievements in the design of continuously operating gas-liquefaction installations. Carl von Linde in Germany in 1895 and William Hampson in England in 1896 used the Joule-Kelvin cooling effect to liquefy air in large quantities. These first commercially feasible systems were further improved in 1902 by Georges Claude, who, using a suggestion originally made by Lord Rayleigh, succeeded in building a machine to liquefy air by adiabatic expansion of the air in an expansion engine.

The mechanical difficulties encountered in producing liquid air in the expansion engine were removed by a modification of the system which became known as the Claude-Heylandt liquefier. The Claude-Heylandt and Linde cycles, with certain mechanical and thermal improvements, are used in producing nearly all the liquid gases consumed in industry.

Once oxygen, air and hydrogen were liquefied in quantity, it became possible to liquefy helium by precooling it to −432° F. by using liquid hydrogen boiling under vacuum.

Kamerlingh Onnes was the first to liquefy helium in 1908. He immediately proceeded to attempt to solidify helium by further reducing the pressure to 0.013 mm., using a battery of condensation pumps, thus obtaining an estimated temperature of −458.2° F.

Kamerlingh Onnes, however, was not successful in solidifying helium, and the final triumph was to be achieved by his colleague and successor P. H, Keesom. Keesom reversed Kamerlingh Onnes' approach, and by increasing the pressure on the helium he brought the melting point in the range of temperature already obtained. It was on July 26, 1926, that Keesom solidified helium, and thus every known substance had been liquefied and solidified by that date.

Others followed Keesom's original successes with further improvements of techniques in the production of liquid helium and detailed studies of the properties of helium. Notable among the early workers were F. Simon (1927) and P. Kapitza (1934). See LOW-TEMPERATURE PHYSICS. See also Index references under "Refrigeration" in vol. 24.

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REFUGEES. Refugees result in the main from wars and political upheavals. Discriminations against particular racial, religious or political groups have historically developed into threats to life and liberty, precipitating the flight of refugees in many instances across national boundaries and without guarantee of asylum. Thereafter they have sought to re-establish their lives as opportunity afforded. Changes in national boundaries, postwar agreements and the actions of aggressor states have also resulted in transfers or exchanges of populations, generally of minority groups, with or without the transfer of possessions.

In the early history of European civilization wars and conquests were often followed or accompanied by considerable movements of population. For a long period this aspect of warfare had disappeared, but with World Wars I and II it recurred. In some cases. these movements, though large, were only temporary. For example, although the Belgian refugees who fled from the German invaders in 1914 were very numerous, they did not attempt to create a new life or to establish new homes outside their native land; their migration was only temporary, like that of the refugees who fled from the invaded provinces of France, Italy and Rumania, and to a smaller extent from all the territories occupied by enemy troops during World War I.

But in other cases, great masses of war refugees had little prospect of ever returning to their homes or of recreating their previous life there. This was the situation, for example. of a considerable proportion of the inhabitants of the Balkan peninsula.

MOVEMENTS IN VARIOUS COUNTRIES, WORLD WAR I

Excluding such temporary movements as those of the Belgians, the emigrations of war refugees of different nationalities were roughly as follows:

Russians.—Between 1917 and 1920 nearly 1,500,000 political refugees from Russia were thrown upon the charity of Europe. Some of these refugees were prisoners taken by the Germans and Austrians during the war, who refused to return to Russia. A great number were members of the defeated armies of Roltchak, Wrangel, Denikin and others. Many of the refugees mere women and children who fled from the bolshevist revolution. In the earlier days of their exile they were dispersed as follows: Germany 300,000, Poland 400,000, France 400.000, Constantinople 100,000, Yugoslavia 50,000, Bulgaria 30,000, Czechoslovakia 26,000, Rumania and Greece 50,000, Baltic states 100,000. In addition a large number, at least 100,000, fled eastward into China.

Greeks.—As the result of warlike operations there fled into Greece between 1915 and 1922 1,250,000 Greek refugees from Asia Minor and eastern Thrace and 50,000 from Bulgaria. In addition there came under treaties for the exchange of population from Bulgaria a further 50,000; from Asia Minor approximately 100 000.

Armenians.—From the year 1915 onward there were expelled from their dwellings in Asia Minor some hundreds of thousands of Armenians. Great numbers of them perished in their wanderings in the mountains; some thousands succeeded in mak-

ing journeys on foot as far as Mesopotamia; others sought protection in the Russian empire. In 1921 the independent Armenian republic of Erivan, with an Armenian population of 800,000, adopted the soviet régime and became part of the Union of Soviet Socialist Republics. To its original population, 300,000 to 400,000 additional refugees from Turkish Armenia were shortly added, and in spite of-their great suffering, they were absorbed with remarkable rapidity into the economic system of the country. It was further estimated that more than 300,000 other Armenians were scattered more or less in destitution over Russia and the near east, particularly Bulgaria and Greece. In 1921 100,000 fled to Syria, many of whom became Syrian subjects in the territory then under French mandate; more than 60,000 fled in the following year to Greece, 35,000 to Bulgaria and 20,000 to 30,000 more fled to the republic of Erivan.

Bulgars.—From 1918 onward a large number of minorities of Bulgarian or quasi-Bulgarian race and language fled from their homes in the Dobruja, in Macedonia and in eastern and western Thrace. It was calculated by the Bulgarian government that their total number amounted to almost 500,000. In addition, about 75,000 Bulgars voluntarily emigrated to Bulgaria from Greece under the terms of the Greco-Bulgarian Exchange of Populations treaty.

Turks.—Approximately 50,000 Turks fled from eastern Thrace and Smyrna when these territories were occupied by Greek forces in 1919, but returned to their homes in 1922. In addition approximately 350,000 to 400.000 Turks were moved from Greece (most of them from Macedonia, Crete and western Thrace) to Asia Minor under the terms of the Exchange of Populations treaty made at Lausanne in 1923.

Effects.—Broadly speaking, the general features of these movements of population during and following World War I may be summarized as follows:

The great emigration of Russian political refugees was, in the first instance, regarded as an almost unmixed evil both for Europe and for the refugees themselves. Their great suffering was not, in the early stages, compensated by any considerable political or economic gain. This is not equally true, however, of the movement of population in the Balkans and in the near east. These movements at least accomplished a great deal toward effective unmixing of the populations in these areas. The mixture of populations had led to so much political trouble in modern times that this unmixing process must be regarded as a very considerable advantage.

Further, in certain countries the influx of refugees, while at first it appeared to be a disaster, in the long run proved to be a source of strength. This was particularly true of Greece, where, thanks to arrangements which will be mentioned shortly, the refugees were absorbed very quickly into the economic system of the country, where they immensely increased the agricultural production and imported industries formerly unknown. There is no doubt that they thus improved the political position of Greece by giving it a homogeneous and vigorous new population and by increasing the economic wealth of the ration as a whole.

In Bulgaria, however, the process was much slower, as the refugees showed less inclination to accept their exile as definitive and to settle down in new homes, than did those who went from Asia Minor to Greece.

Another result of general importance which followed the movement of population caused by World War I was that Asia Minor was left almost exclusively to the Turks. Hitherto inhabited by a very mixed population, including elements which continued the traditions of the ancient civilization of Byzantium, there were now few of these elements left. Furthermore it should be noted that the Russian emigration, which, as already stated, was regarded as an unmixed evil for the refugees and for the countries offering them hospitality began under the guidance of the League of Nations and the International Labour office, in certain countries, especially France, to constitute an important reconstructive economic factor.

Treaties **of** Exchange.—Under these treaties, the most important of which were the Greco-Turkish and the Greco-Bulgarian, impartial committees consisting of one representative from each government and two or three impartial experts appointed by the League of Nations supervised or actually carried out the transportation of the persons moved from one country to the other, valued their property, kept an exact record of it and established their claim for this value against the government of the country to which they went. These treaties of exchange worked with varying success.

So far as the Greco-Turkish treaty was concerned, its principal and most necessary effect was to make room in Greece, by the removal of 350,000 Turks, for a great part of the incoming flood of refugees, who found in the evacuated Turkish properties fields and houses ready for their use. Without this treaty of exchange, and without a refugee settlement loan floated under the auspices of the League, the absorption of the Greek refugees into productive employment in their motherland could never have been done.

On the other hand, the fate of the Turks transported under the treaty from Greece into Turkey and in the absence of such a loan, appears to have been less happy. Official information was not disclosed, but it is obvious that the arrival of 350,000 refugees in a country whose total population did not exceed 5,000,000, necessarily imposed a heavy burden on its resources already straitened by many years of war.

Of the Greco-Bulgarian treaty of exchange, it is enough to say that while the working of its machinery was slow, it laid the foundation for an unmixing of the population in Greek Macedonia and in parts of Bulgaria.

Work **of the** League **of** Nations.—The other personal and economic problems which were raised by the refugee movements above described were dealt with partly by individual governments and partly by the League of Nations. To take the Russians first, many governments throughout Europe accorded them particular privileges and gave them much state help, estimated at £2,000,000 per annum—in particular Yugoslavia, Czechoslovakia and Bulgaria deserve mention. The League of Nations and the International Labour office also played a considerable part through the action of the delegations established in Constantinople and in the Baltic states, Rumania, China, Bulgaria, Greece, Serbia, Germany, Poland, France and other countries, in breaking up the most disastrous congestions of refugees in places where no employment could be found, for example, in Constantinople and Greece; in placing some hundreds of thousands in employment in no fewer than 50 different countries; in securing for the refugees in many countries legal protection, freedom of movement in search of employment and a new form of so-called "League of Nations passport" which secured the recognition of over 50 governments, under which they were enabled to travel from one country to another; and even in securing for a small number who desired it, repatriation to their native land. Cnder the auspices and with the help of these League offices, large movements of Russian refugees were carried out to France, where some thousands were settled as tenant farmers and in industry, to the United States, to Canada, to South America and to other countries where employment could be found.

For the Greek refugees the League did still more. Through its machinery a loan of £12,000,000 for their settlement in agricultural and other employment was obtained, and under the international control of a League commission this settlement was carried out with remarkable success. For the Armenians, who did not enjoy the protection of the government of the Turkish republic, the same passport privileges and legal protection were obtained through the machinery of the League as had previously been obtained for the Russians. (F. NA.; X.)

CONDITIONS BETWEEN WARS

The death of Fridtjof Nansen in May 1930 was a distinct loss to the refugees whose problems had absorbed his attention during the last ten years of his life. After a year of study and uncertainty the League of Nations established in 1931 the Nansen International Office for Refugees to carry on the work which Dr. Nansen had initiated.

The League, while accepting responsibility for the legal pro-

tection of refugees, had always considered its interest in refugee problems to be of a temporary nature. Consequently the new Nansen office was established as an autonomous body under the authority of the League of Nations with mandates to conclude its affairs by 1938 and to restrict its humanitarian activities to the co-ordination of the efforts of private organizations engaged in administering relief to refugees.

In order that the legal protection of refugees might be assured after the closing of the Nansen office, the League of Nations provided, through the medium of the convention of Oct. 28, 1933, for the issuance of Nansen identity certificates by the governments signing the convention and for rights of residence and employment and other benefits for Russians, Armenians and assimilated refugees then under the protection of the Nansen office. In 1938, after the Nansen office had concluded its activities, the League constituted a new high commissioner to deal with refugees hitherto coming under the Nansen office and the office of the high commissioner for refugees coming. from Germany.

Saar.—After the plebiscite in the Saar in 1935 approximately 7,000 former residents of the Saar left that territory, most of them to settle in France. This new group of refugees was added by League action to those already under the protection of the Nansen office and a recommendation was made to the governments that Nansen identity certificates be issued to them.

China.— The war in China beginning in 1937 precipitated one of the largest internal migrations in modern history. It was estimated that approximately 30,000,000 Chinese fled before the Japanese armies in two substantial movements from the coast areas to the agricultural hinterland— one from central China and the southeast to the southwest and the other from the northeast to the north est. Apart from the problem of internal displacement in China the Chinese government was later concerned, at the end of the war, with accomplishing the return of 135,000 overseas Chinese driven back to China by the war to their former homes in countries of southeast Asia. These overseas Chinese had played an important role in the economy of China and the resumption of their trading activities was a matter of importance to China's economic recovery.

Germany.—When the nazi party assumed control of the German government in 1933, thousands of new refugees were dispersed over central and western Europe in the beginning of a movement which later gained momentum during World War II. Those in Germany who opposed the nazi political philosophy— non-Aryans according to the Nürenberg laws, scientists, intellectuals, authors, artists, the members of other liberal professions and labour leaders— were first removed from government posts and later from private positions in the universities, publishing houses and business, were arrested and confined in concentration camps, deprived of their property and citizenship and finally driven from Germany, to find new places of livelihood as best they could in other countries.

Neighbouring countries— Austria. Hungary, Poland, Czechoslovakia. Switzerland, Belgium, the Netherlands and France—accepted the refugees, often in flight over their borders at night, in the expectation of extending hospitality to them for a temporary period until they could emigrate to places of permanent residence overseas. Approximately half of the Jewish refugees who left Germany in the early days of the persecution migrated to Palestine.

The German *Anschluss* with Austria in March 1938 added new thousands to the stream of central European refugees, who were already taxing the capacities of the countries of temporary refuge of western Europe. In an effort to substitute planned migration for the chaotic dispersion of refugees, President Franklin D. Roosevelt summoned 32 governments to the Evian conference of July 1938.

Offers to receive refugees for permanent settlement were not forthcoming at Evian. however, with the exception of the Dominican Republic, which 'offered to accept 100,000 for settlement in agriculture.

The Intergovernmental Committee on Refugees, composed of the governments which had met at Evian in July was organized in London in Aug. 1938. It was believed at that time that the committee, lacking refugee-producing countries in its membership and free, in comparison with the high commissioners of the League of Nations, to negotiate on behalf of refugees who had not yet left their countries of origin but were under pressure to do so, would soon be able to resettle the refugees from Germany and Austria and an additional 185,000 from Czechoslovakia on a pro rata basis in receiving countries. This expectation was not realized.

Spain.— On the collapse of the loyalist army in Spain in Feb. 1939 some 340,000 refugees burst over the border into France. While at first there was indecision in France with respect to admitting the refugees, the final decision was to intern them in refugee camps at Argelès-sur-Mer and Cyprien. Since many of the refugees were fleeing primarily from military action, repatriation to Spain started immediately after the end of the war. However, some 40.000 were political refugees who could not return to Spain with safety and they eventually were placed in labour camps and absorbed in French industry. Others migrated to North Africa, Mexico, the Dominican Republic and Latin and South American countries. (J. G. McD.; X.)

REFUGEES IN WORLD WAR II

Poland.— The German invasion of Poland in Sept. 1939 precipitated an eastward movement of refugees far larger in volume and more rapid and violent in action than the westward movement which had been in process since 1933. Poland's population of 3,000,000 Jews constituted the majority of those affected by the advance of the German armies eastward, but as the war was fought more bitterly, distinctions between the treatment of Jews and Poles at the hands of the Germans became less marked. Fewer than 100,000 refugees from Poland escaped into the Baltic countries and southward into Rumania, Hungary and Bulgaria. More than 1,175,000 Jews became subject to German control in the area of former Poland that was incorporated into the German reich and in Government-General Poland.

Unknown numbers of Polish and Jewish refugees who resided in or fled into the area of former Poland which was occupied by the forces of soviet Russia were moved eastward to Siberia and southeastern Asiatic Russia.

The conquest of Poland also created numerous cross currents of population movements. The policy of the German reich was to repatriate German minorities in eastern and southwestern Europe to the *Altreich.* A treaty concluded with Italy in the fall of 1939 providing for the return of some 270,000 Germans from the south Tirol was the first effort to implement this policy. Later similar treaties were signed with Latvia and Estonia for the return of approximately 75,000 Baltic Germans.

Some 300,000 Germans were also repatriated from Bukovina, Bessarabia and Rumania.

As the members of these German minorities in other countries returned to Germany they crossed the paths of the 300,000 to 400.000 Jewish refugees from Germany, Austria and Czechoslovakia who were constantly being deported eastward to the ghettos established in Warsaw, Lublin and Lwów. These constituted the remainder of the refugees who had been unable to escape from central Europe before the outbreak of the war. The last to escape had gone by boat to Shanghai or through Poland and across Siberia to Harbin and Vladivostok and thence on to the Philippines or to the western hemisphere through Kobe and Yokohama.

As western Poland was incorporated into the reich both Poles and Jews were driven eastward into Government-General Poland. It was estimated by Polish sources that more than 1,200,000 Poles had been moved into Government-General Poland by Germany by the end of 1939. Germans in Government-General Poland were returned to Germany. Germans were also moved from southern and eastern Poland occupied by soviet Russia to Germany.

From this area Poles and Jews were evacuated far eastward into Russia to be replaced by a Russian infiltration westward.

Finland.— Finns from the Karelian isthmus, ceded to Russia by the peace treaty between Russia and Finland after the winter

war of 1939–40, were resettled in the diminished area of that hard-pressed country. More than 400,000 people had to be placed on the land or in industry at a time when the resources of the Finnish government were exhausted by the war.

Some assistance was provided by private funds raised in the United States.

Norway — Norway faced a similar problem of internal resettlement after the German invasion. Approximately 400.000 people were moved from the coast defense areas into the interior of the country, including many who had resisted the invasion in the short-lived defense of their country.

Low Countries and France. — The advance of the German armies into the Low Countries of western Europe in the spring of 1940 uprooted civilian populations on a scale comparable to that precipitated but a few months earlier by the invasion of Poland. This movement of about 3,000,000 Dutch, Belgian and French people in flight to southern France in advance of the German armies was joined by some 140,000 refugees from central Europe who had found temporary respite in the Netherlands, Belgium and France.

The great majority who had fled to safety from military actions returned to their homes after the signing of the armistice between France and Germany, which illustrated the generally temporary character of such war refugee movements.

England after the flight of its defeated army from Dunkerque found itself harbouring some 70,000 central European refugees in addition to the members of the military forces of its allies who had escaped with its own forces. The threat of an impending German invasion from the continent and the fear of "fifth columnists" among the refugees, understandably resulted in the internment of all. Later, when the defenses against invasion were strengthened, the great majority of the refugees were released.

Balkans. — In the late summer and fall of 1940, Germany in its efforts to bind allies in the Balkan countries more closely to the axis cause did not hesitate to utilize minority groups as pawns in its strategy. In Vienna in Aug. 1940, Hungary was awarded part of the coveted area of Transylvania and approximately 2,500,000 people. The fact that many Rumanians were included in the transfer demonstrated again the difficulties involved in legislating boundaries in order to achieve racial homogeneity in the confused pattern of racial strains in southeastern Europe.

South Dobruja was allotted to Bulgaria, which agreed to repatriate 65,000 Bulgarians from north Dobruja. The transfer to Rumania of Rumanians in south Dobruja was also planned. Slovakia undertook to repatriate Slovaks from the protectorate of Bohemia and Moravia.

Luxembourg and Lorraine. — In the west, Luxembourg and Lorraine were incorporated as provinces into the German reich. Again non-Aryan refugees, members of the government of Luxembourg and political refugees were forced to flee. Some 20,000 of the French population of Lorraine were expelled without warning into France and only vigorous protest by the Vichy government prevented the expulsion of larger numbers from their homes. In Nov. 1940, 10,000 Jewish refugees were driven from Baden and the Palatinate into southern France.

U.S.S.R.—The advance of the German armies into soviet Russia in the summer and fall of 1941 drove before it the greatest migration of a decade in which the history of uprooted populations had exceeded in stark tragedy all previous records of modern history. No authentic figures were available, but conservative estimates placed the numbers driven eastward as between 10,000,000 and 20,000,000. More than 2,000,000 inhabitants of the invaded soviet areas survived the hardships and cruelties of the labour camps in which they were confined during the war in eastern Europe. Similar numbers were estimated to have succumbed under the conditions of work which could only result in exhaustion and death.

German Forced Labour. — Apart from the dispersal and flight of political refugees, the transfers of German minorities in pursuit of concepts of racial purism, the transfer of minority groups as political pawns and the flight of masses of civilians from military action, the most outstanding movement of people during World War II was the draft into Germany of more than 8,500,000 workers from countries occupied by the German armies. One-fifth of these slave labourers were women. In addition, 4,000,000 workers were employed away from their homes and often outside their own countries in industrial or military labour in the occupied countries of Europe. Included in this group were many former Polish and French prisoners of war whose status under the Geneva prisoner of war convention was violated by one device or another.

After the occupation of western Europe efforts were made to enlist such labour voluntarily by inducements of high wages and promises of food rations. French prisoners of war were in the first instance returned from Germany to France and released from custody only to be confronted by various pressures to return to Germany immediately as labourers. As the demands of the German war machine increased, legal and proper methods of recruiting were abandoned for more forceful methods.

The conditions of work of the labourers from the east, chiefly Russians and Poles, were deplorable in the early years of the war. On the other hand, efforts were made by the Germans to provide better conditions of work and wages for workers from the western European countries. Finally as the sources of forced labour were exhausted, food, wages and working conditions were equalized for all in desperate efforts to secure maximum production. This policy continued until toward the end of World War II, when deterioration in German organization and control became evident and conditions in the labour camps degenerated to those prevailing in the concentration camps, where the policy appeared to be to drive the inmates to exhaustion by long hours of heavy work with inadequate provisions for food and shelter.

Included among the 8,500,000 workers drawn into Germany were approximately 2,000,000 Russians, 2,000,000 French, 1,500,000 Poles, 500,000 Belgians, 500,000 Dutch, 600,000 Italians and smaller numbers of Czechs, Balts, Hungarians, Rumanians, Danes and Norwegians.

As the German armies disintegrated in the spring and early summer of 1945 these millions of slave labourers were released by the Allied armies as were also the inmates of the concentration camps. In the early days of liberation they provided a problem for the Allied armies intent upon the final destruction of all German resistance. Food and means of care and transport were lacking. The liberated workers trekked homeward as best they could, living on the land; many were in such advanced stages of malnutrition that even hospital care which was soon organized could not save their lives.

POSTWAR PROBLEMS OF DISPLACED PERSONS

Gradually as the occupying armies stabilized conditions within Germany and Austria, orderly means of repatriation were developed. The displaced persons were removed to their home countries by train, truck and air.

Their eagerness to reach home was matched by the necessity of the Allied armies to repatriate them or to organize supply lines to feed them where they were. It proved more practical to repatriate them quickly than to move food and clothing to them in central Europe. Within six months after the cessation of hostilities in the summer of 1945 between 6,500,000 and 7,000,000 United Nations nationals had been returned to their home countries in Europe.

Repatriation slowed down substantially in the winter months of 1945 and 1946 owing to the lack of heated transportation equipment and inadequate reception facilities in the receiving countries. Efforts to re-establish the flow of repatriation in the spring and summer months of 1946 proved unavailing. By that time it appeared that many among the former workers and concentration camp victims were unwilling to return to their countries of origin because of the political changes which had taken place in those countries during the war. More than 1,000,000 displaced persons, including approximately 600,000 Poles, 75,000 to 100,000 Yugoslavs, 250,000 former Baltic nationals and 50,000 Ukrainians, were unwilling to return. They were maintained in displaced persons

assembly centres in Germany, Austria and Italy provided by the occupying military authorities and administered by the personnel of the United Nations Relief and Rehabilitation administration (UNRRA) which in 1946 undertook the responsibility for further repatriations.

The Jewish refugees included among the foregoing total constituted a special group. They had suffered particularly at the hands of the nazis and were reluctant to return to home areas where so many of their relatives and coreligionists had perished during the war. At the end of the war it was estimated that no more than 1,250,000 Jews remained out of a prewar population of approximately 5,500,000 in Europe excluding soviet Russia.

The numbers of Jewish refugees in central Europe was slightly under 100,000 at the end of hostilities in 1945. However, these numbers were swollen by postwar infiltrations from Poland, Hungary and Rumania to 200,000 by the end of 1946. More than 90% expressed the desire for emigration to Palestine.

The displacements of German and Austrian nationals in Germany and Austria at the end of the war were substantial. These had resulted from the dispersion of industry during the war, evacuations from bombed areas and the flights of civilians from final military action. One of these general movements was westward from the Baltic countries, Poland and East Prussia to Denmark and southwestward toward Austria and Switzerland. Some 200,000 Germans in this movement remained interned in Denmark because of the overcrowding and lack of housing facilities in Germany until late 1948.

Following the cessation of hostilities, political pressures and hatreds aroused by the war resulted in the expulsion from Poland, Czechoslovakia and Hungary under the Potsdam agreement (1945) of more than 8,000,000 members of the German prewar minorities in those countries. This substantial movement severely strained the limited housing facilities in Germany resulting from the destruction in the final stages of the war. There were similar expulsions of German minorities totalling 200.000 persons into Austria from Yugoslavia and Rumania which were not covered by the Potsdam agreement.

The presence in Germany, Austria and Italy of more than 1,500,000 United Nations refugees and displaced persons who were unwilling to accept repatriation to their home countries was disturbing to the peace and order of central Europe and a cause of political friction between friendly allied governments. The eastern European governments took the position that their nationals should return to their countries.

The position of the western democracies was that the individual should have complete freedom of choice with respect to repatriation. This principle was formally adopted by the general assembly of the Cnited Nations in its resolution of Feb. 12, 1946 on the subject.

International Refugee Organization.—Between July 1947 and Dec. 1951 the International Refugee organization (IRO), a temporary specialized agency of the UN, which took over the responsibilities in this field of UNRRA and other wartime agencies, assisted over 1,500,000 refugees and displaced persons in camps in Europe for varying periods of time by providing medical care, hospitalization, vocational training, food and clothing. Eighteen government members provided approximately $430,000,000 for these purposes and for the resettlement in overseas countries of 1,040.000 persons; 73,000 were repatriated to their home countries.

Upon the termination of IRO in 1951, the office of the high commissioner for refugees was established by the United Nations to provide legal protection for refugees and to assist governments and voluntary agencies to find permanent solutions for refugee problems. The convention relating to the status of refugees promulgated by the United Nations in 1951 had been ratified by 21 governments by March 1957.

In 1951 the Intergovernmental Committee for European Migration consisting of 27 governments was established to facilitate the movement out of the overpopulated countries of Europe of migrants and refugees who would not otherwise be moved. Between Feb. 1952 and June 1957 over 600,000 persons, including 280,000 refugees, were assisted to resettle in overseas countries.

Germany. — The steady flow of refugees from eastern Germany to western Germany, which began prior to 1952, reached a peak of 340,000 in 1953 and continued at an annual rate of over 200,000 to account for more than 1,500,000 in total by Dec. 1956.

Palestine. — United Nations efforts to resolve the problem of 875,000 Arab refugees resulting from the conflict in Palestine in 1948 persisted between 1949 and 1957. The refugees were housed and fed in camps in Lebanon, Syria, Iraq, Jordan and the Gaza strip. The repatriation of the refugees to Palestine or their permanent resettlement on the land in Arab countries was delayed by the continuing political conflicts in the area.

China.—As a result of the communization of mainland China in 1950 the situation of some 20,000 European refugees remaining in China at that time seriously worsened. Over 8,000 were granted exit permits from China between 1950 and 1957. During the same period approximately 1,000,000 Chinese refugees entered Hong Kong and many other thousands succeeded in reaching Formosa. Severe conditions of overcrowding developed in both areas of asylum.

India, Pakistan.—One of the largest exchanges of populations in recent history resulted from the division of British India into the new nations of India and Pakistan in 1947. Soon thereafter 5,000,000 Hindus and Sikhs moved out of West Pakistan into India and a similar number of Moslems moved out of India into West Pakistan. Additionally, after 1950, 3,000,000 Hindus moved out of East Pakistan into India and approximately 1,500,000 Moslems from India moved into East Pakistan. These movements resulted from political motivations within the populations rather than from agreements between the two governments.

Japan.—Japanese infiltration into other countries of the far east prior to and during World War II was substantial. More than 2,000,000 Japanese were in China at the end of the war, larger numbers in Manchuria, 800,000 in Korea, 500,000 in southeast Asia and 200,000 in Australia and New Guinea. The total of displacement in Japan proper was estimated at 12,000,000 including 2,000,000 Korean labourers and their families. The repatriation of these large numbers of Japanese and Koreans began before the war was over and continued under the direction of the Allied military forces. These infiltrations and later repatriations had their respective effects on the economies of the areas involved and left serious problems of reconstruction which complicated the task of postwar economic and political reorganization.

Apart from the death and destruction resulting from World Wars I and II and from the political events which preceded and followed them, more than 50,000,000 people were uprooted from the areas in which they had resided for generations. Governments were challenged as never before to find places of settlement for the displaced.

Korea and Vietnam. — The war in Korea in 1950 uprooted more than 5,500,000 civilians most of whom took refuge in southern Korea. Over 900,000 refugees from north Vietnam were resettled in south Vietnam after the Asian Conference in Geneva in 1954.

Hungarian Refugees.—As a result of the Hungarian revolution in Oct. 1956, approximately 174,000 Hungarian refugees had fled into Austria by June 30, 1957 and 19,000 into Yugoslavia. Over 140,000 of the Hungarian refugees in Austria and 7,000 of those in Yugoslavia had been resettled in other countries by that date. *See* MIGRATION. *See* also Index references under "Refugees" in vol. 24.

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REFUSE DISPOSAL is the term employed in the United States and Canada for the collection and disposal of the solid wastes of a community, including garbage, rubbish and ashes. In Great Britain this type of refuse is called dry or town refuse, as differentiated from wet refuse (fecal matter) and mixed refuse (a mixture of town refuse and fecal matter).

Garbage is the waste matter resulting from the preparation and consumption of food; rubbish is all nonputrescible solid wastes, except ashes, including both combustible and noncombustible material such as paper, rags, wood, plastic and metals.

Sanitary refuse disposal is essential to community health. Refuse has been shown to be important as a breeding ground or food source for rats, flies and other potential carriers of diseases of man. It has been demonstrated to-be of importance in the transmission of trichinosis of man and vesicular exanthema, foot-and-mouth disease, cholera and other diseases of swine. Rubbish has been found to be a significant factor in the incidence of building fires in the United States. Particulate matter and smoke from the burning of refuse can be a significant source of atmospheric pollution. while improper disposal has sometimes resulted in surface- and ground-water pollution. Potential nuisance factors, such as smoke and odours resulting from open dumps, are well recognized.

Refuse disposal consists of three phases: storage on the premises, collection for transport to the final disposal site and final disposal.

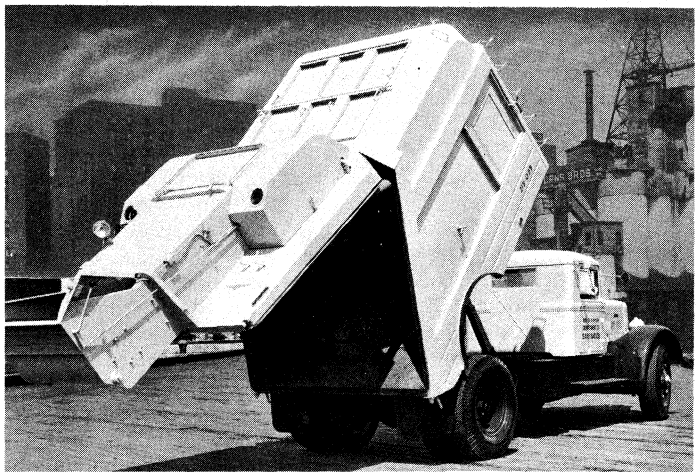
Quantity of Refuse.—A household of four people in an American community may be expected to produce an average of 70 lb. of refuse each week, or about 23 lb. per capita per day. If commercial garbage and rubbish, incinerator ash and solid industrial wastes are included, over 4 lb. of refuse per capita per day may be expected from a community-wide collection system. In England about 672 lb. per capita per annum is considered average. In U.S. and Canadian communities where the refuse has a negligible ash content, garbage has been found to comprise as little as 20%–25% of the refuse by weight, with the remainder rubbish. Garbage has a moisture content of 60%–70%. The moisture content of rubbish usually approximates 25%–35% of its over-all weight.

Premises Storage.—Most cities require that household garbage be well wrapped and stored in durable, easily cleaned containers with tight-fitting covers. Glass or metal food containers should be stored in similar receptacles. Other rubbish may be tied in easily handled bundles or so placed in boxes that it will not cause littering or fire hazard. Ashes should be stored in metal containers. In most U.S. cities household refuse containers ordinarily are not permitted to exceed 26–30 gal. in capacity.

Collection of Refuse.—Methods of collection vary. Garbage may be collected separately from the other refuse; in mixed collection, garbage and rubbish—or sometimes garbage, rubbish and ashes—are collected at one time and from a common receptacle. The trend is toward mixed collection. Separate collection is utilized when garbage is used for feeding to swine or is ground and disposed of in the sewerage system, or when cheaper methods are at hand to dispose of the less objectionable components of the refuse.

Where garbage is collected separately, it is the usual practice to collect it twice a week in the summer and once or twice a week in the winter. A few cities collect more frequently. Most make daily collections in the business sections. Most of the large cities and about half the smaller ones in the U.S. employ municipal collection, contract or private collection being used otherwise.

Collection Equipment.—There is nothing that could be called a standard type of refuse collection vehicle. In America municipal garbage-hauling vehicles are usually custom-designed. Enclosed mixed-refuse collection vehicles are equipped with mechanically or hydraulically operated packing devices to compress



BY COURTESY OF THE CITY OF NEW YORK, DEPARTMENT OF SANITATION

FIG. 1.—ENCLOSED REFUSE COLLECTION VEHICLE. WITH BODY IN DUMPING POSITION. SUCH TRUCKS ARE EQUIPPED WITH MECHANICAL OR HYDRAULIC COMPACTING DEVICES TO COMPRESS REFUSE

the voluminous refuse and thereby increase the amount the vehicle can accommodate. Many industries, and other concentrated production areas use large portable containers which when full are transported to the disposal site by a vehicle equipped with a special hoist.

Disposal.—There are five methods of refuse disposal: reclamation for re-use (although this disposes only of certain components in the refuse); disposal into the sewerage system; incineration; dumping in water; and disposal on land.

Reclamation.—In its simplest form reclamation is the removal of such items as paper or heavy metals for salvage. In Great Britain this is practised in many cities in separation plants constructed for the purpose. In America reclamation is usually carried on as private enterprise, either by the individual householder or by contract arrangement at the disposal site. Metals from incinerator ash and the ash itself are often used for salvage or reclamation purposes.

Feeding waste food to pigs has long been a popular method of garbage disposal because it is relatively cheap and often can be carried on by private enterprise at a profit, thus relieving the authorities of the responsibility and expense of garbage disposal. In Great Britain and Canada it has been required for many years that garbage fed to swine be cooked to disinfect it and to prevent possible spread of disease. In the United States, vesicular exanthema, a disease of swine similar to foot-and-mouth disease and spread primarily by the practice of feeding raw garbage, became epizootic in the early 1950s. By 1960 all of the states had adopted legislation or regulations requiring the disinfection (usually by cooking) of garbage fed to pigs. Although the use of residential garbage in the U.S. for pig food has declined substantially, use of commercial garbage from hotels and restaurants is widespread.

Composting is the biochemical alteration of refuse from a noxious to an innocuous usable humus. During the first half of the 20th century a number of anaerobic and aerobic processing schemes were offered under various proprietary names. None was successfully employed in the United States on a continuing basis, primarily for economic reasons.

Composting of refuse has been successfully carried on in the Netherlands and the Jersey Islands for many years. The method has also been used with some success in Great Britain, France, New Zealand and India.

Reduction, or the cooking of garbage to remove salvable greases and fats for industrial use and to produce tankage usable as an

animal food base, was a recognized method of reclamation in the United States in the first quarter of the 20th century. The introduction of detergents, which reduced the demand for fats in soap manufacture, together with increased labour costs, made this method uneconomical, and the last municipal garbage reduction plant ceased operation in the early 1950s.

Disposal Into Sewerage System.—If garbage is ground into minute particles it can be discharged into the community sewerage system. Millions of household grinder units were installed in the United States following their introduction in the early 1930s. Little difficulty is encountered in a properly designed sewer system as a result of this practice, and household water consumption will increase only 1% to 2% with the installation of a grinder. Increases in solids handling capacities are needed at the sewage treatment plants in cities where large numbers of grinders have been placed in service, however, and for this reason some communities with already overloaded treatment plants had to forbid their use. A few cities having separate garbage collection systems used central grinding stations at which truckloads of garbage could be handled at one time.

Most newly constructed food-handling establishments in the United States, particularly hospitals and other institutions, have kitchens equipped with food waste grinders. The grinding of garbage is an important sanitation device since it eliminates the need for storage and collection of the most noisome and potentially hazardous portion of community refuse.

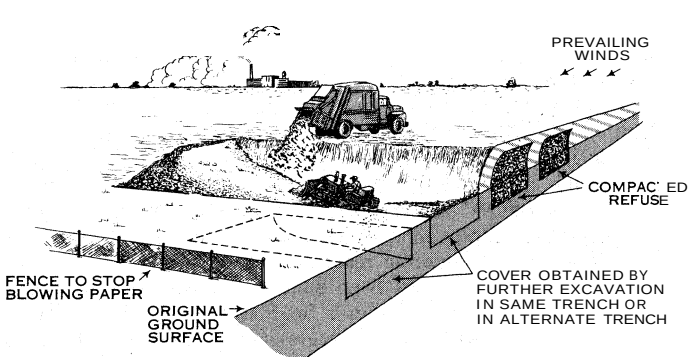
Incineration.—The burning of community refuse is one of the safest and most efficient methods of disposal, provided it is properly done. The special equipment and methods essential to this process are described in the article INCINERATOR.

Dumping in Water.—For many years the disposal of refuse in large bodies of water was an accepted practice. The refuse from a number of large cities was taken to sea on barges and dumped. Unfortunately, much of the lighter material found its way back to the beaches with the wind and the tides.

New York city was prohibited from continuing this practice in 1936 as the result of a ruling by the U.S. supreme court. Very few cities in North America or Europe resort to this method of refuse disposal.

Disposal on Land.—The indiscriminate dumping of refuse on land is an age-old practice still widely followed, particularly in small communities. However, the unsightliness of dumping grounds and the unavoidable presence cf flies, rats, smoke and odours led to the development of more efficient and sanitary methods.

The method of controlled tipping, known in the U.S. as sanitary land fill, was introduced in England in 1912; it makes use of the natural fermentation brought about by microorganisms in the putrescible portion of the refuse. Usually the refuse is deposited in shallow layers, compacted, and covered within 24 hours with compacted earth or other chemically inert material to form an effective seal. Mechanical equipment such as a bulldozer mounted on a heavy tractor is used to grade, compact and cover the refuse. The method often is employed to reclaim otherwise useless land and by the early 1960s was used by over 1,400 American communities. See also SEWAGE DISPOSAL.



BY COURTESY OF THE U S PUBLIC HEALTH SERVICE

FIG. 2.—**TRENCH** METHOD OF SANITARY LAND FILL USED TO DISPOSE OF REFUSE IN A FLAT LAND AREA

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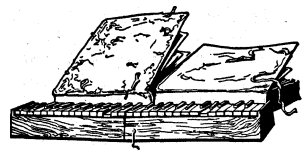


BIBLE REGAL, A PORTABLE ORGAN WHICH FOLDS UP LIKE A BOOK

REGAL, a small late-medieval portable organ, furnished with beating reeds and having two bellows like a positive organ; also in Germany the name given to the reed stops (beating reeds) of a large organ, and more especially the *vox* humana stop. During the 16th and 17th centuries the regal was a very great favourite, and although, because of the civil wars and the ravages of time, few specimens now remain, the instruments are often mentioned in old wills and inventories.

RÉGENCE STYLE is the designation for the French art of the period from 1715 to 1730; it did not quite coincide with the regency of Philippe d'Orléans, duc d'Orléans (1715–23), between the reigns of Louis XIV and Louis XV. The *régence* style marked the transition from the massive, serious baroque art (*q.v.*) to the more elegant. lighthearted rococo style (*q.v.*). The term should not be confused with the English Regency (1811–20) during the latter part of the reign of George III. (WM. F.)

REGENERATION is the process by which organisms replace structures or organs which have been lost by accident or mutilation. This definition is not quite adequate because it does not cover two phenomena which belong undoubtedly to the category of regeneration phenomena. In some invertebrates, such as the fresh-water polyp Hydra, the planarian flatworm Dugesia and the starfish, a small fragment of the body can restore a complete, whole organism rather than merely an organ. Furthermore, many animals can restore structures lost in the normal course of life rather than by accident. The periodic molting of feathers in birds, the shedding of fur in mammals, of the exoskeleton in arthropods and of the epidermal scales in reptiles are followed by regeneration of the discarded structures. The uppermost cornified skin layers in mammals including man are constantly worn off in small bits and replaced by active, proliferating cell layers in the deeper layers of the skin. The same holds for the continuous replacement of hair, nails and claws. The teeth are replaced only once in mammals, including man, but there is a continuous succession of teeth in lower forms, such as the dogfish and shark. The antlers of deer are shed at regular intervals and then regenerated. The periodic changes in the genital tracts of female mammals during menstruation and oestrus also should be included here. All these instances in which replacements are part of the normal life functions are called physiological or repetitive regeneration, in distinction to restorative or reparative regeneration which follows injury. The present article deals primarily with the latter type.

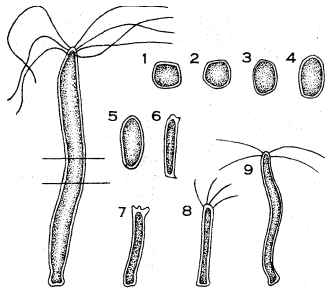
There are wide differences in the regenerative capacity of different animals. The one extreme is represented by the above-mentioned invertebrates, in which a part of the body can restore a whole organism. In higher organisms, as for instance the salamanders among the vertebrates, and many crustaceans and insects, only single organs, such as limbs, can regenerate; mammals cannot restore entire organs, but they can repair damage to tissues, such as bone fractures, skin and muscle injuries and peripheral nerve loss. These phenomena of tissue repair are, of course, included under the general heading regeneration.

General Types.—Regeneration can be accomplished in two ways: (1) by outgrowth of new tissue from the wound surface or (2) by the transformation and reorganization of the remaining parts, without an outgrowth of new material.

Where new tissue is produced, a regeneration bud, or blastema, is formed at the wound surface (see below, Regeneration Process: *Blastema* Formation). It is usually cone-shaped and consists of an embryonic type of cells which gradually form the adult struc-

tures by processes of cell differentiation and growth, much in the fashion of embryonic development. The regeneration of limbs and tails in salamanders is an example of this type of regeneration, which T. H Morgan termed epimorphosis.

The second type of regeneration. the remodeling of old parts, is called morphallaxis (fig. 1). Very small fragments of a freshwater or marine polyp, or of a planarian, undergo a change in shape instead of growing blastemas; they break down old structures, and build in their place new ones of a smaller proportion. All regeneration processes in protozoans are of this type. Occasionally, both types of regeneration take place simultaneously, and there may be no fundamental difference between them. The term regeneration is almost universally adopted as the all-inclusive term, with "epimorphosis" and "morphallaxis" as subheadings. C. M. Child (1941) proposed "reconstitution" as the general term to cover all related phenomena. He used the term regeneration in a narrow sense, synonymously with epimorphosis, as reconstitution by outgrowth, and the term reorganization as reconstitution by internal changes.



FROM E KORSCHELT AFTER T H MORGAN

FIG 1—REGENERATION IN THE FRESH-WATER POLYP HYDRA. THE SHORT PIECE BETWEEN THE TWO LINES (AT LEFT) REGENERATES INTO A NEW POLYP I TO 9 ARE STAGES IN THE REGENERATION PROCESS

The aim of regeneration is to maintain or restore the fitness of an organism after the loss of parts. This aim is best accomplished by a replacement of precisely those structures nhich were lost. However, a number of cases are known in which more than, or less than, the lost part is regenerated, and other cases in which the regenerate is structurally different from the lost part. The term heteromorphosis covers all types of atypical regeneration. The term homeosis is used for those atypical regenerations in nhich the regenerate represents an organ different from the original. For instance. in crabs, an amputated eyestalk, under certain conditions, will be replaced by an antenna. Another type of atypical regeneration has been given special attention; namely, those instances in which the polarity of the regenerate is changed. For example, the posterior cut surface of a piece of planarian, under certain conditions mill regenerate a head instead of a tail. This type of polarity change is called polar heteromorphosis.

Theoretical Considerations.— When a regeneration blastema differentiates into the head of a planarian or into the limb of a salamander, the processes which go on in the blastema are fundamentally of the same nature as the embryonic developmental processes which created these organs originally. Although the regeneration processes are rarely exact replicas of the corresponding developmental processes, they are alike in some fundamental aspects. Both require a building material of plastic, undifferentiated, embryonic-type cells, and a set of specific organizing factors which direct and control the molding and differentiation of such building materials In this sense, regeneration can be defined as the revival, or reactivation. of developmental potencies in organisms which have passed the embryonic stages of development.

If this point of view is adopted, then the close affinity of regeneration processes with asexual reproduction becomes evident. In fact, in some instances it is difficult to draw the line betneen the two. For instance, most protozoans reproduce asexually, by fission. The daughter individuals restore by regeneration those structures which they do not contain at the start of the fission. If a protozoan is cut in tno by a fine instrument, the result is the same—each half regenerates the missing structures. In this instance. fission and regeneration differ primarily in the factors which set the processes in motion. Similarly, some flatworms and annelids (segmented norms) which possess high regenerative powers reproduce regularly by transverse fission or by a budding process at their posterior ends. Their regenerative potencies are placed, so to speak, in the service of reproduction. Budding is a mode of asexual reproduction particularly common among colonial forms. It is practised by coelenterates and tunicates among animals and by plants. A bud is an outgrowth on an adult organism which is an expression of the revival of growth potentialities at a localized area of the body. The parallel to regeneration is obvious. In many marine coelenterates a lateral regeneration bud can be produced easily by making a cut in the body wall. Again, the main difference between regeneration and spontaneous budding lies in the initiating stimuli.

If the ability for regeneration is considered as a residual developmental capacity nhich a number of organisms retain throughout adult life, it is implied that regeneration is the manifestation of a universal property of all organisms; namely, the capacity for gronth and development. This point of view, now generally adopted, did not always prevail. It was seriously contested during the second half of the 19th century. Under the influence of the theory of natural selection, another theory of regeneration mas strongly advocated by August Weismann and others. This theory emphasized the usefulness and adaptive value of regeneration; it stressed the point that regeneration was apparently limited to those organs and structures which are particularly in danger of being injured or mutilated by enemy attacks. It was assumed, therefore, that regeneration is not part of a basic equipment of all organisms, but is acquired secondarily as a special adaptation wherever the ability to regenerate is of crucial survival value in the struggle for existence. It was held that natural selection is instrumental in creating and improving the regenerative capacity. A just objection has been raised against this theory, namely. that in many instances inner organs regenerate which are not liable to injuries, as for instance, the crystalline lens of the amphibian eye, or the liver. For this and other reasons, Weismann's theory in its extreme form is untenable. However, its valid element, the emphasis on natural selection as a mechanism for increasing preexisting limited regenerative capacity, can be readily incorporated in the residual growth theory of regeneration.

Generally speaking, lower organisms have a better regenerative power than do higher organisms, but the regenerative capacity is distributed sporadically among animals and in many instances closely related forms differ nidely in their regenerative capacity. A theory of regeneration has to explain this scattered distribution of regeneration. Natural selection cannot account for it, because there is apparently no close correlation between liability to injury and the regenerative power. The residual growth theory. which assumes that regeneration is a manifestation of a universal property of all organisms, has to account for the fact that this potentiality is lost in a great many forms.

Two prerequisites must be fulfilled if a successful regeneration is to occur: there must be available the necessary building material in the form of unspecialized cells, capable of growth and differentiation; and the necessary organizing factors must be present which direct the development of these cells. Regeneration may be prevented by the loss of either one or of both. The necessary building material may be lost in the normal course of development, during which embryonic cells undergo a differentiation into highly specialized tissues. This differentiation is undoubtedly irreversible in most instances. and the transformation of all cell materials into an irrevocably differentiated form is probably one reason for the lack of regeneration in highly organized animals. Some authors maintain that in some instances a differentiated tissue can dedifferentiate and rejuvenate under certain conditions, and thus become available as a source of regeneration material. Furthermore. in a number of invertebrates and lower chordates. certain embryonic cells remain in an undifferentiated embryonic condition and form a reservoir for regeneration and asexual reproduction (see below). It is obvious that regeneration is impossible in all those organisms which possess neither reserve cells nor tissues capable of de- and redifferentiation. The organizing or "field" factors for regeneration are discussed below. Their loss, in the course of embryonic development, may be an alternative cause for a lack of regenerative power. Finally. an amputation stump may be potentially capable of regenerating but be prevented from doing so either by a de-

ficiency in one of the many subsidiary agents necessary for regenerative growth, such as hormones or nerve-produced agents, or by a block from a rapidly overgrowing skin or wound scar which prevents the outgrowth of the blastema cells. An appropriate treatment of the stump can call forth a regeneration where it would not occur under ordinary conditions.

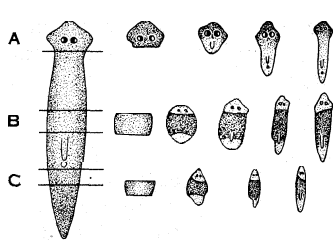
REGENERATION IN DIFFERENT ANIMAL GROUPS

Invertebrates

Protozoa. — Most Protozoa (acellular or one-celled animals) reproduce asexually by longitudinal or transverse fission, or by other modes of division. Fission requires a reorganization and new formation of structures in the daughter individuals, and this process can be considered as a physiological regeneration. The power to rebuild structures is therefore inherent in all protozoans, and it is not surprising to find that most Protozoa can regenerate parts which were lost by accident or removed in an experiment. In all instances, the presence of nuclear material is a necessary prerequisite for successful regeneration. In ciliates which possess a macro- and a micronucleus, the former is essential; the latter is not. In forms such as *Stentor,* in which the macro-nucleus is represented by a beadlike chain, small segments of the chain are sufficient to enable a fragment to regenerate. In Amoeba, which has no highly specialized organelles, a non-nucleate fragment can grow and survive up to 30 days, but it cannot divide. The most highly differentiated Protozoa, the ciliates, have been the subject of extensive studies on regeneration; Paramecium and *Stentor* are the favourite materials. Their regenerative power is excellent. Fragments as small as $\frac{1}{64}$ of an individual can form a complete new organism. The new organelles are formed either by remodeling of the remnants of the old ones or by breakdown of the latter and rebuilding of entirely new structures. In parasitic Protozoa the regeneration capacity seems to be poor or entirely missing.

Sponges. — The regeneration of amputated parts in Porifera, or sponges, does not seem to be very extensive. However, a series of interesting experiments revealed a remarkable capacity of the sponge cells to reorganize themselves into a whole organism, following a complete breakup of their organization. Sponges were strained through bolting silk and thus completely dissociated. Following this treatment, small cell groups reunited into larger aggregates which reorganized themselves and eventually formed a typical sponge.

Coelenterates. — These occur in the forms of polyps and medusae (jellyfish). The well-known fresh-water form Hydra takes its name from the mythological nine-headed monster which was believed to regenerate two heads in the place of each amputated head. The regenerative power of Hydra is at least as startling as that of its namesake. It was in this form that the Swiss naturalist Abraham Trembley made the first planned regeneration experiments (1744), which aroused a tremendous interest and were soon followed by those of R. A. F. de Réaumur, Lazzaro Spallanzani and others. Small fragments of the body can regenerate a whole individual (see fig. 1). One tentacle with a small portion of the mouth region is capable of forming a new individual. The regenerative power of other hydroids differs in different species. *Tubularia* and other marine forms have been widely used for experiments on the physiology of regeneration.

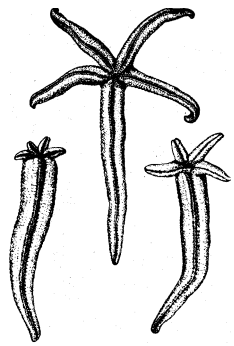


FROM E KORSCHELT, AFTER T H MORGAN

FIG 2.— REGENERATIONIN THE PLANARIAN FLATWORM DUGESIA. THE THREE ROWS SHOW REGENERATION OF (A) ANTERIOR SECTION, (B) MIDSECTION AND (C) POSTERIOR SECTION OF THE ANIMAL AT THE LEFT

The regenerative capacity of the medusae (jellyfish) is much restricted. The Anthozoa (sea anemones and corals) have a considerable regenerative capacity.

Flatworms. — This phylum, Platyhelminthes, includes the planarians, which have an exceedingly high regenerative capacity, and which have therefore been used more than any other form for regeneration experiments. A planarian (Dugesia) may be cut in any direction by one or more transverse, longitudinal or oblique sections, and each fragment will regenerate a whole, though smaller, individual (see fig. 2). Planarians possess complex structures such as eyespots, brain and pharynx. Any or all of these can be rebuilt from a fragment not containing them. Of three closely related groups of Turbellaria (free-living flatworms), distinguished mainly by differences in the shape of the intestine, only the triclads, or planarians, have a high regenerative power, and even within this group there are great differences with respect to the ability to regenerate.



FROM E KORSCHELT

FIG. 3.—REGENERATION IN THE STARFISH, ONE ARM REGENERATES A WHOLE STARFISH (CENTRE)

The entirely parasitic flukes (Trematoda) and tapeworms (Cestoda) have not been thoroughly investigated. They seem to lack regenerative power.

Annelids. — Regeneration in the common earthworm is well known. It can regenerate many segments at the posterior part of the body, but regeneration of the anterior part is limited. Up to five segments can be completely restored, but if more are removed, fewer than the normal number are rebuilt; no regeneration takes place if 15 or more anterior segments are amputated. Some relatives of the earthworm can do better. For instance, the fresh-water worm Criodrilus regenerates as many as 25 anterior segments. In another fresh-water form. *Nais,* two isolated segments can regenerate a whole worm. One of the remarkable features in these annelid regenerations is the formation of gonads in the regenerated segments, although the stumps which give rise to the regenerates may not contain a trace of gonad material. The regenerative power of the more highly specialized marine polychaetes is, in general, lower than that of the earthworm and its relatives (oligochaetes). It is very low in the leeches (Hirudinea).

Echinoderms. — The arms of starfish (Asteroidea) and brittle stars (Ophiuroidea) can regenerate a whole individual in some instances, even if the amputated arm contains no trace of the central disc. Occasionally, there may be found on the seashore an odd-looking starfish with one or two normal-sized and several very short arms (see fig. 3); the latter are in the process of regeneration. Sea urchins can repair damage in the skeleton and restore tube feet and spines. Sea urchin and starfish larvae (plutei) have little regenerative power.

Mollusks. — Parts of the shells of snails (Gastropoda) and valves of clams and relatives (Lamellibranchia) can be replaced. Damage can be repaired at the margin, at which the shell is formed, and also in central parts. The mantle and the foot likewise can regenerate. Some snails have highly complex eyes at the tips of tentacles. The amputation of a tentacle at its base results in its regeneration, including the eye. However, the entire head of a snail cannot be regenerated. Squid, octopus and cuttlefish (Cephalopoda) can regenerate amputated arms.

Arthropods. — The body of an arthropod has many appendages such as legs, wings, antennae, stalked eyes, mandibles and tail. These are all readily exposed to accidental damage, and most of them can be regenerated when lost. This holds particularly for the best-known and most thoroughly investigated groups, the crustaceans (crayfish, crab, lobster, etc.) and the insects. All arthropods molt periodically; that is, they shed the chitinous exoskeleton. Its replacement may be considered a type of physiological regeneration. The regenerative power of insects is high during larval and pupal stages but greatly reduced in the adult. The regeneration of structures such as wings or legs of adult insects is either limited and incomplete or entirely impossible. On the other hand, crustaceans continue to molt throughout adult stages, and they are capable of regenerating complex organs such as legs or eyes.

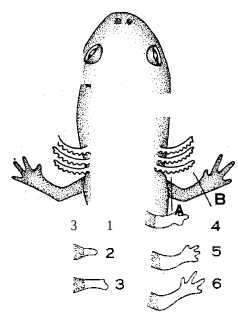
Sea Squirts. — High regenerative power is found in the seden-

tary ascidians. A small part of the body can regenerate a whole individual.

VERTEBRATES

Fishes.—In the bony fishes the regenerative capacity is limited. They can regenerate the tail fins and the other paired and unpaired fins. A few other structures are known to be capable of regeneration, such as the gill cover, parts of the gills and of the lower jaw.

Amphibians.— The tailed Amphibia, salamanders and newts (Caudata), have by far the most extensive regenerative potency of all vertebrates and have therefore been the favourite subjects for experiments on vertebrate regeneration. ,In particular, limb regeneration of salamanders has been analyzed in many respects, ever since it was discovered by Spallanzani in 1768. Any part of a foot or hindlimb can be regenerated; one of the remarkable features is the precision with which the missing part is restored. If the foot is amputated (fig. 4[B]), only this part is replaced; if the leg is removed at its base (fig. 4[A]), it will be replaced in its entirety. Other organs can regenerate equally well, among them the tail, parts of the snout and eyes and parts of inner organs such as lungs and gonads. The regenerative capacity of salamander larvae and of young specimens exceeds even that of full-sized specimens.



(TOP) FROM V. HAMBURGER, MANUAL OF EXPERIMENTAL EMBRYOLOGY REPRODUCED BY PERMISSION OF THE UNIVERSITY OF CHICAGO PRESS

FIG. 4.—ARM REGENERATION IN A SALAMANDER. 1–6 ARE REGENERATION STAGES, FOLLOWING AMPUTATION AT A; BLASTEMA AT 1 AND 2. (SEE TEXT)

In the tailless Amphibia, frogs and toads (Salientia). the regenerative capacity is limited to larval stages. The tadpoles can readily regenerate a tail which is clipped at the tip or even near the base. The hindleg regeneration proceeds rapidly and efficiently in young tadpoles, but this capacity subsides when the larva approaches metamorphosis. Adult frogs do not regenerate limbs, contrary to a common belief. Usually the stumps heal without regenerating. If the arm of an adult frog is amputated and the wound surface is bathed repeatedly in a saturated sodium chloride solution, the stump will proceed to form a regenerate. However, the regenerated arm is never complete and normal. It is assumed that in untreated adult frogs the thick skin closes up rapidly over the wound surface and suppresses regeneration.

Reptiles.— Vertebrates higher than Amphibia have greatly reduced regenerative potentialities. The tail of a lizard is the only highly specialized structure in reptilians which can regenerate. The animal makes occasional use of this capacity: when captured by its tail. it shakes the tail off and leaves it behind. Lizards with regenerated tails are occasionally encountered in the field. However. tail regenerates are never complete; their inner structures are atypical. Amputated limbs of lizards do not regenerate.

Birds.—The regeneration of fragments of beaks has been reported in several birds. The periodic renewal of the plumage after each molt is a type of physiological regeneration, and the growth of a feather from a feather rudiment resembles other regenerative processes.

Mammals.— These present numerous instances of tissue regeneration, but very little, if any. evidence for the regeneration of complex structures. The change of hair, of teeth and of red blood cells and the regeneration of antlers in deer illustrate physiological regeneration. Reparative regeneration, following an amputation, is limited to tissues, such as bone, muscle, liver, skin and peripheral nerves. Whole organs cannot be regenerated.

GENERAL CONCEPTS

What general concepts can be derived from this survey? In the first place, it brings into proper relief a point which has been emphasized by students of regeneration since the early days, that there is a correlation between regeneration potentiality and level of organization; *i.e.,* lower organisms have a high regenerative power, and this power decreases with increase in complexity. Mammals, including man, pay for their high organization with an almost complete loss of regenerative capacity. The relation between regenerative power and level of organization, however, holds only in a general way and breaks down in numerous special instances. For example, some planarian species have an exceptionally high regenerative power, but closely related species have none. The same holds for Annelida. The regenerative ability of the fishes is lower than that of the more highly organized tailed amphibians. The regeneration of the crystalline lens of the eye of salamanders is perfect in one genus and absent in another. These examples could be multiplied easily. They show that factors other than the general level of organization of the animal often play a decisive role.

It has also been asserted that since regeneration is a developmental process, embryos, larvae and young animals, in general, should be more readily capable of regeneration than adult stages of the same animal. This expectation is fulfilled in many instances. but again it is not a rigid rule. It is true that salamander larvae regenerate limbs and tails more rapidly and more perfectly than adults do, and lens regeneration in some salamander species is limited to larvae; frog tadpoles can regenerate a hindlimb, but an adult frog cannot. On the other hand, sea urchin and starfish larvae do not regenerate, while the adults do. The same holds for annelids and for tunicates. Again, factors other than age determine the limitation of regenerative power in these forms. Finally, one would expect that external organs and appendages which are readily exposed to injury and loss would show a higher regenerative capacity than inner organs. This, again, holds in a general way. However, several examples have been mentioned of the regeneration of inner organs which are rarely subject to injury during the normal course of life.

AUTOTOMY

A number of animals, when attacked and caught by a leg or tail, save their lives by casting off this appendage. The organ which is sacrificed can usually be restored by regeneration. This act of self-amputation is called autotomy. Instances of autotomy are found in a number of different animal groups, such as coelenterates mollusks. echinoderms, annelids, arthropods and others, although this means of escape is used only by a few representatives of these phyla and by no means by all of them. The only case of autotomy in vertebrates, and perhaps the best known of all, is that of the autotomy of the tail in lizards. The facility with which the tail breaks off is astounding. This is because of a special structural adaptation. A breaking plane is prepared at the base of the tail along which it is severed when grasped. Several vertebrae are split across the middle. The halves are held together by cartilage which ruptures readily. The regeneration usually begins at the breaking plane. The regenerated tail is not quite typical. It contains no vertebrae but merely a cartilaginous skeletal axis; the muscle and nerve distribution is likewise atypical. Nevertheless, such a regenerated tail can regenerate a second time.

Many crabs, insects and spiders have a similar device to facilitate autotomy, namely, a preformed breaking plane at the base of legs or antennae. The chitinous exoskeleton is soft and thin at certain levels, and the muscle arrangement expedites self-amputation. It is not always the same segment of the leg at which such a breaking plane is prepared, but the mechanism is apparently similar in all species. In the walking stick, or stick insect, all three pairs of legs are adapted for autotomy. Quite frequently, special care is taken to avoid an excessive loss of blood: the skin contracts over the wound and closes it off. A few other instances of autotomy may be mentioned: some sea anemones release a tentacle when it is strongly stimulated; starfishes cast off an arm voluntarily, and some annelids can autotomize the hindmost body segments and regenerate them subsequently.

One of the most startling instances of autotomy is the self-evisceration in sea cucumbers, which, when strongly stimulated, cast off their anterior ends, including tentacles, mouth parts and the water-vascular system, and at the same time discard through the anus the intestine and attached structures, such as gonads.

The discarding of the inner organs is accomplished by strong muscle contraction. The nearly empty hull composed of skin and muscles is capable of regenerating the autotomized organs. *Thione* can accomplish this feat within a month.

There is only one step from spontaneous autotomy to spontaneous fission for the purpose of asexual reproduction. For instance, certain starfishes and certain sea cucumbers break apart at more or less regular time intervals and the fragments regenerate a whole individual. Likewise, in certain annelids and flatworms posterior parts of the body are constricted off and the fragments regenerate into new individuals. This performance has been established as a regular mode of reproduction. The close affinity of regeneration and reproduction in lower animals is thus again affirmed.

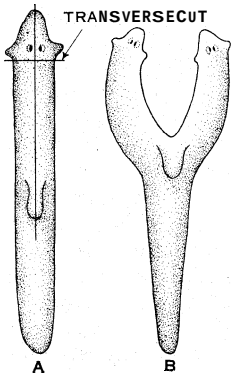


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FIG. 5.— REGENERATION OF A DOUBLE HEAD IN A PLANARIAN (SEE TEXT). A REGENERATE; TISSUE IS UNSTIPPLED

HETEROMORPHOSIS

A regenerate is ordinarily a replica of the original structure, but a number of cases are known in which regeneration is atypical in that either more or less than was lost is regenerated. Occasionally, the regenerate represents an organ entirely different from the one it replaces. All forms of atypical regeneration are called heteromorphosis. The last-mentioned category of heteromorphic regenerations is called homeosis.

Incomplete Regeneration.— This type of heteromorphosis is common both in naturally occurring and in experimentally induced regeneration. Regenerated tails of lizards invariably show certain structural deficiencies, such as the absence of normal vertebrae. Regenerated salamander limbs frequently have a reduced number of digits or even greater deficiencies. Those of arthropods may have a reduced number of segments. Several species of annelids can regenerate only a limited number of head segments. If more are amputated, the total segment number of the worm after completed regeneration will be subnormal. Planarians occasionally regenerate a head with two fused eyes, or only one eye, or eyeless heads, instead of the normal head with two separate eyes.

Such atypical head regenerates can be produced experimentally by exposing the regenerating animals to any one of a number of chemical agents which are known to impair developmental processes in a general, nonspecific way.

Superregeneration.— Of greatest interest among the superregenerations are those in which a single organ is replaced by a duplicated or multiple formation. Instances of such monstrosities have been observed in practically all regenerating animal forms, as, for instance. in hydranths of Hydra and of its marine relatives, in heads and tails of planarians and annelids, in tails of lizards and limbs or digits of amphibians and particularly frequently in appendages of arthropods. Double claws of crabs or lobsters, double legs and antennae of beetles and of other insects have been described. Starfishes with bifurcated arms and sea cucumbers with duplicated body parts also have been observed. Triplicate appendages are commonest in arthropods and occasionally are found in other forms. They originate probably in most instances in the following way: a leg, claw or antenna ruptures at a joint without breaking off completely. As a result, two wound surfaces are exposed, each of which begins to regenerate the distal parts. The two new formations, together with the persisting original structure, form the triple monstrosity. It was found that such triplicate structures follow a definite rule of symmetry relations (Bateson's rule): two adjacent components, namely, the middle one and one of the marginal components, are mirror images of each other, whereas the two marginal parts have the same symmetry pattern.

It is often difficult or impossible to decide whether double or triple monstrosities found in nature have been brought about by regeneration or whether the duplication occurred in early embryonic development. Therefore, experimental methods were devised that make it possible to study the origin of duplications by regeneration under controlled conditions. An expedient way of accomplishing this is to create a wound surface which will produce two separate blastemas instead of one. For instance, if the tail of a tadpole is amputated by two oblique cuts, in the form of an arrowhead (instead of by one transverse cut), then two blastemas and tails will grow out, each with its main axis perpendicular to the oblique, cut surface (Barfurth's rule). Multiple digits in salamander legs were produced in the same fashion, by making two oblique transections. Two-headed planarians can be obtained by making a longitudinal fission in the median plane through the anterior part of the animal, and a subsequent amputation of the two halves of the head (fig. 5[A]). Each separate anterior body half then regenerates the missing lateral parts and, in addition, a whole head at the anterior surface (fig. 5[B]). By repeating this procedure, animals with multiple heads (up to ten) have been obtained. In the same way, planarians with double tails can be produced experimentally.

Homeosis.—This category of atypical regenerations includes all those instances in which the regenerate represents a structure different in type from the original. Homeosis occurs mainly in arthropods. It is a characteristic of this phylum that most of the numerous body segments bear appendages which are of different types in different body regions (*e.g.*, antennae, mandibles, claws, thoracic legs. abdominal appendages). In homeosis, the appendage of one type substitutes for another type. A few examples may serve as illustrations: in crustaceans (crayfish, lobster. crab), a thoracic leg with claws was regenerated in place of a maxilliped; in other cases an abdominal leg was found in place of a thoracic leg. A leg may be regenerated in place of an antenna or of a mandible, and vice versa. An anterior wing of a butterfly or moth may replace a posterior wing. Of particular interest is the regeneration of an antenna in place of a stalked eye, which was observed in marine decapod crustaceans of the genus *Palinurus, Palaemon* and in others (fig. 6). Curt Herbst discovered that if the optic ganglion, which is located at the base of the eyestalk, is removed along with the eye, an antenna grows out, but if the optic ganglion is left intact and the eye alone is amputated. a normal eyestalk and eye regenerate. The ganglion, then, determines the quality of the regenerate.

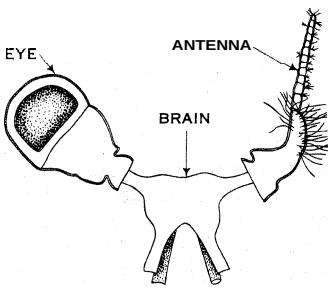

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FIG. 6.—HOMEOSIS IN THE SHRIMP PALAEMON. THE EYE WITH ITS STALK WAS AMPUTATED AT THE RIGHT SIDE. AN ANTENNA REGENERATED IN ITS PLACE

REGENERATION PROCESS

ORIGIN OF REGENERATION MATERIAL

Blastema Formation.— Regeneration, as noted above, can be performed by reorganization of the old piece (morphallaxis) or by outgrowth of new tissue at the cut surface (epimorphosis). Only the latter mode of regeneration is discussed in the following. In limb and tail regeneration of salamanders, in head and tail regeneration of planarians and in many similar instances, a regeneration bud or blastema is formed at the amputation surface. The blastema is at first a slight elevation which grows to a cone-shaped structure and then begins to differentiate into tissues or organs. The blastema is an accumulation of cells of embryonic type, whose origin has been the topic of numerous investigations. The material that builds up the regenerate may be derived from three different sources. In several invertebrate phyla, including coelenterates, annelids and flatworms. a special type of undifferentiated cells, the so-called reserve cells or neoblasts, are stored in different parts of the body. When the need for regeneration arises they are mobilized and migrate to the site of injury. Tissue out-

growth is a second source. The differentiated tissues at the cut surface (for instance, skin or muscle) may simply grow out and each form tissue of its own kind. Finally, the blastema cells may be derived from formerly differentiated tissues of the amputation stump which have dedifferentiated and returned to an embryonic-type condition. It is conceivable that when the blastema proceeds to develop, such cells may differentiate into a type of tissue different from the one from which they mere derived. For example. in salamander limb regeneration, a former muscle cell may become a bone cell, or vice versa. This transformation is referred to as metaplasia.

Tissue **Outgrowth.**—This mode of regeneration is characteristic of tissue repair such as bone regeneration following a fracture, restitution of a muscle injury or liver regeneration. Peripheral nerves regenerate in this fashion, by outgrowth from the cut end. In amphibian limb regeneration. apparently only nerves and skin regenerate in this way. The skeletal elements of the regenerate do not originate from old skeletal tissue at the cut surface. This was demonstrated by an experiment in which the upper arm bone (humerus) mas carefully removed and the limb then amputated across the upper arm. The regenerated forearm and digits contained all typical skeletal elements, although no bone tissue was present at the amputation surface.

Reserve Cells **(Neoblasts).**—A glance at some of the extensive regenerations in lower animals shows that in these cases tissue outgrowth cannot be the primary source of the new formations. For example, a narrow piece from the middle of a planarian can regenerate a new individual, with such organs as brain, eyes, pharynx and reproductive organs, no trace of which was present in the original piece. In flatworms, annelids, coelenterates and tunicates the reserve cells or neoblasts are the major source of the building material for new organs. These cells have been set aside in the embryo for this purpose, and have never undergone any specialized differentiation. In the common coelenterate Hydra, which is famous for its regenerative capacity, a type of connective tissue or mesenchyme cell, the so-called interstitial cell. is found scattered throughout the body; these cells migrate to a cut surface and form the chief or even exclusive source of the blastema. In some annelids the neoblasts can be identified as particularly large cells, stored in different parts of the body. However, it seems that tissue outgrowth and metaplasia also contribute to regeneration in annelids, and there is a great deal of variation in details in this group.

Different species of flatworms vary greatly in their capacity for regeneration, and a correlation seems to exist between the degree of regenerative power and the quantity of reserve cells present in the body. The role of these reserve cells in planarian regeneration was firmly established by the use of a modern tool, irradiation. It was found that reserve cells are more sensitive than ordinary body cells to X-rays and other radiation. If the whole animal is exposed to a mild dosage, the neoblasts can be destroyed nithout destroying the animal, which survives for at least several weeks; these individuals have no capacity for regeneration. A modification of this experiment gave evidence that reserve cells can migrate over long distances to reach the amputation surface. If the anterior part of a flatworm is irradiated and the posterior part shielded, and then the head removed by a transverse cut within the irradiated region, head regeneration occurs uith a considerable delay because the reserve cells in the intact posterior region have to migrate across the irradiated band to reach the amputation surface. The wider the band, the longer the delay, but eventually a head is regenerated.

Metaplasia.—The question of whether metaplasia, as defined above, exists is of great theoretical interest: it goes to the heart of the problem of cellular differentiation. Is the process of differentiation of an embryonic cell into a highly specialized cell, such as a muscle or bone cell, reversible? Can a full-fledged muscle cell revert to an embryonic state and then, under certain conditions, differentiate in a new direction and become a bone cell? The origin of the limb-regeneration blastema in salamanders has always been in the centre of this discussion, without, however, yielding crucial evidence one way or the other. First, the question had to be settled whether the blastema cells come from the amputation stump or from more distant parts of the body, or perhaps even from formed elements of the blood. Irradiation experiments gave the answer: if part of a salamander limb is irradiated and the rest of the body shielded, and an amputation is then performed in the irradiated region, regeneration fails to occur; conversely, irradiation of the whole animal, except for the limb, does not interfere with limb regeneration. Contrary to what happens in planarians, then, the blastema cells do not come from distant parts but derive from the cells near the amputation surface.

Microscopic study of the events following the amputation of a limb reveals that a dedifferentiation of differentiated muscle and cartilage or bone actually occurs near the cut surface during the few days preceding the formation of the blastema. The multinuclear muscle fibres break up into fragments forming small cells with single nuclei, which have the appearance of embryonic cells or fibroblasts. There seems to be agreement that these cells, together with similar cells of skeletal origin and with ordinary fibroblasts, contribute materially to the blastema. If by metaplasia is meant merely the loss of highly specialized structure and the transformation into a fibroblastlike embryonic-looking cell, then this is a case in point. But this is not metaplasia in the strictest sense. The crucial question is still open: Have these cells actually lost all their biochemical and metabolic specifications? Have they reverted to a true embryonic pluripotential state which would enable them to differentiate into a cell type different from the one they represented before? A definitive answer to this question awaits new techniques.

There is, however, one clear case of true metaplasia. This is the regeneration of the crystalline lens of the salamander eye, often referred to as Wolffian lens regeneration in recognition of one of the co-discoverers and most active students of this very remarkable phenomenon. If the lens is carefully removed with fine instruments, it is replaced by a new lens that originates at the upper margin of the iris; the latter is the pigmented part of the eye, enclosing the pupil. The first change, following lens extirpation, is the disappearance of the pigment in the upper iris; that is, a process of dedifferentiation. Next, the two tissue layers that comprise the iris separate and expand at the rim where they are continuous, and form a small vesicle. This vesicle grows downward to assume the normal position of a lens; eventually it becomes detached from the iris and differentiates into a typical lens. Here may be observed directly the transformation of pigmented iris cells into lens cells. Another case of true metaplasia, the regeneration of brain tissue from epidermis in annelids, is well documented.

Analysis

Initial Stimulus. — The regeneration process is ordinarily initiated by the injury that accompanies the loss of a part. The trauma seems to play an activating role similar to that of fertilization in the egg. The physiological and metabolic equilibrium at the wound surface is undoubtedly disturbed, and it is likely that the injured tissues produce a chemical agent or agents that set the process in motion. However, the actual loss of a part is not a necessary prerequisite for regeneration. An injury such as an incision in the stem of a coelenterate or in the body of a planarian is sufficient to initiate a new growth process. If ultraviolet irradiation is applied to the elbow region of a salamander limb, a local injury ensues, and an accessory, well-formed forearm with digits may grow out at this place. Duplications of limbs and other organs encountered occasionally in amphibians, arthropods and other groups, may have originated in this fashion, by local injury.

In some instances not even an injury is necessary for activation of the regeneration process. The above-mentioned lens regeneration in the salamander eye is initiated simply by removal of the old lens, which can be done without injury to the upper iris, from which the regenerating lens is derived. What is the stimulus in this instance? Experiment has shown that the lens produces a chemical agent that holds the upper iris in check. If this inhibitor is removed, along with the lens, the regeneration process is set in

motion. The coelenterate *Tubularia,* a marine relative of the common Hydra, which has been widely used for regeneration experiments, consists of stolon, stem and hydranth, the latter containing the mouth opening surrounded by two rows of tentacles (fig. 8). The stem is sheathed in a transparent coat. the perisarc. If a small area of the stem tissue is exposed to sea water by cutting a hole in the perisarc. a bud grows out at that place and forms eventually a new hydranth. In this instance, the local increase in oxygen tension serves as the activating stimulus. This experiment again illustrates the close relationship between regeneration and asexual reproduction by budding.

Regeneration Fields in Amphibians. — Once a blastema is formed, it is possible to inquire into the organizing factors that so direct the further development of the blastema that exactly the missing parts are replaced. The problems faced here are similar to those the embryologist encounters when he tries to analyze the factors that determine the origin of an embryonic organ primordium (*see* EMBRYOLOGY, EXPERIMENTAL). The regeneration blastema can be considered as equivalent to an organ primordium; the same types of organizing and determining factors probably are in operation in both, and the same kinds of experimental methods, such as extirpation and transplantation. are applied for their analysis. However, it should be stated that analysis of the regeneration process is much less advanced than that of embryonic processes.

The concept of regeneration fields has been found useful for an understanding of regeneration phenomena; the field concept also has been applied to embryonic development. The capacity for regeneration of an organ such as limb. tail or snout in salamanders is limited to a well-circumscribed area. For instance, limb regeneration after amputation can be obtained at any level down to the base, but if a still larger area, including the limb girdle, is removed, no regeneration occurs. By this type of extirpation experiment, regeneration fields for different organs have been demarcated. The fields are the units of regeneration; therefore. it is not quite correct to say that the salamander regenerates a limb; rather, the limb regeneration field restores its wholeness when it has been impaired. The field concept conveys another notion: the organizing factors for regeneration are distributed over the whole field in such a fashion that if the field district is injured at two separate points, two regenerates of the same type can be formed In this nay duplicate limbs or tails can originate by experiment or by accidental injury. An example is an experiment mentioned above in uhich local irradiation at the elbow of a salamander called forth the formation of an extra limb. If a field can give rise to more than one organ. then part of a field should be able to produce a whole organ This expectation is fulfilled in the following experiment: if the salamander hand is amputated and the forearm split lengthwise, each half of the cross section can regenerate a whole hand with four digits. The regeneration field shares this remarkable regulative property uith the embryonic fields.

Determination. — Very young limb or tail blastemas apparently resemble early embryonic structures in that they are not yet irreversibly determined but show a certain plasticity. If a few-days-old blastema of a salamander forelimb is transplanted onto the stump of an amputated hindlimb, the regenerate is a hindlimb. However, if the blastema is a week old. or older, it forms a forelimb in a foreign position; that is, its fate has been determined in the meantime. Obviously. the blastema acquires gradually its specific characteristics. It must get its "instructions" from the underlying stump tissue, but the determinative mechanisms are unknonn.

Organizers and Induction. — The discoveries of inductors and organizers were landmarks in experimental embryology. Transplantation experiments showed that certain embryonic areas, called inductors, produce chemical agents that stimulate the formation of an organ, such as inner ear, nose, lens. in an adjacent embryonic area. The organizer, discovered by H. Spemann in early amphibian embryos. is a complex inductor that. when transplanted to another embryo, induces in the latter not merely a single organ but a more or less complete secondary embryo. Similar phenomena were discovered in the regeneration of lower forms. If a small piece from the mouth region of a coelenterate polyp (fig. 8) is transplanted into the stem of another individual, a secondary individual grows out, composed largely of host material; the transplant contributes the organizing factors but little material. Similarly, if a piece of the head of a planarian is transplanted to the middle of the body of another planarian, a secondary individual is induced. If individuals of different colour are used in this experiment. it is possible to establish clearly the share of the graft and of the host in the new formation, and it can be seen that the graft forms only a small part of the outgrowth. Obviously, it is important to distinguish between organizing factors and building material.

Organ induction also has been demonstrated. In certain species of planarians, the brain produces a diffusible substance that induces eye regeneration. In the above-mentioned case of lens regeneration in the salamander eye from the upper iris. it is not enough to remove the lens-produced inhibitor; in addition an inductive substance, produced by the retina of the eye, must be present.

Role of the Nervous System. — The presence of nerves at the cut surface has long been recognized as a necessary prerequisite for amphibian limb regeneration. No regeneration takes place if simultaneously with limb amputation all limb nerves are transected in the region of the limb girdle. However, the nerves themselves can regenerate. and as soon as the regenerating nerves reach the amputation level a belated blastema formation begins. Limb regeneration can be prevented permanently by repeated nerve transections. If this is done in larval salamanders, not only is there no regeneration, but the amputation stump begins to regress and is eventually completely resorbed. The nerves apparently produce a trophic (nutritive) agent of unknown chemical nature that promotes the blastema formation. Once the blastema has reached a certain size, it becomes independent of the nerve influence. This trophic factor should be counted among the general, nonspecific metabolic conditions for regeneration, and not in the category of specific organizing factors. because the nerves do not determine the specific quality of the regenerate; they do not decide whether it is to be a forelimb or a hindlimb. The question of nhether any special nerve fibre type, such as sensory, motor or sympathetic. is responsible for the production of this trophic agent was a matter of controversy for a long time, the issue being finally settled by M. Singer, who found that the requirement for nerves is quantitative, not qualitative; a certain minimum number must be present at the amputation surface, but the source from which they are derived is immaterial.

The nervous system also plays a role in the regeneration of certain invertebrates. For instance, head regeneration of the earthworm seems to be dependent on the presence of the ventral nerve cord at the amputation surface. Eye regeneration in some marine decapod crustaceans presents a particularly interesting case.

A normal eye regenerates if the eye and eyestalk are removed but the optic ganglion at the base of the stalk is left intact; if the latter is also removed, then an antenna is formed in the place of the eye (fig. 6; homeosis).

In other arthropods antennae and legs can regenerate in the absence of nerves.

Hormones in Regeneration. — Hormones (*q.v.*) play an important role as agents controlling a great variety of body functions. Their influence on growth and development is illustrated by the well-known cretinism, which results from deficiency of the thyroid hormone, and by the control of amphibian metamorphosis by .the thyroid gland. The pituitary body (*q.v.*) produces a growth hormone; its underproduction results in dwarfism and its overproduction in gigantism. Since regeneration is a special type of growth and development. similar hormonal influences on regeneration would be expected, and this is indeed the case. The regeneration of limbs in adult newts (tailed amphibians) is inhibited when the entire pituitary is removed. This effect is exerted only on the very first phase of the regeneration process, following amputation, namely the breakdown of tissue (dedifferen-

tiation) near the cut surface. Instead of formation of the blastema, a thick pad of skin grows over the wound and blocks further outgrowth.

Regeneration proceeds in a normal fashion if the regeneration process is allowed to get a start of five or six days before the gland is removed. It is assumed that the hormone is involved in the breakdown of proteins. Thyroid hormone has a similar effect on amphibian limb regeneration, and hormonal effects on regeneration in insects also have been reported.

Polarity; Gradient Theory. — The familiar distinction between head. trunk and tail, or anterior and posterior end, calls attention to the axial organization, or polarity. of most animals. In the polyps of coelenterates, polarity is expressed in the formation of a tentacle-bearing hydranth with mouth opening at the apical end of the stem and a stolon at the basal end (fig. 8). One of the striking phenomena in the regeneration of lower animals is the retention of polarity even in small fragments.

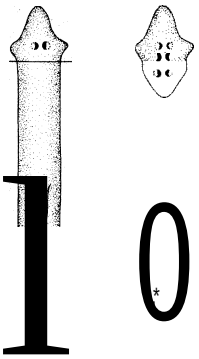

FIG 7 —POLAR HETEROMORPHOSIS (REVERSAL OF POLARITY) IN A PLANARIAN. AN AMPUTATED HEAD OR A SHORT POSTERIOR BODY PIECE MAY REGENERATE A HEAD WHERE A TAIL WOULD BE EXPECTED REGENERATED TISSUE IS UNSTIPPLED

A slice of a planarian taken from any part of the body regenerates a head at the anterior cut surface and a tail at the posterior cut surface. However. exceptions do occur; reversal of polarity is referred to as polar heteromorphosis (fig. 7).

How can the maintenance of polarity in regenerates be explained? Older theories that postulated specific cell types or specific morphogenetic substances for head or tail formation have been abandoned. The axial gradient theory of C. M. Child offers a more dynamic interpretation. According to this theory, polarity is the manifestation of a gradient of physiological activities along the main axis. the head end representing the highest activity and the tail end the lowest. Each section of the body or stem shares in this axial gradient. The theory assumes further that a head, or hydranth in coelenterates. regenerates at the anterior surface of an isolated piece because this is the region of relatively highest metabolic activity in the fragment; and the tail or stolon forms at the level of relatively lowest activity. In other words. the fate of a regeneration blastema is determined by its relative position in the whole gradient system.

Polar heteromorphoses, which occur predominantly in very short pieces (fig. 7), are explained by assuming that in such pieces the activity at the two surfaces is nearly equal and the differential too small to determine two different types of structures.

The nature of the physiological activity postulated by the theory has never been clearly defined, and efforts to demonstrate single gradient systems of oxygen consumption or of other general metabolic activities, consistent over a wide range of eggs, embryos and lower animals, have failed. However, there are some indirect methods that give indications of rather widespread gradients, for instance in the susceptibility of lower animals, eggs and embryos to toxic agents. In this context, gradients of regeneration capacity are of special interest. In the stem of the coelenterate *Tubularia* the rate of regeneration, measured by the amount of tissue regenerated per hour. decreases gradually from the apical to the basal regions; this is attributed to the gradient concentration of a catalyst. Likewise, if a planarian is cut in six or eight transverse pieces of equal size, the quality of head regeneration is highest in the anteriormost piece and declines from there in a graded fashion.

The concept of physiological dominance is an integral part of the axial gradient theory It is postulated that the region of highest physiological activity not only forms a head or a hydranth but at the same time suppresses head or hydranth formation at any other part of the regenerating piece. It sets itself up as a "dominant region" and thus guarantees the unity in the regenerating system. One experiment, selected from many others, may illustrate dominance. As illustrated in fig. 8. a piece of the stem of the coelenterate *Tubularia* would normally regenerate a hydranth at the apical end, at surface 1, and a stolon at surface 2. If regeneration at the apical end is prevented by a ligature, then the basal end regenerates a hydranth. In terms of the theory, the ligature has eliminated all influences of the apical region; thus, the basal end has been released from the inhibitory effect of the original dominant region and set itself up as a new dominant region. Incidentally, a polar heteromorphosis has been produced in this way.

Nerve Regeneration. — The great practical importance of nerve regeneration following nerve injury in man justifies a brief special consideration of this process. Only peripheral nerves can regenerate; the nerve cells, or neurons, that make up the tissue of the brain and spinal cord, and the ganglia, cannot be replaced once they are destroyed. The peripheral nerves are actually bundles of nerve fibres embedded in connective tissue. Each fibre is a delicate protoplasmic thread spun out in early development by one of the nerve cells in the central nervous system or ganglion. The fibre remains part of its cell of origin and depends on its cell body for nutriment throughout life. This fact is important for an understanding of nerve fibre regeneration. When a nerve is transected, regeneration starts from the so-called proximal stump of the fibre (that is. the part that remained connected with its cell body), whereas the disconnected, distal or peripheral stump dies off. The fibres at the proximal stump begin to sprout new threads that penetrate the gap between the two cut ends.

How do these fine processes bridge this gap? How do they find their uay to the peripheral organs they are supposed to reinnervate? They obtain substantial aid from a special type of companion cells, the so-called Schwann cells. These very versatile small cells serve several important functions. They are lined up all along the nerve fibre, forming a continuous. very delicate coat around it During development, they produce an insulating coat around the fibre, the so-called myelin sheath, which gives the nerve its white, glistening appearance. In nerve regeneration, they play a major role in reconstructing the peripheral pathway for the regenerating fibres. The peripheral parts of the nerve fibres themselves that were severed from their cell bodies break down and disappear; not so the Schuann cells that surround them. These become very active. They multiply and form long dense strands, or cords, in the peripheral nerve stump.

These cords are then invaded by the newly regenerating fibres from the proximal stump and serve the outgrowing fibres as a substrate and a guide, from the cut end all the way to their destination at the periphery.

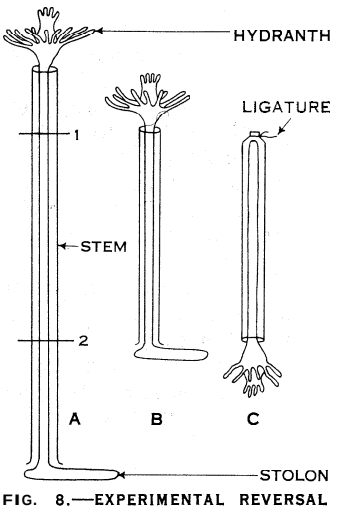

FIG. 8.—EXPERIMENTAL REVERSAL OF POLARITY IN THE MARINE POLYP TUBULARIA ILLUSTRATING PHYSIOLOGICAL DOMINANCE. (A) PIECE 1–2 REGENERATES NORMALLY (B) A HYDRANTH AT 1 AND A STOLON AT 2. (C) IF A LIGATURE IS MADE AT 1, A HYDRANTH REGENERATES AT 2

The greatest hazard for the regenerating nerve fibres is the crossing of the gap between the two cut ends of the nerve. In this they are also aided by the Schwann cells; the latter, together with fibroblasts, form between the two cut ends a bridge of parallel strands which is then used as a track by the outgrowing fibres. In this phase of nerve regeneration, the surgeon can lend a helping hand by facilitating the crossing of the gap. Particularly if the gap is wide, the two ends may be connected with sutures, or fitted together with a sleeve made of a piece of artery or other material. Growth of the regenerating nerve fibre proceed~at the rate of several millimetres per day. In man. functional recovery takes several months, the time depending, of course, on the distance between

the cut end and the peripheral end organ.

See DEVELOPNEXT. ANIMAL; EMBRYOLOGY. EXPERIMENTAL; REPRODUCTION. *See* also references under "Regeneration" in the Index volume.

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REGENSBURG (RATISBON), a city and episcopal see of Germany, in the *Land* of Bavaria. Pop. (1959 est.) 123,476. It is on the right bank of the Danube, opposite the influx of the Regen, 86 mi. by rail N.E. from Munich, and 60 mi. S.E. of Nuernberg. The pre-Roman settlement of *Radespona* was chosen by the Romans, who named it *Castra Regina*, as the centre of their power on the upper Danube. It afterward became the seat of the dukes of Bavaria and was the focus from which Christianity spread over southern Germany. St. Emmeran founded an abbey there in the middle of the 7th century, and St. Boniface established the bishopric about 100 years later. Regensburg acquired the freedom of the empire in the 13th century, and was for a time the most flourishing city in southern Germany. It became the chief seat of the trade with India and the Levant, and the boatmen of Regensburg are frequently heard of as expediting the journeys of the crusaders. Numerous imperial diets were held there in the middle ages, and after 1663 it became the regular place of meeting of that body. The Reformation found only temporary acceptance at Regensburg and was met by a counter-reformation inspired by the Jesuits. Before this period the city had almost wholly lost its commercial importance because of the changes in the great highways of trade. Regensburg is said to have suffered in all no fewer than 17 sieges. In 1810 the town and bishopric were ceded to Bavaria. In 1809 the French reduced a great part of the city to ashes.

Across the river is Stadt-am-Hof, connected with Regensburg by a stone bridge of the 12th century. One of the most characteristic features in its architecture is the number of strong loop-holed towers attached to the more ancient dwellings.

The cathedral, though small, is an interesting example of pure German Gothic. It was founded in 1275 and completed in 1634, with the exception of the towers, which were finished in 1869. Adjoining the cloisters are two chapels of earlier date than the cathedral itself, one of which, known as the "old cathedral," goes back perhaps to the 8th century. The church of St. James —also called Schottenkirche—a plain Romanesque basilica of the 12th century, derives its name from the monastery of Irish Benedictines ("Scoti") to which it was attached. The old parish church of St. Ulrich is a good example of the Transition style of the 13th century. Examples of the Romanesque basilica style are the church of Obermünster, dating from 1010, and the abbey church of St. Emmeran, built in the 13th century, and remarkable as one of the few German churches with a detached belfry. The cloisters of the ancient abbey, one of the oldest in Germany, are still in fair preservation. In 1809 the conventual buildings were converted into a palace for the prince of Thurn and Taxis. The town hall, dating in part from the 14th century, contains the rooms occupied by the imperial diet from 1663 to 1806. Among the chief manufactures are pottery, parquet flooring, musical instruments, furniture, sugar, chemicals, tobacco and lead pencils.

REGENT, one who rules or governs, especially during the absence, minority or incapacity of the sovereign. William I of England appointed *ad hoc* administrators whenever he left for Normandy, and in the course of the 12th century it became customary for the justiciar to act as regent when the king was abroad In 1216 the barons chose the earl of Pembroke to be *rector regis et regni* ("guide of king and kingdom") for the boy king. Henry III. By the statute of 28 Henry VIII c 7, advance provision was made for the selection of a regent upon Henry's death to serve until the new sovereign should attain the age of 18 if a male or 16 if a female. Although it was always subsequently assumed that a regent could be appointed only by or pursuant to an act of parliament, it was not until the Regency act, 1937, that permanent provision was made for the selection of a regent if the sovereign is under 18 or is found by a commission composed of his or her spouse, the lord chancellor, the speaker of the house of commons. the lord chief justice and the master of the rolls to be infirm of body or mind.

At the universities of Oxford and Cambridge the term regent was applied to a resident master who presided over disputations in the schools, and Cambridge once called the upper house of the university senate Regent house. In the Scottish universities the term designated a tutor for undergraduates; in France it designated a teacher of elementary arts or sciences in a secondary school. The term nas occasionally used in Europe and elsewhere to refer to the governing board of a city, and in some Moslem states for the chief of state. In Java it was the title given to a native chief through whom the Dutch colonial officials governed a residency. In the United States the term is little used except by some educational institutions, especially state universities, for a member of the governing board; *e.g.*, the regents of the University of California. (J. A. C. G.)

REGER, MAX (1873–1916), German composer, was born at Brand, Bavaria, on March 19, 1873. He studied at Weiden, Sondershausen and Wiesbaden, and taught at the Royal academy, Munich, from 1905–07, when he became a teacher at the Leipzig conservatorium, a post which he retained until his death, on May 11, 1916. His early piano works, Variations on a Theme from Bach, Variations on a Theme from Beethoven, the passacaglia and Fugue, and later the violin sonata in F sharp minor, which show already his individuality and remarkable technical powers, were followed by his first orchestral work, *Sinfonietta* (1906). After moving to Leipzig he wrote the violin concerto and piano concerto, with the powerful Symphonie Prologue to a Tragedy and the Comedy Overture, a number of choral pieces including *Die Nonnen, Der romische Triumphgesang* and *Die Weihe der Nacht*, the fine motets written for the Thomaner-Chor and the *Schlichte Weisen* sonatinas. From the period 1911–13, when he was also director of the court orchestra at Meiningen, there dates the Romantische Suite, Bocklin Suite, Ballet Suite, and later, Variations on a Theme from Mozart. From 1914 onwards his numerous compositions include many chamber works, pieces for choir and orchestra, for the piano and for the organ, and songs.

Reger was one of the most prolific and, in some respects, remarkably gifted composers of his day. His fertility was extraordinary, and he turned out work after work, often on the largest scale and in the most complex forms, with astonishing ease. His powers as a contrapuntist were especially noteworthy, and the fugue was one of his favourite forms. But as to the value of his immense output critical opinion is sharply divided.

A list of Reger's works is given in Grove's *Dict. of Music* (3rd ed., 1928). *See* also K. Hasse, *Max Reger* (Leipzig, 1921); E. Segnitz, *Max Reger* (Leipzig, 1922); and R. Würz, *Max Reger* (Munich, 1920).

REGGIO DI CALABRIA (anc. Regium, *q.v.*), a town and archiepiscopal see of Calabria, Italy, capital of the province of Reggio Di Calabria. on the Strait of Messina, 248 mi. S.S.E. from Naples by rail. Pop. (1957) 148.970 (commune). It is the terminus of the railways from Naples along the west coast, and from Metaponto along the east coast of Calabria. The straits are there about 7 mi. wide, and the distance to Messina nearly 10 mi. The ferryboats to Messina therefore cross by preference from Villa S Giovanni, 8 mi. N. of Reggio, now included within its communal boundary, whence the distance is only 5 mi. In 1894 the town suffered from an earthquake, though less severely than in 1783. It nas totally destroyed however, by the great earthquake of Dec. 1908; in the centre of the town about 35.000 out of 40 000 persons perished The cathedral, which dated from the 17th century, and the ancient castle which rose above it. were wrecked. Great damage was done by n seismic wave following the shock. The town was heavily bombed in 1943.

REGGIO NELL'EMILIA, a city and episcopal see of Emilia-Romagna. Italy, the capital of the province of Reggio Nell'Emilia (till 1859 part of the duchy of Modena), 38 mi. by rail N.W. of Bologna. Pop. (1906) 19,681; (1957 est.) 110.923 (commune). The town is in the shape of a diamond. The cathedral, originally erected in the 12th century, was reconstructed in the 15th and 16th; the façade shows traces of both periods, the Renaissance work by Prospero Spani (1516–84) being complete only in the lower portion. The Madonna della Ghiara, built in 1597–1619 in the form of a Greek cross. is beautifully proportioned and finely decorated in stucco and with frescoes of the Bolognese school of the early 17th century. S. Prospero has a good façade of 1753. There are several good palaces of the early Renaissance, a fine theatre (1857) and a museum containing important paleethnological collections. ancient and medieval sculptures, and the natural history collection of Lazzaro Spallanzani.

Lodovico Ariosto, the poet (1474–1533), was born in Reggio, and his father's house is still preserved. The industries embrace the making of railway locomotives and carriages and streetcars, and of cheese.

Regium Lepidi was probably founded by M. Aemilius Lepidus during the construction of the Via Aemilia (187 B.C.), on which it lay half-way between Mutina and Parma. It was during the Roman period a flourishing town. The bishopric dates perhaps from the 4th century A.D. Under the Lombards the town was the seat of dukes and counts; in the 12th and 13th centuries it formed a flourishing republic, busied in surrounding itself with walls (1229), controlling the Crostolo and constructing navigable canals to the Po. About 1290 it first passed into the hands of Obizzo d'Este, and the authority of the Este family was finally recognized in 1409.

REGICIDE, the name given to anyone who kills a sovereign (Lat. *rex,* a king, and *caedere,* to kill). Regicides is the name given in English history at the Restoration of 1660 to those persons who were responsible for the execution of Charles I. The number of regicides was estimated at 84, this number being composed of the 67 present at the last sitting of the court of justice, 11 others who had attended earlier sittings, four officers of the court and the two executioners.

The trial of the regicides before a court of 34 commissioners took place in Oct. 1660. Twenty-nine were condemned to death, but only ten were actually executed, the remaining 19 with six others being imprisoned for life. The ten who were executed at Charing Cross or Tyburn, London, in Oct. 1660, were Thomas Harrison, John Jones, Adrian Scrope, John Carew, Thomas Scot and Gregory Clement, who had signed the death-warrant; the preacher Hugh Peters; Francis Hacker and Daniel Axtel, who commanded the soldiers at the trial and the execution of the king; and John Cook the solicitor who directed the prosecution.

In Jan. 1661 the bodies of Cromwell, Ireton, and Bradshaw were exhumed and hanged at Tyburn, but Pride's does not appear to have been treated in this way. Of the nineteen or twenty regicides who had escaped and were living abroad, three, Sir John Barkstead, John Okey and Miles Corbet, were arrested in Holland and executed in London in April 1662; and one, John Lisle, was murdered at Lausanne. The last survivor of the regicides was probably Edmund Ludlow, who died at Vevey in 1692.

BIBLIOGRAPHY.—Ludlow's Memoirs, edited by C. H. Firth (Oxford, 1894), give interesting details about the regicides in exile. See also D. Masson, Lije oj Milton, vol. vi. (1880), and M. Noble, Lives *of* the English Regicides (1798); L. E. Welles, *History* of the Regicides (1927).

REGILLUS, an ancient lake of Latium, Italy, famous in the legendary history of Rome as the lake in the neighbourhood of which occurred (496 B.C.) the battle which finally decided the hegemony of Rome in Latium. Of the various sites proposed, the best is Pantano Secco. some 2 mi. N. of Frascati.

REGIMENT. In European and U.S. armies, the regiment is a body of troops headed by a colonel and organized into companies, battalions, or squadrons for tactical control. French cavalry units were called regiments as early as 1558 The word is derived from the Latin *regimen,* a rule or system of order, and describes the regiment's functions of raising, equipping and training troops. As a regiment developed individuality, through its name or number, colours, coat of arms, distinctive uniform and insignia, and achievements in battle, it also became a central object of loyalty, pride and esprit *de corps* of its soldiers.

In early U.S. service, as in European armies up to that time, the usual number of companies in a regiment was ten, forming a single battalion in battle. Early in the 19th century, Napoleon Bonaparte organized the regiments of the French army into three battalions or squadrons, of which two were in the field and one was in quarters recruiting and training additional troops. Later, Lord Cardwell reorganized the British infantry into two-battalion regiments, each having one battalion at the regimental depot at home and one stationed overseas. The U.S. army adopted a three-battalion infantry regimental organization in 1901, and incorporated regiments of this type in the divisions employed in World Wars I and II and Korea. In the late 1950s, the U.S. army inaugurated a system of organizing, out of each historic regiment selected for retention, a variable number of tactical units in proportion to the size of the army. (E. SR.)

REGINA, the capital and largest city of the province of Saskatchewan, Can., is located in the south central part of the province, 357 mi. W. of Winnipeg. Founded in 1822 as Pile O' Bones and renamed Regina, it was capital of the Northwest Territories from 1882 to 1905, having been chosen because of its central location on the Canadian Pacific railway, and was selected as capital city when Saskatchewan became a province in 1905.

Regina is a busy distribution centre serving a rich agricultural area. Both major Canadian railway systems serve the city and five main highways converge on it, one of these the Trans-Canada. Regina is on the main Trans-Canada Air line and has regular air service with. most other Saskatchewan cities. It has good daily newspaper service, a television station on a national hookup and three radio stations. It obtains abundant natural gas from provincial sources and uses local artesian and Saskatchewan river water for domestic and industrial needs.

Regina experienced rapid physical expansion and economic development after World War II and became an important prairie manufacturing centre. Its industry includes two large oil refineries, one co-operatively owned; extensive assembly plants; a cement plant; a brewery; and various services to the petroleum and agricultural industries. A steel production and fabricating industry was established in the early 1960s.

Regina is the provincial government seat, with its legislative and administration buildings, various government and educational institutions including a provincial university college. several affiliated colleges and the provincial natural-history museum. It is the headquarters for Canada's largest co-operative, the Saskatchewan Wheat Pool. and has been an important centre in the growth of the co-operative movement in Canada. Pop. (1961) 112.141. (C. S. BR.)

REGINON (REGINO OF PRÜM), medieval chronicler, was born at Altripp near Spires, and was educated in the monastery of Prüm. There he became a monk, and in 892, just after the monastery had been sacked by the Danes, he was chosen abbot. In 899, however, he was deprived of this position and he went to Trier, where he was appointed abbot of St. Martin's. He died in 915, and was buried in the abbey of St. Maximin at Trier, his tomb being discovered there in 1581.

Reginon wrote a Chronicon, dedicated to Adalberon, bishop of Augsburg (d. 909), which deals with the history of the world from the commencement of the Christian era to 906, especially with the affairs in Lorraine. The chronicle was first published at Mainz in 1521; another edition is in Band I. of the *Monumenta Germaniae* historica. Scriptores (1826); the best is the one edited by F. Kurze (1890); German trans. by W. Wattenbach (1890). Reginon also drew up at the request of his patron, Radbod, archbishop of Trier (d. 915), a collection of canons, Libri duo de *synodalibus causis* et disciplinis ecclesiasticis; this is published in Migne's Patrol. Lat. t. 132.

REGIOMONTANUS: *see* MÜLLER, JOHANN (REGIOMONTANUS).

REGIONALISM. The clustering of men into areas and regions of all kinds is one of the enduring facts of history. Specific regions, such as Kashmir or Scandinavia. England's black country

or the Donetz basin, the Tirol or Texas, often mirror a more faithful palimpsest of history than does history itself. Regionalism, that is, the doctrine and practice of geographic grouping according to selected criteria of cohesiveness. prevails among mankind simply because human beings are gregarious yet spacebound. Even nomads have to delimit the region over which they roam. The most extended domain in history previous to that of modern Russia was Genghis Khan's Mongol empire, stretching from Peking to Vienna; but even his dynamic hordes had to fall back upon their own grazing regions on the Asian steppe.

Social and Geographic Factors. — Regionalism, as a concept expressing spatial relationship, is to the social sciences what ecology is to the biological sciences and what the newer field theory is to the physical sciences. In defining regions, two classes of criteria are employed: the physical factors of geography, climate or natural resources; and the social phenomena of culture, economics or government. For a region must not only have a geographic framework; it must also possess sufficient cohesion among its occupants and homogeneity in conditions to allow it to deal with common concerns and to differentiate itself from other regions. It is hard to tell where to draw the boundary line. But, by concentrating on the regional core instead of the margins, it is possible to delimit a region or set of regions.

The most tenacious type of region known to man is the resource-based region administered by the political arm of society. The ancient river basins, for example, with their irrigated alluvial lands, were the sites of the original city-states and the riverine societies of Mesopotamia, Egypt, India and China. Associated with their origins were such concrete regional devices as the irrigation province. Indeed, the Egyptian hieroglyphic for "province" was a pictograph denoting irrigation. It is no wonder that 20th-century reconstruction programs in these ancient countries stress river-basin development and regional administrative authorities; *e.g* , the Damodar Valley corporation in India, a nation which in the second half of the 20th century was trying to reconcile its older, cultural regions with its newer, political ones.

Regionalism was also being fostered by means of technical assistance programs sponsored by the more developed countries and the United Nations. The UN charter specifically recognizes international "regional arrangements" (art. 52), and those UN agencies that were concerned with economic and social development on a broad regional basis, such as the UN Economic Commission for Latin America (ECLA), were vigorously supported. Other operating regional undertakings of international scope were found in western Europe, where the Benelux customs union, European Coal and Steel Community (E.C.S.C.) and Euratom co-ordinated the resources and productivity of blocs of nations with a long history of mutual antagonism. *(See* PAN-EUROPEAN MOVEMENT.)

The most genuine forms of regionalism have appeared within individual nations, with their greater homogeneity. although the cultural and class cleavages which cut across the most cohesive political regions should not be underestimated. All modern nations subdivide their territory into counties, states, provinces or other regions; and often these are not merely convenient administrative districts for the central authority but possess a distinct autonomy as do, for example. the cantons of the Swiss confederation. However, the degree of regionalism does not depend on whether a government is federal or unitary in character, since regions appear under various guises in different nations.

United States and Great Britain. — The United States of America has produced some of the richest forms of regional differentiation and decentralization, despite its national stereotypes and standardized economy. Its politically powerful states, although often artificially bounded by straight lines, established unique regional patterns. True, this led to the traumatic experience of civil war, and an anachronistic racial discrimination persisted in the south into the second half of the 20th century. But there also was established the Tennessee Valley authority, an inspiring regional experience more copied abroad than at home A whole series of other inventive American devices were contrived, involving river-basin development and regional resources administration, interstate compacts and intergovernmental agencies. federal decentralization and metropolitan reorganization. These changes were accompanied by detailed researches of particular regions and scientific studies about regionalism unmatched anywhere in the world.

British regionalism was particularly instructive. Centrally guided by Whitehall, Britain's spreading conurbations and parochial countryside were diligently administered by counties, boroughs. county boroughs and by urban, rural and special districts. But a nostalgic regionalism continued to prevail, and there mas even a tenacious nationalism in the form of separate cabinet ministries for Scottish affairs and Welsh education. Under the stress of World War II a dozen defense regions were established with certain civil functions. but these lapsed in peacetime.

Europe. — With its roots in the power-centred Roman empire, modern Italy originally rejected a system of regional autonomy advocated by its founders, Cavour and Mazzini. Following World War II, Italy revised its centralized arrangement in favour of a partial system of regional devolution. Spain exhibited more widespread agitation for regional independence to its "small fatherlands." but in practice Spanish regionalists exacted little from their rulers.

Regionalism has long stalked through French history under the banners of recalcitrant Burgundians and revolutionary Girondists Napoleon, himself a little corporal from Corsica. erased at one stroke three dozen historic provinces in favour of 90 administrative *départements,* which governed 19th- and 20th-century France. But fiery French poets and provincial intellectuals, who coined the very word "regionalism" in the 1870s, restored the regional spirit.

Modern Germany curbed its regional particularism, without entirely destroying the pride of Bavaria or Hanover, by combining Prussian centralization with joint authorities for special purposes. After defeat in World War II, the German Federal Republic mas compelled to decentralize and to reconstitute its *Lander,* enhancing the movement toward regional "rationalization." Less rational but more experimental was Russian regionalism. Like the tsars. the Communists struggled with the administration of their vast Eurasian expanses and their profusion of nationalities. But Russian enthusiasm for autonomous republics. federated regions, economic development areas and other deviations from "democratic centralism" could not hide the fact that the U.S.S.R. was still struggling to free itself from a top-heavy administration at the monolithic centre in order to release human talent at the regional periphery.

Speedier communications and wider-ranging administration had in the second half of the 20th century enabled man to expand his regional influence until he was tampering with interstellar space. But modern technology also had a distinctly decentralizing and regionalizing impact upon economic development and especially upon the devolution of governmental power. The urge of human intimacy continued to tie man to his sense of place. and modern complexity compelled him more than ever to seek the coherent community and the balanced region.

For a discussion of literary regionalism, *see* the various articles on national literatures. The principal regions of the U.S. are discussed in NEW ENGLAND; SOUTH, THE; MIDDLE WEST, THE; and WEST, THE. For the U.S. frontier as a region with a distinctive outlook and culture, *see* AMERICAN FRONTIER. (A. LY.)

REGIONAL PLANNING, a term used by political scientists. engineers, sociologists. geographers and others to describe the process of considering systematically the functional organization of the natural and human resources of an area of the earth. Regional planning may involve extensive areas that include one or more nations or more limited areas such as drainage basins or metropolitan areas. The objectives may be general or specific. Examples of international regional planning include the European common market and the Colombo plan (*q.v.*), involving whole nations, the St. Lawrence seaway (*q.v.*) and the Nile valley and Amur river schemes, involving parts of two or more nations. In many instances a regional plan involves the creation of a new organization for its particular purpose as, for example, the Tennessee Valley authority, the boundaries of whose area coincide

with those of no general political jurisdiction but which in its operation involves the co-operation of several to their mutual advantage.

Regional planning is essentially a process of orderly and systematic anticipation of the future of a region, involving recommendations of the necessary remedial and constructive actions by public and private agencies to achieve the objectives of the plan. In one sense it is as old as society. In modern times. significant contributions to knowledge of planning principles have been made by geographers who are concerned with the nature of man's occupancy of the earth and of its regional similarities and differences; by economists whose concerns include the flows of goods, money and credit to, from, and within regions as well as theories relating to the location of economic activity; by sociologists who are concerned with the regional aspects of the organization of society and of social action; by political scientists whose concern includes the institutional means by which plans are made and effected; by psychologists, philosophers and others concerned with motivation and the setting of social goals; by engineers, architects and others concerned with the physical structures and forms involved in man's utilization of resources; and by specialists in many other fields.

Planning does not set goals or objectives within a society; it rather points out the consequences of alternative decisions relating to the utilization of resources and the organization of society in space and recommends programs of action considered most appropriate and effective in the light of the objectives which the particular society sets for itself.

The Nature of Regions.— Regions are human creations for the purpose of analysis, synthesis and planning. The extent and character of a region will depend upon the purpose or purposes for which it is created and the number of possible regions is infinite. Geographers recognize two types: homogeneous and nodal. Homogeneous regions are areas nithin which, for the purposes for which the region is being defined, the similarities from place to place are considered to be more significant than the differences. Such similarities may be in a single element, such as climate, soils, population density, drainage characteristics, religion or language. For multipurpose planning or comprehensive planning a combination of elements is employed in defining a region; two or more of these may exhibit coincidences in their variations or may on the other hand show no significant variations from place to place within the region. The second type of region is the nodal region, which is an area of concentration of elements or activities, such as an urban or metropolitan area or the intensively developed core of a more extensive homogeneous region.

A major difficulty in preparing and especially in effecting a regional plan is that most appropriate real units very rarely coincide with a governmental jurisdiction. Metropolitan areas such as New York. Chicago, London. Tokyo and Paris involve many municipalities and other units of local government; river basins seldom are included entirely within individual states or provinces and many of them such as the Rhine, Rio Grande, Columbia and Congo, are international. The co-ordination of capital improvement programs of a multiplicity of units of government presents a challenge to the planner. In some instances the problem can be solved by the creation of new units of government, such as the metropolitan municipality of Toronto and the various types of special-function authorities such as the Port of New York authority. the metropolitan sanitary district of Greater Chicago and the Tennessee Valley authority.

The Process Of Regional Planning.— Whether the planning is for a homogeneous or a nodal region. whether comprehensive or special-purpose, and whether undertaken by a regular governmental unit, a special public agency or a private organization, it involves several steps: (1) inventory and survey of the resources or other elements relative to their character, quantity, quality, availability and distribution within and without the area; (2) analysis of the relationships among the natural and human resources of the region and of their significance; (3) making of the plan. including proposals for maximizing the effectiveness of utilization of the resources in terms of the plan objectives, and recommendations as to the staging or timing of the various proposed steps; and (4) effectuation of the plan, including the carrying out of the responsibilities of the various bodies and agencies concerned with each aspect of the regional development. The first three steps generally involve the planning agency directly; most planning agencies do not have the responsibility of effectuation but rather recommend the necessary steps to the appropriate agencies and at times may suggest the creation of new agencies for specific purposes. Inventory, analysis and the making of the plan involve the efforts of many specialists, and the professional planner is essentially a co-ordinator. Once a plan is prepared and adopted, it is essential, in most instances, that it be subjected to continuous or periodic review and revision in the light of subsequent developments. The continuity of operation of planning agencies is therefore important. The nature of the process of effectuation, of course, varies with the nature of the government and other institutional operations in the region or for the objectives of the particular plan. In some countries, as in the Soviet Union, effectuation of a plan is by a central authority with absolute powers; in democratic countries the authorities are responsible directly to the public and in many instances the plan or major elements of it may be subject to referendum. In most instances, legislative bodies within areas of appropriate jurisdiction adopt either total plans or the individual proposals contained within the plans. Educational programs and information services on the nature of planning and the objectives and content of specific plans are therefore essential aspects of planning in democratic countries. Most regional planning involves multiple purposes and the regions are demarcated in such a way as to serve the maximum number of purposes with the maximum effectiveness. The conservation movement in the United States in the early 20th century was an important incentive to regional planning; later the multipurpose development of water resources, as in the Tennessee valley and the Columbia basin, constituted an important type of regional planning. Meanwhile, the spread of cities beyond the boundaries of municipalities and the development of metropolitan areas and conurbations became important incentives for another type of regional planning, typified in the United States by the Burnham plan of Chicago, published in 1909, the Regional plan of New York city and its environs, in the 1920s, and the creation of many metropolitan planning agencies in the 1950s, and in Great Britain by the numerous regional planning schemes of the period during and shortly after World War II.

Aspects of Regional Planning.— Much of the concern of regional planning relates to two aspects of man's relations to regional resources. The first may be termed the static aspect, and it includes those features, tangible and intangible, which have fixed locations at any point in time, such as land uses, buildings, population distribution and other features of culture; the second may be termed dynamic and refers to the interchange of people, goods and ideas within and among regions and places. as expressed by transportation facilities and the flows of traffic as well as by communication. No place or region can be completely self-sufficient; each has innumerable bonds with other regions and places. The strength and relative importance of these bonds vary with the size. distance and complexity of the various regions and places and are subject to change with the existence and utilization of alternative opportunities represented by competing regions and places, the possibility of substitution of resources of other places or of other types. changes in the material or intangible cultures of the respective regions, and the competition among alternative routes and forms of transportation. Transportation makes regional specialization possible, and the planning of facilities for the handling of movement to, from, and within regions has become an important aspect of regional planning. In many regions of the world where economic development has been retarded by inadequate transportation facilities. a major concern of regional planning is the selection of appropriate forms of transportation, as between railnays, highways. airways and inland and coastal waterways, and the determination of the amount and routes of transportation to be recommended. In the United States, the Federal Highway act of 1956, which provided for a

new 41,000 mile interstate highway system, was a stimulus for the organization of regional planning in many areas, as was the focusing of the highway networks upon urban centres and the stimulation of peripheral expansion of population and development within and beyond metropolitan areas as a result of the increased availability of motor transportation.

Regional planning on the one hand is an extension of local planning at the municipal and county level and on the other hand is a part of national and international planning. In the United States regional planning was stimulated in the 1930s by the National Resources Planning board, which was terminated with the advent of World War II. In the second half of the 20th century, however, numerous state planning agencies were in operation, as well as a number of metropolitan and *ad hoc* regional planning agencies.

See also CITY PLANNING.

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REGISTRATION: *see* SHIPPING INDUSTRY: *Classification and Tonnage Measurement;* BILL OF SALE; ELECTORAL SYSTEMS; COMPANY; CORPORATION; FRIENDLY SOCIETY; SAVINGS AND LOAN ASSOCIATION; COPYRIGHT; LEGITIMACY AND LEGITIMATION; TRADE-MARKS AND NAMES; PATENT; TITLE TO LAND.

REGIUM, a city of the territory of the Bruttii in south Italy, on the east side of the strait between Italy and Sicily *(see* REGGIO DI CALABRIA). A colony, mainly of Chalcidians, partly of Messenians from the Peloponnesus, settled at Regium in the 8th century B.C. About 494 B.C., Anaxilas, a member of the Messenian party, made himself master of Regium (apparently with the help of the Samians; *see* MESSINA) and about 488 joined with them in occupying Zancle (Messina). In 433 Regium made a treaty with Athens and in 427 joined the Athenians against Syracuse, but in 415 it remained neutral. An attack which it made on Dionysius I of Syracuse in 399 was the beginning of a great struggle which in 387 resulted in its complete destruction and the dispersion of its inhabitants as slaves, but it soon recovered its prosperity. In 280 Pyrrhus invaded Italy, and the Regines admitted within their walls a Roman garrison of Campanian troops; these mercenaries revolted, massacred the male citizens, and held the city till in 270 they were besieged and put to death by the Roman consul Genucius. The city remained faithful to Rome throughout the Punic Wars, and Hannibal never succeeded in taking it.

It took the name Regium Iulium under Octavius (Augustus); and the pedestal of a statue erected in his honour (as Augustus) has been found there. It continued to be a Greek city even under the empire. Toward the end of the empire it was made the chief city of the Bruttii.

REGIUM DONUM or ROYAL GIFT, an annual grant formerly made from the public funds to Presbyterian and other Nonconformist ministers in Great Britain and Ireland. In 1690 William III made a grant of £1,200 a year to the Presbyterian ministers in Ireland as a reward for their services during his struggle with James II. Because of the opposition of the Irish house of lords, the money was not paid in 1711 and some subsequent years, but it was revived in 1715 by George I, who increased the amount to £2.000 a year. Further additions were made in 1784 and in 1792, and in 1868 the sum granted to the Irish Presbyterian ministers was £45,000. The Regium Donum was withdrawn by the act of 1869 which disestablished the Irish church. Provision was made, however, for existing interests therein, and many Presbyterian ministers commuted these on the same terms as the clergy of the church of Ireland.

In England the Regium Donum proper dates from 1721, when Dr. Edmund Calamy (1671–1732) received £500 from the royal bounty "for the use and behalf of the poor widows of dissenting ministers." Afterward this sum was increased to £1,000 and was made an annual payment "for assisting either ministers or their widows," and later it amounted to £1,695 per annum. It was given to distributors who represented the three denominations, Presbyterians, Baptists and Independents, enjoying the grant.

Among the Nonconformists themselves, however, or at least among the Baptists and the Independents, there was some objection to this form of state aid. and it was withdrawn in 1857.

See J. Stoughton, *History of Religion in England* (1901); J. S. Reid, *History of the Presbyterian Church in Ireland* (1867); and E. Calamy, *Historical Account of My Own Life,* ed. *by* J. T. Rutt (1829–30).

REGNARD, JEAN FRANÇOIS (1655–1709), French dramatist, one of the most successful of Molière's immediate successors. Baptized in Paris on Feb. 8, 1655, he inherited a fortune and traveled widely in his youth (he was a prisoner of the Algerian corsairs for seven months, 1678–79). He held a post in the financial administration in Paris, but from 1688 devoted himself almost entirely to the theatre. writing first for the Italian comedians, then, from 1694, for the Comédie Française. He 'also published accounts of his travels. Of his numerous plays, the best-known are *Le Joueur* (1696) and *Le Légataire universel* (1708). but *La Sérénade* (1694), *Le Distrait* (1697), *Démocrite* (1700), *Les Folies amoureuses* (1704) and *Les Ménechmes, ou les Jumeaux* (1705) also helped to make his reputation. He imitated both the Italians and Molière quite openly. Regnard died on his estate of Grillon, in Normandy, on Sept. 4, 1709.

There are collected editions of his works by E. Fournier, 2 vol. (1854) and by A. Michiels (1875) and selections ed. by G. d'Heylli, 2 vol. (1886).

See P. Toldo, "Études sur le théâtre de Regnard," *Revue d'histoire littéraire de la France* (1903–04); *H.* C. Lancaster, *History of French Dramatic Literature in the 17th Century,* part iv (1940).

(W. G. ME.)

REGNAULT, (ALEXANDRE GEORGES) HENRI (1843–1871), French painter of allegorical and historical subjects, was born at Paris on Oct. 31, 1843, the son of the scientist Henri Victor Regnault (*q.v.*). He studied successively under Antoine A. Montfort, Lamothe and Alexandre Cabanel, and in 1864 exhibited two portraits at the Salon. In 1866 he won the Grand Prix with "Thetis Bringing the Arms Forged by Vulcan to Achilles." In Rome Regnault came under the influence of the modern materialistic Hispano-Italian school. His paintings include an imaginative portrait of the Spanish soldier Marshal Prim at the head of his troops, inspired by a glimpse of his subject received when traveling in Spain; "Judith" (1870), "Salome" and the realistic "Execution Without Hearing Under the Moorish Kings," painted at Tangiers. Regnault was killed in the Franco-German War on Jan. 19, 1871. There is a monument to his memory at the École des Beaux-Arts.

REGNAULT, HENRI VICTOR (1810–1878), French chemist and physicist, who worked on the problem of the expansion of gases by heat, was born on July 21, 1810, at Aix-la-Chapelle. His early life was a struggle with poverty. He worked in a textile establishment in Paris until 1829 and then entered the École Polytechnique, passing in 1832 to the École des Mines. After studying under Justus von Liebig (*q.v.*) at Gressen, Ger., he was appointed to a professorship at Lyons. His most important contribution to organic chemistry was a series of researches, begun in 1835, on the halogen and other derivatives of unsaturated hydrocarbons. He also studied the alkaloids and organic acids, introduced a classification of the metals and effected a comparison of the chemical composition of atmospheric air from all parts of the world. In 1840 he became professor of chemistry in the École Polytechnique in succession to Gay-Lussac and was elected a member of the Académie des Sciences; in 1841 he succeeded Pierre Louis Dulong (*q.v.*), professor of physics in the Collège de France. In 1847 he published a four-volume treatise on chemistry which was translated into many languages. Regnault's work in physics was remarkably accurate and painstaking. He designed standard types of apparatus for a large number of measurements.

Regnault executed a careful redetermination of the specific heats of many solids, liquids and gases. *(See* CALORIMETRY.) He

investigated the expansion of gases by heat. and showed that, contrary to previous opinion, no two gases had precisely the same coefficient of expansion. By delicate experiments he proved that Boyle's law is only approximately true for real gases. He studied the subject of thermometry (*q.v.*) critically; he introduced the use of an accurate air-thermometer. and compared its indications with those of a mercurial thermometer, determining the absolute expansion of mercury as a step in the process. He also paid attention to hygrometry and devised Regnault's hygrometer.

In 1854 he was appointed director of the porcelain manufactory at Sèvres. He carried on his great research on the expansion of gases in the laboratory at Sèvres. but all the results of his latest work were destroyed during the Franco-German War, in which also his son Henri (*q.v.*) was killed. Regnault never recovered from the double blow. and. although he lived until Jan. 19, 1878, his scientific labours ended in 1872. Regnault's most important work is collected in vol. 21 and 26 of the *Mdmoires de l'Académie des Sciences*.

RÉGNIER, HENRI FRANÇOIS JOSEPH DE (1864–1936). the foremost French poet of the first decade of the 20th century, was born at Honfleur on Dec. 28, 1864. of an old Norman family. Going to Paris to study law, he came under the influence of the Symbolist poets there. His first books of poems, *Lendemains* (1885), was followed by several other minor collections, eventually reprinted in two volumes, *Podmes 1887–1892* (1895) and *Premiers podmes* (1899). In 1896 he married the poet J. M. de Heredia's daughter Marie, herself later well-known as a poet under the pseudonym Gérard d'Houville.

By this time Régnier showed a preference for themes from classical antiquity or from the Renaissance, so that while the personal quality of his approach and certain metrical licences still reflected the Symbolist influence, his subject matter came to be more like that of his Parnassian father-in-law. His most characteristic poems in this style appeared in *Les Jeux rustiques et divins* (1897), *Les Médailles d'argile* (1900). *La Cite' des eaux* (1902), mainly about Versailles, *La Sandale ailée* (1906) and *Le Miroir des heures* (1910). His aristocratic manner distinguished him from his more bohemian contemporaries, and he became the favourite poet of *la belle époque*. He was elected to the Académie Française in 1911 (received 1912). He published some patriotic verse in *1914–1916* (1918), but his only major collections of poems after World War I were *Vestigia flammae* (1921) and *Flamma tenax, 1922–1928* (1928). From 1894. however, Régnier had been publishing also novels and short stories, in which he combined realism with a hedonistic attitude to morality. These include *Contes à soi-même* (1894; reprinted in *La Canne de jaspe,* 1897), *La Double Maîtresse* (1900), *La Peur de l'amour* (1907), *L'Amphisbène* (1912), *Romaine Mirmault* (1914). *La Pkcheresse* (1920), *Le Divertissement provincial* (1923) and *Le Voyage d'amour* (1930). Henri de Régnier died in Paris on May 23, 1936.

RÉGNIER, MATHURIN (1573–1613), French satirist, was born at Chartres on Dec. 21, 1573, the son of Jacques Regnier, and Simone Desportes, sister of the poet. Little is known of his youth, except that he received the tonsure at eight years old, and it is chiefly conjecture which fixes the date of his visit to Italy in a humble position in the suite of the cardinal, François de Joyeuse, in 1587. Régnier found his duties irksome, and when, after many years of constant travel in the cardinal's service, he returned definitely to France about 1605, he took advantage of the hospitality of Desportes. In 1606 Desportes died and Régnier obtained a pension of 2,000 livres, chargeable upon one of Desportes' benefices. He was also made in 1609 canon of Chartres through his friendship with the lax bishop, Philippe Hurault, at whose abbey of Royaumont he spent much time in the later years of his dissipated life. The death of Henry IV. deprived him of his last hope of great preferments. He died at Rouen, Oct. 22, 1613.

His undoubted work falls into three classes: regular satires in alexandrine couplets, serious poems in various metres, and satirical or jocular epigrams and light pieces, which often, if not always, exhibit considerable licence of language. The real greatness of Régnier consists in the vigour and polish of his satires, contrasted and heightened as that vigour is with the exquisite feeling and melancholy music of some of his minor poems. He was an acute critic. and the famous passage (Satire ix., *À Monsieur Rapin*) in which he satirizes Malherbe contains the best denunciation of the merely "correct" theory of poetry that has ever been written. All Régnier's merits are displayed in the masterpiece entitled *Macette ou l'Hypocrisie déconcertée,* which does not suffer even on comparison with *Tartufe;* but hardly any one of the 16 satires which he has left falls below a very high standard.

REGNITZ, a river of Germany, 42 mi. long, and a left-bank tributary of the Main. It rises in the Jurassic rocks of the Frankish Jura, but its course is along the Trias. through an undulating vine-clad country, past Fiirth, Erlangen, Baiersdorf and Forchheim, from which point it is navigable, and joins the blain at Bischberg. below Bamberg. The Ludwigs canal connects it with the Main and the Danube. Its main tributaries are the Pegnitz, on which is Nurnberg, the Gründlach and the Wiesent (right) and the Zenn, the Aurach and the Aisch (left). *(See* MAIN and RHINE.)

REGULATORY AGENCIES. Administrative regulation is a basic feature of 20th-century government that sharply distinguishes it from government in the 19th century. Formerly governmental regulation was provided for almost entirely by statutes, whose prescriptions were enforced through the traditional machinery of the courts. Such legislative regulation proved inadequate to deal with the complexities of a modern industrial economy. In its place, there developed a system of administrative regulation. Under it, the legislature provides only the broad principles of a particular regulatory scheme, leaving their detailed implementation to the agency charged with administering the law. The latter is vested with the power to prescribe regulations having the force of law, to police those subject to its authority to ensure that such regulations are not violated, and to decide cases involving alleged particular violations. The administrative agency is able to furnish the continuous supervision and expert knowledge that cannot, as a practical matter, be expected of the legislature.

United States.—The need for administrative regulation first became apparent in the United States in the railroad industry. and it was out of the attempts to deal with the railroad problem that the first modern U.S. administrative agency, the Interstate Commerce commission (ICC), was developed. Established by the Interstate Commerce act of 1887 and with its power expanded by the Hepburn act of 1906 and subsequent statutes, it is composed of 11 members appointed by the president, and confirmed by the senate, who serve for staggered terms of seven years. The commissioners may be removed only for cause and have, in practice, been able to function free from direct presidential control. This has led some to characterize them as a "headless fourth branch" of the government.

ICC is the classic example of a quasi-judicial regulatory agency. As such, it applies the broadly stated legislative policies to concrete cases by a procedure patterned upon that of the courts. The commission fixes reasonable rates and ensures that they are observed. It grants licences to those seeking to engage in interstate transportation. It exercises injunctive power over discriminatory practices. The commission also performs important nonjudicial functions. It promulgates safety and other regulations. It controls railroad financing and planning. It is the commission which gives specific form and content to the congressional policies expressed in the Interstate Commerce act as amended. Its position has been compared to that of a superboard of directors of the railroad industry. It also has extensive authority over motor carriers. *(See* also INTERSTATE COMMERCE)

The assertion of governmental control in other economic fields led to the creation of many other regulatory agencies modeled upon the ICC, chief among these being the Federal Trade commission (FTC; 1914), Federal Power commission (FPC; 1920), Federal Communications commission (FCC; 1934), Securities and Exchange commission (SEC; 1934) and Civil Aeronautics board (CAB; 1938). *(See* COMMISSION.) In addition, regulatory powers were conferred upon the ordinary executive departments; *e.g.,* the department of agriculture under the Packers and Stock-

yards act, 1921, and the Agricultural Adjustment act, 1938. As traditional legal devices proved inadequate to cope with economic abuses. they were superseded by administrative controls. This was especially true of the period following the depression of the early 1930s. The New Deal program was largely carried out through administrative regulation. During the same period, a comparable development took place in the states.

Other Countries. — Administrative regulation is not a purely U.S. phenomenon. Similar problems have given rise to the creation in other countries of some analogous regulatory agencies. In England the starting point was the setting up of the Railway and Canal commission in 1888. In 1921 the Railway Rates tribunal was established to fix railroad rates. With the nationalization of British railways in 1947, these bodies were superseded by the Transport tribunal. which determines the rates to be charged by the governmental operator of the nationalized industry, English motor transport is regulated by licensing authorities, which grant licences and control road service. Similar regulation is provided for in other areas, such as the marketing of agricultural products.

There is, however, an important difference between administrative authority in the United States and that in other countries. Administrative regulation is basically of two kinds. In certain fields the normal rules of free competition are recognized to be inapplicable. In them, the state tolerates the existence of virtual monopolies, but by regulation it ensures that the monopolistic power shall not be abused. This is the usual practice regarding public utilities. In other areas, free competition governs but the state intervenes to prevent abusive practices conceived deleterious to the working of a free competitive system. Thus, the FTC was established in the United States to prevent unfair trade practices.

In other countries. there is less room for these types of administrative regulation than in the United States. In the field of public utilities the dominant theme is not regulation but operation. Toward abusive practices other governments also tend to adopt more of a hands-off policy than does the U.S. This applies in both Britain and in continental European countries, though less so in the former in view of the specific types of British regulation already mentioned, as well as the setting up in 1948 of a Monopolies and Restrictive Practices commission patterned upon the U.S. Federal Trade commission.

Abuses **of** Administrative Power. — Administrative regulation enables government to cope with the need to control economic power in the public interest. But at the same time raises the basic problem of whether the regulator himself is adequately controlled for the executive and legislature are responsible to the people whereas the administrator has no analogous responsibility. In democratic countries, he is, it is true, responsible to the law, but this "rule of law" becomes less effective under statutes delegating wholesale discretion. Under such "skeleton" legislation, the flesh and the blood (not to mention the soul) of regulation are left to the administrator. Excessive discretion opens the door to administrative arbitrariness.

The growth of administrative regulatory power was accompanied by the development of safeguards to ensure against administrative abuses. In the U.S. the emphasis is upon procedural devices and judicial review. Due process (*q.v.*) requires that, before administrative action adversely affects an individual, he be given notice and a full opportunity to be heard. Such hearings must include the essentials (though not the forms) of judicial procedure. The fundamentals of fair administrative procedure were prescribed in the Federal Administrative Procedure act, 1946, and in similar laws in many states. Those aggrieved by administrative action can obtain review in the courts. In Anglo-American countries such review is in the ordinary courts. In France and many civil-law countries there is a special administrative-court system to review the legality of administrative action. There is also legislative control. This is most fully developed under parliamentary systems; *e.g.,* in Britain, where administrative regulations are subject to direct annulment by parliament. In the United States, control by the congress did not prove effective in practice, though attempts were made to remedy the situation in the Legislative Reorganization act, 1946, by giving standing congressional committees direct responsibility over administrative agencies. This did not prove workable because of the preoccupation of such committees with other matters and their lack of adequate expert staffs.

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REGULUS, MARCUS ATILIUS, Roman general and consul (for the second time) in the ninth year of the First Punic War (256 B.C.). He was one of the commanders in the naval expedition which shattered the Carthaginian fleet at Ecnomus, and landed an army on Carthaginian territory *(see* PUNIC WARS).

The other consul was recalled, Regulus being left behind to finish the war. After a severe defeat at Adys near Carthage, the Carthaginians were inclined for peace, but the terms proposed by Regulus were so harsh that they resolved to continue the war. In 255 Regulus was completely defeated and taken prisoner by the Spartan Xanthippus. There is no further trustnorthy information about him. According to tradition, he remained in captivity until 250, when after the defeat of the Carthaginians at Panormus he was sent to Rome on parole to negotiate a peace or exchange of prisoners. On his arrival he strongly urged the senate to refuse both proposals and, returning to Carthage, was tortured to death (Horace, *Odes,* iii, 5). The story is insufficiently attested; it may have been invented to excuse the treatment of Carthaginian prisoners at Rome but it served to make Regulus the type of heroic endurance to the later Romans.

REHABILITATION, MEDICAL AND VOCATIONAL. Rehabilitation has been defined as the ultimate restoration of the disabled person to his maximum physical, emotional, social and vocational capacity. This article will discuss first the medical and then the vocational aspects of rehabilitation.

MEDICAL REHABILITATION

Medical rehabilitation frequently has been termed the third phase of medicine and surgery, following preventive medicine and curative medicine and surgery. Its objectives are: first, to eliminate the physical disability if that is possible; second, to reduce or alleviate the disability to the greatest extent possible; and third, to retrain the person with a residual physical disability to live and work within the limits of his disability and to the extent of his capabilities.

Much of the interest in expanding rehabilitation opportunities and services for the handicapped resulted from World Wars I and II, when attention was drawn to the problems of disabled servicemen. Interest also was heightened later by the increase in the age of the population in many parts of the world. In the developed parts of the world, rehabilitation services for the handicapped became a part of an expanding consciousness of social welfare that was reflected in similar advances in all educational, health and social services.

Except in a few isolated instances, the physically handicapped person must be retrained to walk and travel, to care for his daily needs, to use normal methods of transportation, to use ordinary toilet facilities, to apply and remove his own prosthetic devices and to communicate orally or in writing. These are such simple things that they are frequently overlooked, but the personal, vocational and social success of the handicapped person is dependent upon them.

Outstanding rehabilitation programs in various parts of the world have demonstrated that rehabilitation to the point of self-care and even to full or limited employment is possible for many persons who have been hospitalized for long periods.

Information about the number of persons who require rehabili-

tation world-wide is meagre and inexact because of a lack of reporting facilities, such as exist in some local and state health departments for collecting data on communicable diseases, and varying definitions of physical disability., It was estimated that on an average day in the U.S. in 1954 there were approximately 2,900.000 persons of ages 14–64 who were unable to work or follow other normal activities because of physical or mental disease or impairments. .When persons under age 14 and over age 64 were included, the total number became 5,300,000 or about 3.3% of the civilian population. Of these persons, 1,200,000 were in institutions. The office of vocational rehabilitation of the U.S. department of health, education and welfare estimated that about 2,000,000 men and women in the United States need vocational rehabilitation in order to engage in suitable employment. Each pear about 250.000 disabled persons are added to the list of those needing vocational rehabilitation. The office of vocational rehabilitation also estimated the total homebound population of the U.S. (*i.e.*, persons of all ages confined to their homes for at least one year but excluding persons in institutions) to be approximately 1,000,000.

Four of the disabling conditions in which medical rehabilitation is used frequently are hemiplegia, paraplegia, cerebral palsy and multiple sclerosis. all of which are discussed below.

Hemiplegia.—One of .the 'major causes of disability throughout the world, and particularly in the northern European and North American countries, is hemiplegia, or paralysis of one side, which is caused by a stroke. Stroke formerly was believed to be a hopeless situation and the patient was relegated to a chronic disease hospital or to a back bedroom to wait until a fatal second, third or fourth attack came. This concept, however, was proved to be invalid.

In a study reported in 1949, it was noted that 90% of the strokes suffered by individuals in the older age groups were caused by thrombosis. or a blocking of the blood supply. For persons who survive six to eight weeks after the initial stroke, life expectancy is about the same as for others of their age who have not had strokes. Thus, even a severe stroke need not mean the end of a productive, useful life. In a study made at Bellevue hospital, New York city. 900 (90%) of 1,000 patients who underwent modern rehabilitation training after strokes were able to walk, meet all the needs of daily living and live noninstitutional lives; 40% were able to return to gainful work.

A program of rehabilitation for the hemiplegic patient has six goals: (1) to prevent deformities; (2) to treat deformities if they occur; (3) to retrain the patient in walking and in going up and down stairs; (4) to teach the patient to perform the activities of daily living and working with the unaffected arm and hand; (5) to retrain the affected arm and hand to their maximum capacity; and (6) to treat facial paralysis and speech disability if they are present.

If treatment of the hemiplegic is started early, *i.e.,* as soon as the patient becomes conscious, there will be no limitation of motion at the joints, and the affected arm and leg can be moved passively through their normal range. If, however, the patient is not given early rehabilitation, contractures usually result, especially at the shoulder. One of the most difficult problems in the medical rehabilitation of the hemiplegic is aphasia (speech impairment'), which may occur in varying degrees and may be permanent or temporary, depending on the type of lesion.

Most patients with hemiplegia caused by a stroke can be rehabilitated within two months.

Paraplegia. — Paraplegia results from the severing of the spinal cord, the patient being left without the power of motion or feeling below the level of the severance. Formerly, most patients suffering such disabilities died within a relatively short time from kidney infections, decubitus ulcers (bedsores) or other complications. Of the 400 Cnited States veterans of World War I thus disabled, only 2 were alive 20 years later. With the 2,503 United States paraplegic veterans of World War II, however. the story was different. More than 80% of them were alive in the early 1950s.

The advances in paraplegic rehabilitation for disabled veterans in Great Britain and the United States were extended to the far greater number of civilians who suffer the same condition as a result of automobile accidents, surf and diving accidents and disease. Although paralyzed from the waist down. these people have demonstrated that with proper rehabilitation they can once again take their places in society as self-sufficient, productive citizens.

When medical and surgical care are completed, the paraplegic is placed on the following program of rehabilitation: General conditioning exercises are performed on a mat on the floor; these include strengthening exercises for the muscles of the upper extremities, abdomen and trunk. Particular attention is paid to development of the latissimus dorsi muscles. which help move the shoulder and upper arm, since they will be important in the use of crutches. The patient is taught to balance while sitting erect. Short crutches may be used to practise push-ups while sitting on a mat. General exercises are followed by a workout in the ambulation room. The patient. who is fitted with braces, is taught to do a swing-to gait and eventually a swing-through on the parallel bars. As he becomes more proficient and his sense of balance improves, he is started on crutches within the parallel bars, after which he is allowed to walk outside the parallel bars with an attendant. and finally alone. Patients are instructed in the necessity for standing in braces and crutches at least one hour a day in order to increase calcium metabolism in the long bones and to prevent formation of kidney and bladder stones. Even if he does not eventually walk to any great extent. the patient is urged to stand up at least one hour a day for the rest of his life.

Cerebral Palsy. — Cerebral palsy (*q v.*) was an almost totally neglected disability for many years but beginning in the late 1940s it gained attention throughout the world. Cerebral palsy is a neuromuscular disability that is caused by congenital or early postnatal damage to the motor centres of the brain. It causes varying disturbances of motor function, such as spasticity, weakness, incoordination. athetosis, rigidity or tremors These dysfunctions may be accompanied by mental retardation, sensory disorders, convulsions, ear and eye disabilities and disorders of behaviour.

Each palsied child must be considered individually He must be provided with the specialized medical. rehabilitation and educational services he needs and then his mental capacities must be evaluated to determine his ability to profit by these services.

Multiple Sclerosis. — This is a chronic, crippling disease of the nervous system that occurs most frequently in persons between the ages of 20 and 40; it also was once considered a hopeless disease. There is no specific diagnostic test; its cause and cure are unknown and the disease is progressive and unpredictable The myelin surrounding the nerves is destroyed in patches and replaced by scar tissue. As a result, nerve impulses do not pass properly from the brain to the muscles and other organs that they activate. Although the disease is progressive and crippling, the life span of most multiple sclerosis patients is not much less than that of persons who do not have the disease.

In rehabilitation, the problems of multiple sclerosis are the same as those of any other chronic. progressive. crippling disease. Progression of the disease. however, must be evaluated: if it outstrips training, the training is obviously wasted. Medical evaluation of the patient must include, in addition to general diagnostic studies muscle and joint range of motion tests.

Other Disabilities. — Medical rehabilitation also can produce good results in patients with chronic arthritis. pulmonary diseases. epilepsy, the chronic degenerative neurologic diseases, and in those patients who hsve hypertensive, arteriosclerotic and rheumatic myocardial and vascular lesions.

Regardless of the disease that causes the disability and regardless of the degree of disability within the individual, experience has shown that there are fen., if any, disabled persons for whom something cannot be done through medical rehabilitation to assist them in reaching a higher level of physical, social or emotional adjustment.

VOCATIONAL REHABILITATION

After World War I, the U.S. federal government and the individual states worked together to provide vocational rehabilitation

services for persons who could be made employable, Studies showed that the federal government recouped in income taxes alone ten dollars for each dollar invested in such services; this program rehabilitates and returns to employment approximately 90,000 persons yearly. The state-federal program of vocational rehabilitation in the U.S., as authorized by federal vocational rehabilitation legislation enacted in 1954, is characterized by its primary concern for disabled persons who can become economically independent. Its objective is to help physically and mentally impaired persons, through the provision of substantial rehabilitation services, to be placed in gainful employment, including sheltered workshop or home employment. These services also are extended to persons who can contribute to the national economy in other ways; for example, homemakers.

The program is organized and administered as a state-federal partnership. Federal responsibilities are discharged by the office of vocational rehabilitation in the department of health, education and welfare. Matching federal grants are made to states for providing rehabilitation services to the disabled and for encouraging them to offer new services and to cover new geographical areas. The office also makes studies, conducts investigations and disseminates information on the needs and capabilities of the handicapped. It provides consultation on specialized aspects of rehabilitation and assists the states in interpreting their programs to the public. Most technical and consultative services reach state agencies through the federal regional representatives.

Actual services to the disabled are provided by public agencies in all of the states. Each agency operates its own program in accordance with a state plan developed in co-operation with the federal office of vocational rehabilitation. A state plan describes the organization of the program, standards of personnel administration and the policies governing program operations. To insure flexibility, a state plan may provide for a decentralization of administration to county or municipal agencies.

Disabled persons are referred to a state rehabilitation agency from many sources—private medical practitioners, hospitals, health departments, public employment offices, public assistance agencies and crippled children's administrations.

Generally, the criteria for eligibility for vocational rehabilitation are these: an individual must have a physical or mental disability that is a substantial handicap to employment; he must be of, or near, working age; and there must be a reasonable expectation that the services will render him fit to engage in remunerative employment. The actual determination of eligibility in each case, however, is a responsibility of the state agency.

The individual receives a thorough examination in which all factors influencing the course and outcome of rehabilitation are evaluated. To the degree needed, this study embraces the individual's personality, intelligence, educational status, work experience. vocational aptitudes, personal and social adjustment, and employment opportunities. On the basis of these data an individual plan of vocational rehabilitation is formulated; the plan sets forth a vocational objective and names the services necessary to attain the objective.

Comprehensive services are available to the disabled under the U.S. program. These include medical diagnosis, individual counseling and guidance. physical restoration, training for a job, transportation, maintenance, occupational tools, initial stocks of goods for small business enterprises, job placement and follow-up. The use of public funds for services other than medical diagnosis, counseling, placement and follow-up depends on the economic status of the client.

In its early years, vocational rehabilitation consisted largely of attempts to "get around" the disability by specialized job training and by helping the disabled to find work. Federal-state action to eliminate or reduce a handicap through medical services first was authorized by federal legislation in 1943. Since that time. emphasis on medical services has increased; in the early 1960s physical restoration services were received by more than half of the persons being rehabilitated and accounted for more than 40% of the expenditures for case services. Among the services included in the term "physical restoration" are medical and surgical treatment; psychiatric treatment; dentistry, nursing, hospital and clinic services; convalescent or nursing home care; drugs; prosthetic devices; physical therapy; occupational therapy; and medically directed speech or hearing therapy. These services are made available only in instances where (1) the clinical status of the individual's condition is stable or slowly progressive (*i.e.*, not acute or transitory); (2) where a favourable outcome may be expected within a reasonable period of time; and (3) where the individual's financial need has been demonstrated.

See also BLIND, TRAINING AND WELFARE OF; DEAF AND HARD OF HEARING, TRAINING AND WELFARE OF; INDUSTRIAL MEDICINE; PHYSICAL THERAPY; RETARDED CHILDREN; VETERANS ADMINISTRATION, U.S.

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REHAN, ADA (ADA CREHAN) (1860–1916), U.S. actress, for 20 years star of Augustin Daly's company, whose special gift was for comedy, was born in Limerick, Ire., on April 22, 1860. The family moved to the United States when she was five years old. She made her acting debut in 1873, in *Across the Continent,* a melodramatic potboiler written by her brother-in-law. Oliver Doud Byron. Miss Rehan—who changed her name from Crehan after a printer's error produced it thus on a theatre program—next joined Mrs. Drew's company at the Arch Street theatre in Philadelphia. In 1879. after six years of acting experience in various companies, she joined Daly's company at the Olympic theatre in New York city, remaining Daly's star until his death in 1899. She retired from the stage in 1905, when the artificial 19th-century acting style was giving way to the new naturalism, and died in New York on Jan. 8, 1916. (S. W. H.)

REHOBOAM, last king of the united kingdom of Israel and first king of the southern kingdom of Judah, son and successor of Solomon, began to reign c. 931 B.C. The events are related in I Kings xi–xiv and II Chron. x–xii. Rehoboam was not acceptable to the northern tribes, who recalled Jeroboam (*q.v.*) from his exile in Egypt and made Rehoboam's contemptuous refusal of their demands the occasion for instituting a rival kingdom under Jeroboam (I Kings xii). It is probable that this was done with the encouragement of Egypt. Sheshonk I (Shishak) of Egypt attacked the kingdom of Judah c. 930, and despoiled the temple at Jerusalem of its treasures. Rehoboam's reign mas marked by constant conflict with the northern kingdom of Israel. An unfavourable judgment is pronounced on him by the editor of Kings because he favoured customs connected with Baal worship. The fact that his mother was an Ammonite woman may in some measure account for this. He was succeeded after a reign of 17 years by his son Abijah (in I Kings, Abijam), of whom little is known save a victory over Jeroboam.

REICHENAU, a picturesque island in the Untersee or western arm of the lake of Constance, Baden-Württemberg, Ger., 3 mi. long by 1 mi. broad, and connected with the east shore by a causeway $ mi long. It had 2,034 inhabitants in 1950. The soil is fertile, and excellent wine is produced in sufficient quantity for exportation. The Benedictine abbey of Reichenau, founded in 724, was long celebrated for its wealth and for the services rendered by its monks to the cause of learning. In 1540 the abbey, previously independent. was annexed to the see of Constance. and in 1799 it was secularized. The abbey church. dating in part from the 9th century, contains the tomb of Charles the Fat id. 888), who retired to this island in 887, after losing the empire of Charlemagne.

REICHENBACH, GEORG VON (1772–1826), German

astronomical instrument maker, was born at Durlach in Baden on Aug 24, 1772. By 1796 he mas engaged in the construction of a dividing engine In 1804 he was one of the founders of an nstrument making business in Munich; and in 1809 he helped establish an optical works at Benedictbeuren nhich was later moved to Munich. He withdrew from both enterprises in 1814, and was instrumental in establishing a new optical business, from nhich he retired in 1820. He died at Munich on May 21. 1826

Reichenbach built for F. W. Bessel in 1819 an instrument in which he introduced the meridian or transit circle, combining the transit instrument and the mural circle into one instrument This combination had been introduced earlier, but aith the exception of the transit circle constructed by Edward Troughton in 1806. had not been adopted. Reichenbach's form of instrument came into general use. (S. C HR.)

REICHENBACH, a town of Germany. in the district of Karl-Marx-Stadt, situated in the Vogtland 11 mi S IS'. of Znickau Pop. (1959 est.) 29,937. The earliest mention of the town occurs in a document of 1212. Woolen manufacture was introduced in the 15th century, and took the place of the mining industry. Industries include the manufacture of textile goods and machinery.

REICHSTADT, NAPOLEON FRANCIS JOSEPH CHARLES, DUKE OF (1811–1832), known by the Bonapartists as Napoleon II, was the son of the emperor Napoleon I and Marie Louise. archduchess of Austria. He was born on March 20, 1811, in Paris at the Tuileries palace. He was at first named the king of Rome. after the analogy of the heirs of the emperors of the Holy Roman empire. By his birth the Napoleonic dynasty seemed to be finally established; but in three years it crumbled in the dust. At the time of the donnfall of the empire (April 1814) Marie Louise and the king of Rome were at Blois with Joseph and Jerome Bonaparte, who aished to keep them as hostages. This design, however, was frustrated. Napoleon abdicated in favour of his son; but events prevented the reign of Napoleon II from being more than titular.

While Napoleon repaired to Elba. his consort and child went to Vienna; and they remained in Austria during the Hundred Days (181j), despite efforts made by the Bonapartists to carry off the prince to his father at Paris.

In the settlements of 1814 and 1815 *(see* MARIE LOUISE) the powers opposed all participation of the prince in the affairs of his mother's duchy of Parma. He therefore remained at Vienna.

From this time onward he became, as it were, a pawn in the complex game of European politics, his claims being put forward sometimes by Metternich, sometimes by the unionists of Italy, while occasionally malcontents in France used his name to discredit the French Bourbons. In Nov. 1816 the court of Vienna informed Marie Louise that her son could not succeed to the duchies. This decision was confirmed by the treaty of Paris of June 10, 1817. The title of "duke of Reichstadt" was conferred on him on July 22, 1818. by way of compensation. The upheaval in France in 1830 and the disturbances which ensued led many Frenchmen to turn their thoughts to Napoleon II; but though Metternich dallied for a time with the French Bonapartists, he had no intention of inaugurating a Napoleonic revival. The duke died on July 22, 1832.

REICHSTEIN, TADEUSZ (1897–), Swiss chemist, was born at Wloclawek, Pol . on July 20, 1897. He shared with E. C. Kendall and P. S. Hench the 1950 Nobel prize for medicine "for their discoveries concerning the suprarenal cortex hormones, their structure and biological effects." His family acquired Swiss citizenship in 1914, and he was educated at Zurich. where he obtained his first degree, in chemical engineering (1920), and his doctorate, in organic chemistry (1922). For several years he was engaged in industrial chemical research, but from 1930 onward he held in succession the posts of instructor. assistant to Leopold Ruzicka. assistant professor and associate professor in the department of organic chemistry at the State Technical college, Zurich. In 1938 he was appointed head of the department of pharmacology and director of the Pharmacological institute of the University of Basle, where in 1946 he became head of the organic division and director of the organic laboratories. His investigations were mainly concerned with steroids, particularly uith the hormones of the adrenal cortex. 26 of nhich he and his associates isolated. One of these hormones. isolated and described by Reichstein in 1936 and named by him "Substance Fa," proved to be identical with Kendall's "Compound E," and was later renamed cortisone. Apart from these researches. Reichstein's best-known work is the synthesis of ascorbic acid (vitamin C), which he carried out independently of Sir Norman Haworth and his coworkers. in 1933. (W. J. BP.)

REID, THOMAS (1710–1796), Scottish philosopher, was the critic of David Hume's sceptical empiricism and the first exponent of the so-called philosophy of common sense continued by the "Scottish school." He was born on April 26, 1710, at Strachan, Kincardineshire, the son of a minister and of his wife Margaret Gregory, who belonged to the famous family of mathematicians. He was educated at Marischal college, Aberdeen. where he had as tutor George Turnbull who left an influence on his philosophy, particularly in the use of the appeal to language. After studying theology and being licensed for the ministry in 1731. Reid remained at Marischal college as librarian from 1733 to 1736. From 1737 he held the living of New Machar for 14 years, during which period he was aroused by his study of Hume's *Treatise of Human Nuture* (1739) and began his lifelong task of examining its doctrines. In 1751 he was elected to the chair of philosophy in King's college, Aberdeen, where he remained until in 1764 he succeeded Adam Smith as professor of moral philosophy in the University of Glasgow. During the tenure of his post at Aberdeen he devoted himself to the problems of epistemology raised by Hume, offering the preliminary results of his examination in four graduation addresses delivered to the university (*Philosophical Orations*, 1st ed., by W. D. Humphries. Aberdeen, 1937), which were more fully developed, with special reference to problems of perception, in his first book, *An Inquiry Into the Human Mind, on the Principles of Common Sense* (1764). Further deliberation at Glasgow (where in 1780 he ceased to lecture, in order to devote himself wholly to research) resulted in the *Essays on the Intellectual Powers of Man* (1785; new ed. by 4. D. Woozley, London, New York, 1941), their scope being uider than that of the earlier work, and in the *Essays on the Acttve Powers of Man* (1788), in which he upheld a rationalist theory of ethics against the current subjectivism of Francis Hutcheson and Hume. His only other publications were "An Essay on Quantity" (in the *Transactions* of the Royal society. 1748), *A Brief Account of Aristotle's Logic* (1774) and the posthumous *Statistical Account of the University of Glasgow* (1799). He died on Oct. 7, 1796, four years after the death of his wife and cousin Elizabeth Reid, whom he had married in 1740.

Brought up himself on the theory of ideas (the theory that ideas alone are the direct objects of the mind's awareness) and starting out as a Berkeleian, Reid was shaken out of his acceptance of this orthodoxy by realizing, as he thought, the sceptical lengths to which the theory led in Hume; for it appeared to deprive us of the possibility of knowing almost all that Reid felt convinced that we do know. Finding himself unable to accept Hume's conclusions or to refute the arguments by which they were reached, he set himself to examine the premisses from uhich the arguments started, namely the theory of ideas, and came to the conclusion (at the time bold and original) that the theory was based on no better ground than the prejudices and confusions of philosophers. Against the supposition that the immediate data of perception are ideas or in any way peculiarly mental he argued (1) that it is pure hypothesis. unsupported by evidence; and (2) that it does not perform the function for which it was introduced, since its only result is to leave all questions about the veracity of any perception in principle unanswerable. The latter objection would apply only to a representationalist theory such as Locke's; the former would apply to Berkeley and Hume as well, if Reid's interpretation of them was correct. Reid himself propounded a view of perception which might be called indirect realism. According to this, our senses provided us with immediate sensations (which are neither veridical nor nonveridical), plus a noninf erential belief in the existence of corresponding material objects which cause the sensa-

tions, such a belief being liable—but not committed—to error; the function of sensation is to "suggest" the material objects. Thus Reid attempted to retain what seemed the common-sense elements in Locke's account, without the ideas and inferences from them which appeared both unjustified and fatal to it. As on many other topics, Reid's account of perception is tantalizingly incomplete and, without further explication of the notion of "suggestion," appears liable to criticisms similar to those which he had brought against Locke.

Reid rejected the orthodox representationalist theory of memory on similar grounds. In the first place, he denied the existence of the images which the theory held to be likenesses of the event or situation remembered; in effect he was protesting against being misled by the use of the noun "image" into the supposition that there was a special kind of mental entity of which it was the name. Secondly, the supposition that remembering consists of having images, related in a certain way to their originals, would preclude us from any justification of our memory beliefs. An acceptable theory of memory must be such as would entitle us (1) to claim that at least some remembering is reliable (although not infallible); and (2) to provide criteria for distinguishing correct remembering from misremembering or imagining. In general Reid was objecting, although not with entire clarity or consistency, against the "picture" model which seemed the fatal error of the theory of ideas. While all thought requires an object of thought, this does not necessitate that the object shall exist, even mentally. At times, indeed, Reid advances to a view more in accord with 20th-century thought: namely, that a concept is the meaning of the appropriate word or expression, that to have a concept is to know the meaning of the expression (*e.g.,* to have a concept of circle is to know the meaning of the word "circle") and that to know the meaning of a word, expression or sentence is to know how they are used.

As the founder of the philosophy named after it, Reid may appear to say disappointingly little directly about common sense, but his practice makes his principles reasonably clear. He was claiming, not that common sense is an oracle of truth (this was the view which Kant contemptuously but ignorantly attributed to him), but that there is such a thing as common-sense knowledge, as evidenced partly by the structure of language (which he held, without producing any evidence for it, to be to a high degree uniform from one natural language to another) and partly by the uniformity of our practical conduct.

The business of philosophy is not to challenge what each of us perfectly well knows to be true: for example, that there are material objects of whose existence and character we are aware by perception; that he is a continuing and identical person at least as far back as he can remember; that there are other persons like himself possessing life and intelligence; that he has some freedom of decision and of action; that expectatioh of the future based on experience of the past may be reasonable; and so on. To question such pieces of knowledge as these, as though they were empirical hypotheses to be tested, is to misconceive the philosopher's task, which is rather to attempt to understand more fully and clearly than is required for the unreflective, practical purposes of life the meanings of the propositions concerned. If philosophers had paid more attention to the basic facts and functions of language, they would have avoided the extravagances of scepticism and irrationalism into which they plunged. In emphasizing that the typical philosophical problem is not whether we know that something is the case, but what exactly it is that we do know when we know that something is the case, Reid was pointing the way which much British philosophy followed in the 20th century under the more immediate and more stimulating influence of Ludwig Wittgenstein and of G. E. Moore.

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REID, THOMAS MAYNE (1818–1883), better known as MAYNE REID, British novelist, was born at Ballyroney, County Down, Ire., on April 4, 1818. His own early life was as adventurous as any boy reader of his novels could desire. When 20 years old he went to America in search of adventure. He traded on the Red river, studying the ways of the Indian and the white pioneer; he made acquaintance with the Missouri in the same way. In Philadelphia, where he was engaged in journalism from 1843 to 1846, he met Edgar Allan Poe. When the war with Mexico broke out in 1846 he obtained a captain's commission, was present at the seige and capture of Vera Cruz and led a forlorn hope at Chapultepec, where he sustained severe injuries. In one of his novels he says that he believed theoretically in the military value of untrained troops, and that he had found his theories confirmed in actual warfare. He offered his services to the Hungarian insurgents in 1849, raised a body of volunteers and sailed for Europe, but arrived too late.

He then settled in England, and began his career of **a** novelist with the publication, in 1850, of the *Rifle Rangers.* This was followed next year by the *Scalp Hunters.* He never surpassed his first productions, except perhaps in *The White Chief* (1859) and *The Quadroon* (1856); but he continued to produce tales of self-reliant enterprise and exciting adventure in great number. He died in London on Oct. 22, 1883.

See Memoir (1890) by his widow, Elizabeth Mayne Reid.

REID, WHITELAW (1837–1912), U.S. journalist and diplomat, ambassador to Great Britain prior to World War I, was born near Xenia, O., on Oct. 27, 1837. He graduated from Miami university, Oxford, O., in 1856, and spoke frequently in behalf of John C. Frémont, the Republican candidate for the presidency in that year. In 1860 he became legislative correspondent at Columbus for several Ohio newspapers, including the *Cincinnati Gazette,* of which he was made city editor in 1861. He was war correspondent for the *Gazette* in 1861–62, serving also as volunteer aide-de-camp to Gen. Thomas A. Morris and to Gen. William S. Rosecrans in West Virginia, and was Washington' correspondent of the *Gazette* in 1862–68. In 1868 he became a leading editorial writer for the *New York Tribune,* in the following year was made managing editor, and in 1872, upon the death of Horace Greeley, became the principal proprietor and editor in chief. In 1905 Reid relinquished his active editorship of the *Tribune,* but retained financial control. He served as minister to France in 1889–92, and in 1892 was the unsuccessful Republican candidate for vice-president on the ticket with Benjamin Harrison. In 1897 he was special ambassador of the United States on the occasion of Queen Victoria's jubilee; in 1902, special ambassador of the United States at the coronation of King Edward VII; and in 1905 he became ambassador to Great Britain. He died in London on Dec. 15, 1912.

His publications include *After the War* (1867); *Our New Duties* (1899); *Later Aspects of Our New Duties* (1899); *Problems of Expansion* (1900); *The Greatest Fact in Modern History* (1906); and, posthumously, *American and English Studies* (1913).

See Royal Cortissoz, *The Lije of Whitelaw Reid* (1921).

REIGATE, a municipal borough (1863) in the Reigate parliamentary division of Surrey, Eng., 22 mi. S.S.W. of London bridge by road. Pop. (1951) 42,248. Area 16 sq.mi. Reigate (Cherchefelle was the Saxon village; Regate, the "roe gate," is mentioned in 1203), at a crossroad on the Pilgrim's way, at the foot of the North Downs, had a castle, a stronghold of the Warennes in the 12th–14th centuries. The manor of Cherchefelle was granted by William Rufus to Earl Warenne, through whose family it passed in 1347 to the earls of Arundel. It was held by the Somers family from 1697 until 1922, when it was conveyed to the corporation by deed of gift. Reigate priory, originally an Augustinian foundation, was purchased by the corporation in 1948. Of the castle (destroyed *c.* 1648), there remains only the entrance to a sandstone cave beneath. The grounds are laid out as a public garden.

The old town hall (1708, presented to the corporation in 1922) is on the site of an ancient chapel dedicated to St. Thomas Becket. In the chancel of the parish church of St. Mary (Transitional Norman to Perpendicular) is buried Lord Howard, the commander of the English navy against the Spanish Armada. The boys' grammar school was founded in 1675, but the Girls' County

school is a modern foundation (1905). The borough, largely residential, which was considerably extended in 1933, includes the town of Redhill (aith a growing industrial area on its outskirts) and Merstham, part of which is now a London County council housing estate.

REIMARUS, HERMANN SAMUEL (1694–1768), German' philosopher and man of letters, was born at Hamburg, on Dec. 22, 1694 He aas educated by his father and by the famous scholar J. A. Fabricius. whose son-in-law he became, and later at Jena. He uas professor of Hebrew and oriental languages in the high school of his native city from 1727 till his death. His house was the centre of the highest culture. and a monument of his influence in that city remained in the *Haus der patriotischen Gesellschaft,* where the learned and artistic societies partly founded by him continued to meet. He died on March 1, 1768.

Reimarus' reputation as a scholar rests on the valuable edition of Dio Cassius (1750–52) which he prepared from the materials collected by J. A. Fabricius. He also published *Abhandlungen von den vornehmsten Wahrheiten der natürlichen Religion* (Hamburg, 1754; 6th ed.. 1791); *Vernunftlehre* (Hamburg and Kiel, 1756; 5th ed., 1790); *Betmchtztngen über der Kunsttriebe der Thiere* (Hamburg, 1762; 4th ed., 1798). But his best-known work is his *Apologie oder Schutzschrift fur die vernünftigen Verehrer Gottes* (kept back during his lifetime) from which, after his death, Lessing published certain chapters under the title *Wolfenbüttel Fragments (see* LESSING, GOTTHOLD *EPHRAIM).* Other portions were published by "C. A. Schmidt" (1787) and D. W. Klose (1850–52).

The standpoint of the *Apologie* is that of pure naturalistic deism. Miracles and mysteries, with the exception of the Creation, are denied, and natural religion is put forward as the absolute contradiction of revealed. The essential truths of the former are the existence of a wise and good Creator and the immortality of the soul. These truths are discoverable by reason, and are such as can constitute the basis of a universal religion and lead to happiness. A revealed religion could never obtain universality, as it could never be intelligible and credible to all men.

See the "Fragments" as published by Lessing, reprinted in vol. xv of *Lessing's Werke,* Hempel's edition; *D.* F. Strauss, H. S. *Reimarus und seine Schutzschrift fur die verndnftigen Verehrer Gottes (1862;* 2nd ed., 1877); C. Voysey, *Fragments from Reimarus* (1879) *(a* translation of Strauss's book, with the second part of the seventh fragment, on the "Object oi Jesus and his Disciples").

REIMS (RHEIMS), a city of northeastern France, chief town of an *arrondissement* of the *département* of Marne, 98 mi. E.N.E. of Paris, on the Eastern railway. Pop. (1954) 114,682. Reims stands in a plain on the right bank of the Vesle, a tributary of the Xisne, and on the canal which connects the Aisne with the Marne. South and west rise the "montagne de Reims" and vine-clad hills.

Before the Roman conquest Reims, as Durocortorum, was capital of the Remi, from whose name that of the town was subsequently derived. The Remi made voluntary submission to the Romans. and by their fidelity secured the special favour of their conquerors. Christianity was established in the town by the middle of the 3rd century, at which period the bishopric was founded. The consul Jovinus, an influential supporter of the new faith, repulsed the barbarians who invaded Champagne in 336; but the Vandals captured the town in 406 and slew St. Nicasus, and Xttila afterward put it to fire and sword. Clovis, after his victory at Soissons (486), was baptized at Reims in 496 by St. Remigius. Later kings desired to be consecrated at Reims with the oil of the sacred phial which was believed to have been brought from heaven by a dove for the baptism of Clovis and was preserved in the abbey of St. Remi. Meetings of Pope Stephen III with Pippin the Short, and of Leo III with Charlemagne, took place at Reims; and there Louis the Debonair was crowned by Stephen IV. Louis IV gave the town and countship of Reims to the archbishop Artaldus in 940. Louis VII gave the title of duke and peer to William of Champagne. archbishop from 1176 to 1202, and the archbishops of Reims took precedence of the other ecclesiastical peers of the realm.

In the 10th century Reims had become a centre of intellectual culture. Archbishop Adalberon, seconded by the monk Gerbert (afterward Pope Silvester 11), having founded schools where the "liberal arts" were taught. Adalberon was also one of the prime authors of the revolution which put the Capet house in the place of the Carolingians. The most important prerogative of the archbishops was the consecration of the kings of France — a privilege which was exercised, except in a few cases, from the time of Philip Augustus to that of Charles X. Louis VII granted the town a communal charter in 1139. The treaty of Troyes (1420) ceded it to the English, who had made a futile attempt to take it by siege in 1360; but they were expelled on the approach of Joan of Arc, who in 1429 caused Charles VII to be consecrated in the cathedral. A revolt at Reims, caused by the salt tax in 1461, was cruelly repressed by Louis XI. The town sided with the League (1585), but submitted to Henry IV after the battle of Ivry. In the foreign invasions of 1814 it was captured and recaptured; in 1870–71 it was made by the Germans the seat of a governor general and impoverished by heavy requisitions.

Reims suffered severely during World War I. The town was heavily bombarded by the Germans in Sept. 1914, and the population took shelter in the huge subterranean wine cellars, occupying old chalk quarries, where dormitories were made, schools were held and a daily paper was published. In 1917 the civilian population which remained was evacuated; in 1918 the town was one of the objectives of the Germans, but it was held until freed by the Allied offensive in October. Reims was then in ruins, and the cathedral was severely damaged, especially on the southwest side. The work of restoration of the cathedral, to the cost of which there was a large U.S. contribution, took many years to complete. The cathedral and other famous buildings were not damaged during World War II, although the town again suffered wartime destruction. The statue of St. Joan of Arc, which stood in front of the cathedral, was removed during World War I for safety and replaced in 1921; many of the art treasures, tapestries, etc., were also saved.

The oldest monument in Reims is the Mars gate (so called from a temple to Mars in the neighbourhood), a triumphal arch 108 ft. in length by 43 ft. in height, consisting of three archways flanked by columns. It is popularly supposed to have been erected by the Remi in honour of Augustus when Agrippa made the great roads terminating at the town, but probably belongs to the 3rd or 4th century. In its vicinity a curious mosaic, measuring 36 ft. by 26 ft., with 3 j medallions representing animals and gladiators, was discovered in 1860. To these remains must be added a Gallo-Roman sarcophagus, said to be that of the consul Jovinus and preserved in the archaeological museum in the cloister of the abbey of St. Remi.

The cathedral of Notre Dame, where the kings of France used to be crowned, replaced an older church (burned in 1211) built on the site of the basilica where Clovis was baptized by St. Remigius. The cathedral, with the exception of the west front, was completed by the end of the 13th century. That portion was erected in the 14th century after 13th-century designs — the nave having in the meantime been lengthened to afford room for the crowds that attended the coronations. In 1481 fire destroyed the roof and the spires. The facade was one of the most perfect masterpieces of the middle ages. The three portals are laden with statues and statuettes. The central portal, dedicated to the Virgin, was surmounted by a rose window framed in an arch itself decorated with statuary. The rose window, the statue of the smiling angel, the still more famous "Beau Dieu" statue were all severely damaged in World War I. The gallery of the kings above the rose window survived but the angel spire was destroyed.

The archiepiscopal palace, built between 1498 and 1509 and in part rebuilt in 1675, was almost completely destroyed. The church of St. Remi (11th, 12th, 13th and 15th centuries) retained intact its facade and two Romanesque towers; the nave and choir were ruined, and the mausoleum of St. Remigius (1847), containing the reliquary of the saint, behind the high altar, had to be reconstructed.

Reims became the seat of an archbishop, a court of assize and

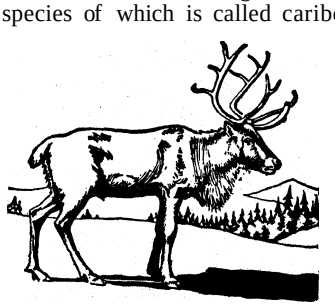
a subprefect, and a tribunal and a chamber of commerce. It also became an important centre for the combing, carding and spinning of wool and the weaving of woolen goods of all kinds. The manufacture of and trade in champagne are also very important. The wine is stored in large cellars tunneled in the chalk. The town also became well known for its cakes and biscuits.

REINACH, JOSEPH (1856–1921), French author and politician, who is remembered chiefly for his defense of Alfred Dreyfus, was born in Paris on Sept. 30, 1856. After leaving the Lycée Condorcet he was called to the bar in 1887. He attracted the attention of Gambetta by articles on Balkan politics published in the *Revue bleue,* and in Gambetta's *grand ministère* Reinach was his secretary. In the *République française* he waged a steady war against General Boulanger which brought him three duels, one with Edmond Magnier and two with Paul Déroulède. Between 1889 and 1898 he sat for the chamber of deputies for Digne. He brought forward many reform bills, advocated complete freedom of the theatre and the press, the abolition of public executions, and denounced political corruption. But he is best knoun as the champion of Dreyfus. At the time of the original trial he attempted to secure a public hearing of the case, and in 1897 allied himself with Scheurer-Kestner to demand its revision. He denounced in the *Siècle* the Henry forgery, and Esterhazy's complicity. His articles aroused the fury of the anti-Dreyfusard party, especially as he was himself a Jew and therefore open to the charge of bias. He lost his seat in the chamber of deputies and, having refused to fight Henri Rochefort, eventually brought an action for libel against him. Finally, the "affair" being terminated and Dreyfus pardoned, he undertook to write the history of the case, the first four volumes of which appeared in 1901. This was completed in 1905. In 1906 Reinach was re-elected for Digne. He died in Paris on April 18, 1921.

SALOMON REINACH (1858–1932), born at St. Germain-en-Laye on Aug. 29, 1855, brother of Joseph Reinach, was educated at the École Normale Supérieure, and joined the French school at Athens in 1879. He made valuable archaeological discoveries at Myrina near Smyrna in 1880–82, at Cyme in 1881, at Thasos, Imbros and Lesbos (1882), at Carthage and Meninx (1883–84), at Odessa (1893) and elsewhere. He received in 1886 an appointment at the National Museum of Antiquities at St. Germain; in 1893 he became assistant keeper, and in 1902 keeper of the national museums. In 1903 he became joint editor of the *Revue archdologique,* and in the same year officer of the Legion of Honour. The lectures he delivered on art at the École du Louvre, 1902–03, were published by him under the title of *Apollo.*

REINCARNATION: *see* METEMPSYCHOSIS.

REINDEER, a large arctic and subarctic deer, the American species of which is called caribou. The reindeer constitutes the genus *Rangifer,* characterized by the possession of antlers by both sexes, though those of the male are larger and more complex. Reindeer are clumsily built animals, with large lateral hoofs, hairy muzzles and a curious type of antler with the brow tine directed downward. The compact, dense coat is clove brown in colour above and white below, with a white tail patch. The ears and tail are short and the throat is maned. A tarsal gland is present. The lateral metacarpal bones are represented only by their lower extremities *(see* DEER).



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REINDEER (RANGIFER TARANDUS) It inhabits arctic and subarctic regions

The type of the genus *(R. tarandus)* is the Scandinavian wild form. In America the barren ground caribou are forms of the old world species. The woodland caribou *(R. caribou* and *R. novaterrae)* are other species. All caribou move around and many herds undertake great migrations in the spring and autumn. A small species *(R. platyrhynchus)* inhabits Spitzbergen and Novaya Zembla.

The reindeer has been domesticated by the Lapps and introduced as a domestic animal into arctic Canada and Alaska. Reindeer feed largely on lichens. one species of which is the so-called "reindeer moss." The brow tine is not used to scrape away snow; this is done with the hoofs, the horns being shed before spring.

See also Index references under "Reindeer" in vol. 24.

REINDEER LAKE, in northern Canada, straddles the Saskatcheaan-Manitoba border in Pre-Cambrian rock terrain near the northern limit of the coniferous forest. At an altitude of 1.150ft., it is 2,444sq mi. in area, 152 mi. long and up to 35 mi. wide, irregularly shaped and island-dotted. Fed by numerous streams. it drains southward over a control dam into the Churchill river via the Reindeer. In fur trade days the lake was a transport link and tno small settlements formed near its extremities. More recently, commercial and sport fishing produced a third settlement on the east shore connected by truck road with the railhead at Lynn Lake. Manitoba. (C. S. BR.)

REINDEER MOSS *(Cladonia rangiferina),* a species of lichen found in great abundance in arctic lands. It is an erect, many-branched plant, a few inches in height, which covers immense areas somewhat in the manner of pasture grasses in the temperate regions. In many districts it forms the chief food of the reindeer. and it also provides forage for the barren-ground caribou and the musk ox. *See* LICHENS.

REINECKE, KARL (HEINRICH CARSTEN) (1824–1910). German composer. pianist and conductor who was regarded as the best interpreter of the piano music of Mozart of his time. was born at Altona, June 23, 1824. He appeared in public as a child, toured Scandinavia at the age of 18 and in 1843 settled in Leipzig. where his close contact with Mendelssohn and Schumann was of decisive influence in his development. He conducted the Leipzig Gewandhaus concerts from 1860 to 1895. Of his numerous works, which include operas, symphonies, concertos, overtures and chamber music, those written for educational purposes are the most valuable and his pieces for children are still fresh and alive. He died at Leipzig, March 10. 1910. (H. GA.)

REINFORCED CONCRETE: *see* CONCRETE.

REINHARDT, MAX (1873–1943), Austrian theatrical producer and director, the most influential and productive theatre figure of his generation, directed many kinds of plays in many types of theatres and introduced new concepts of design and production to audiences in Berlin Vienna. London and New York. He was born at Baden, near Vienna, on Sept. 9, 1873. From 1893 to 1903 he studied acting, chiefly under Otto Brahm. but spent the rest of his career as a play director and teacher, principally in Berlin.

Reinhardt popularized classical plays such as *Oedipus Rex, Everyman, Faust* and those of Shakespeare by giving them a contemporary flavour through the appeal of spectacle, a new translation or novel staging. He brought together young artists who successfully realized in their costume and scenic designs many of the revolutionary ideas of E. G. Craig and Alexander Tairov. He broke the convention of the proscenium wall and staged his plays in circuses, cathedrals, Greek-style theatres and on cathedral steps. In addition to his spectacles for large audiences, he staged light operas and modern plays with clean precision in ballrooms (the Redoutensaal in Vienna) and intimate theatres and cabarets.

From the time of his first popular success with *Sumurun,* an oriental pantomine, to his last spectacle, *The Eternal Road* in New York in 1937. Reinhardt worked on the development of his artistic theories. Chief among his beliefs was that the function of the director was to realize the specific atmosphere of a play and that every play, whether new or old. must be made to live for a contemporary audience. Occasionally his zeal for theatrical effect and publicity caused him to distort the fundamental dramatic values in a script. but those cases are exceptions and insignificant in relation to his total record. He believed in careful preparation of a production before beginning rehearsals, and his director's manuscript or *Regiebuch* for any play, with its detailed annotations and diagrams, is a legendary document.

Reinhardt left Germany in 1933. In Hollywood he directed films and established a school for actors and directors. He became

a U.S. citizen in 1940 and died in New York on Oct. 31, 1943.

See Huntley Carter, *The Theatre of Max Reinhardt* (1914); Oliver M. Sayler (ed.), *Max Reinhardt and His Theatre (1924).* (*E. P. K.*)

REINKENS, JOSEPH HUBERT (1821–1896), German Old Catholic bishop, was born at Burtscheid, near Aix-la-Chapelle, on March 1, 1821. He became professor of ecclesiastical history at Breslau (Wroclaw), and in 186j rector of the university. In 1870. Reinkens opposed the proclamation of the dogma of papal infallibility. He signed the Declaration of Niirnberg in 1871, and took a conspicuous part in the Bonn conferences with the orientals and Anglicans in 1874 and 1875. The Old Catholics having decided on secession, Reinkens was chosen their bishop in Germany at Cologne in 1873 *(see* OLD CATHOLICS). His best-known theological work is his treatise on Cyprian and the unity of the church (1873). In 1881 Reinkens visited England, and in 1894 he defended the validity of Anglican orders against the Old Catholics of Holland. He died at Bonn on Jan. 4, 1896.

REINMAR VON HAGENAU (REINMAR DER ALTE) (d. *c.* 1205), was the most notable exponent of *Minnesang* toward the end of the 12th century (*see* MINNESINGERS). His birthplace was probably in Alsace but he moved early to Vienna where he became court poet of the Babenberg dukes. Among his pupils was Walther von der Vogelweide (*q.v.*), who later became his rival. Reinmar was considered by his contemporaries to be the "nightingale" of the poets of his day. In matters of form he sought purity of rhyme and smoothness of rhythm and rejected any phrase or emotion which might have offended courtly susceptibilities. The modern reader. however, may find his songs stereotyped as he sang mostly of unrequited love. The volume of songs attributed to him is considerable but modern scholarship doubts the authenticity of all but some 30 of them, assigning the rest to his pupils.

See K. von Kraus (ed.), *Des Minnesangs Frühling* (1939).

(W. W. Cs.)

REINSCH, PAUL SAMUEL (1869–1923), U.S. political scientist, who was a pioneer in the field of serious study by Americans of world affairs. was born in Milwaukee, Wis., June 10, 1869. Graduated (A.B., LL.B. and Ph.D.) at the University of Wisconsin, Madison, after studying in Europe, he taught there until 1913. Gifted, ambitious, perceptive and dynamic, he excelled in the social sciences and soon achieved repute as an authority on international relations.

He was active in the founding of the American Political Science association (president in 1920), served as a U.S. delegate at several conferences in Central and South America and lectured as Roosevelt exchange professor (1911–12) in Germany. In 1913 Pres. Woodrow Wilson appointed him U.S. minister to China. He contended brilliantly, emphatically and prophetically for proficient attention to matters far eastern. His *An American Diplomat in China* (1922) is an illuminating memoir. He resigned in 1919, became an adviser to the Chinese government and, traveling in that capacity, died in Shanghai on Jan. 24, 1923. Outstanding among Reinsch's many books were his *World Politics at the End of the Nineteenth Century, as Influenced by the Oriental Situation* (1900), *Colonial Government* (1902), *Colonial Administration* (1905), *Public International Unions* (1911) and *Intellectual and Political Currents in the Far East* (1911). (S. K. H.; S. G. L.)

REINSURANCE. Reinsurance is the term used to denote the transaction whereby a person who has insured a risk insures again a part or the whole of that risk with another person. The purpose of reinsurance is to relieve the original insurer from a liability which is too heavy for him to carry. There is no privity of contract between the reinsurer and the original insured, so that the latter could not sue the former to recover any part of a loss. but the insured could recover in respect of a loss against the original insurer up to the full amount of the policy, notwithstanding that part of it had been reinsured.

In a reinsurance transaction the company which reinsures is called the ceding company, the accepting company is called the reinsurer and the transaction itself is termed a cession.

It is not known when reinsurance was first practised. though there is evidence of its existence at least as early as the first half of the 18th century. In the early days of insurance, insurers did not, as a rule, insure for greater amounts than they were prepared to keep for themselves, and, even when this rule began to be relaxed, the arrangements whereby they relieved themselves of heavy commitments partook more of the nature of co-insurance than of reinsurance. Under such arrangements the original insured was in contractual relationship with each of the insurers.

However, in marine business reinsurance was known nearly 200 years ago, for in 1746 an act of parliament made it illegal. a prohibition which was not raised until 1864. It is thought by some that the act of 1746 really prohibited double insurance; *i.e.,* where the insured covered his property twice, but the word used in the act is "reassurance." However this may be, it is certain that the growth of reinsurance in various sections of the business was slow until well into the 19th century.

Facultative Reinsurance.—This was the original form. By this method each risk is offered for reinsurance separately and the ceding company has a free choice as to where it will offer the business. Similarly the reinsurer has freedom to accept or decline. The term facultative is derived from the power of choice, which this method implies. This system of reinsurance is cumbersome. as each risk reinsured has to be handled separately. The particulars of the risk are first shown to the reinsurer on a slip, which it initials for the share it is prepared to accept. This is followed by a request note; *i.e.,* a formal demand issued by the ceding company to the reinsurer for the specified reinsurance. Upon this the reinsurer issues its "take" note, which is its official acceptance given pending the issue of a reinsurance policy,

Reinsurance by Treaty.—A treaty is an obligatory arrangement, under which the ceding company binds itself to cede, and the reinsurer binds itself to accept, a fixed share of every risk, of a nature as defined in the contract, which the ceding company has to reinsure. A treaty, therefore, provides not for the reinsurance of an individual risk, but for all the risks of a given class. The power of choice is here eliminated. The two parties are reciprocally bound, one to cede and the other to accept.

This is an advantage to both, since the ceding company knows in advance that it can place the reinsurances and the reinsurer can rely on receiving a regular flow of business under the treaty. It is a condition of all treaties that, as soon as a reinsurance is placed thereunder, the reinsurer's liability commences from the same moment as the liability of the ceding company, while the obligation to cede prevents the ceding company placing some of its reinsurances with one reinsurer and some with another, or favouring one at the expense of another. It is customary to arrange a treaty so that a number of reinsurers share in it, each accepting only a proportionate part of the business ceded.

Quota-Share Treaty.—A quota-share treaty is one under which the ceding company agrees to cede a fixed share of every risk which it accepts from its clients. There is a necessary tendency for reinsurance business to comprise risks of a second class nature, since the better the risk the more the ceding company keeps. But in a quota-share treaty this feature is not present. Every risk must be reinsured. For this reason the quota-share treaty is not greatly used, except by small companies, which can obtain sound cover only by offering attractive terms.

Surplus Treaty.—The surplus treaty is that in common use. Under this the ceding company first fixes the amount it will keep, which is called its retention, and the remainder of the amount insured constitutes the surplus. This is divided amongst the treaty reinsurers according to their due proportion. The whole surplus is usually divided into percentages, each reinsurer taking 1% or more as agreed of every surplus. But the amount which can be ceded is governed by the ceding company's retention.

Excess of Loss Treaty.—An excess of loss treaty is an agreement under which no part of any individual risk is reinsured, but the ceding company arranges to cover only the excess of any one loss over and above an agreed figure. This is a treaty to guard against catastrophe. A ceding company may arrange to cover itself by reinsurance against the excess of loss over £50,000 in respect of any one fire, the cover to run, say, up to £100,000; *i.e.,* a further £50,000. Then if one fire results in a loss to that company of £50,000, or less, the reinsurers pay nothing, but if the

cost of the fire exceeds that figure the reinsurers pay the amount of the excess, according to their agreed proportions. This kind of treaty is largely used in motor insurance; but in fire insurance its use is a modern development. In that branch it is operated independently of and in addition to the surplus treaty. The ceding company must still use its surplus treaty to limit its liability on individual risks. taking out an excess of loss cover only to protect itself against heavy conflagrations.

Conditions of Reinsurance. — The conditions applying to a reinsurance are, as a rule, the same as those which apply to the original insurance. Thus the reinsurer receives the same rate of premium and must pay its proportionate share of any claim. There are. however. exceptions to this rule. Under an excess of loss treaty the reinsurer receives no specific premium, but is paid a percentage of the total premium income derived by the ceding company from the class of business to which the treaty applies. In marine reinsurance there is a practice to reinsure risks which are affected by a possibility of loss, and in such cases much higher premium may be paid than under the original policy.

The share of premium payable to the reinsurer is subject to a deduction of commission, which varies from 20% to 35% or, in rare cases, 40% or 45%. Reinsurance commission has to cover not only the agent's commission paid on the original insurance but also a part of the ceding company's expense of obtaining and dealing with the business. The rate of reinsurance commission depends partly on the level of the expense of dealing with the business and partly on the quality of the treaty. Treaties giving consistently good results can command better terms than poor treaties. As well as commission deducted from premium. the reinsurer has to pay a commission — usually 10% — on the profits. In this way the profitable treaty automatically receives better terms than the bad one. The profit on a treaty is computed after making due provision for all claims and liabilities outstanding at the end of the year. The commission is payable on the average of the profit of the year of account, and of the two preceding years, so that a reinsurer shall not be required to pay away part of its profits in a year which follows a year showing a heavy loss.

The reinsurer, being liable to pay its share of all losses, is entitled to a like share of any amounts recovered as salvage. The ceding company has the control of all loss settlements and may settle a loss or contest a claim as it thinks fit. The reinsurer is bound to follow the fortunes of the ceding company in this matter.

Disputes arising between the parties to a reinsurance treaty, as to any matter coming thereunder, are almost invariably settled by arbitration.

Bordereaux. — Particulars of cessions made under a treaty are advised by the ceding company to the reinsurer by means of bordereaux. A bordereau is a statement giving the name and address of the insured, the nature of the risk, the sum insured, the premium. the amount reinsured and the reinsurance premium. No reinsurance policies are issued under treaties, as the reinsurance cover operates under the treaty contract. In marine business, however, properly stamped policies have to be issued even for reinsurance, under the provisions of the Stamp Act, 1891, and the Marine Insurance Act, 1906.

Retrocession. — A reinsurer, receiving particulars of its cessions by bordereaux, will itself deal with the business so received, and will in its turn arrange treaties to cede off its own surplus lines. A reinsurance of a reinsurance is called a retrocession. Retrocession is an important part of reinsurance business because where a reinsurer has a share of many treaties it will frequently receive a share of the same risk under many of its different treaties and must needs relieve itself by retrocession of the accumulation of risk. (C. E. G.)

United States. — The U.S. reinsurance business grew rapidly during the 20th century. As in the European countries facultative and the three kinds of treaty insurance are used, but the percentage of facultative is rapidly diminishing because of delay and uncertainty.

What may be called a variation of the fixed treaty is the "pool" or "syndicate." Here as many as 3j companies will enter into an agreement to share all insurance in a given territory on a basis of certain agreed proportions both in regard to premiums and losses.

In order to facilitate the placing of reinsurance and to bring about greater uniformity of practice, reinsurance clearing houses or exchanges were established. Here the detailed reinsurance agreement is subscribed to by the member companies who are all represented by a manager.

Many of the life insurance companies continued to use the facultative plan of reinsurance.

There are two ways of reinsuring. The smaller companies will reinsure the amount at risk with term insurance. Most of the larger companies use the coinsurance plan, whereby the reinsurance company receives a proportionate part of the premium and guarantees a proportionate part of all payments including expenses and taxes.

There are many insurance companies whose business is entirely reinsurance. (R. RET.; X.)

REISKE, JOHANN JAKOB (1716–1774), German philologist, who surpassed all his predecessors in the range and quality of his knowledge of Arabic literature, was born on Dec. 25, 1716, at Zorbig in electoral Saxony. From the orphanage at Halle he passed in 1733 to the University of Leipzig, and there spent five years. He bought Arabic books, and when he had read all that was then printed he thirsted for manuscripts. He qualified as a doctor. but failed to secure any medical practice at Leipzig, and lived, as before. on ill-paid literary hack work. Although the electoral prince gave him the title of professor he was not permitted to lecture. At length in 1758 the magistrates of Leipzig rescued him from poverty by giving him the rectorate of St. Nicolai. and, though he still met with hostility in the university, he enjoyed the esteem of Frederick the Great, of Lessing, Karsten, Niebuhr and many foreign scholars. Reiske died on Aug. 14, 1774, and his manuscript remains are now in the Copenhagen library.

In the *Adnotationes historicae* to his *Abulfeda Annales Moslemici,* 5 vol. (1789–91), Reiske collected a veritable treasure of original research: he knew the Byzantine writers as thoroughly as the Arabic authors, and was alike at home in modern works of travel in all languages and in ancient and medieval authorities. In Greek his corrections are often hasty and false, but a surprisingly large proportion of them have since received confirmation from manuscripts. He was interested too in numismatics, and his letters on Arabic coinage form the basis of that branch of study.

REITH, JOHN CHARLES WALSHAM REITH, 1ST BARON OF STONEHAVEN (1889–), one of the principal British architects of the modern pattern of publicly owned but independent utility corporations, was born at Stonehaven, Kincardineshire, Scot., on July 20, 1889. He mas educated at Glasgow academy, Gresham's school. Holt, Norfolk, and the Royal Technical college, Glasgow. Trained as a civil engineer, in 1916–17 he was engaged in the United States on the supply of munitions to the United Kingdom. As general manager of the British Broadcasting company from 1922, and director general of the corporation, as it became. from 1927 to 1938, he was responsible for the creation and development of broadcasting throughout the British Isles, and also for the inauguration of the empire short-wave broadcasting service and the first regular service of high-definition television in the world (1936). He had been knighted in 1927. In 1938 he became chairman of Imperial Airways and in the following year was responsible for its merger with British Airways and the creation of the British Overseas Airways corporation, of which he became chairman. He was made a peer in 1940. After holding a number of ministerial and other appointments in World War II, Lord Reith was responsible in 1946 for a reordering of the cable and wireless system of the commonwealth. becoming chairman of the new Commonwealth Telecommunications board (1946–50). He was chairman of the New Towns committee (1946). the Hemel Hempstead Development corporation (1947–50) and the National Film Finance corporation (1948–51). From 1950–59 he was chairman of the Colonial Development corporation and served on

other commercial and industrial boards. Lord Reith published his autobiography, *Into the Wind*, in 1949. (G. R. M. G.)

RÉJANE (GABRIELLE CHARLOTTE RÉJU) (1857–1920), French actress, regarded as the queen of the comedy stage, was born on June 6. 1857, in Paris, where she made her debut at the Vaudeville in 1875. Her first big success was in Henri Meilhac's *Ma Camarade* in 1883. She became a favourite, playing in many of the Parisian theatres and also in England and America, where she was very popular. On her first appearance in London, in 1894, Bernard Shaw. then a dramatic critic, paid her a great tribute. She did not attempt tragedy or classical roles, but was unequaled in light comedy. She had great emotional powers, which she displayed in *Madame Sans-Gêne*, in which she attained world renown. She was also extremely successful in *Zaza* and *La Passerelle.* In 1905 she opened the Théâtre Réjane in Paris under her own management. and in 1906 she took over the Royalty theatre in London, intending to make it a French repertory theatre. She toured South Africa in 1909 and retired in 1915, dying in Paris on June 14, 1920. Réjane had great beauty, charm and remarkable clarity of diction, and she was also a typical Parisienne.

(W. J. M.-P.)

REJERIA, the Spanish form of openwork screens made from combinations of wrought- and cast-iron work. The word *reja* is used for a screen, individually; *rejeria* properly signifies this whole class of ironwork. A magnificent example is the *reja* of the Capilla Mayor of Seville cathedral (1518–33). Many beautiful examples of this type are found as window guards in Spanish Renaissance houses. *See* IRONWORK.

REJUVENATION, or the restoration of youthfulness, has long been an aspiration of mankind. To stop the inevitable march toward senile decline, to turn the clock back, countless generations of men from philosophers to explorers have sought the elixir of life. the source of eternal youth. Although the causes of aging have been little understood, a most obvious change occurs in the reproductive capacities of men and animals as they approach the twilight of their mature years. It is not unnatural, therefore, that the genital powers and the genital organs have been the centre of preoccupation by those who have sought the secret of rejuvenation.

Early historical records indicate that the elders and priests of ancient China and India. 3,000 years ago, consumed the sexual organs of wild animals in order to improve their vigour and acuity and thus to offset the decline of old age. Long before the Christian era, roughly 1400 B.C., the testicles of sacrificial animals were employed to counteract sexual weakness. Such fancy and such practices have not waned during the intervening centuries, since some primitive societies still indulge in these crude attempts at rejuvenation.

The achievement of rejuvenation was claimed during the early 20th century by several surgeons of Europe and the U.S. who maintained that operations on the genital organs or transplantation of young testicular tissue into elderly men brought about a new feeling of well-being, physiological youthfulness and, in some instances, a renewal of sexual potency. This era stemmed from the accounts of the physiologist Charles Edouard Brown-Séquard (*q.v.*) who in 1889, at the age of 70, injected himself with testicular material from dogs and guinea pigs and claimed a renewal of vigour, mental alertness and the "enjoyment of life." Twenty-five years later Jiirgen W. Harms believed that he had accomplished the same thing in senile guinea pigs and, further, that he had regenerated sexual activity by the transplantation of testicles from young, healthy animals.

The foremost names in the field of induced rejuvenation were those of the Viennese scientist Eugen Steinach who experimented mostly with rats, and Serge Voronoff, a French surgeon who combined animal and human experimentation. The Steinach operation consisted merely of ligation and severance of the male seminal duct. Voronoff transplanted young human or monkey testicular tissue into the testicular sacs of elderly men. In both procedures, the operation was regarded as increasing the secretion of the testicular hormone androgen thereby giving new vigour to the organism (*see* HORMONES). In the most dramatic cases of rejuvenation of 65- to 83-year-old men, the results claimed were long-lasting improvement in mental alertness, sense of well-being, visual acuity, muscle tone, blood pressure, hair growth, skin elasticity, libido and sexual potency.

Although loudly proclaimed, these procedures were not well founded in theory and have not withstood the tests of time and confirmation. No evidence has been discovered that aging of the body as a whole is dependent on either the activity or the failure of the sexual glands per se. These glands have their own characteristic functional life span, just as do other organs and tissues in the organism. Both the spermatozoa-forming and the hormone-secreting functions of the testis are mainly devoted to reproduction of the species and not to growth, differentiation and maintenance of the body against the ravages of old age.

Voronoff's transplantations of monkey glands in men could not possibly have persisted as active, growing tissues and could at best only have supplied a temporary exogenous source of androgenic substance. The apparent results were probably mainly responses to the sudden and temporary flood of androgen throughout the system, combined with readjustment in subjective and psychological attitudes. and improvement in nutritive and constitutional factors. It has been well recognized among clinical circles that some cases of human infertility in both men and women have responded to improved conditions of diet, rest, relaxation and peace of mind when previous medical therapy had been of no avail.

With the chemical identification and synthesis of the male hormone testosterone there was ample opportunity to test its capacity to induce true rejuvenation as well as to study its general physiological effects on the organism. Its administration to elderly men followed in some instances by feelings of well-being. sexual interest, improved circulation and increased muscle tone, but analogous results also have been obtained with other stimulants and strengthening methods. The effects are temporary and did not offset the slow decline of old age. Indeed, some danger is involved in such a one-sided stimulation since the organism as a whole may not be physically constituted to withstand the sudden and abnormal stress.

The systemic effects of testosterone administered to experimental animals under controlled conditions were found to include a multitude of physiological responses: modification in blood pressure, red blood cell count, muscle tone, glycogen storage, electrolyte and water retention, enzyme activity, carbohydrate and protein metabolism. oxygen and carbon dioxide exchange and brain wave pattern. Moreover, it is known that through the intricate integration of the endocrine system androgen administration has an important action on the all-powerful pituitary gland and on the adrenals as well. Obviously then. a sudden change of disturbance in the androgen balance might have profound effects throughout the system. A practical example of the effect of androgen stimulation may be found in the annals of horse racing: a run-down and over-aged horse was able, after testosterone administration, to perform well with his younger competitors. The response was temporary, however, and not devoid of some risk.

Attempts to induce the revitalization by surgical means have been confined to the male. Apparent rejuvenation, however, has been frequently described in women suffering from ovarian tumours and reproductive disorders. This misuse of the term in these instances has resulted from the effects of excessive secretion of the female hormone estrogen. Although estrogen may seem to offset some of the appearances of aging—thus its widespread incorporation into facial creams—the effect on rejuvenescence is relatively superficial. As in the male, the sexual hormones may alter the background of physiological reactions and modify the structural integrity of the cells and tissues, but they have little lasting effect on the primary causes of aging and senility.

A kind of "rejuvenescence" has been acknowledged as occurring among certain types of single-celled animals. These Protozoa undergo various forms of sexual recombination (conjugation or endomixis) which add new life to the organism or to the strain (*see* REPRODUCTION). This phenomenon, however, is analogous in the higher animals not to rejuvenation of the individual but to procreation of a new being. Life continues uninterruptedly from gen-

eration to generation, with the germ plasm manifesting signs of immortality. Thus, while the germinal elements become the source of posterity, the body seems predestined to weaken, grow old and die, and no means have been found to seriously alter this decline.

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RELANDER, LAURI MRISTIAN (1883–1942), president of Finland, born May 31, 1883, and educated at Helsinki university. He was a member of the central committee of the agrarian party in 1909, sat in the diet from 1910 to 1913 and 1917–19, when he became its speaker. From 1925 to 1931, he was president of the republic. He died Feb. 9, 1942.

RELAPSING FEVER (FEBRIS RECURRENS) is an infectious disease characterized by recurring febrile symptoms and caused by spirochetes that have been given a number of conflicting genus and species designations: Borrelia (*Treponema*) recurrentis (obermeieri, duttoni, etc.). The spirochetes are transmitted from man to man by lice of the genus Pediculus, and from animals to man by ticks of the genus *Ornithodoros*. The human disease is characterized by sudden onset with violent febrile symptoms, which persist for about a week in cases contracted from lice, and usually for a shorter period in the tick-transmitted disease. The attack ends by crisis with profuse sweating. followed after about a week, during which time the patient is fairly well, by a return of the febrile symptoms. Additional relapses may follow—rarely more than one or two in the louse-borne disease, but up to 12 (usually decreasing in severity) in cases contracted from ticks. The mortality is variable. ranging from nil in some tick-transmitted varieties to 6% or as high as 30% in some recorded louse-borne epidemics associated with famine conditions. The spirochetes may invade the central nervous system and cause a variety of neurological symptoms, although these usually are not severe.

Relapsing fever spirochetes were the first microscopic organisms to be associated clearly with serious human disease. Otto Obermeier observed these organisms in the blood of relapsing fever patients in 1867–68 and published his observations in 1873 The organisms are corkscrew-shaped spiral threads, which rotate rapidly in performing forward, backward and twisting movements.

They are easily observed in dark-field microscopic preparations of the patient's blood collected during the height of a febrile attack, but disappear from the blood during the intervals between attacks. These observations, as well as the relapsing symptoms, have been related to changes in the immunological (antigenic) characteristics of the spirochetes, which cause each attack and relapse. As the patient develops immunity to the prevailing immunological type and recovers from the attack, a new (mutant) immunological type of the spirochete develops and produces the relapse. Louse-borne relapsing fever has tended to occur in extensive epidemic outbreaks when human populations live under conditions which are conducive to louse infestation. Since neither the bite nor the excreta of the louse is infectious, human infections usually result from crushing the louse on the skin while scratching. Tick-transmitted relapsing fever does not occur in extensive epidemics. Cases usually are related to tick-infested human or animal habitats, because the ticks tend to engorge rapidly, detach and hide about the premises while digesting their meal, mating and laying eggs. The adult ticks may live and remain infectious for as long as five years without feeding. The spirochetes frequently invade the eggs of infected female ticks and survive in the body of the developing lawae and nymphs. Therefore, all developmental stages of the tick may transmit the infection by bite or otherwise.

Arsphenamine and related arsenical drugs have been used extensively in the treatment of relapsing fever. However, many treatment failures with these drugs have been recorded. Penicillin has proved effective in curing many cases of the disease. Other antibiotics such as aureomycin, terramycin and related compounds also have proved to be effective therapeutic agents. Inadequate therapy commonly results in relapse after treatment, probably due to the persistence of live spirochetes in the brain, where the drug concentration does not reach curative levels. After treatment these protected spirochetes may reinvade the blood stream and start a relapse. (V. T. S.)

RELATIVITY. Since the time of Galileo the concept of relativity, in its broadest sense, has always been present in physics. Loosely speaking, this concept can be expressed simply as a question: Do the laws of nature. and hence the physical situations described by them, always appear to be the same to different observers, even though the state of motion of the observers is not identical? It is with this question that we will be concerned in the following discussion.

GALILEAN RELATIVITY

If we wish to describe a physical event, a system of reference is needed to specify its position. The reference system can be formed by a co-ordinate system in space and by clocks which are fixed to this co-ordinate system to indicate the time. Also, we need a noncommittal word to describe experience. We will consider the experiences as a succession of events, each of which happens at a given point in space at a given time. Mechanical experimentation has shown that there are systems of reference such that a body in them, not acted upon by external forces, moves with constant speed along a straight line, and the laws of mechanics take a very simple form; to wit, if forces are acting upon the body, the acceleration will be proportional to the acting force. Such frames of reference are called inertial. (The name originates from the way the laws were visualized. We may assume that an innate property. inertia. keeps the body moving on a straight line in the absence of external forces, while the acceleration arises via an interplay of the external forces and inertia.) Is there more than one inertial frame? If so, then all these inertial frames will be equivalent, since in all of them the laws of mechanics (and, we hope, the laws of physics as well) will be the same. If we survey our everyday experiences we can observe immediately that such equivalent systems of reference do indeed exist. For example, consider the fact that experiments performed upon the earth, involving only observations relative to the earth. tell us nothing about the motion of the earth around the sun. not to mention' the motion of the solar system through space. Similarly, observations performed in a smoothly moving railway car, without looking out the window, do not enable us to decide whether the car is at rest or in uniform motion. Of course, if the car proceeds with jolts we realize that it is not at rest, or not moving with a constant velocity.

Thus we may tentatively announce this statement: if a system of reference S is inertial, and if another system S′ moves with a constant velocity relative to S, S' will also be an inertial system of reference. However, this does not enable us to specify completely the relations between the description of events in S and S. To do this we have to answer the following question: If in S′ an event took place at the point x' at time t', what will be the place x and time t of the same event in system S?

To fix the ideas with an example let us consider a simple case. Brown is traveling in a railway train which moves with a uniform velocity of 60 m.p.h. along a straight line. This moving train is system S'; the distances x' can be measured, say, by numbering the cars. The time Y is the time shown on the clocks in each car. While Brown is walking to the dining car, he slips and breaks his leg. This is the event we will discuss. This event happened in the first car, and we can specify x' by measuring it along the train and tracks. The time when the event happened was just two hours after the train's departure, according to the clocks in the train. This specifies Y, to wit t'= 2 hr. Vow, shifting to another frame of reference, S, the frame in which the railway stations are at rest. what are the values of x and t? Here classical mechanics makes the following assumptions: the time of the event is the same in both frames (the clock at the railway station shows the same time as the ones in the train); lengths measured in both frames are the same. Consequently, in frame S, $t = t' = 2$ hr.

In turn, x can be calculated this way: The train has traveled for two hours, and during each hour the distance covered was 60 mi.; hence, the total distance traveled is 120 mi. If we measure distances in S from the point of departure, $x=120$ mi. Formally, this relationship between the co-ordinates x, y, z, t and x', y', z', t' gives the following transformation equations:

$$\begin{aligned} x &= x' + ut' \\ y &= y' \\ z &= z' \\ t &= t'. \end{aligned} \qquad (1)$$

Here we have assumed that the co-ordinate axes in S and S' are parallel, that their origins coincide and that the motion takes place in the x direction; u is the velocity of the primed co-ordinate system S', relative to the unprimed one, S. A transformation based on these assumptions bears the name Galilean transformation.

Thus the principle of special relativity takes the following form in classical mechanics: if S is an inertial system of reference, and S' is a system of reference which moves with a constant velocity relative to S, then the laws of mechanics must have the same form in S and S', provided x, y, z, t and x', y', z', t' are connected by a Galilean transformation. Briefly. we may say the laws of Newtonian mechanics are invariant under Galilean transformations.

Of course, the next question is whether the rest of the physical laws are also invariant under this transformation. In other words, this would mean that such experiments which do not rely exclusively on the laws of mechanics should also be unable to tell the observer whether he is at rest or in uniform motion, using the connections given by equations (1) between the primed and unprimed quantities. We encounter such experiments in electrodynamics where we deal with the behaviour of the electric and magnetic fields; *e.g.*, the propagation of light. However, we very soon realize that such is not the case. The simplest way to see this is perhaps the following. The Galilean transformations, equations (1), give rise to a certain addition law of velocities, the one we commonly use in everyday life. For example, if a man walks along a moving train with a velocity of 2 m.p.h. relative to the train, in the direction of motion of the train, and if the train moves with a velocity of 60 m.p.h. along the tracks, then the velocity of the man relative to the tracks will be, we say, 62 m.p.h. If in place of the walking man we think of a light signal traveling along the train, emitted from a source on the train, we would expect that its velocity also would be different if it is measured relative to the train or relative to the tracks. However, experiments show that the speed of light is the same in all inertial systems of reference. (The experiment performed by Michelson and Morley will be discussed later.) Consequently, the Galilean principle of relativity applies only to mechanics, and not to electrodynamics. Putting it in another way, the Galilean principle of relativity and the constancy of the light velocity in an inertial frame of reference seem to be logically incompatible.

SPECIAL THEORY OF RELATIVITY

The resolution of this paradox was accomplished by Albert Einstein in 1905. He clearly realized the three assumptions underlying the Galilean principle of relativity and the different roles the constancy of light velocity plays in each. The three assumptions were the following: there are inertial systems in which the laws of physics are identical; if one system is inertial, any system of reference which moves with a constant velocity relative to the first one is also inertial; the transcription of space and time data from one inertial system to another has to be done according to the Galilean transformations as given by equations (1). The first two assumptions assert that it is the relative configurations of bodies which determine the physical phenomena (and not their configurations and motions relative to some external frame of reference), while the last one indicates how we have to translate the results we have obtained in one inertial frame to get the results observed in any other inertial frame. Experiments indicate that in electrodynamics, as well as in mechanics, all phenomena depend on relative configurations and motions only. Thus the first two assumptions should be valid no matter what assumptions we make about the velocity of light. What about the third one? As we have seen in the discussion preceding equations (1), the Galilean transformations assume tacitly that the position and time of occurrence of an event are the same in all inertial frames. The question arises uhether or not this assumption is sensible if the velocity of propagation of signals (light signals) is not infinite. This would question, then, in our example of the train, whether it is sensible to assume that the clock at the railway station shows the same time as the one in the moving train. We can see that this is not a valid assumption. To show this, let us try to achieve simultaneous operation of the clocks. We could start two identical clocks, one in the railway station and one in the car when the train is at rest at the railway station. If the rate of the clock would not change when the train is set in motion we would have accomplished our task. However we do not know this, and we either have to test this hypothesis or proceed in a different fashion. What we inevitably will do is the following: we take two identical clocks, put one on the train and leave the other one at the railway station. Now, when the train is in motion we send a signal from the station to the train, say exactly at noon. If this signal would travel with an infinite speed we simply would set the clock in the train to indicate noon, and the synchronization would be accomplished. However, if the signal travels with a finite speed we must take into account the time which is needed for the signal to reach the train. It is just this delay which is ambiguous. The conductor, knowing that the stationmaster is to send the signal at the time t later than the train was at the station, says that the distance is ut, where u is the velocity of the train, and if the signal velocity is c, the delay is $(u/c)\ t=\beta t$, where $\beta=u/c$. He will then expect to receive the signal at $t'=t\ (1+\beta)$. The stationmaster will say that, since the train is receding during the signal's flight, the distance traveled by the signal is $u\ (t+\Delta t)$ and the delay time is given by $\Delta t=\beta\ (t+\Delta t)$ or $t'=t+\Delta t=t\ (1-\beta)^{-1}$.

The difference in the two computations is exactly that in the naive Galilean reference it is impossible that the signal velocity, c, can take the same numerical value in two reference systems moving with a velocity u with respect to each other. Since both conductor and stationmaster observe, in the train and in the station, respectively, that light velocity has the same numerical value, c, each computes the delay time as though the other is moving away from him. The conflict between the computations of conductor and stationmaster is resolved if each believes that the other's clock runs slow by the factor $\sqrt{1-\beta^2}=\sqrt{(1+\beta)(1-\beta)}$. The conductor will then say that his clock should register $t'=t\ (1+\beta)/\sqrt{1-\beta^2}=t\sqrt{(1+\beta)/(1-\beta)}$, whereas the stationmaster will compute $t'=t(1-\beta)^{-1}\sqrt{1-\beta^2}=t\sqrt{(1+\beta)/(1-\beta)}$. They will still disagree about whose clock runs slow. and still disagree about the delay in the signal, but they will agree in the computation of the relation between t' and t, an agreement that is verified experimentally.

To sum up this important step, we can say that the constancy of the velocity of light in different frames. and the existence of equivalent frames, are logically compatible if we modify the transcription of space and time data from one inertial system to another. This means that we must find another set of transformations which will take the place of the Galilean transformations. Moveover, this modification is not only permissible but required, from a physical standpoint. since it is the mathematical description of the empirical procedure to set up synchronous clocks in different inertial systems of reference. It was the brilliant achievement of Einstein to realize that this modification of our space and time concepts (to achieve the logical compatibility of equivalent frames with the existence of a constant velocity of light) is required if we analyze carefully how a finite signal velocity influences the meaning of time in a system of reference, if time is defined in terms of operations such as the indications of clocks which are situated in the immediate neighbourhood of the event, moving with the same velocity as the observer.

Our next step is then to find that set of transformations which will replace the Galilean ones. This will furnish us with the rela-

tions which tell us how to correlate space and time data in two different systems of reference, moving with a constant velocity relative to each other, in such a fashion that the velocity of light should be the same in both. If we try to satisfy chis last condition we find the transformations to be of this form:

$$\begin{aligned} x &= (x' + ut')\gamma \\ y &= y' \\ z &= z' \\ t &= (t' + \tfrac{x'u}{c^2})/\gamma \end{aligned} \qquad (2)$$

where c is the speed of light, $\beta = u/c$ and $\gamma = \sqrt{1-\beta^2}$

The relative arrangement of the co-ordinate systems is the same as for equations (1). These equations describe the so-called Lorentz transformations, named for Hendrik Antoon Lorentz, a Dutch physicist who investigated them for the first time before Einstein.

We have then a framework which is based on three postulates: that inertial systems of reference exist; that inertial systems differ from each other at most by the fact that they may move with a constant velocity relative to each other; and that the transcription of space and time data from one inertial system to another is done according to the Lorentz transformations, equations (2). The physical description of the external world which satisfies these conditions is called Lorentz invariant and forms the Special Theory of Relativity.

The experimental confirmation of this theory is so extensive that we can give only a few examples. First let us discuss the special implications of the Lorentz transformations. Naturally, we will expect that some interesting consequences arise from the fact that we no longer have an absolute time, the same in all frames of reference. This means that both the spatial distance between points and the duration of a process will change as we change systems of reference. For example, a metre rod, if at rest relative to us, has the length one metre. Set it in motion in the direction of its axis, measure its length again, and the new measurement will be less by a factor $\sqrt{1-\beta^2}$. For ordinary velocities this factor is practically one; for large velocities, however, it may be much less than one. For example, if the metre rod is flying by an observer with a velocity of about 0.85 times the velocity of light ($\beta = 0.85$), the observer will measure its length to be only a half metre.

With time indications it is just the other way around. The seconds indicated by a moving clock will be longer by a fraction $1/\sqrt{1-\beta^2}$ (longer, since this factor is bigger than one). This is very dramatically confirmed by recent experiments on elementary particles. In nature we encounter elementary particles, the mesons, which have a rather short lifetime. In principle this lifetime could be used as a time measure, and so the meson could function as a clock. Accordingly. the lifetime of a moving meson ought to be longer than the lifetime of a meson at rest. In cosmic rays the mesons move practically with the velocity of light, and thus the life of a moving meson should be much longer than that of the meson at rest. Indeed, mesons which are stopped in an absorber have a lifetime of about 1.5×10^{-6} sec. On the other hand, in cosmic radiation a meson travels a distance of about 50 km. before it decays. From this fact we find that the speed of such a meson is about $(1 - 1/5{,}000)$ times the velocity of light. and the lifetime of a meson in our reference frame is increased by the enormous factor of 50.

As far as electrodynamical experiments are concerned, they naturally will agree nith the Special Theory of Relativity, since the latter was created just to incorporate these experiments. Consequently, the success of Maxwell's electrodynamics means automatically the success of the relativity theory as well. For historical reasons we mention the famous Michelson and Morley experiment which showed conclusively that the velocity of light is the same in all inertial systems of reference. The idea of the experiment, which is due to James Clerk Maxwell, is very simple. Suppose that the velocity of light does depend on the state of motion of the observer; then. test the consequences of this hypothesis. We send outa light signal in the direction of motion of the earth, and another signal in the opposite direction. In one case the observer travels in the same direction as the light, which, under the hypothesis, would make the observed light velocity less than if the observer had been at rest. In the other case the velocity of light as observed should be larger than the velocity observed by an observer at rest. The difierence between these two velocities could be observed interferometrically. This task was performed first by A. A. Michelson (1881), and later in improved form by Michelson and E. W. Morley (1887) (see MICHELSON-MORLEY EXPERIMENT). The result was negative; no difference in the velocity of light was found. Naturally, there were attempts to explain this before establishment of the Special Theory of Relativity.

In 1893 G. F. Fitzgerald, an Irish physicist, and in 1895 Lorentz proposed independently the following explanation. Suppose that the velocity of light does vary with the state of motion of the observer. But suppose as well that the linear dimension of a body in the direction of the motion contracts in the ratio $\sqrt{1-u^2/c^2}$. Then, the observed velocity would be the same, independent of the velocity of the observer. Moreover? this supposition conformed with the theory of electrodynamics, since Lorentz showed that if matter consisted only of charged particles held together by electromagnetic forces, then, if set in motion, the relative positions of the particles would adjust themselves in such a fashion that the contraction would take place.

We know now that this contraction does not depend on the special nature of the forces which keep matter together. but is a simple consequence of the Lorentz transformations, as we have seen in the discussion of equations (2).

Let us turn now to the mechanical experiments. First, a remark. While electrodynamics was born Lorentz-invariant, though its creator. Maxwell, did not realize it, mechanics was made to be Lorentz-invariant. This happened in two steps. First, modifications were introduced in the definitions of mechanical quantities so that the Newtonian equations of motion would conform to the Special Theory of Relativity. The classical concepts of mechanics, such as inertia and force. were retained, however. Finally, with the advent of the General Theory of Relativity, even these concepts were modified or removed. In this section we will discuss the first stage of development, while the next stage will form the content of the description of the General Theory.

The reformulation of dynamics in a Lorentz-invariant form, while retaining the classical concept of force, brought some beautiful results. Classical dynamics contained three most important laws concerning the conservation of energy, momentum and mass. These laws were essentially independent. and we would have been able (in principle) to drop one and retain the others. In the Lorentz-invariant formulation this freedom no longer exists. Here, the three conservation laws are fused into one: and the violation of one entails the violation of all. Moreover, because the conservation of energy is linked to the conservation of mass. processes are permitted which would change energy into mass, or mass into energy (if the amount of mass which disappears in a given physical event is m, there will appear an amount of energy $E = mc^2$, c being the speed of light). Indeed, the last of these processes is the one which provides us with prodigious amounts of energy in nuclear reactions.

In other respects, the differences between the classical and relativistic dynamics are most pronounced in the description of fast particles. This is natural, for we know that the difference in the classical and relativistic descriptions arises from the fact that in the classical theory there is no limiting velocity. If a particle moves slowly, it cannot make any difference, as far as the result is concerned, whether we consider a limiting velocity which is very large, or actually infinite. Expressing it in another way, classical Newtonian mechanics must be a limiting case of relativistic mechanics. This limiting case can be reached from the relativistic formulation by placing the velocity of light equal to infinity. and it can be applied in cases where the actual velocities of the bodies under description are much less than that of light. (This is a good example of the growth of physical theories. Each theory describes a part of our experiences correctly. However, the conditions under which this description is correct are usually

less general than was originally thought. With the arrival of new facts this is realized, and a new, more general theory is created which, though it may be based on entirely different concepts. contains the mathematical formalism of the old one as a limiting case. Thus a new physical theory does not replace the old one but generalizes it.)

There are numerous examples showing that the proper description of fast-moving particles is the relativistic one. In modern research, physicists often experiment with very fast particles, which are accelerated in machines by electromagnetic fields. In the design of these machines (cyclotrons, betatrons, etc.) the physicist uses relativistic dynamics with the same confidence that an engineer feels when he uses Newtonian mechanics to design motorcars. The successful operation of particle-accelerating machines shows how correct the relativistic description of fast particles is.

The mathematical description of the Special Theory of Relativity and its content was greatly simplified by the geometrica! interpretation given to it by Hermann Minkowski, a German mathematician. This interpretation had the most far-reaching significance, since geometrization provided the clues which finally enabled Einstein to generalize the theory so as to embrace gravitational forces as well. Moreover, Minkowski's interpretation suggested the proper mathematical tools, tensor calculus and differential geometry, which gave the theory great elegance.

The underlying idea is the following. Every observer must specify four data (x, y, z, t) to describe an event. The first three of these will specify the location of the event relative to a co-ordinate system, while the last one specifies the time relative to a clock at rest in this co-ordinate system. In those cases where there are only three (or two) quantities to be specified. it is quite customary to draw a graph to represent the totality of these measurements at one glance. Even if in practice we cannot draw a four-dimensional graph (plot four quantities at once), we can think about it. To facilitate our understanding we will now contemplate only situations where the position can be given by two data only. So, let us suppose that we are aboard an ocean liner and we want to have a graphical record of our journey. The simplest thing to do is to take the map and at each hour, say, put a point at the proper latitude and longitude where the boat is, and write next to it the time, It is much more revealing, however. if we make a three-dimensional model, and put the dot not on the map, but above the intersection of the proper longitude and latitude. The perpendicular distance from map to point should be proportional to the time elapsed from the departure. If we do this each hour and finally connect all these points with a thin wire. the wire will contain in a graphical form all the information about the journey.

This information shows not only the location of the boat at a given time, but much more. If the wire is straight, it tells us that the boat has traveled on a straight line with constant speed. If the wire lies in one plane (normal to the map), but describes a curve in this plane, the boat was traveling on a straight line, though the speed did change during the course, etc.

Now if we take a particle instead oi the boat and note mentally in a four-dimensional space its position (x, y, z) at time t for each instant of time, we will get a similar plot. Each point on the plot specifies an event. and the resulting curve is called the world line of the particle; it describes the history of this particle. The four-dimensional continuum in which the plotting takes place is called space-time (*q.v.*). The immense importance of this concept is as follows: suppose that several different observers, each using a different inertial system of reference, are observing the motion of a particle, and each is asked to construct a space-time diagram of the motion. According to the Special Theory of Relativity, each observer will construct exactly the same curve in space-time for the history of the particle. The different states of motion of the observers (since they use different inertial systems of reference) will manifest themselves by the fact that the co-ordinate axes in space-time, x, y, z, t (which localize an event in space-time relative to the inertial system of reference used by the observer): will be different for different observers. The relations between these axes is that given by equations (2); thus, we can pass from one set of axes in space-time to another set by a Lorentz transformation.

This is the great moment of geometrization. In geometry we are dealing with the description of objects and the relations among them. Such objects can be points, lines, planes, surfaces, bodies, etc. We describe them by giving the co-ordinates of the corresponding points relative to a co-ordinate system. If we change the co-ordinate system we change the description, but we do not change the configuration of the points we describe. In relativity theory the histories, the configurations of points describing events, are objective. Their description relative to an observer depends, however, on the co-ordinate system in space-time that the observer uses and the co-ordinate system in turn depends on the state of motion of the observer. A Lorentz transformation corresponds to a change of co-ordinates in space-time. As a co-ordinate transformation leaves the configuration of points unchanged, so a Lorentz transformation does not change the histories. Also, in a co-ordinate transformation the new co-ordinates, in general, will be given combinations of the old co-ordinates. In a Lorentz transformation the new space-time co-ordinates will be a combination of the old space-time co-ordinates. The mixing of space and time co-ordinates in a Lorentz transformation is then no more mysterious than the mixing of co-ordinates in an ordinary co-ordinate transformation. Moreover. the physical laws will now be geometrical propositions concerning world lines. In this way our geometrical intuition can come into play again, and can furnish help in the formulation of theories and problems. We will at once expect that the significant geometrical properties, such as curvature, torsion and straightness, will also describe physically significant properties. Indeed, this is so. For example: a curved world line shows that the particle was accelerating, and thus we know that a force was acting on the particle whose history is described by this world line. The place and time of the action can be determined by locating the curved section of the world line relative to a system of reference in space-time. The magnitude of the curvature will be simply proportional to the magnitude of the force and the work done by the force. As a corollary we see that if no forces are acting on a particle its history is a straight line in space-time.

In geometry it is the distance between two points which has an intrinsic significance: while the projections of this distance upon the co-ordinate axes depend on the co-ordinate system, and vary as the co-ordinates change. A similar thing happens in relativity theory.

The distance between events, which we will call an interval, is something absolute, represented by a line segment connecting the two events. Each observer will split this interval into a space part and a time part., relative to his own inertial system of reference; the spatial part will be the projection of the interval upon the spatial co-ordinates (x, y, z), while the time part will be the projection of the interval upon the time axis. This splitting into spatial and time parts will depend on the orientation of the co-ordinate system x, y, z, t in space-time.

For example, take as one event the Great Fire in London. and for the other event the outburst of the nova Persei. The observer who is at rest relative to the earth (and so, relative to London) will split space-time with his co-ordinate axes and find that the outburst took place a century before the Great Fire and many millions of miles away from London. An observer who travels with a constant velocity relative to the earth may conclude that for him the distance and time elapsed is different. There will even be an observer with a certain velocity such that for him the two events took place simultaneously. Each observer slices up space-time into a space part and a time part, and the slicing depends on the orientation of the co-ordinate system. Thus, as Minkowski has put it: "Space in itself and time in itself sink to mere shadows, and only a kind of union of the two retains an independent existence."

GENERAL THEORY OF RELATIVITY

The Special Theory of Relativity has not only solved problems,

but has posed some new questions. As is usual in physical theories. the advent of new viewpoints forces us to re-examine the concepts which we used freely before. With the advent of the Special Theory of Relativity these questions were abundant. In discussing the Special Theory we have learned that the histories in space-time have some permanent significance, at least so far as Lorentz transformations are concerned. Now, if the geometrical interpretation makes sense, we would think that the other, more general transformations should be also of significance. (A geometrical figure remains the same, irrespective of the co-ordinates we use to describe it.) At firs; sight the introduction of general transformations is clearly nonsensical. Such transformations in space-time correspond physically to the use of noninertial coordinate systems. Now, it is a familiar story that in noninertial systems of reference we have fictitious forces acting. Such forces are the centrifugal and Coriolis forces, which manifest themselves in rotating systems of reference. They are called fictitious because we can make them disappear by changing back into an inertial frame of reference. Consequently, we can distinguish between these frames of reference and inertial frames, and thus the simple principle of relativity cannot hold. However, our geometrical intuition insists that there must be something behind this idea. So let us analyze what happens if we observe a physical system from an accelerated system of reference. The fictitious forces we encounter have two important characteristics. First! they impart the same acceleration to every body, irrespective of its mass; second, these forces can be transformed away by the simple device of transferring ourselves to an inertial system of reference. As an example, consider what happens when we ride in a railway train. As long as the train moves in a straight line with a uniform velocity, everything inside the train behaves as if the train were at rest. Now the train makes a turn; the luggage in the train starts to slide, the water surface in a pitcher is no longer horizontal. Sitting inside the train, we conclude that a force is acting on these objects. The acceleration imparted by this force is the same for each body, and it disappears as soon as the train runs in a straight line with constant velocity. However, we can also say that, after all, the objects in the train wanted to continue to travel on a straight line with a uniform velocity on account of their inertia, and only we, the observers (and our system of reference, the train), were accelerating; hence, it is natural that all objects should have the same acceleration, since after all this is just the observer's acceleration in the opposite direction. Thus, the inertia of the body is essentially what we see as a fictitious force. Also. it is obvious that if we cease to be in an accelerated frame of reference, we will see the other objects travel along straight paths with constant velocities (if they are not acted on by other forces), thereby transforming away the fictitious forces. If we say all that, we are correct. The puzzling thing, however, is that there is another force, the gravitational force, which has these two properties. A falling apple undergoes the same acceleration as a falling cherry. though their masses differ. Also, if we fall together with the apple, it will appear to be at rest relative to us. apparently with no force acting on it.

This suggests that there must be an equivalence between noninertial systems of reference and gravitational fields, in the sense that an observer performing observations locally cannot distinguish between gravitational forces and forces which arise on account of accelerated systems of reference. Consequently, the admission of noninertial systems is necessary to construct a theory of the gravitational forces. But if accelerated systems are equivalent to gravitational forces, then gravitational forces should be in all respects similar to the fictitious forces. We have seen that these fictitious forces are essentially the manifestations of the inertia of bodies. The gravitational forces then must be similar manifestations.. How could we formulate this?

We have learned in the Special Theory that the world lines of particles not acted upon by any forces are straight lines. These world lines have the important geometrical property of being as "straight" as possible. In geometry such lines are called geodesics. This we will consider as the proper characterization of inertia, and we can say that the world line of a particle subjected only to its own inertia is the straightest line in space-time; it is a geodesic. Then, if we exclude any other forces, except gravitational and other fictitious forces which should be the manifestations of the inertia of the bodies, we should be able to say the following: there are no forces acting on bodies; bodies always move freely under the influence of their own inertia. Consequently, their motion is such that their world lines are geodesics in space-time.

This space-time, of course. cannot be the space-time of the Special Theory, for there, we have just learned, the geodesics correspond to the motion of bodies which are not subjected to gravitational forces in the ordinary Newtonian usage of the word. The space-time continuum of the General Theory of Relativity must have additional properties. What are they? Again, our geometrical intuition comes to help. We know that the properties of geodesics depend on the curvature of the geometrical space. As a simple example let us take a two-dimensional space, a surface. If.this surface is flat, the geodesics on it are ordinary straight lines (in the sense of Euclidean geometry); if the surface is curved, *e.g.,* if it is part of the surface of a sphere, the geodesics are not "straight" any longer in the Euclidean sense. On the surface of a sphere the geodesics are great circles! and their projections onto a plane will appear as curves. Thus, our analogy will lead us to believe that, in general, space-time will be curved. while the space-time of the Special Theory was flat. The history of a particle will be described by a geodesic in this curved space-time. If we would project this geodesic onto the flat space-time used in the Special Theory, we would get a curve which is not a geodesic in this flat space-time. The deviation from a geodesic in flat space-time will become larger as the curvature of space-time increases. However, our considerations must embrace the fact that in Newtonian mechanics gravitational forces exist only in the neighbourhood of masses. This must find its counterpart in the geometrical picture. The reasoning is very simple. If gravitational forces find their expression in the curvature of space-time, and these gravitational forces were caused by masses in the Newtonian theory, then, in the General Theory, the masses must cause the curvature of space-time. Indeed, this seems to be the solution.

The structure of the Newtonian theory of gravitation is the following. Space and time are the stage upon which physical processes are displayed. In these processes the masses are acting directly upon each other. In the General Theory of Relativity, space and time are first fused together into a continuum called space-time. The geometrical properties of this space-time determine the evolution of the physical processes in space and time. The geometrical properties of the space-time continuum in turn are determined by the masses (and physical processes) present in space and time. Thus in the latter theory we do not have anything external or uninfluenced. and the series of causes of mechanical phenomena is closed. (Observe, however, that this is not so for phenomena caused by electromagnetic and nuclear forces.)

These ideas and their mathematical formulation were finally given by Einstein in 1916. The geometrical properties of space-time are characterized by ten functions, which form the so-called "metric tensor" of this four-dimensional continuum. (Knowing the metric tensor, we can compute the separation of any two events in space-time.) Einstein formulated the field equations which relate these ten functions and their derivatives to ten other functions which describe the material content of space-time. These second ten functions form the "energy-momentum tensor," and they are the measure of the amount of energy (hence also mass) and momentum present in a portion of space at a given time.

The relationship mentioned has a very simple physical significance and is the mathematical expression of the idea that the curvature of space-time is caused by the masses and their motion. From the metric tensor and the derivatives of its components we can form another tensor which is the measure of the curvature of space-time at a given point in space-time. Einstein's equations state essentially that the curvature of space-time at a given point in space-time is proportional to the amount of energy and momentum present at that point in space-time. Moreover, from the

geometrical picture we can see that there always will be such a system of reference in which events in the immediate neighbourhood of the observer (local events) can be described according to the Special Theory. This follows from the fact that any curved space can be approximated locally by a flat space which is tangential to the curved space at that point. (For example. think of the curved space as the surface of a sphere, and the tangential flat space as the tangential plane.) Physically this corresponds to an accelerated frame of reference which has the same acceleration as caused by the gravitational forces at that point. (Thus again we can see how a more general theory embraces the special one as a limiting case.)

For any given material content, we can solve. in principle, the field equations and obtain from them the metric tensor. From the metric tensor we can compute the geodesics of space-time, which describe the history: and thereby the motion, of matter in the universe. The history of light rays can also be obtained, since they iorm a special class of geodesics, the "null geodesics." (These have no simple geometrical analogies from ordinary geometry, so we will omit discussion of them.)

Logically, then, the theory rests in its present form on two different postulates. First, the metric tensor shall satisfy the field equations; second, the history of a particle is given by a geodesic in space-time having the aforementioned metric tensor. Although we have seen that the second postulate played an important role in the formulation of the theory, the question arises whether we should not be able to discard it and extract all the information from the field equations only. Indeed, this proves to be the case. In a beautiful set of papers, Einstein and his coworkers attacked the problem in this fashion during the years 1938–49. Let us assume that mass points can be represented by singularities of the metric tensor. If, then. we want to have a solution for the field equations, the singularities must satisiy certain conditions. These conditions turn out to be just the equations of motions of mass points.

Sow what about the experimental verification of the theory? The theory was subjected to three important tests. First. we can compute the orbits of planets from the General Theory. Barring the planet Mercury, the difference between the Newtonian orbit and the relativistic one is negligibly small for practical purposes. However, for Mercury. the Newtonian theory predicted the orbit incorrectly. Since the time of U. J. Leverrier, the French astronomer, it was known that there is a discrepancy between the observed motion of the Mercury perihelion and the one predicted by Newton's theory, even if we take into account the perturbations caused by the other planets. The first big success of the General Theory came when Einstein showed that this discrepancy disappears if we perform the calculations relativistically.

There are two other effects predicted by the General Theory, both concerning the propagation of light. According to the General Theory the world lines of light rays must also be geodesics (null geodesics). Consequently the propagation of light will also be influenced by the presence of masses. For this reason light rays will be deflected from their original path if they pass in the neighbourhood of bodies. If these bodies are very large, the effect can be observed. (Actually; rays which pass the object near enough will circle around it a few times before they go off to infinity!) The most suitable large mass at our disposal is the sun. The measurements can be performed in the following fashion. First we take a photograph of a part of the sky when the sun is not in that neighbourhood. Sext we take one when the sun is there. Saturally, the latter picture has to be taken during a total eclipse; otherwise, we will not see the nearby stars at all. If the sun deflects the light rays, the angular distance between two stars lying at diametrically opposite sides of the sun must be larger on the second picture than on the first one. There have been five attempts to measure the effect precisely. All measurements have shown the effect to be present. The precise evaluation of the numerical magnitude. however, is very difficult on account of experimental complications. The theoretical value is 1.74 sec. The five experimental observations scatter around this value, and each observation has a probable error large enough to embrace the theoretical value. (Two of the five observations took place in 1919, and one each in 1922, 1929 and 1951.)

The third experiment concerns the frequency shift of spectral lines emitted by atoms located in a gravitational field. We have already mentioned in discussing the Special Theory that atoms can be considered as clocks, since the radiation emitted by them has a periodicity· the frequency, which can be used to measure time. One of the predictions of the General Theory is that clocks in a gravitational field run slower than the same clock would run if the gravitational field were not present. Consequently, the slowing down of an atomic "clock" will mean the emission of light with a smaller period and thus a frequency shift in the spectral lines toward the red. All investigations have confirmed the existence of this effect. However, for atoms located on the surface of the sun, there are so many other disturbing factors which modify the effect that we hardly can attach great significance to the numerical values obtained for the red shift caused by the sun. On the other hand, measurements performed on light emitted by the companion to Sirius give the same order of magnitude as that predicted by the theory.

In our discussion which led up to the formulation of the General Theory we have reduced the concept of gravitational force to that of inertia, eliminating the idea of force (at least the idea of gravitational force). We have done this by agreeing that the world line of a particle should be a geodesic in space-time. The action of other bodies manifests itself only by changing the geometrical properties of space-time.

However, we can now think of this in another fashion. If gravitation could have been conceived as a sort of mutual interaction of bodies (and of course we now have reduced the idea of gravitation to that of inertia) then could we perhaps conceive that inertia is actually a manifestation of a mutual action between bodies? As far as the histories of particles are concerned, we have already done that. But the inertial properties of matter find their expression also in the mass of bodies. So the question arises whether the concept of mass does not depend essentially on the existence of other bodies in the universe. Ernst Mach, an Austrian physicist, first posed this problem, before the advent of relativity theory. It seems that the General Theory answers the question in the affirmative. It follows from the theory that (1) the mass of a body increases when ponderable masses approach it; (2) if neighbouring masses are accelerated there is a force acting on the body (in the same direction as the acceleration) ; and (3) a rotating hollow body creates a field of force inside itself! a field which acts on particles inside the hollow body. These effects are much too small (for ordinary bodies) to be observed. However, it might be possible that if the rotating masses are of cosmic magnitude. of the size of galaxies, for example, the effects on light rays could be detected.

Another interesting inierence we can draw from the General Theory is the way gravitational disturbances are traveling. This is of great interest, since one of the chief objections to Newton's theory was the instantaneous action of gravitational forces; *i.e.*, their infinite speed of propagation. The results are the following. Moving bodies, on account of their motion, emit a weak gravitational field in the form of waves. These waves travel with the velocity of light. At a large distance from the source the waves are transverse and polarized. The energy loss of the source due to this radiation is very small, being proportional to the inverse fifth power of the velocity of light. For double stars the energy loss per year would be about 10^{-12} part of the total energy.

Until now we have discussed how individual masses influence the geometry of space-time. The result has shown that in the main the Newtonian conclusions were good approximations, though the concepts invoked were of an entirely different nature. This was connected with the smallness of the masses, distorting only a little the flatness of space-time. If this be the case, we may reasonably expect that great differences may arise if we consider problems which entail the universe as a whole, considering all the masses in the universe. In other words we may expect that the cosmological theories stemming from the General Theory of Relativity can

be of an entirely different nature than the Newtonian ones. Relativistic cosmologies vary in scope and importance, and though some of them describe part of our experiences correctly, none can be singled out as the best. (*See* COSMOLOGY; COSMOGONY.)

UNIFIED THEORIES

The General Theory of Relativity has eliminated the concept of gravitational forces. The "guidance" of particles does not take place by a direct interaction between them, but is accomplished by the geometrical structure of space and time. Gravitational forces, in the Newtonian sense, arise only if we refuse to interpret properly the geometry of space-time.

Naturally this makes us wonder whether the other existing forces, electromagnetic and nuclear, are also merely misinterpretations of the geometry of space-time. Our aesthetic sense would be greatly pleased if these forces were found to stem from the same origin as the gravitational forces.

There were numerous attempts to endow space-time with such a geometrical structure from which the existence of the other forces would follow. However, while nature gave us a guide in the case of the gravitational forces, to wit, the similarity between fictitious and gravitational forces, we do not see any simple or suggestive relation between the gravitational forces and electromagnetic and nuclear forces. In addition to this, it is also possible that unification cannot be achieved in this fashion. We know now that the description of the microscopic properties of matter and its interaction with radiation brings entirely novel features to physics, features which are dealt with in quantum theory (*see* QUANTUM MECHANICS). These features are not present in the General Theory; and it is quite possible that unification has to proceed via a theory which embodies the quantum aspects. (There were attempts to introduce the quantal aspects by formal manipulations in the General Theory [quantization of the gravitational field]. The nonlinearity of the gravitational field equations makes this approach somewhat ambiguous. For weak gravitational fields the quantization is mathematically unambiguous; the results would indicate that the gravitational field has a particlelike aspect where the particles have a spin two. [Compare this with the electromagnetic field, which, upon quantization, also acquires a particlelike aspect. The particles there are called photons.])

The general trend toward constructing a unified field theory is somewhat as follows: the Riemannian geometry of four dimensions, which described the geometry of space-time in the General Theory of Relativity, has no available functions which could be used to describe other fields of forces. Consequently we have to enlarge this geometry in such a fashion that just the sufficient number of functions appears.

If the unification extends over the gravitational and electromagnetic fields there will be at least 14 functions needed, 10 to describe the gravitational fields as in the General Theory and at least 4 to characterize the electromagnetic field, as in Maxwell's equations. Of course the unification may bring in some additional functions, too, just as in the General Theory ten functions are needed to characterize the gravitational field completely, while in the Newtonian theory one was enough.

Suppose we have some ideas about what this geometry should be; what will then be the essential features of the theory? First, it must furnish a sufficient number of equations from which we can determine the functions describing the fields. Next, it should furnish in some fashion the equations of motions of charged and uncharged particles. If possible, it also ought to furnish a good definition for particle (as, for example, in the General Theory a mass point was a singularity of the gravitational field). Finally, we would expect that the fields will be, in general, tangled up (otherwise we would have only a formal unification), and will reduce to distinct electromagnetic and gravitational fields only under certain conditions, which, loosely speaking, would correspond to weak fields. The theory also should furnish the condition for weakness. If we want to incorporate the nuclear forces, we have to include in our program the description of additional fields, called meson fields.

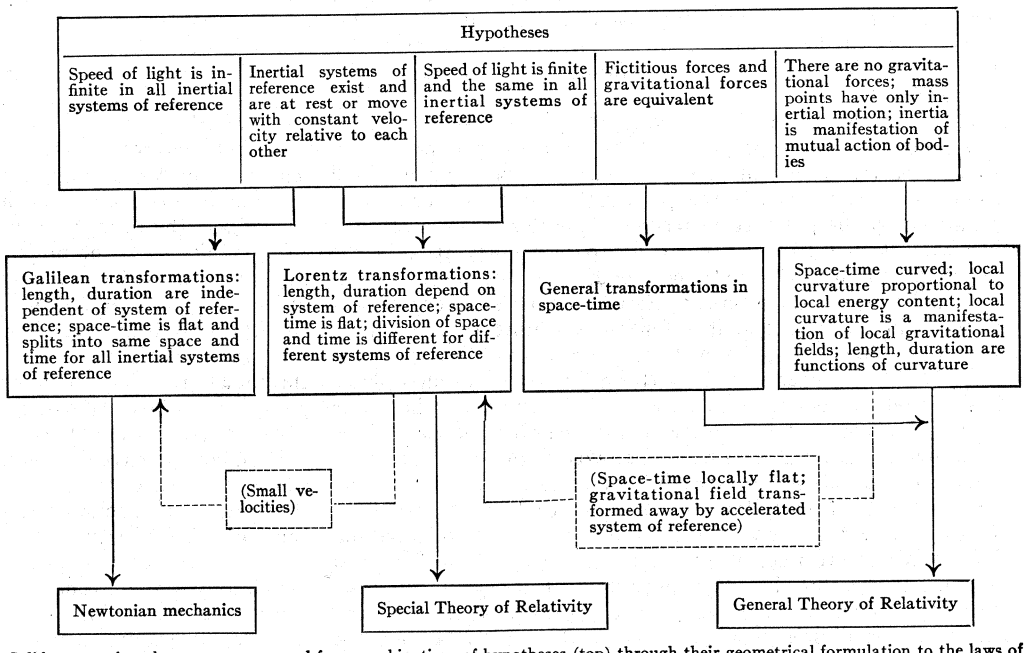
This alone is already a formidable program. However, it is aggravated by the following problem. Suppose we have established tentatively a system of geometrical field equations. The functions, or field components, which are connected in this way have to be identified now with physical quantities, and the equations must be identified with physical field equations. This is not at all so simple as it may sound, and ambiguities may arise. This difficulty of interpretation is a rather novel feature of our unification problem, and it is intimately linked with the fact that our generalization proceeds from mathematical considerations and not from physical ones, which immediately would have given a meaning to the mathematical quantities used to represent the physical observables entering these considerations.

The loosening up of the geometrical structure to accommodate the additional field variables was pursued in two rather different ways. One way retained the idea of a four-dimensional continuum as the playground of physical phenomena, but used a non-Riemannian geometry in place of the Riemannian geometry which described space-time in the General Theory. The other way used a higher-dimensional continuum and projective or conformal geometries (*see* UNIFIED FIELD THEORY).

It is not easy to tell how far these attempts will prove successful. On the one hand, we cannot see clearly the conclusions which can be drawn because of the mathematical complications. On the other hand, as we have mentioned, the physical interpretation is in general far from being evident, and for this reason the interpretation and the mathematical development must proceed together. This complicates both the mathematical understanding and, thereby, the hope of experimental verification or refutation.

However, there is in both theories one prediction, obtained by

Outline of Hypotheses and Their Interrelationships



Solid arrows show how we may proceed from combinations of hypotheses (top) through their geometrical formulation to the laws of Newtonian mechanics and the Special and General theories of relativity. Dotted arrows show ways of passing from one theory to another by using the approximations shown in the dotted boxes.

Erwin Schroedinger, which in principle makes possible an experimental test. Alas, the effect is too small to be measured. This effect is the following: if in a region of space-time gravitational and electromagnetic fields are present simultaneously, an electric current field must be present in the same region, in general. On the surface of the earth, where gravitational and magnetic fields are simultaneously present, this mould correspond to a small additional magnetic field, the strength of which is of the order of r/R times the primary magnetic field strength (the latter being about one-third gauss). The factor r/R is fantastically small, r being the gravitational radius of the earth (a few centimetres) while R is the actual radius of the earth (about 6.4×10^8 cm.).

It is much more difficult to give a coherent and simple account of the unified theories which use higher dimensional geometries. In all these cases the additional dimensions have no physical significance and their introduction is purely formal. The additional dimensions simply enable us to obtain enough functions to describe the different kinds of fields. At some stage or another we have to eliminate, by some assumption, the explicit appearance of the variables describing the additional dimensions (but not, of course, the additional fields), since these dimensions have no physical significance.

Apart from the formal nature of these considerations the principal difficulty is that most of these theories give only a formal unification of the electromagnetic and gravitational fields: both fields remaining clearly separated, irrespective of their strength.

See GRAVITATION ; SPACE-TIME. *See* also Index references under "Relativity" in the Index volume.

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RELATIVITY: PHILOSOPHICAL CONSEQUENCES. The most important philosophical consequence of the theory of relativity is the clarification it has brought into the relations between science and philosophy. The position may be briefly summarized as follows. Up to the 17th century the subject matter of these studies formed a unity, the rudiments of that which we now call science being simply a part of a larger whole. A rift then appeared and gradually widened until, by the beginning of the 20th century, science and philosophy had become quite distinct and a person expert in one was usually very inexpert and ill-informed in the other. The effect of the relativity theory was to re-establish physics on a philosophical basis and thereby to elucidate certain bewildering implications of current research.

More particularly, the position was this. The general problem of philosophy is to give a rational account of experience with the minimum of presuppositions. Consequently it was not originally presupposed that physical experience must be regarded as an effect on our senses of an objectively existing external world having certain definite and ascertainable properties: that was a matter for discussion, and both affirmative and negative answers were given. Modern science, however, originated in the determination to ignore the metaphysical question and to accept experience as an object of study, whether or not it was "real." Thus Galileo discovered the law of falling bodies by measuring how the space covered varied with the time of fall. By carrying out certain processes of measurement he obtained results which stood in a certain relation to one another, and this relation remained true whatever metaphysical status one assigned to motion.

This became the origin and type of a large body of investigation which. by reason of its distinctive character and its rapid growth and success. came to be regarded as something other than traditional philosophy and was given the name "science." Nevertheless. it was still an attempt to give a rational account of experience with the minimum of presuppositions. Moreover, although it needed no supplement. it was in fact coupled from the beginning with a particular view of what the measurements signified. Galileo, for instance. supposed that they represented the magnitudes of certain characteristics of the external world which he regarded as possessing only mechanical properties such as size, shape, position. motion; other qualities (*e.g.*, colours. sounds, temperatures) he thought were not properties of the bodies which seemed to possess them but were contributed by the observing subject. This view was tenable in his day since he was unable to measure such things; but after the invention of thermometers, spectroscopes. etc.. there remained no reason for distinguishing these so-called secondary qualities so fundamentally from motions and shapes. and they were gradually put back into the external world and included among the objectively existing properties of bodies. which science investigates.

The progress of physics from Galileo's time up to the beginning of the 20th century had therefore a t ofold aspect: in practice it was a faithful prosecution of the program of carrying out certain operations of measurement and finding relations between their results; in theory it mas an investigation of the metrical properties of an external world. While the latter view was of almost indispensable assistance in pointing the way to the most profitable operations of measurement to perform. the achievements of physics can clearly stand in their own right if it is abandoned and if no suppositions at all are made about the metaphysical status of the measurements performed. So instinctive. however, had this particular metaphysical interpretation of physics become that when. in 1887, the Michelson-Morley experiment (*q.v.*) gave an incredible result, it occurred to no one for nearly 20 years to inquire whether the root of the anomaly might not lie in the invalidity of that interpretation. That this was actually so is the essential point of Albert Einstein's special relativity theory of 1905.

In the Michelson-Morley experiment a comparison was made between the passage of light along material bars in different states of uniform motion. The bars. when relatively at rest, were equal in length, and since, according to the metaphysical view just described, its length is an objective property of a bar, they were equal in length when in uniform relative motion. for uniform motion, according to Newtonian mechanics, can have no mechanical effect. But if that view is rejected. the "length of a bar" is not an objective property but simply the result obtained when a particular operation of measurement is made. Now the operation for measuring length was well-known, but it required that the body measured must be at rest with respect to the measuring scale; it was inapplicable if the body was moving along the scale. Hence one had no right to speak of the "length" of a moving bar. This was not because the length, an objectively existing property. could not. because of practical difficulties. be ascertained. It was because one had no right to use the word until one had the result of a particular operation to which to apply it, and no such operation had been devised for a moving body.

The theory of relativity prescribed an appropriate operation, and the experiment was then satisfactorily explained. This belongs to physics, but one aspect of it has philosophical implications. The reason why the ordinary operation for measuring length was inapplicable to a moving body was that the scale readings for the two ends of the bar varied with time when the body was moving. To get a definite result, therefore, they had to be taken simultaneously. Hence one had to know how to determine that two events at different places occurred at the same time, and on analysis it appeared that this was impossible without some arbitrary stipulation. Here again, then. the idea of something existing objectively which physical measurement revealed had to be given up. It was not that, because of practical limitations. we could not determine which of a number of spatially separated events were simultaneous. There was no meaning in speaking of the simultaneity of such events until one had prescribed a process for determining it, and there was a wide degree of liberty in prescribing such a process.

Physics was thus thrown back on the unadorned description of itself as the discovery of relations between the results of chosen operations of measurement. This description adequately covered

the whole of physics from Galileo's basic discoveries onward; but the metaphysical accompaniment that had provided the imagination with a model and the experimenter with a guide was now proved misleading. The philosopher must henceforth interpret physics in terms of operations and their results alone, leaving external existences out of account. But the physicist, finding a picture of an external world indispensable, began to devise a better one. In the old picture the world consisted of pieces of matter, measured essentially by their mass, moving about, without thereby becoming changed, in an infinite extension called space and an independent extension called time. According to the revised picture, matter, space and time are no longer independent but merge into a single continuum, space-time—a device made possible by the fact that, according to the definitions adopted for the length of moving bodies and the time relations of separated events, a certain combination of the space and time separations of events is independent of the state of motion which we choose to assign to any one of the bodies concerned. We can thus suppose that this combination of our measurements measures some absolute quality of events, just as we previously thought that the measurement of length indicated some absolute quality of a body. The masses of bodies, however, still change with motion; but going farther in the same direction, the general theory of relativity succeeds in prescribing a combination of space, time and mass measurements that is independent of motion altogether and so—for the time being, at any rate—can pose as an aspect of an external world of which physical measurements provide a quantitative description. From the philosophical point of view, however, it would be exceedingly unwise to forget, as pre-relativity physics did, that all such pictures are but an aid to investigation and have no fundamental significance whatever. It has been shown, indeed, that when the phenomenon of radiation is treated in the same manner as the phenomenon of motion, an "entropy-time" emerges which is of precisely similar character to the space-time of mechanics. Neither of these concepts is to be regarded as objective in the way that space and time were formerly thought to be.

The general effect of all this on the philosophy of science has been to emphasize the distinction between the empirical and the rational. It was the theory of relativity that chiefly inspired the Vienna circle, later known as the logical positivist school, to formulate their verification principle, according to which the meaning of any statement is determined by the empirical steps necessary to verify it. Statements that are not susceptible of empirical verification (or falsification) are either rational (*i.e.*, tautological) or nonsensical. The absolute simultaneity of separated events is a typical example of a nonsensical concept since it is neither empirically determinable nor a rational necessity.

Precisely the same classification was made by Sir Arthur Eddington, who also was inspired primarily by the relativity theory: but whereas the logical positivists have developed their views in the direction of an analysis of language in general, without special reference to physics, Eddington undertook the detailed examination of physical theory. He was led to the conclusion that the whole scheme of physical law mas rational in nature and could have been derived without any experience at all of actual events. In other words, although, as a historical fact, the laws have been derived by studying the results of measurements, they are actually so abstract that they characterize only the nature of the processes of measurement and are therefore independent of the particular results that applications of those processes have yielded.

Eddington's views on this point are not generally accepted. but it must be acknowledged that they are either not understood or misunderstood by the majority of critics—a fact for which Eddington himself is not entirely blameless. His mathematical work is not without error, and his gift for picturesque language led him at times to sacrifice rigour of expression for the sake of a vivid metaphor. He himself advanced, as the crucial argument for his view, the claim that he had derived all the dimensionless constants of physical theory from purely rational considerations; but the derivation involved such a wealth of little-known mathematical processes that a lengthy analysis was required before it could be finally appraised. One common misunderstanding, however, can here be removed: he did not claim that the whole course of physical experience could have been predicted; on the contrary, he held that none of it could. The laws of physics, he believed, were not the laws of behaviour of observed bodies but those of postulated entities. Only when observed bodies were identified with such entities were the laws applicable to them, and any lack of agreement mould indicate, not a failure of the laws, but false identification.

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RELAXATION PHENOMENA, in physics, are phenomena associated with the approach of a system to equilibrium. If a force is suddenly applied to a system and thereafter maintained constant, some time may elapse before the system settles down to a new state of equilibrium. For instance, gas contained in a vessel contracts immediately the pressure applied to it is increased, and becomes warmer in the process; subsequently, as the gas cools to the surrounding temperature, a further slow contraction occurs. A more extreme example of relaxation is to be found in a substance like pitch, which reacts as a solid to forces of short duration, but as a liquid to prolonged stress. In such cases one may consider the system to require a certain characteristic time to stabilize itself, and to exhibit different behaviour according as the duration of the stress is much longer or much shorter than this. If the duration is comparable with the characteristic time, or if the stress is periodic with a comparable period, the failure of the system to achieve internal stability shows itself in hysteresis behaviour of the sort which commonly leads to the degradation of mechanical energy into heat. Some of these typical properties mav be examined in more detail with the help of a simple electrical circuit, which serves as a useful model of a relaxing system.

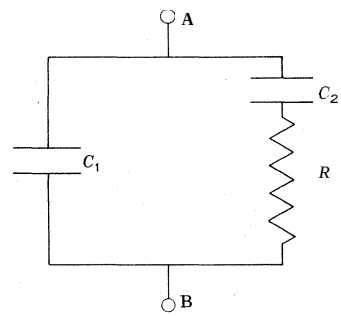

FIG. 1.— SIMPLE ELECTRICAL CIRCUIT ILLUSTRATING A RELAXING SYSTEM (SEE TEXT)

The circuit is shown in fig. 1 and consists of two capacitances, C, and C_2, and a resistance R. If a voltage V is applied suddenly (at time $t = 0$) across the terminals AB, the charge which flows will be as represented by the graph in fig. 2; there is an initial immediate flow of C_1V, charging up the condenser C_1, and a slower charge flow amounting in all to C_2V as current flows through R to charge the condenser C_2. This second process is described by an exponential law, the charge on C_2 being given by $C_2V\ (1 - e^{-t/\tau})$. in which the characteristic time τ (called the "relaxation time") is equal to C_2R. Now consider the application of an alternating voltage across AB. If the angular frequency ω is low, so that $\omega\tau \ll 1$, the voltage will change sufficiently slowly that there is time for C_2 to receive very nearly as much charge as if the voltage were steady, and under these conditions the circuit will behave like a condenser of capacity $C_1 + C_2$. If however the frequency is high. so that $\omega\tau \gg 1$, there will be insufficient time for C_2 to receive any charge before a reversal the voltage tends to remove it again and therefore C_2 will remain virtually uncharged; thus the circuit will behave like a condenser of capacitance C_1. At intermediate frequencies, when $\omega\tau \sim 1$, the effective value of the capacitance will take intermediate values and there will also be significant heat production by the currents flowing in the resistance. Fig. 3

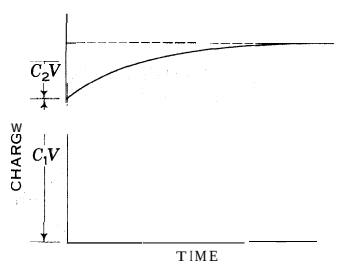

FIG 2.—CHARGE FLOW WHEN VOLTAGE IS APPLIED TO TERMINALS AB OF FIG. 1

shows on a logarithmic frequency scale the variation of the effective capacitance and the heat production per cycle; the latter varies in proportion to the frequency at low frequencies, and in inverse proportion at high frequencies. Two points may be particularly observed about the behaviour of this model. The first is that the transition is extended over a wide band of frequencies, *i.e.*, values of $\omega\tau$ ranging between $\frac{1}{10}$ and 10; the second is that the height of the peak representing resistive losses is directly related to the difference between low- and high-frequency capacitances. This is particularly clearly shown by a graph of the (complex) effective capacitance of the circuit. If the impedance Z between A and B is used to define formally the effective capacity C_{eff} by the equation $Z = 1/i\omega C_{\text{eff}}$ the two curves in fig. 3 represent the real and imaginary parts of C_{eff}; the imaginary part is resistive and determines the heat production per cycle. In fig. 4 is shown a representation of C_{eff} on a complex diagram, where the whole variation is described by a semicircle. As the frequency is increased the value of C_{eff} for the circuit moves anticlockwise from $C_1 + C_2$ to C_1; the parts reached at various frequencies are indicated on the diagram. Analogues of this complex diagram are observed in many physical systems, which may be inferred therefrom to exhibit relaxation effects governed by a simple exponential law. The examples given below are of this type, but it should be remembered that there are many more complicated examples showing qualitatively similar, but not identical, behaviour, for which a more elaborate theory is needed.

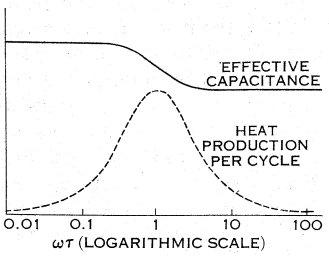

FIG. 3.—VARIATION OF EFFECTIVE CAPACITANCE AND HEAT PRODUCTION PER CYCLE

Alternating voltage across AB of fig. 1

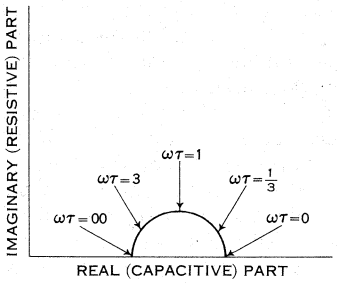

FIG. 4.—EFFECTIVE CAPACITANCE OF THE SYSTEM IN COMPLEX PLANE

Data in Fig. 3 have been replotted with $\omega\tau$ entering as a parameter

Systems of which the above circuit is a helpful model are to be found in almost all branches of physics, but perhaps particularly in the fields of elasticity and acoustics. One of the most famous examples concerns the propagation of ultrasonic waves in gaseous carbon dioxide (CO_2). The velocity of sound in a gas is expressed by the formula $\bar{v}\sqrt{\gamma/3}$, in which $\bar{v}$ is the root mean square velocity of the molecules and γ is the ratio of the principal specific heats C_p/C_v; since $C_p - C_v$ is equal to R, the gas constant, γ may also be related to C_v by the formula $C_v = R/\gamma - 1$. Now it is found experimentally that sound waves of a frequency less than 2 kc. per second travel at a velocity of 268 m. per second in pure CO_2, while if the frequency is greater than 200 kc. per second the velocity is increased to 280 m. per second. Since $\bar{v}$ does not depend on the frequency this result may be interpreted to mean that the effective value of γ, or C_v, depends on the frequency. In fact the low-frequency value of C_v determined by this argument is 6.85 cal. mole^{-1} degrees^{-1} and the high-frequency value 4.95 cal. mole^{-1} degrees^{-1}. The latter value is almost precisely that predicted by Boltzmann's Equipartition law (*see* CHEMISTRY: *Physical Chemistry: The Kinetic Theory of Gases*) for a gas molecule having five degrees of freedom, and herein is an interpretation of the experiment. When a portion of the gas is alternately compressed and expanded by the passage of the wave, kinetic energy is transmitted to or extracted from the molecules by collisions—in other words, on adiabatic compression the gas is heated. This kinetic energy is taken up immediately in translational energy of the molecules, and by collision is shared almost as quickly with the rotational motions of the molecules. If enough time is allowed, ultimately some of this energy will be transmitted to the vibrational motions of the atoms constituting the molecule, but this takes much longer. The main reason is that the vibrational motions are quantized and energy can be exchanged only in units of $h\nu$, where ν is the vibrational frequency involved; in CO_2 all the quanta $h\nu$ of the various vibrations are several times higher than the mean kinetic energy of the molecules, so that only the rare collisions between exceptionally energetic molecules are effective in transferring energy. There is thus a characteristic relaxation time τ, about 10^{-5} sec. in pure CO_2 at room temperature, for imparting energy to the vibrations. If the angular frequency ω of the wave motion is such that $\omega\tau \ll 1$, the vibrational modes are able to come into thermal equilibrium with the external (translational and rotational) modes, and the value of C_v reflects about seven degrees of freedom. But if $\omega\tau \gg 1$, the vibrational modes are unable to exchange energy and C_v has a value corresponding to only the five external modes. The analogy between the internal and external modes in this example, and the capacitances C_1 and C_2 in the model analyzed above, should be obvious. At a frequency of 20 kc. per second, when $\omega\tau \sim 1$, the peak of resistive loss in the model is paralleled by a peak of attenuation of the sound wave; the energy in the sound wave is halved in a distance of only $5\frac{1}{2}$ wave lengths, or $7\frac{1}{2}$ cm.

Many other examples of this type of relaxation have been studied, as well as a similar type associated with structural rearrangements, particularly in liquids and solids. Detailed discussions of many will be found in the references below, but one example must suffice here, elastic relaxation of certain cubic metals containing dissolved impurities. When carbon dissolves in tantalum, the atoms occupy interstitial sites which may be said to be of three kinds, according as the nearest tantalum atom lies in the x, y or z direction, these three directions defining the cube axes of tantalum. So long as the tantalum is unstrained, there is no preference between sites, which are all equally likely to be occupied; but if the tantalum be compressed along the x-axis, the x-sites are deformed differently from the y- and z-sites, and in equilibrium the two types of site will become differently occupied by the migration of carbon atoms toward the preferred sites. The deformation resulting from a given compressional force now depends on whether enough time is given for migration to occur. In fact fig. 2 may be interpreted as a schematic graph of the deformation due to a constant force, while the curves of fig. 3 serve to represent the variation of compressibility and elastic loss with frequency when a periodic force is applied. The relaxation time τ is related to the time taken by carbon atoms to diffuse from site to site and is highly temperature-dependent according to the law $\tau \propto e^{H/RT}$, where H is a heat of activation. Thus if the frequency is kept constant and the temperature varied, $log\ (\omega\tau) =$ constant $+ H/RT$ and a plot of elastic behaviour against $1/T$ should look like fig. 3. This is shown in fig. 5, from the scale of which it may be immediately deduced that H for this diffusion process is 25,000 cal. per molecule. Relaxation peaks of this nature are found in many solids and are often the most sensitive way of detecting the presence of certain impurities; *e.g.*, it is pos-

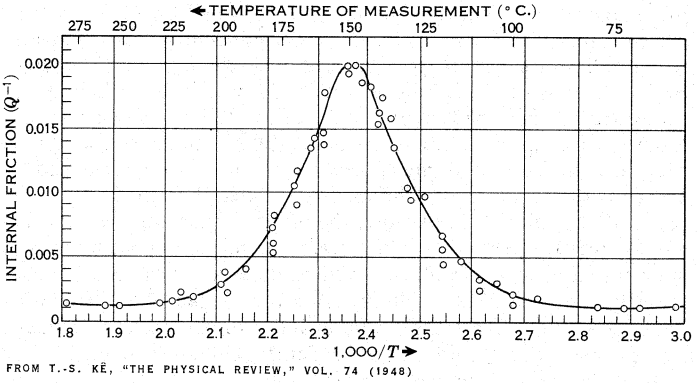

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FIG. 5.—VARIATION WITH TEMPERATURE OF ELASTIC LOSS IN TANTALUM DUE TO 0.013% DISSOLVED CARBON

sible to trace one part in a million of carbon in iron. Finally it should be mentioned that exactly analogous phenomena are observed when sound waves pass through mixtures of substances in chemical equilibrium, when oscillatory electric fields are applied to metals and to many dielectric substances and when oscillatory magnetic fields are applied to many paramagnetic substances. Detailed study of these provides information on the rate at which equilibrium is attained and hence may suggest the mechanisms which are operative in establishing the state of equilibrium.

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(A. B. PI.)

RELEASE, in law, the term applied to the discharge of some obligation. by which it is extinguished (see DEBTOR AND CREDITOR LAW). and to the conveyance of an estate or interest in real or personal property to one who has already some estate or interest therein. For the special form of conveyancing known as "lease and release," see LAND TENURE: ECONOMIC AND AGRARIAN ASPECTS: Leases.

RELICS, any objects once connected with the person of a departed saint, especially the body or parts of the body. Veneration of the relics of saints, especially of martyrs, appears at an early date both in the Eastern and in the Western Church. St. Thomas Aquinas formulates the doctrinal principles thus: "It is clear . . . that he who has a certain affection for anyone, venerates whatever of his is left after death, not only his body and the parts thereof, but even external things, such as his clothes and such-like. Now it is manifest that we should show honour to the saints of God. as being members of Christ. and children and friends of God, and our intercessors. Wherefore in memory of them we ought to honour any relics of theirs in a fitting manner: principally their bodies, which were temples, and organs of the Holy Spirit dwelling and operating in them, and are destined to be likened to the body of Christ by the glory of the resurrection. Hence God Himself fittingly honours such relics by working miracles at their presence." (*Summa* Theol., iii, *q.* 25, art. 6.)

The council of Trent, in its 25th session, solemnly affirmed the same doctrine. while condemning those who hold the practice in contempt, and modern canonical legislation was framed in accordance with these principles (Codex *Iuris Canonici,* especially canons 1276–89). It is noted expressly that relics are to be honoured with a veneration that looks beyond the relics to the saints themselves, whom the relics commemorate (canon 1255 § 2). Further prescriptions attempt to assure the authenticity of relics exposed for public veneration (canons 1283–86); the fabrication of false relics. their sale or distribution, or their exposition for public veneration involves *ipso* facto excommunication (canon 2326). The Old Testament refers to the cult of relics, in the religious character of the burial of saintly persons (Gen. xxxv, 19, 20; l, 2j, 26; Exod. xiii, 19), in the miraculous power of Elijah's mantle (IV [11] Kings, ii, 13, 14) and the bones of Elisha (ibid., xiii, 21); but the practice assumes its definitive form in the New Law (see Matt. ix, 20–22; Acts xix, 11, 12). St. John Chrysostom refers frequently to the relics of the martyrs as sources of divine favours (Eulogy of St. Eustathius, in J. P. Migne, Patrol. Graeca, 1, 600; Homily on the Martyrs, ibid., 648, 649; Eulogy of St. Julian, ibid., 670–672). St. Augustine makes clear reference to the practice (for example in De Civitate Dei, in Migne, Patrol. Lat., xli, 255), and indeed all the great doctors of early Christianity extolled the veneration of the relics of the saints. Inevitably, the insatiable demand of churches and of private persons led to a traffic in relics, both genuine and spurious, and to other abuses, which ecclesiastical authority constantly strove to hold in check. Already in 386, the Theodosian code legislated against the traffic in relics of the martyrs, and the sale of relics was forbidden by the fourth Lateran council in 1215 (canon 62) and by the council of Trent.

The veneration of relics is a practice rooted in ecclesiastical tradition and in human psychology. It is to be understood and judged by reference to its doctrinal foundations, rather than to its abuses.

See article "Reliques," by P. Sejourne, in the *Dictionnaire de théologie catholique,* ed. *by A.* Vacant *et al.,* vol. xiii (Paris, 1937); and the article "Reliques et reliquaires," by H. Leclercq, in the *Dirtionnaire d'archéologie chrétienne et de liturgie,* ed by F. Cabrol and H. Leclercq, fasc. clx–clxi (Paris, 1947).

RELIEF. The term "relief" is used in sociology and social work to denote aid given to needy persons who would otherwise suffer without it. It is contrasted with work relief and social insurance. Relief as a generic term is used to cover all forms of aid, in cash and in kind, public and private, to needy persons. As a specific term it is sometimes used in the United States to distinguish aid given on a noncategorical undifferentiated and emergency basis from the types of public assistance far which federal funds are given under the Social Security act. In both Great Britain and the United States, the term relief was being replaced in the 1950s by the word "assistance."

Relief has been provided in ancient as well as modern forms of society. Helping one another in a time of emergency such as sickness, orphanhood or old age was practised in simpler and early societies. (For early history, see PHILANTHROPY.) Private forms of relief exist through individuals and voluntary institutions.

UNITED STATES

Responsibility for providing relief was, in accordance with the tradition and statutes of Great Britain, accepted by the American colonists as a local governmental responsibility. (See POOR LAW.) During the period 1910–30 state governments in the United States began to take financial and administrative responsibility to assist the localities for various categories of needy persons such as the aged, the blind, and dependent children. In 1932–33 the federal government began to assume responsibility for aid in the relief of human need and suffering. An important and far-reaching development was the enactment in 1935 of the Social Security act, which provided for the establishment of federal old-age insurance and state programs of unemployment insurance which greatly reduced the need for relief. (See SOCIAL SECURITY.) In addition the federal government made grants to the states lor "assistance" to the needy aged, blind, and dependent children. In 1939 the federal old-age insurance program was broadened to include survivors insurance and in 1950 to add a fourth category of assistance to needy persons who are permanently and totally disabled. In 1954 the federal old-age and survivors insurance program was expanded to cover virtually all persons who work for a living. As a result of these legislative changes, the increase in the aged and child population, and the relatively high levels at which the economic system operated, the role of relief in the American economy changed in important respects after 1932.

Relief Programs in 1932.—There was no system of federal relief in existence when the depression began in the United States in 1929 Public relief was provided under state "poor laws," and was usually limited to almshouse care, medical care, burial and small amounts of relief, financed by towns and counties. In structure. social theory and method of administration, this system of local public relief had remained practically unchanged from the days of Elizabethan England. This kind of public relief was supplemented by private charity.

For three years after 1929, notwithstanding the rapid growth of unemployment (which rose from an estimated 2,000,000 to 15,000,000), the federal government held that the relief of unemployment was a local problem. to be handled by state and local governmental resources supplemented by private charity. Two successive committees were set up by Pres. Herbert Hoover to co-ordinate private and local governmental relief efforts—the president's emergency committee for employment, and the president's organization on unemployment relief

Appeals for federal relief, however, became more and more insistent. The Reconstruction Finance corporation, a new federal agency which was making loans to distressed banks, railroads and businesses, was authorized by congress in July 1932 to make loans for relief purposes to states and municipalities. Because of the various restrictions imposed on such relief loans, only $80,000,000 was disbursed by Jan. 1, 1933.

Federal Emergency Relief Administration, 1933–35.—With the inauguration of Franklin D. Roosevelt as president in

March 1933, the principle of federal participation in relief was immediately broadened. Instead of a financial agency making loans to states and municipalities in distress, a new social agency, the Federal Emergency Relief administration, was created to undertake a program of federal grants-in-aid to states. While the grants were made to the state governments, the actual administration of relief was primarily in the hands of the local communities to which the state government granted the available federal funds. together with state appropriations where such had been made. The FERA assumed a major share of the cost, the rest being borne by states and local communities.

The FERA attempted to set up minimum standards for relief administration, under penalty of withholding the federal grants. It also had authority, which it exercised only in exceptional circumstances, of, administering federal relief directly in those states where it met with no co-operation. In addition, the FERA earmarked a portion of the grants to the states for a number of special programs. for classes of persons whose needs could not be met effectively by the general relief program. These included transient relief. education, college student aid and rural rehabilitation.

One of the objectives of the FERA from the beginning was the development on a national scale of the system of work programs for employable persons that had been initiated by some state relief administrations. During the first six months, however, comparatively little was accomplished along that line because of the pressure of the more elementary needs of the unemployed for food, shelter and clothing. The early state work projects were in some cases poorly conceived, for it took time to realize that there was certain work the unemployed could do that would be socially useful and not compete with private industry. There was generally a shortage of funds for materials since only local funds—not federal moneys—could at the beginning be used for that purpose.

Civil Works Administration, 1933–34.—The deficiencies of the local work relief programs. the critical unemployment situation and the need of stimulating business recovery by large scale governmental expenditures prompted President Roosevelt to start a new works program in the fall of 1933. This was the program of the Federal Civil Works administration. instituted within two weeks after the creation of the agency on Nov. 9, 1933. While the civil works program was directly administered by the federal government through a nationwide organization, most of the projects were initiated and sponsored by local governments.

Workers were paid on the basis of the work performed rather than on the "budgetary deficiency" basis which characterized local work relief projects.

Within two months of its organization, the civil works program reached a peak employment of 4,200,000, roughly half of the workers being taken from the relief rolls. The greater part of the program was terminated at the end of March 1934. The program resulted in total expenditures of $951,600,000, of which the federal government contributed $860,400,000, the local communities $85,000,000, and the states the remainder.

Though hastily organized, the civil works program for the first time revealed the large variety of socially useful projects that could be operated with unemployed labour. Its field of activity embraced the repair and construction of roads and streets, the rehabilitation and new construction of school buildings, recreational facilities, the building of new sanitation works, and a wide array of white-collar and service projects.

During the period of the CWA program, the FERA continued to function as an agency subsidizing the state relief agencies, although local work relief programs were very much curtailed. With the discontinuance of the CWA, the FERA, in co-operation with the states, set out to develop a more adequate work relief program than had been in operation in 1933. Those CWA projects which had not been finished were taken over and completed. New projects were developed on the same principles. Thus, federal funds were made available for the purchase of materials; better supervision of projects was instituted.

Wages in the FERA work program were based on the principle of "budgetary deficiency." A relief family's sources of available private income were determined by the social service staff and deducted from the estimated budgetary needs. The principal breadwinner was given as many hours of work as would yield the requisite income deficiency.

In the case of large families, work relief earnings were. often supplemented by direct relief. In addition, surplus foods were sometimes furnished to general relief cases through the Federal Surplus Relief corporation, which was largely financed with FERA funds. (It later became an agency in the G.S. department of agriculture.)

In 1935 congress and the administration made an important change in the method of dealing with the problem of unemployment relief. This new method involved, first, the turning over of direct relief to the states and local communities and. second. the setting up of a large federal works program to provide emergency employment, particularly to employable heads of families on relief rolls.

The decision to take the federal government "out of the business of relief'! was made at the moment a comprehensive social security system was set up. This system made provision not only for unemployment and old-age insurance, but for old-age assistance, aid to the blind and aid to dependent children, to be administered by the states with matching grants by the federal government. It was felt that once these three categories of destitution were taken care of, and once the federal government assumed responsibility for the employment of employables on relief, the remaining direct relief problem could be handled by the states and local communities with their own resources.

WPA, 1935–39.—The new feature in the reoriented programs of 1935 was the introduction of a broad program of project work, comprising locally planned and sponsored undertakings that were, however, to be federally directed and in large measure federally financed. Workers were to be removed from the relief rolls and paid fixed monthly security wages. The security wages represented a compromise between the CWA principle of regular wages and the FERA principle of budgetary needs. Monthly wages were fixed at the same level for the same type of work regardless of family diversities, but the wages for the different classifications of skills and different regions of the country represented less than the corresponding normal earnings in private industry. Most of the work projects were directed by the newly created Works Progress (later Work Projects) administration, which was originally intended to serve as a co-ordinating agency for the entire works program but which became the principal operating agency as well.

In addition to the system of work projects, the works program of 1935 continued the emergency employment programs on heavy public works carried on by the bureau of public roads and the Public Works administration. These phases of the work program were carried on by the contract method. At first these agencies were required to see to it that contractors selected their crews as far as possible from the relief rolls—a requirement that proved difficult to enforce and was later dropped. The 1935 works program also continued the program of the Civilian Conservation corps, which provided employment and training to needy youths between 18 and 25. A National Youth administration was established within the WPA, which, in addition to providing aid for high school, college and graduate students, developed work projects for needy youths between 16 and 2j.

The cost of WPA operations was borne largely by the federal government. But since the work projects concentrated on local needs, it was felt desirable that local communities should suggest and sponsor the projects that were put in operation and should at the same time pay part of the cost. Sponsors' contributions varied with the financial resources of the community, the character of the public improvements it desired to carry out and the gravity of the local unemployment problem. Contributions averaged about 20% for the nation as a whole after July 1937. Beginning Jan. 1, 1940, the average of sponsors' contributions for each state was required by law to be 25% of the total cost of projects subsequently approved and initiated.

A few federal projects (notably the arts projects) were operated by the WPA on a nationwide basis with relatively small contributions from co-sponsors. The Emergency Relief Appropriation act of 1939 provided that the WPA could not itself sponsor projects.

Thereafter the arts projects were continued where state and local governments were interested in sponsoring and sharing in the cost of the work. The theatre projects were entirely discontinued on July 1, 1939, by act of congress.

About 80% of WPA activities were in the construction field, while 20% represented goods projects (canning projects and sewing rooms for women) and white-collar projects.

Surplus Farm Commodity Distribution. — Surplus farm commodities were first distributed to needy persons in 1933 under emergency relief legislation. Nearly 13,000,000 received such surplus farm commodities in 1939. The department of agriculture was assigned the responsibility for delivering the commodities in carload lots to state and local welfare agencies which distributed them in accordance with state or local eligibility standards. At the end of 1954, about 2,500,000 needy persons were receiving such commodities. of whom about one-fourth were persons on the public assistance rolls. Schools and charitable institutions were also made eligible for surplus farm commodities.

Public Assistance Under the Social Security Act, **1935–54.** — The provisions of the public assistance titles of the Social Security act of 1935 were designed to overcome some of the major limitations of the earlier relief programs. The selection of the term "assistance" instead of "relief" was intended by those who drafted the act to distinguish the categorical forms of aid as a more liberal, humane and modern form of aid in contrast with restrictive, harsh and haphazard forms of relief. The Dill-Connery bill for federal aid to needy aged persons. which was favourably considered by the house of representatives in 1934, used the terms "relief" and "assistance." But the proposal recommended to the congress by Pres. Roosevelt's committee on economic security in 1935 adopted the term "assistance:" which was accepted by the congress and written into the federal law without debate or controversy.

The Social Security act also included the specific language that assistance meant "money payments" to the needy individuals. This limited the federal funds to cash payments and was intended to limit and discourage payments in kind such as grocery orders and direct distribution of commodities. The unrestricted cash payment was intended to eliminate the restrictive control exercised by local authorities in the granting of aid. In 1950 congress made an exception to the principle of unrestricted money payments to the individual by amending the federal act to permit payment of federal funds within certain maximums in cases where states paid medical bills directly to the doctor, hospital or to others providing medical care. The special characteristics of medical care — particularly irregularity and unpredictability — distinguish it from other types of needs.

The Social Security act of 1935 also required as a condition of receipt of iederal aid that the state make a financial contribution to the program, a single state agency administer each program, the state have a "state plan" in effect in political subdivisions of the state, and the individual be given th portunity for a fair hearing if his claim for assistance is denie ach of these requirements was aimed at eliminating certair incial and discriminatory methods of administering relief tc persons.

Congress also provided that no al funds could be used to pay assistance to any adult in a public institution or to any child in any institution. This was the outgrowth of dissatisfaction with county homes, almshouses, orphan asylums and other large institutions. (*See* POOR LAW.) As a result, the assistance program encouraged aiding persons in their own homes and in practically eliminating almshouses. In 1950, however, congress amended the law to permit iederal funds for payment of assistance to adults in certain types of public medical institutions. A growing number of chronically-ill aged persons came to be cared for in public and private nursing homes operating under standards established and maintained by the states. The 1950 amendments also required the states to establish and maintain standards for private or public institutions if the state plan includes payments to individuals in such institutions.

In 1939 congress amended the law to require the states to select and promote their personnel in accordance with a merit system so that the programs would be administered on a professional basis. Another requirement added to the law by the congress in 1939 provided that the states establish safeguards which restrict the use or disclosure of information concerning applicants and recipients to purposes directly connected with administration of assistance. This provision was the subject of much controversy in 1951 and congress amended the law to permit states to enact legislation prescribing any conditions under which public access might be permitted to records of disbursements if such legislation prohibited the use of any list of names for commercial or political purposes.

Enactment of the federal assistance programs and the requirement for the establishment of a single state agency for the administration of each program helped accelerate the trend toward the establishment of state departments of welfare and the co-ordination of all state welfare functions in one state agency. The result was an improvement in welfare programs through the leadership, standard-setting. research and community organization and planning undertaken by the state welfare departments. While conditions continued to vary widely in the various states, there was a substantial measure of progress. Since in many states the state departments of public welfare also help finance or administer the general assistance or relief programs, there has been a tendency for standards in the general relief programs to be administered to some extent along the same lines as the categorical programs for which federal funds are received and federal standards maintained. However, in the states which left the entire general assistance problem to the localities. there still remained in the 1950s a great deal of the same type of inadequacies which existed prior to the enactment of the social security program.

Numerous groups which studied the assistance, relief and related programs in the United States made recommendations for changes in the federal and state legislation. Perhaps the most important in helping reduce the need for assistance and relief was the expansion and liberalization of the federal old-age and survivors insurance program in 1950, 1952 and 1954, and of the federal and state provisions for unemployment insurance. Increased coverage under private pension. health and welfare plans. particularly as a result of collective bargaining, also aids in reducing the need for assistance and relief. The number of aged persons receiving old-age insurance became larger than the number of aged persons receiving assistance for the first time in 1951. The year 1953 was a turning point in the history of public assistance. The number receiving old-age and survivors insurance benefits at the end of 1953 was larger than the number receiving all four types of public assistance (including general assistance). At the end of 1954, there were about 6,800,000 persons receiving insurance benefits compared with 5,700,000 receiving assistance.

General Assistance. — General assistance. often called general relief in the United States, is supported by the localities and the states with no participation by the federal government. It is the only recourse of needy persons in want who are ineligible for one of the four federal-state assistance programs. General assistance also is provided to some extent to recipients of the special types of public assistance when the maximum amounts of categorical aid they can get are insufficient to meet their needs.

In some states the general assistance program is integrated with all or some other assistance programs at the local level. In other states general assistance is administered separately. The amount of financial aid and supervision supplied by the state welfare departments to the local units varies greatly from state to state. In 10 states in 1954, the state paid the entire bill for general assistance. At the opposite extreme were 16 states where the localities met the full cost. In the other states, the localities and the state shared the cost in varying degrees. Total expenditures for general assistance in the mid-1950s were shared approximately 50% by the localities and 50% by the states.

In most states with little or no state financial participation, each locality decides for itself who shall be eligible for aid and how much assistance in cash or kind he shall get. Thus the place where a needy person lives is likely to be a primary determinant of the adequacy with which his needs are met. In many places throughout the nation a needy person deemed employable can get assistance only if he is in the direst straits — and then only for a tempo-

rary period. In such places in most cases the breadwinner is suffering from acute illness or disability that is not sufficient in degree to qualify him for aid to the permanently and totally disabled. Some states still have local settlement laws which originated before the days of modern transportation and high mobility of population. On the other hand, in some states general assistance is available at substantially the same standard as the special types of public assistance for any needy person for whom there is no other provision.

Consideration has been given from time to time to providing federal funds and federal standards for general assistance. In 1948, an Advisory Council on Social Security recommended such legislation and the congress considered such a proposal in 1949. Congress did not adopt the proposal but did add a fourth category of assistance to the Social Security act in 1950 for persons permanently and totally disabled, thus narrowing the scope of general assistance. A large number of the disabled persons were transferred from general assistance to the disabled category. General assistance tended to decline in terms of its role in the total assistance picture. In 1940 expenditures for general assistance represented about 40% of expenditures for all forms of public assistance; but by 1950, they had dropped to about 13% and by 1954 they were only about 7%.

Medical Care.—A large proportion of the number of persons receiving public assistance are disabled or chronically ill and require medical care. The states vary in the extent to which they provide medical care to needy persons. This variation depends upon the availability of funds, and the extent of available hospital care and services from physicians. About $200,000,000 was paid annually in the mid-1950s by public assistance agencies directly to doctors, hospitals and other suppliers of medical care for medical services for assistance recipients. About one-quarter of all expenditures for general assistance at that time was for payments directly to such suppliers of medical care. Medical care to public assistance recipients improved slowly in both coverage and scope after 1950 when the Congress earmarked a limited amount of federal funds for this purpose. However, because of the many inadequacies, Pres. Dwight D. Eisenhower in 1955 recommended that the Congress earmark additional federal funds for medical care for public assistance recipients.

Status of Relief and Assistance Programs.—Total relief and assistance expenditures in the United States reached a peak of $300,000,000 a month in 1938–39. Expenditures for these purposes declined sharply during the World War II years 1942–45. As a result of increased population—particularly aged persons and children—increased prices and more adequate standards of assistance, expenditures began to increase after World War II. Nevertheless, measured as a per cent of the national income, relief and assistance expenditures were substantially below the proportions for the years immediately prior to 1940. During the fiscal year ending June 30, 1954, nearly $2,800,000,000 was expended for all five forms of public assistance and their administration. This amount was equivalent to about 1% of all personal incomes in the nation, or $16 per capita for the year. The federal government assumed about 52% of total assistance payments made under all five programs; the states 37%; and the localities 11%.

Approximately 5,700,000 persons were receiving public assistance at the end of 1954. Of this number about 2,500,000 were receiving old-age assistance, 2,000,000 persons were receiving aid to dependent children, 100,000 aid to the blind, 300,000 aid to the permanently disabled and about 800,000 general assistance.

OTHER COUNTRIES

Programs of public assistance or relief for the general population or for some categories of needy people are in operation in many countries. Although there are some common features, there are notable differences among the countries in such matters as the method of determining need, the extent of local and national administrative and financial responsibility, and the age, residence and other requirements.

While in most of western Europe social welfare functions are delegated to the provincial and local governments, in some countries of the British Commonwealth relief is a function of the central government. Thus, in the United Kingdom a national assistance board administers the principal assistance programs, which, except for certain institutional and welfare services, are nationally financed and have standardized payments.

Australia and Canada, which have a federal form of government like the United States, employ some different methods than either Great Britain or the United States. In Australia, the Commonwealth Department of Social Services administers social security and relief for needy persons not eligible for any of the categorical payments. In Canada, the general relief function remains in the hands of the local governments. The provinces pay mothers' pensions and administer and share the financing with the national government of the system of old-age assistance for persons aged 65–69, inclusive.

(*See* also PHILANTHROPY; PENSIONS; POOR LAW; SOCIAL SECURITY; and SOCIAL SERVICE.)

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RELIEF, literally, the projection of forms from a ground; in sculpture, a work in which figures or ornaments are shown as projecting from a ground. The height of elevation may vary. In a low relief (*basso-rilievo* or bas-relief) the design is more or less of a piece with the ground, projecting but slightly and with little, if any, undercutting of outlines. In a high relief (*alto-rilievo*) the forms are made to stand out more detachedly and may in parts be completely disengaged from the ground, so as to approximate sculptures in the round. But a reference to and, in most cases, physical connection with the ground must be taken to be a constituent feature of all representations in relief, in contrast to statuary which is not related to any ground and can be viewed from all sides. The 19th century tendency to employ the term "bas-relief" indiscriminately for all kinds of relief, high as well as low, is unjustified linguistically and seems now to be subsiding.

Rarer forms of relief are the "sunk reliefs," especially of ancient Egypt, where the forms are carved in and beneath the surrounding ground rather than rising from it. Intaglio, likewise, is a hollow relief, but carved as a negative image like a mold instead of a positive form. Actually the most common use of intaglio is in engraved seals of precious stones or metal, designed to produce a positive imprint when pressed into a plastic material such as heated wax. However, intaglio techniques may also be used without such a purpose; *e.g.,* in the decoration of transparent materials such as glass.

Modes of representation and composition in relief are always determined by their dependence on the ground plane from which the forms emerge, or on which they are superimposed. In this important respect reliefs are more nearly related to painting than to the detached roundness of statuary. Ancient Egyptian art, which differentiated the various branches of art in the most systematic manner, from the beginning applied the same basic principles of representation to reliefs as to painting. Usually the design stands out from the ground in very low relief, however carefully modeled. Figures are shown sidewise, standing on base lines, and precisely outlined in conformity to the plane surface from which they are carved. As to their methods of representation, and regardless of their materials—wood, soft stones, hard stones or metal—they must therefore be classified with painting. Similar observations are true of other early arts, like those of Mesopotamia and the ancient near east.

High reliefs first became common in Greek art; notable examples are the Attic tomb reliefs, with individual figures or family groups shown almost in the round, of the 4th century B.C. On the whole the Greek reliefs, also, follow rather closely the development of contemporary painting. Sculptured friezes were often used in architectural decoration. A doubt may arise regarding the famous pedimental sculptures of Greek classical temples which are composed of large figures worked singly, and not physically connected with the ground, thus resembling free statues. (*See* GREEK ART; OLYMPIA; PARTHENON; etc.)

However, since these figures were placed in the pediments and consequently not seen freely but against a background wall, their compositions must in effect be regarded as a kind of high reliefs. Likewise in Roman art (*q.v.*), the pictorial character of the reliefs is undeniable. A rich field of study for the relation between ground and figures in classical reliefs can be found in the numerous sculptured sarcophagi which constitute one of the most representative achievements of Roman art during the 2nd and 3rd centuries A.D. Excellent examples of ancient relief are also available in the minor arts, both of Greece and Rome, especially

in silver and ivory. (See SILVERSMITHS' AND GOLDSMITHS' WORK.) Moreover the rapid expansion of the classical style in and beyond the Mediterranean area after the Hellenistic period gave rise to a flowering art of relief sculpture in the far east, first of all in the religious art of India.

It appears as a natural consequence of the classical tradition that during the early middle ages, a period which generally exhibits a marked preference for painting over statuary, the emphasis in sculpture was definitely on relief work. This statement holds good of Byzantine no less than western art. Not only does a wealth of very fine reliefs appear in the minor arts, Byzantine as well as western medieval, but French Romanesque art, especially, reached a new height of relief sculpture in architectural decoration. Some of the most outstanding examples of medieval art are among the Romanesque portals ("tympana"), sculptured capitals of columns and other reliefs decorating the ecclesiastic buildings of France, England and other European countries. (See SCULPTURE; SCULPTURE TECHNIQUE.)

The Gothic period continued this tradition, often preferring a higher relief than the Romanesque, in accordance with the renewed interest in statuary typical of the later middle ages. Reliefs were much in demand also for funeral monuments of bronze or stone, a number of which include some of the finest works of the period. The latest examples of Gothic relief art are the frequent carved altars, mostly of wood, and other church furniture of the "international style" shown in churches all over western and central Europe from Spain to Poland. (See WOOD CARVING: European and American.)

During the Italian Renaissance period the status of relief work among the total output of art begins to change. Between painting and statuary the number of reliefs decreases, except perhaps in the minor arts. No longer are certain places traditionally reserved for decoration in relief, as was true of the medieval church buildings. On the other hand the condition of representations in relief now became subjected to new studies and experimentation with a revisory intent, as a task of art different from both painting and statuary. The first striking results of the new trend are the bronze doors which Ghiberti created for the famous baptistery of Florence. Characteristic is the free play between high and low relief, from which a strikingly illusionistic style of composition can be derived, supporting the new interest in space as a subjective, visual experience.

Donatello further exploited these experiments, adding to the interplay of high and low relief the contrasts between rough and smooth surfaces, as well as between forms shown fully modeled and others only indicated in an almost painterly, impressionistic state of incompleteness. As a result, Florentine artists after Donatello pursued for a while two rather different trends regarding the treatment of reliefs. Typical of the one are the delicate and low reliefs in marble and terra cotta, for which Desiderio da Settignano and Mino da Fiesole became best known. The other, more contrasting trend became incorporated in the relief style of Bertoldo and later, Michelangelo.

Baroque art continued these experiments, often on a very large scale. Characteristic are large compositions—a kind of marble painting—of which the Roman churches, especially, hold many excellent specimens. These compositions, because of their large size and high relief, often approach the effect of tableaux vivants shown in deep boxlike frames and special, stagelike conditions of lighting. L. Bernini's "Ecstasy of Sta. Theresa," with figures carved almost fully in the round but encased in a marble altar, in the church of Sta. Maria della Vittoria, Rome, offers a most impressive example.

Neoclassic art of the early 19th century, following a more puritan attitude toward artistic principles, temporarily revived experimentation with low reliefs, relying for effect on fine surface modeling and clarity of design. The works of Antonio Canova and Bertel Thorwaldsen are typical. However, on the whole the Renaissance concept of relief prevailed. Its dramatic and impressionistic possibilities were sensed keenly and employed vigorously by subsequent sculptors of the 19th century such as F. Rude ("The Marseillaise," decorating the Arc de Triomphe in Paris) and later, most famously, Auguste Rodin ("Portal of Hell" and other reliefs). In continuation of these trends relief techniques came to be used in modern art. not only for representational but also for abstract compositions which exploit freely the spatial element as well as the contrasts of light and shade, in reliefs conceived as a succession of overlapping planes. The latter concept, by its nature, often leads to a greater emphasis of the pictorial qualities inherent in relief art. It is typical of this situation that modern painters not infrequently show an interest in the art of relief as did Picasso, among others, during the evolution of his Cubism. See also SCULPTURE; SCULPTURE TECHNIQUE; etc.

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RELIGION (AND THEOLOGY), ARTICLES ON.

For the purpose of enumerating the main articles in this section, a division will be made into Christian and Non-Christian.

CHRISTIAN

The number of articles on the different aspects of Christian doctrine, faith and church is so great that nothing beyond a casual selection of titles can be made here. Anything approaching a complete guide to the separate religious divisions would be a lengthy index of titles of differing merit. To begin with, all the prophets of the Old Testament, all the disciples of the New Testament, and all the books of the Bible have separate articles under their own headings. Special terms occurring in the Scriptures, such as ALPHA AND OMEGA; ARMAGEDDON; APOSTLE; ANGEL. etc.. have articles to themselves, where their meaning and connection with other passages in Holy Writ are given in some detail. The article BIBLE is divided. for convenience of reference, into sections and subsections, with appropriate subheads and sideheads to mark out the main points of interest. CONCORDANCE is exhaustively treated, and the article JESUS CHRIST deals with the life of the Founder of Christianity and all his activities and influences. JOSEPH (husband of Mary) and MARY (the Mother of Jesus), are important articles, and those such as REVELATION, BOOK OF and PASTORAL EPISTLES are deserving of attention. VULGATE; ATHEISM; DEISM; IMMORTALITY; MIRACLE; MYSTICISM; ESCHATOLOGY; APOLOGISTS, EARLY CHRISTIAN; DOGMA; ABSOLUTION; ANTICHRIST; ATONEMENT; BAPTISM, CHRISTIAN; BENEDICTION; CATECHISM; CATHOLIC; CHURCH; CONFESSION; CONFIRMATION; CREED; EXCOMMUNICATION; EXTREME UNCTION; FASTING; GRACE; MARTYRS. EARLY CHRISTIAN; PREACHING; RELICS; SACRAMENT; SIN and WORSHIP. are all important articles well worthy of special attention. The different sects and divisions of Christian practice and worship are treated under their own headings.

Some of the major councils (*e.g.*, BASEL. COUNCIL OF, etc.) are treated in separate articles apart from the main article COUNCIL. Some of the major synods, too, have special articles under the names they usually bear, as is also the case with the different courts. The famous heresies are also treated under their separate names. There is also a large article PAPACY.

The chief saints of the Church Calendar are noted and details are given under their respective names. The popes have biographies. and are also treated in connection with their special work in separate articles where there is historical mention of their times. The reader should refer to CONSTITUTIONS. APOSTOLIC; APOSTOLIC FATHERS, etc., for the Christian documents required.

There are comprehensive articles on the religious orders. (See for example, BENEDICTINES; CAPUCHINS, etc.) In addition to the main article ROMAN CATHOLIC CHURCH, all important subdivisions of this aspect of Christian worship have articles under their own headings, *e.g.*, IMMACULATE CONCEPTION; INDULGENCE; PENANCE. etc.

All the main Eastern Churches have articles devoted specially to them. All relationships of the Church of England and the modern Continental churches, their special forms of worship and attitude to problems of belief and practice, are treated under their own headings.

Ecclesiastical offices are treated under separate headings, *e.g.*, ABBOT; ACOLYTE; ARCHBISHOP; ARCHDEACON, etc. The ecclesiastical seasons have all their own headings, and this is also the case with Ecclesiology and its subdivisions: Bible and Biblical criticism is a section which contains important articles on the prophets and books of the Old Testament, and the Apostles and books of the New.

NON-CHRISTIAN

In this section appear such major articles as BABYLONIA AND ASSYRIA: *Religion;* GREEK RELIGION; ROMAN RELIGION; HINDUISM; ANCESTOR WORSHIP; ZOROASTER (for Zoroastrianism); ASCETICISM. etc. Apart from the main articles on Greek and Roman religion, there are numerous short articles on the gods and goddesses of the ancient classical world. Such articles as ANIMISM; ANTHROPOMORPHISM; DEMON; DIVINATION; EXORCISM; FETISHISM; FCNERARY RITES AND CUSTOMS; IDOLATRY, LYCANTHROPY: MYTHOLOGY; PRIEST; RITUAL and WITCHCRAFT are the main supports of the non-Christian religious program.

In addition to these there are numerous accounts, each under its own heading, of the gods and spirits of Brahmanism, Buddhism, etc, and the early faiths of Scandinavia, Europe, and the two divisions of America.

RELIGION. The treatment of this subject will fall into two distinct sections, *A. Primitive Religion* and *B. The Higher Religions.*

A. PRIMITIVE RELIGION

I. Definition of Primitive Religion.—Amongst the numberless definitions of religion that have been suggested, those that have been most frequently adopted for working purposes by anthropologists are Tylor's and Frazer's. Sir E. B. Tylor in *Primitive Culture* (1), i. 424, proposes as a "minimum definition" of religion "the belief in spiritual beings." Objections to this definition on the score of incompleteness are, firstly, that, besides belief, practice must be reckoned with (since, as W. Robertson Smith has made clear in his *Lectures on the Religion of the Semites, 18 sqq*, ritual is in fact primary for primitive religion, whilst dogma and myth are secondary); secondly, that the outlook of such belief and practice is not exclusively towards the spiritual, unless this term be widened until it mean next to nothing, but is likewise towards the quasi-material, as will be shown presently. The merit of this definition, on the other hand, lies in its bilateral form, which calls attention to the need of characterizing both the religious attitude and the religious object to which the fornner has reference. The same form appears in Sir J. G. Frazer's definition in *The Golden Bough* (3rd ed), i. 222. He understands by religion "a propitiation or conciliation of powers superior to man which are believed to direct and control the course of nature and of human life" He goes on to explain that by "powers" he means "conscious or personal agents." It is also to be noted that he is here definitely opposing religion to magic, which he holds to be based on the (implicit) assumption "that the course of nature is determined, not by the passions or caprice of personal beings, but by the operation of immutable laws acting mechanically" His definition improves on Tylor's in so far as it makes worship integral to the religious attitude. By regarding the object of religion as necessarily personal, however, he is led to exclude much that the primitive man undoubtedly treats with awe and respect as exerting a mystic effect on his life. Further, in maintaining that the powers recognized by religion are always superior to man, he leaves unclassed a host of practices that display a bargaining, or even a hectoring, spirit on the part of those addressing them *(see* PRAYER). Threatening or beating a fetish cannot be brought under the head of magic, even if we adopt Frazer's principle (*op. cit.* i. 225) that to constrain or coerce a personal being is to treat him as an inanimate agent; for such a principle is quite inapplicable to cases of mere terrorism, whilst it may be doubted if it even renders the sense of the magician's typical notion of his mode of operation. viz., as the bringing to bear of a greater *mana* or psychic influence *(see* below) on what has less, and must therefore do as it is bidden. Such definitions, then, are to be accepted, if at all, as definitions of type, selective designations of leading but not strictly universal features. An encyclopaedic account, however, should rest rather on an exterior definition which can serve as it were to pigeon-hole the whole mass of significant facts. Such an exterior definition is suggested by E Crawley in *The Tree of Life*, 209, where he points out that "neither the Greek nor the Latin language has any comprehensive term for religion, except in the one ἱερά and in the other *sacra*, words which are equivalent to 'sacred.' No other term covers the whole of religious phenomena, and a survey of the complex details of various worships results in showing that no other conception will comprise the whole body of religious facts." It may be added that we have here no generalization imported from a higher level of culture, but an idea or blend of ideas familiar to primitive thought. An important consequence of thus giving the study of primitive religion the wide scope of a comparative hierology is that magic is no longer divorced from religion, since the sacred will now be found to be coextensive with the magico-religious, that largely undifferentiated plasm out of which religion and magic slowly take separate shapes as society comes more and more to contrast legitimate with illicit modes of dealing with the sacred. We may define, then, the religious object as the sacred, and the corresponding religious attitude as consisting in such manifestation of feeling, thought and action in regard to the sacred as is held to conduce to the welfare of the community or to that of individuals considered as members of the community.

II. Aspects of the Nature of the Sacred.—To exhibit the general character of the sacred as it exists for primitive religion it is simplest to take stock of various aspects recognized by primitive thought as expressed in language. If some, and not the least essential, of these aspects are quasi-negative, it must be remembered that negations—witness the Unseen, the Unknown, the Infinite of a more advanced theology—are well adapted to supply that mystery on which the religious consciousness feeds with the slight basis of conceptual support it needs. (1) *The sacred as the forbidden.* The primitive notion that perhaps comes nearest to our "sacred," whilst it immediately underlies the meanings of the Latin *sacer* and *sanctus,* is that of a *taboo,* a Polynesian term for which equivalents can be quoted from most savage vocabularies. The root idea seems to be that something is marked off as to be shunned, with the added hint of a mystic sanction or penalty enforcing the avoidance. Two derivative senses of a more positive import call for special notice. On the one hand, since that which is tabooed is held to punish the taboo-breaker by a sort of mystic infection, taboo comes to stand for uncleanness and sin. On the other hand, since the isolation of the sacred, even when originally conceived in the interest of the profane, may be interpreted as self-protection on the part of the sacred as against defiling contact, taboo takes on the connotation of ascetic virtue, purity, devotion, dignity and blessedness. Primary and secondary senses of the term between them cover so much ground that it is not surprising to find taboo used in Polynesia as a name for the whole system of religion, founded as it largely is on prohibitions and abstinences. (2) *The sacred as the mysterious.* Another quasi-negative notion of more restricted distribution is that of the mysterious or strange, as we have it expressed, for example, in the Siouan *wakan,* though possibly this is a derivative meaning. Meanwhile, it is certain that what is strange, new or portentous is regularly treated by all savages as sacred. (3) *The sacred as the secret.* The literal sense of the term *churinga,* applied by the Central Australians to their sacred objects, and likewise used more abstractly to denote mystic power, as when a man is said to be "full of *churinga,*" is "secret," and is symptomatic of the esotericism that is a striking mark of Australian, and indeed of all primitive, religion, with its insistence on initiation, its exclusion of women, and its strictly enforced reticence concerning traditional lore and proceedings. (4) *The sacred as the potent.* Passing on to positive conceptions of the sacred, perhaps the most fundamental is that which identifies the efficacy of sacredness with such mystic or magical power as is signified by the *mana* of the Pacific or *orenda* of the Hurons, terms for which analogies are forthcoming on all

sides. Of *mana* R. H. Codrington in ***The*** *Melanesians,* 119 *n.,* writes: "It essentially belongs to personal beings to originate it, though it may act through the medium of water, or a stone or a bone. All Melanesian religion consists . . . in getting this *mana* for oneself, or getting it used for one's benefit." E. Tregear's *Maori-Polynesian Comparative Dictionary* shows how the word and its derivatives are used to express thought, memory, emotion, desire, will—in short, psychic energy of all kinds. It also stands for the vehicle of the magician's energy—the spell; which would seem likewise to be a meaning, perhaps the root-meaning, of *orenda (cf.* J. *N. B.* Hewitt, *American Anthropologist,* N.S., iv. 40). Whereas everything, perhaps, has some share of indwelling potency, whatever is sacred manifests this potency in an extraordinary degree, as typically the wonder-working leader of society, whose *mana* consists in his cunning and luck together. Altogether, in *mana* we have what is *par excellence* the primitive religious idea in its positive aspect, taboo representing its negative side, since whatever has *mana* is taboo, and whatever is taboo has *mana.* (5) *The sacred as the animate.* The term "animism," which embodies Tylor's classical theory of primitive religion, is unfortunately somewhat ambiguous. If we take it strictly to mean the belief in ghosts or spirits having the "vaporous materiality" proper to the objects of dream or hallucination, it is certain that the agency of such phantasms is not the sole cause to which all mystic happenings are referred (though ghosts and spirits are everywhere believed in, and appear to be endowed with greater predominance as religious synthesis advances amongst primitive peoples). Thus there is good evidence to show that many of the early gods, notably those that are held to be especially well disposed to man, are conceived rather in the shape of magnified non-natural men dwelling somewhere apart, such as the Mungan-ngaur of the Kurnai of S.E. Australia *(cf.* A. Lang, *The Making of Religion,* x. *seq.).* Such anthropomorphism is with difficulty reduced to the Tylorian animism. The term, however, will have to be used still more vaguely, if it is to cover all attribution of personality, will or vitality. This can be more simply brought under the notion of *mana.* Meanwhile, since quasi-mechanical means are freely resorted to in dealing with the sacred, as when a Maori chief snuffs up the sanctity his fingers have acquired by touching his own sacred head that he may restore the virtue to the part whence it was taken (R. Taylor, Te *Ika* a *Maui,* 165), or when uncleanness is removed as if it were a physical secretion by washing, wiping and so forth, it is hard to say whether what we should now call a "material" nature is not ascribed to the sacred, more especially when its transmissibility after the manner of a contagion is the trait that holds the attention. It is possible, however, that the savage always distinguishes in a dim way between the material medium and the indwelling principle of vital energy, examples of a pure fetishism, in the sense of the cult of the purely material, recognized as such, being hard to find. (6) *The sacred as the ancient.* The prominence of the notion of the *Alcheringa* "dreamtime," or sacred past, in Central Australian religion illustrates the essential connection perceived by the savage to lie between the sacred and the traditional. Ritualistic conservatism may be instanced as a practical outcome of this feeling. Another development is ancestor-worship, the organized cult of ancestors marking, however, a certain stage of advance beyond the very primitive, though the dead are always sacred and have *mana* which the living may exploit for their own advantage.

III. The Activity of the Sacred.—The foregoing views of the sacred, though starting from distinct conceptions, converge in a single complex notion, as may be seen from the many-sided sense borne by such a term as *wakan,* which may stand not only for "mystery," but also for "power, sacred, ancient, grandeur, animate, immortal" (W. J. McGee, *15th Report of U. S. Bureau of Ethnology,* 182). The reason for this convergence is that, whereas there is found great difficulty in characterizing the elusive nature of the sacred, its mode of manifesting itself is recognized to be much the same in all its phases. Uniform characteristics are the fecundity, ambiguity, relativity and transmissibility of Its activity. (1) *Fecundity.* The mystic potency of the sacred is no fixed quantity, but is big with possibilities of all sorts. The same sacred person, object, act, will suffice for a variety of purposes. Even where a piece of sympathetic magic appears to promise definite results, or when a departmental god is recognized, there would seem to be room left for a more or less indefinite expectancy. It must be remembered that the meaning of a rite is for the most part obscure to the participants, being overlaid by its traditional character, which but guarantees a general efficacy. "Blessings come, evils go," may be said to be the magico-religious formula implicit in all socially approved dealings with the sacred, however specialized in semblance. (2) *Ambiguity.* Mystic potency, however, because of the very indefiniteness of its action, is a two-edged sword. The sacred is not to be approached lightly. It will heal or blast, according as it is handled with or without due circumspection. That which is taboo, for instance, the person of the king, or woman's blood, is poison or medicine according as it is manipulated, being inherently just a potentiality for wonder-orking in any direction. Not but what primitive thought shows a tendency to mark off a certain kind of mystic power as wholly bad by a special name, *e.g.,* the *arungquilta* of Central Australia; and here, we may note, we come nearest to a conception of magic as something other than religion, the trafficker in *arungquilta* being socially suspect, nay, liable to persecution, and even death (as amongst the Arunta tribe, *see* Spencer and Gillen, *The Arunta,* ii. 414 *n.),* at the hands of his fellows. On the other hand, wholly beneficent powers seem hardly to be recognized, unless we find them in beings such as hfungan-ngaur ("father-our"), who derive an ethical character from their association with the initiation ceremonies and the moral instruction given thereat *(cf.* Lang, *l.c.).* *(3) Relativity.* So far we have tended to represent the activity of the sacred as that of a universal force, somewhat in the style of our "electricity" or "mind." It remains to add that this activity manifests itself at numberless independent centres. These differ amongst themselves in the degree of their energy. One spell is stronger than another, one taboo more inviolable than another. W. H. R. Rivers *(The Todas, 448)* gives an interesting analysis of the grades of sanctity apparent in Toda religion. The gods of the hill-tops come first. The sacred buffaloes, their milk, their bells, the dairies and their vessels are on a lower plane; whilst we may note that there are several grades amongst the dairies, increase of sanctity going with elaboration of dairy ritual *(cf. ibid.* 232). Still lower is the dairyman, who is in no way divine, yet has sanctity as one who maintains a condition of ceremonial purity. (4) *Transmissibility.* If, however, this activity originates at certain centres, it tends to spread therefrom in all directions. F. B. Jevons (in *An Introduction to the History of Religion,* vii.) distinguishes between "things taboo," which have the mystic contagion inherent in them, and "things tabooed." to which the taboo-infection has been transmitted. In the former class he places supernatural beings (including men with *mana* as well as ghosts and spirits), blood, new-born children with their mothers, and corpses; which list might be considerably extended, for instance, by the inclusion of natural portents, and animals and plants such as are strikingly odd, dangerous or useful. Any one of these can pass on its sacred quality to other persons and objects (as a corpse defiles the mourner and his clothes), nay to actions, places and times as well (as a corpse will likewise cause work to be tabooed, ground to be set apart, a holy season to be observed). Such transmissibility is commonly explained by the association of ideas, that becoming sacred which as it were reminds one of the sacred; though it is important to add, firstly, that such association takes place under the influence of a selective interest generated by strong religious feeling, and, secondly, that this interest is primarily a collective product, being governed by a social tradition which causes certain possibilities of ideal combination alone to be realized, whilst it is the chief guarantee of the objectivity of what they suggest.

IV. The Exploitation of the Sacred. **A.** Methods.—It is hard to find terms general enough to cover dealings with the sacred that range from the manipulation of an almost inanimate type of power to intercourse modelled on that between man and man. Primitive religion, however, resorts to either way of ap-

proach so indifferently as to prove that there is little or no awareness of an inconsistency of attitude. The radical contrast between mechanical and spiritual religion, though fundamental for modern theology, is alien to the primitive point of view, and is therefore inappropriate to the purposes of anthropological description. (1) *Acquisition.* Mystic power may be regarded as innate so far as skill, luck or queerness are signs and conditions of its presence. On the whole, however, savage society tends to regard it as something acquired, the product of acts and abstinences having a traditional character for imparting magico-religious virtue. An external symbol in the shape of a ceremony or cult-object is of great assistance to the dim eye of primitive faith. Again, the savage universe is no preserve of man, but is an open field wherein human and non-human activities of all sorts compete on more or less equal terms, yet so that a certain measure of predominance may be secured by a judicious combination of forces. (2) *Concentration.* Hence the magico-religious society or individual practitioner piles ceremony on ceremony, name of power on name of power, relic on relic, to consolidate the forces within reach and assume direction thereof. The transmissibility of the sacred ensures the fusion of powers drawn from all sources, however disparate. (3) *Induction.* It is necessary, however, as it were, to bring this force to a head. This would appear to be the essential significance of sacrifice, where a number of sacred operations and instruments are made to discharge their efficacy into the victim as into a vat, so that a blessing-yielding, evil-neutralizing force of highest attainable potency is obtained *(see* H. Hubert and M. Mauss, "Essai sur la nature et la fonction du sacrifice" in *L'Année sociologique,* ii.). *(4) Renovation.* An important *motif* in magico-religious ritual, which may not have been without effect on the development of sacrifice, is, as Frazer's main thesis in *The Golden Bough* asserts, the imparting of reproductive energy to animals, plants and man himself, its cessation being suggested by such phenomena as old age and the fall of the year. To concentrate, induce and renovate are, however, but aspects of one process of acquisition by the transfusion of a transmissible energy. (5) *Demission.* Hubert and Mauss show in their penetrating analysis of sacrifice that after the rite has been brought to its culminating point there follows as a pendant a ceremony of re-entry into ordinary life, the idea of which is preserved in the Christian formula *Ite, missa est. (6) Insulation.* Such deposition of sacredness is but an aspect of the wider method that causes a ring-fence to be erected round the sacred to ward off casual trespassers at once in their own interest and to prevent contamination. We see here a natural outcome of religious awe supported by the spirit of esotericism, and by a sense of the need for an expert handling of that which is so potent for good or ill. (7) *Direction.* This last consideration brings to notice the fact that throughout magico-religious practice of all kinds the human operator retains a certain control over the issue. In the numberless transitions that, whilst connecting, separate the spell and the prayer we observe as the accompaniment of every mood from extreme imperiousness to extreme humility an abiding will and desire to help the action out. Even "Thy will be done" preserves the echo of a direction, and, needless to say, this is hardly a form of primitive address. At the bottom is the vague feeling that it is man's own self-directed mysterious energy that is at work, however much it needs to be reinforced from without. Meanwhile, tradition strictly prescribes the ways and means of such reinforcement, so that religion becomes largely a matter of sacred lore; and the expert director of rites, who is likewise usually at this stage the leader of society, comes more and more to be needed as an intermediary between the lay portion of the community and the sacred powers.

V. Results. — Hitherto our account of primitive religion has had to move on somewhat abstract lines. His religion is, however, anything but an abstraction to the savage, and stands rather for the whole of his concrete life so far as it is penetrated by a spirit of earnest endeavour. The end and result of primitive religion is, in a word, the consecration of life, the stimulation of the will to live and to do. This bracing of the vital feeling takes place by means of imaginative appeal to the great forces man perceives stirring within him and aboat him, such appeal proving effective doubtless by reason of the psychological law that to conceive strongly is to imitate. Meanwhile, security against any clashing of conceptions to inhibit the tendency of the idea of an acquired "grace" to realize itself in action, is assured by the complete unanimity of public opinion, dominated as it is by an inveterate custom. To appreciate the consecrating effect of religion on primitive life we have only to look to the *churinga*-worship of the Central Australians (as described by Spencer and Gillen in *The Native Tribes of Central Australia,* [1] *The Northern Tribes of Central Australia* and *The Arunta).* Contact with *these* repositories of mystic influence "makes them glad" (*Nat. Tr.* 165); it likewise makes them "good," so that they are no longer greedy or selfish *(North. Tr.* 266); it endows them with second sight *(ibid.);* it gives them confidence and success in war (*Nat. Tr.* 135); in fact, there is no end to its "strengthening" effects *(ibid. n.).* Or, again, we may note the earnestness and solemnity that characterize all their sacred ceremonies. The inwardness of primitive religion is, however, non-existent for those who observe it as uninitiated strangers; whilst, again, it evaporates as soon as native custom breaks down under pressure of civilization, when only fragments of meaningless superstition survive: for which reason travesties of primitive religion abound.

It remains to consider shortly the consecration of life in relation to particular categories and departments. (1) *Education.* Almost every tribe has its initiation ceremonies, and in many tribes adult life may almost be described as a continuous initiation. The object of these rites is primarily to impart mystic virtue to the novice, such virtue, in the eyes of the primitive man, being always something more than social usefulness, amounting as it does to a share in the tribal luck by means of association with all it holds sacred. Incidentally the candidate is trained to perform his duties as a tribesman, but religion presides over the course, demanding earnest endeavour of an impressionable age. (2) *Government.* Where society is most primitive it is most democratic, as in Australia, and magico-religious powers are possessed by the whole body of fully initiated males, age, however, conferring increase of sacred lore and consequently of authority; whilst even at this stage the experts tend to form an inner circle of rulers. The man with *mana* is bound to come to the top, both because his gifts give him a start and because his success is taken as a sign that he has the gift. A decisive "moment" in the evolution of chiefship is the recognition of hereditary *mana,* bound up as this is with the handing on of ceremonies and cult-objects. Invested, as society grows more complex, with a sanctity increasingly superior to that of the layman, the priest-king becomes the representative of the community as repository of its luck, whilst, as controller of all sacred forces that bear thereon, he is, as Frazer puts it, "dynamical centre of the universe" (*The Golden Bough* [3rd ed.], iii. 1). Only when the holy man's duty to preserve his holiness binds him hand and foot in a network of taboos does his temporal power tend to devolve on a deputy. (3) *Food-supply.* In accordance with the principle of Renovation *(see* above), the root-idea of the application of religion to economics is not the extorting of boons from an unwilling nature, but rather the stimulation of the sources of life, so that all beings alike may increase and multiply. (4) *Food-taking.* Meanwhile, the primitive meal is always more or less of a sacrament, and there are many food-taboos, the significance of which is, however, not so much that certain foods are unclean and poisonous as that they are of special virtue and must be partaken of solemnly and with circumspection. (5) *Kinship.* It is hard to say whether the unit of primitive society is the tribe or the group of kinsmen. Both are forms of union that are consolidated by means of religious usages. Thus in Australia the initiation ceremonies, concerned as they partly are with marriage, always an affair between the kin-groups, are tribal, whilst the totemic rites are the prime concern of the members of the totem clans. The significance of a common name and a common blood is immensely enhanced by its association with mystic rights and duties, and the pulse of brotherhood beats faster. (6) *The Family.* Side by side with the kin there is always found the domestic group, but the latter

institution develops fully only as the former weakens, so that the one comes largely to inherit the functions of the other, whilst the tribe too in its turn hands over certain interests. Thus in process of time birth-rites, marriage-rites, funeral-rites, not to mention subordinate ceremonies such as those of name-giving and food-taking, become domestic sacraments. *(7) Sex.* Woman, for certain physiological reasons, is always for primitive peoples hedged round with sanctity, whilst man does all he can to inspire awe of his powers in woman by keeping religion largely in his own hands. The result, so far as woman is concerned, is that, in company with those males who are endowed with sacredness in a more than ordinary degree, she tends as a sex to lose in freedom as much as she gains in respect. *(8) Personality.* Every one has his modicum of innate *mana,* or at least may develop it in himself by communicating with powers that can be brought into answering relation by the proper means. Nagualism, or the acquisition of a mystic guardian, is a widely distributed custom, the essence of which probably consists in the procuring of a personal name having potency. The exceptional man is recognized as having *mana* in a special degree, and a belief thus held at once by others and by himself is bound to stimulate his individuality. The primitive community is not so custom-bound that personality has no chance to make itself felt, and the leader of men possessed of an inner fund of inspiration is the wonder-worker who encourages all forms of social advance.

VI. Psychology of the Primitive Attitude Towards the Sacred.—We are on firmer ground when simply describing the phenomena of primitive religion than when seeking to account for these in terms of natural law—in whatever sense the conception of natural law be applicable to the facts of the mental life of man. One thing is certain, namely, that savages stand on virtually one footing with the civilized as regards the type of explanation appropriate to their beliefs and practices. We have no right to refer to "instincts" in the case of primitive man, any more at any rate than we have in our own case. A child of civilized parents brought up from the first amongst savages is a savage, neither more nor less. Though race may count for something in the matter of mental effectiveness—and at least it would seem to involve differences in weight of brain—it clearly counts for much less than does *milieu,* to wit, that social environment of ideas and institutions which depends so largely for its effectiveness on mechanical means of tradition, such as the art of writing. The outstanding feature of the mental life of savages known to psychologists as "primitive credulity" is doubtless chiefly due to sheer want of diversity of suggestiveness in their intellectual surroundings. Their notions stick fast because there are no competing notions to dislodge them. Society suffers a sort of perpetual obsession, and remains self-hypnotized as it were within a magic circle of traditional views. A rigid orthodoxy is sustained by means of purblind imitation assisted by no little persecution. Such changes as occur come about, not in consequence of a new direction taken by conscious policy, but rather in the way that fashions in dress alter amongst ourselves, by subconscious, hardly purposive drifting. The crowd rather than the individual is the thinking unit. A proof is the mysterious rapid extinction of savages the moment that their group-life is broken up; they are individually so many lost sheep, without self-reliance or initiative. And the thinking power of a crowd—that is, a mob, not a deliberative assembly—IS of a very low order, emotion of a "panicky" type driving it hither and thither like a rudderless ship. However, as the students of mob-psychology have shown, every crowd tends to have its *meneur,* its mob-leader, the man who sets the cheering or starts the running-away. So too, then, with the primitive society. Grossly ignorant of all that falls outside "the daily round, the common task," they are full of panicky fears in regard to this unknown, and the primary attitude of society towards it is sheer avoidance, taboo. But the mysterious has another face. To the mob the mob-leader is mysterious in his power of bringing luck and salvation; to himself also he is a wonder, since he wills, and lo! things happen accordingly. He has *mana,* power, and by means of this *mana,* felt inwardly by himself, acknowledged by his fellows, he stems the social impulse to run away from a mystery. Not without nervous dread—witness the special taboo to which the leader of society is subject—he draws near and strives to constrain, conciliate or cajole the awful forces with which the life of the group is set about. He enters the Holy of Holies; the rest remain without, and are more than half afraid of their mediator. In short, from the standpoint of lay society, the manipulator of the sacred is himself sacred, and shares in all the associations of sacredness. An anthropomorphism which is specifically a "magomorphism" renders the sacred powers increasingly one with the governing element in society, and religion assumes an ethico-political character, whilst correspondingly authority and law are invested with a deeper meaning.

VII. The Abuse of the Sacred.—Lest our picture of primitive religion appear too brightly coloured, a word must be said on the perversions to which the exploitation of the sacred is liable. Envy, malice and uncharitableness are found in primitive society, as elsewhere, and on their behalf the mystic forces are not infrequently unloosed by those who know how to do so. To use the sacred to the detriment of the community, as does, for instance, the expert who casts a spell, or utters a prayer, to his neighbour's hurt, is what primitive society understands by magic (cf. *arungquilta,* above), and anthropology has no business to attach any other meaning to the word if it undertakes to interpret the primitive point of view. On the other hand, if those in authority perpetrate in the name of what their society holds sacred, and therefore with its full approval, acts that to the modern mind are cruel, silly or revolting, it is bad science and bad ethics to speak of vice and degradation, unless it can be shown that the community in which these things occur is thereby brought nearer to elimination in the struggle for existence. As a matter of fact, the earlier and more democratic types of primitive society, uncontaminated by our civilization, do not present many features to which the modern conscience can take exception, but display rather the edifying spectacle of religious brotherhoods encouraging themselves by mystical communion to common effort. With the evolution of rank, however, and the concentration of magico-religious power in the hands of certain orders, there is less solidarity and more individualism, or at all events more opportunity for sectional interests to be pursued at other than critical times; whereupon fraud and violence are apt to infect religion. Indeed, as the history of the higher religions shows, religion tends in the end to break away from secular government with its aristocratic traditions, and to revert to the more democratic spirit of the primitive age, having by now obtained a clearer consciousness of its purpose, yet nevertheless clinging to the inveterate forms of human ritual as still adequate to symbolize the consecration of life—the quickening of the will to face life earnestly.

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B. THE HIGHER RELIGIONS

No attempt can here be made to deal in detail with the Higher Religions. These are treated elsewhere under their respective headings. The different Higher Religions will only be considered in so far as they exhibit general principles. The main object of this section will be to show the lines on which the higher religious consciousness has developed, the broad features which it discloses, and the way in which it gives expression to human needs.

I. THE BASIS OF HIGHER RELIGION

Higher religions have developed on a pre-existing basis, in response to an impulse of the religious spirit seeking better self-expression. They have grown out of primitive religion, and all of them exhibit traces of their lineage. The survival of primitive traits in developed religion is a recurring phenomenon.

Evidently a higher religion can only emerge from a lower by a process of selection ana development. Certain elements in early religion were intractable to development, while others were capable of it. To the former must be reckoned the strongly local character and particularist tendency of primitive religion. Spirits or powers attached to a definite spot, or embodied in a specific object are not easily elevated or expanded. Sentiment is conservative, and the being reverenced is too much lacking in individual quality to be readily transformed into a personal god. On the other hand, though the feeling of the clan that its objects of worship belong to it resists absorption in a larger cult, the strong sense of affinity with divine powers is capable of being elevated to a higher religious relationship. The same holds of primitive rites of communion. So too primitive ideas of Tabu and Interdiction have naturally passed into conceptions of the sacred and not-sacred, the pure and the impure, ideas that play a great part in developed religion. Again the cult of the dead, passing into that of family ancestors (see ANCESTOR WORSHIP) easily expands with the enlargement of society: it has contributed important elements to national religion as in the case of China and ancient Rome. There are then higher possibilities in primitive religion, but they can only come to fruition with the emergence of new needs and a wider outlook.

II. THE RISE AND GROWTH OF POLYTHEISM

Higher religions emerge after the tribal has been superseded by the national culture. The transition to the more developed stage was the outcome of social changes which were reflected in the growth of man's inner life. This enrichment of personal life carried with it the need of a revised idea of the objects of worship and of the religious relation. The old spiritism, with its multitude of indefinite powers and capricious daemons. no longer corresponded to man's better ordered life and his varied and specialized interests. The larger and more constant values of a social order based on agriculture required divine beings capable of responding to its wants, and the rise of polytheism was the answer to these religious demands. The polytheistic system was the expression of man's vision of the world, a world of diverse departments and manifestations though not a real unity. But polytheism marks an advance. For it helped (a) to liberate religion from its bondage to purely local associations. And (b), it replaced the colourless powers or *numina* of older belief by a number of divine beings of more specific character and with more or less definite spheres of activity. A god, as distinguished from a spirit, is a being with determinate qualities which embody the values of which men are conscious.

(1) *The* Emergence of Gods.—The formless spirits supply only a shifting and uncertain basis on which to evolve a god. It has been suggested that the Greek deities Hermes and Artemis were developed in this way, and the Roman goddess Juno has been construed as the general personification of the fertility *numen* or Juno of every woman. In any case such a process is infrequent. And the instances in which a totem has grown into a god, if they do occur at all, are extremely rare. What is clear is, that many of the greater gods have a connection with the phenomena of nature, and show traces of this relationship. Sometimes the connection is quite definite. Thus the Egyptian Ra and the Babylonian Shamash are sun-gods. The Greek Zeus, to whom corresponds the Vedic Dyaus, is a sky-god, and Ushas of the Vedic Hymns is a dawn-goddess. But there are many instances where the connection of a deity with nature cannot be precisely stated, though the general fact is not in doubt. Thus it remains uncertain what the natural basis of the Egyptian Osiris is; and we cannot say more of the Vedic Varuna and Vishnu than that they are connected with light and the heaven. The later development of a deity usually furnishes a very slender clue to his real origin. Moreover when the identification of a deity with a phenomenon of nature is transparent and precise, it is difficult for the god to develop by assuming new and higher qualities.

But while the greater phenomena of nature, by the fact that they possess a kind of physical universality, were a means of helping the mind to rise to the conception of deities of wider range and power, all gods are not to be explained thus. For some of them have their origin in the cult. The Hindu Soma is the power of the sacrificial libation, and Brahma the power of the sacrificial prayer personified. The Greek Hestia and the Roman Vesta (*q.v.*) have grown out of the sacred hearth as the centre of family life. Again, aspects of the cultural life, such as war and agriculture, have suggested deities who preside over them. In some cases men remarkable for their power and deeds have been exalted to the rank of divine, or semi-divine beings, *e.g.*, the Greek Herakles and Asklepios. (See ASCLEPIUS and HERCULES.) The motives which develop polytheism are complex.

(2) The Characterization *of* the Gods.—As social Life expands, its values become more varied, and the representations of the gods gain correspondingly in content. A god takes on new qualities and aspects in response to the needs and desires of his worshippers, and this process appears in all religions. Few gods have acquired so varied qualities and offices as the Greek Apollo. His identification with the sun is comparatively late, and his original character obscure. But he came to figure as the lord of flocks and herds, the master of oracles and prophecy, the god of healing, of purification, and of poesy. The imaginative process which predicated diversified attributes to a deity at the same time expressed the interests and aspirations of his worshippers. And the cultus was the chief medium by which these tendencies were developed and took concrete form.

The problem of organization is urgent where a religion arises out of the fusion of different cultures Conspicuous instances are Babylonian and Greek religion. The Semitic invaders of Babylonia absorbed the older Sumerian culture, and found a place for Sumerian deities within their own pantheon. Greek civilization, as we now know, was the result of a fusion of two races, a race of Aryan invaders with the "Helladic" race. And it is almost certain that some of the Hellenic deities, e.g Athene, Artemis, and Aphrodite, were adopted by the Greeks from the older culture. Yet it is always hard to achieve organization in the religious complex of polytheism even when a fusion of cultures seems to render it essential. The local associations and the cult-interests of the dei-

ties of the conquered race resist absorption. This difficulty may be overcome by fitting them into the enlarged pantheon as sons or servants of greater gods. Even then the older cults and beliefs will linger on. Homeric religion is no doubt an example of organisation; but it is artificial and literary. it does not fairly represent the actual beliefs and cult-practices in Greece. Still, however imperfectly the process may work itself out, there is behind polytheistic religion an impulse towards order and system. The development of social life, with its well-marked departments and functions, prompted the mind to conceive the divine world after the pattern of the human. The needs of worship, where not dominated by magical ideas, led in the same direction. For worship at the higher level cannot be easily apportioned among a number of divine beings whose mutual relations are quite indefinite. Some order and gradation are necessary.

III. THE CULTUS IN HIGHER RELIGIONS

The cultus is the focus of a religion: here it is concentrated and symbolized. As the focus of religious life the cultus becomes the point at which the sense of the sacred is most concentrated and intense. Radiating from this centre the sacred suffuses associated elements, investing with religious significance things and persons, places and times.

(1) The *Sacred* Place.—In early religion a place or thing became sacred through the presence in it of a spirit or power: *numen inest.* But when men began to build houses, when the house became the centre of family life, the thought lay to hand that there must be a house for the deity to be the focus of his worship. So the temple arose, reared often on sacred spots or "high places," hallowed by immemorial associations. As the deity was supposed to be more intimately present in his temple, it often became a centre of oracles and prophecy.

(2) *Sacred Men: tire Priesthood.*—To holy places correspond holy men. The priest has his precursor in the wizard of the lower culture. The priest is a man endowed with a special knowledge of the cultus, is possessed of ritual purity, and embodies in his person the power of the sacred. At first priestly functions were not the exclusive privilege of a class. The head of the family, or the king as head of the people, offers sacrifice, so in the old Hebrew and Roman religions. But with the growing value attached to sacred functions there was the tendency to assign the priestly office to a particular class, as in the Hebrew, Persian and Hindu religions. Nowhere have the priests formed a more strict and exclusive caste than in Brahmanism.

(a) Prayer.—Perhaps nowhere does the spirit of a religion reveal itself more intimately than in its prayers. Yet even in the higher religions the idea of prayer as the free outpouring of the soul to the divine comes late. Primitive prayer is closely allied to the spell, and it must take a fixed form of words to be effective. The elevation of prayer comes with the development of inner life and an enhanced sense of ethical and spiritual values. Some knowledge of the kind of prayers offered in the cultus may be gathered from liturgical forms, *e.g.* from the sacrificial hymns of the Gathas and the Vedas. Prayer as petition to the gods is universal. But only in a few religions do we find prayers containing confessions of sin *e.g.* in the penitential psalms of the Hebrew and the Babylonian religions. Nowhere is the mysterious potency of prayer so exalted as in Brahmanism. Here prayer becomes a cosmic power which constrains the gods, and is finally construed as the divine principle of things. But wherever prayer ceases to be the expression of a fundamental dependence on the Divine, it loses its essential meaning and value. An intrinsically efficacious form of words is really a reversion to the magic spell. (See PRAYER.)

(b) *Sacrifice.*—Sacrifice springs from a deep-rooted impulse of the religious nature. It plays a part in early religion, and is present in some form in all the higher religions. The purpose of sacrifice is to maintain and strengthen. or to restore. fellowship with divine powers. and it takes a central place in the cultus. In the burnt-offering the sacrifice is wafted to the gods. In the bloody offering the victim, through contact with the altar, becomes charged with the sacred, and its sprinkled blood has atoning virtue. The idea of substitutionary atonement is later and is due to reflection. In sacrifices of purification and atonement there is an ethical element which may lead to the higher development of religion. Just as with prayer, however, sacrifice may evolve in a way which is detrimental to the religious relation. What lifts sacrifice to an ethical and spiritual level is the conception of the righteousness of God. Where this obtains it is the inner side of the sacrificial act which is emphasised, the offering of the contrite heart and the obedient will. (See SACRIFICE.)

IV. RELIGIONS OF OBSERVANCE AND PROPHETIC RELIGIONS

The ritual aspect of religion tends to grow with the increasing complexity of the social order. When this tendency prevails religion takes on the specific character of legal observance.

(1) Religions of Observance *and* Law.—The idea of fixed observances or rules binding on the faithful develops where the idea of ritual purity is emphasised. The roots of the conception of the clean and unclean go back to primitive ideas of the sacred and of the dangerous with the associated apotropaic rites of expulsion. The growth of a sacral system leads to the fuller definition of the clean and unclean, and rules and forms are prescribed to preserve purity and remove impurity. In many higher religions there are detailed methods and a ritual of cleansing. In Roman religion we have lustration, which combined cathartic and apotropaic rites, and in Greece cathartic rites were specially connected with Apollo, the god of ritual purity. It is, however, in later Persian religion that rites of purification receive the most comprehensive and detailed expression, and nowhere is the notion of purity so dominant and pervasive. To all the numerous defilements that are possible correspond stated cleansings, and the Vendidad itself has been described as a kind of sin-codex. With this we may compare the laws of purity and impurity in the book of Leviticus, a book which embodies the cathartic ritual of post-Exilic Judaism. When a higher religion has developed a complicated system of ritual observance it brings the sense of the sacred into close and constant relation with the varied details of life. On the other hand, the religion itself is exposed to great dangers. The magical beliefs, which are a heritage of older religion, always tend to reassert themselves, and the religious rites readily degenerate to a mechanical performance which has intrinsic efficacy. When this happens the way to spiritual development is closed, and the later Persian and Jewish religions did not wholly escape the danger.

(2) Prophetic Religion.—Religion as piety has its centre within. The prophetic spirit proclaims this principle, and is itself the issue of personal and moral conviction. The prophet turns from the formal and external side of religion to emphasize its inner life, and when such a movement appears within a national religion it involves a loosening of religion from the social and political system. Great religious reforms and renewals arise from an individual or individuals for whom religion has become an intense and personal concern. Such a prophetic figure was Zarathustra. As we picture him from the Gathas he was a man of burning conviction, for whom Ahura Mazda was a supreme and moral deity whose cause is the right as against the lie. In this conflict the prophet calls men to fight and freely to choose the good. A like intense moral conviction and faith in the righteousness of Jahveh appears in the eighth century prophets of Israel linked with an even greater stress on the inner side of piety. The same note recurs in the teaching of Jèsus that the vision of God is for the pure in heart.

It is curious to find an emphasis on the inner side of religion appearing within Hinduism. It emerges in the doctrine of Bhakti which has its classical expression in the Bhagavad Cita. Here we have the doctrine that trust and devotion, faith and love, to the divine power are a means of salvation. Religion assumes a personal colour. With Buddha this principle appears in the form of an extreme subjectivism. Within man himself lies the secret of salvation.

The work of the prophetic spirit makes possible the high stages of spiritual religion. Apart from its vivifying influence institu-

tional religion tends to grow formal and fixed, and its inner life to ebb. "Where there is no vision the people perish." The uprising of the prophet is a token that a religion which seems dead has still within it the springs of life.

V. REDEMPTIVE RELIGIONS

The prophetic movement is one symptom of the enhanced sense of personal and religious values, and the emergence of religions of salvation or redemption is another. Both indicate a slackening of the tie which binds religion to the national and political structure. For the official religion which men share simply as citizens of the state, a religion concerned with external observance rather than inner spirit and motives, no longer satisfies the more personal needs of which men are becoming aware. Corresponding to this increasing self-consciousness there grows up a craving for a more intimate and individual relation with the divine Power, a craving which the traditional religious forms cannot meet. And this feeling is deepened by the personal sense of the evils and sufferings of life. This longing for deliverance finds no fulfilment in the customary and external religion that a man inherits from his social group. Some better way is necessary; and the personal consciousness of the need of salvation carries with it a sense of responsibility for realizing it. So men seek some mode of expressing the religious spirit which shall embody their choice and preference, for religion must be in a more intimate sense their own. As the new movement takes its rise from broadly human needs. the form of religion which meets these needs cannot be merely local and particular: in its meaning at least it mill be universal. This implies that the form of the religious relation is reconstituted. and this carries with it a differentiation of the religious community from political society. There now come into being religious associations or churches, where membership is based on a voluntary adherence to a particular religion or cult. This principle of a sacred society or church. clearly distinguished from secular society, is of great significance in the evolution of religion. For only under such conditions can the other-worldly or transcendent element in faith come to its due, and religion itself be delivered from bondage to political and secular interests. The idea of the sacred gains spiritual significance: the sacred community is united not merely in the observance of sacred rites but by a common disposition of the mind and will toward a religious good. And this good is not mundane but supramundane.

The new tendency finds expression in different ways. It appears as a movement which. without deliberately breaking with existing religion, takes form in religious associations which minister to felt religious wants. Again it appears as a philosophic gospel which offers spiritual deliverance to elect souls. Finally it manifests itself in the birth of a new religion, a religion which originates with a personal founder who proclaims a message of salvation. To the first class belong the various forms of mystery religions which were common in Creek and Mediterranean lands for a period of eight centuries B.C. One of the best known is the Orphic mysteries, a cult open at least to all Hellenes who underwent initiation. This cult held out the prospect of immortality and union with the divine. The body was a kind of tomb (σῶμα, σῆμα) from which the soul had to win deliverance. The way of salvation was by purification, abstinence and sacramental rites. The idea of something peculiarly sacred, in which the initiated participate, is common to mystery religions. The later mystery cults. like those of Attis, Isis and Mithras. which were widespread in eastern Mediterranean lands in the post-Alexandrian period, set in the foreground the spectacle of the dying and reviving god. Their votaries, through baptism, purification and a sacramental meal, somehow shared in the being of the god and with him rose to new life.

In the philosophic sphere, Neoplatonism proclaims the deliverance of the soul through an ecstatic union with the One that transcends rational thinking. Philosophic Brahmanism likewise has a doctrine of salvation, but a salvation through knowledge of the identity of the self with the Absolute or Brahman.

In Buddhism and in Christianity the spirit of redemptive religion is most fully expressed. In Buddhism the principle is seen taking an extreme subjective form. Buddha discards the metaphysics of Brahmanism, though he shares with it the idea that salvation comes through knowledge. The Enlightened, the Arahat, knows that thirst, with its attendant desire and suffering, is the evil of life, and by following the Noble Eightfold Way he advances to that indefinable goal, Nirvana. Redemption is thus a negative process: it is a gospel for the monk who breaks with the world rather than for the ordinary man who has to live in the world. Christian redemption is a richer and more positive conception. The deliverance sought is from moral evil or sin, and it is conditioned by repentance and faith. The end is not the extinction of personality but its enrichment through the power of a divine life, and it has corporate expression in life in the Kingdom of God which overcomes the evil in the world. Christian redemption is marked by its theistic basis, its sense of personal values and its positive character. The religious society of Buddhism is a monkish community: that of Christianity is the church, or the fellowship of the faithful united in the service of God.

VI. PANTHEISM, MYSTICISM AND MONOTHEISM

These are features found only in the higher religious culture. They all claim to be an advance on some existing religious system.

(1) *Pantheism.*

Pantheism is in the main a result of the development of reflective thinking. In the many it finds merely the passing appearances of the One. If pantheism is a late development, it was at least foreshadowed at earlier stages of religious evolution. Men soon became dimly conscious of a unity pervading the cosmic order and everywhere operative throughout it. In the Hindu conception of Rita and of Karma we have the idea of a power behind all things working by inflexible law. The ancient Chinese Tao conveys a sense of the eternal order and way of the universe. The Greek Moira and the Persian Asha contain the same ideas. This belief in a universal principle, when applied to polytheism, leads to the notion of a common power behind the gods and suggests that the various gods are only forms of the one Reality. Thus during the middle kingdom in Egypt reflective thinking treated the various gods as manifestations of Ra, and among the priesthood there was an esoteric pantheism.

The trend toward pantheism works itself out more readily when the gods are not sharply defined in their specific character and attributes. This was the case with the Vedic gods, since the qualities of one were often transferred to another. In the avatars of Vishnu one god assumes many divine forms. So by an easy process of transition the pantheism of the Upanishads and the Vedanta is reached. Here pantheism is thoroughgoing. All cosmic and psychical phenomena are unified in the one real Being: Brahman-Atman, the soul and the Absolute, are identical. Tat *tvam asi:* "that art thou." The multiplicity of the phenomenal world is only Maya or illusion; it disappears with knowledge. In contrast the clear-cut gods of Greece resisted a process of fusion. The Stoic pantheism, which identified Zeus with the universal and immanent reason or Logos, was rather an independent speculative theory than a development of Greek religion.

Religious pantheism is in the main a reflective development resulting from rational demands. If consistent, it is not a working religious creed, for it abolishes the religious relation by reducing it to an identity. (See PANTHEISM.)

(2) *Mysticism.*

Mysticism. like pantheism, in the strict sense is a phenomenon of highly developed religion. Individualistic in character, it is the outcome of a longing for intimate communion with the Divine. The mystery religions show a mystic tendency in their doctrine of union with the god through the sacramental meal. The same is perhaps true of Hindu Yoga which is a method of inducing religious ecstasy by concentration and absorption of mind. The Yogin became for others a kind of supernatural being. But mysticism proper is a conscious reaction against the externality of a merely intellectual knowledge of God: its goal is a perfect union with the Deity in which the element of difference implied in thinking is overcome. The Neoplatonic union of the

soul with the One is a purely mystical experience. The same spiritual movement appeared within Islam in Sufism, which no doubt was influenced by Neo-Platonism. The sufi sought to purge his mind of all that was not God, and the perfect man attained to absorption in God. The great mediaeval mystics sought the same consummation. an *unio mystica* achieved by transcending the form of thinking. Mysticism is loosely related to official and institutional religion. Possessing a "more excellent way," it can dispense with the recognized means of mediation. But if it invests religion with a new warmth and intimacy, it is deficient as a social power. And mysticism is always exposed to the danger of falling into pantheism. *(See* MYSTICISM.)

(3) Monotheism.

Monotheism is a late phenomenon of religion. The hypothesis of a primitive monotheism lacks foundation, and is intrinsically improbable. Beyond doubt the spirit and meaning of religion attain their fullest and best expression in some form of monotheistic faith. Polytheism disperses the religious interest: intimacy of worship and the confidence of trust are only possible when there is one, and only one, object of religious devotion. The trend towards monotheism was gradual, and it had preparatory stages. The first stage was what is called monarchianism. After the analogy of human society one deity is exalted above the rest, and becomes the king of the gods. A familiar example is the Homeric Zeus who stands supreme over all the gods and looks down on the conflicts of mortals among whom his will is accomplished. (Διὸς δ' ἐτελείετο βουλή.) The Babylonian Marduk and the Egyptian Ra are illustrations of the same phenomenon of one deity attaining a position of undisputed sovereignty. A rather more advanced stage is that of monolatry, where other gods are admitted to exist, but worship is reserved for one. This we find in Hebrew religion in the pre-prophetic period.

The earliest attempt—an abortive one—to introduce a pure monotheism, in this case a solar monotheism, is that of the Egyptian Amenhotep IV. in the XIVth century B.C. More impressive is the monotheism of Zarathustra, perhaps some eight hundred years before our era. This monotheism rests on a comprehensive view of the world. The physical and moral order derive from the one God, his will is right, and all the pure elements of life belong to his kingdom. The pronounced dualism of the later Avesta is absent from the prophet's teaching. With the eighth century prophets of Israel the earlier monolatry became a true monotheism. This monotheistic universalism finds its clearest utterance in the work of Deutero-Isaiah. From this heritage of Hebrew religion Christianity derived its pure monotheism, and the same influence is manifest in the monotheism of Islam.

Monotheism is the ripest expression of the religious consciousness. It rests on the conviction that the ethical and religious values must have a sufficient ground, and this is the one God on whom all existence and value depend.

VII. REVELATION AND THEOLOGY

Belief in the communication of truth to man from a divine source is common in religions. This kind of communication usually concerns the future, and may be subject to a process of interpretation. Hence the practices of divination, the reading of omens and auspices, and star-lore. But the communication may be in and to the individual, for instance through visions and dreams.

(1) *Revelation.*

More especially is revelation thought to come through inspiration or "possession" by a divine power. The words spoken by the individual thus "possessed" are identified with the utterances of the god The Greek Xpollo was the god of prophecy, and the words spoken by his inspired priestess at Delphi were deemed to be the authentic voice of the god himself. The religious value of revelation depends on the character of the deity who is believed to reveal; and it is the consciousness of ethical values leading to an ethical idea of deity which purifies the content of revelation. Revelation in the large and comprehensive sense is linked with monotheistic religion. So Zarathustra proclaimed the message communicated to him by Ahura Mazda, and Mohammed in his visions had the truth revealed to him by Allah. The divine word came to the prophets of Israel, and the preface to their message was, "Thus saith the Lord." What they spoke Jahveh had caused them to know. At this level revelation centres in an experience or illumination within. But these inspired utterances were afterwards written down and collected: in the form of sacred books they came to be regarded as objective statements of divine truth. Hence the claims made for the Avesta, the Veda, the Koran, and the Old and New Testaments. Books which were accepted as statements of revealed truth naturally became authoritative, and as expressing authoritatively the content of a religion they furnished a basis for theology.

(2) *Theology.*

Theology grows out of the beliefs contained in an historic religion: it is an endeavour to state what is involved in a definite religious type of experience in general propositions or doctrines. The earliest anticipation of this is the myth framed to explain the meaning of something done in the cult. Theology is not detached like speculation, it is a natural and necessary outgrowth from the life of religion itself. It is the product of a mature religion, and commonly has its basis in the sacred books which record its religious experience. We find theological developments in Judaism and Buddhism, but in a more complete form in Islam and in Christianity. The Islamic and the Christian theologies claim to interpret the authoritative revelation contained in their sacred scriptures. In both instances the growth of theology was stimulated by the presence of beliefs judged to be heretical. The Mutazalite movement, with its doctrines of faith and free-will and its criticism of tradition, impelled the orthodox party in Islam to define the true doctrine of Allah and his attributes. In a like way the Gnostic heresies provoked the growth of a Christian theology which sought to expound the doctrines involved in Christian faith and practice. The Islamic conception of religion, however, is too much interwoven with what is external and political to furnish a favourable field for theological development. Christianity, on the other hand, has developed a body of religious experience of a wealth and amplitude capable of sustaining an impressive body of doctrine.

The function of theology is primarily to interpret. As contrasted with speculation it leans on authoritative revelation, and stands in organic relation to a specific historic religion. *(See* THEOLOGY.)

VIII. ETHICS AND ESCHATOLOGY

The ethical element is of fundamental importance in determining the quality of a religion: it is a powerful factor in elevating the object of worship, the religious relation, and the religious life. At the pre-deistic stage the sacred is interpenetrated with magical beliefs, and ethical principles have their lowly precursor in the sanctity of tribal custom. When through the growth of social culture the moral virtues are recognized as values, they are made to qualify the character of the gods.

(1) *Ethics.*

The process may not be easy when the deity has a pronounced natural basis, but still it does occur, as in the case of the Vedic Varuna and the Babylonian Shamash. On the other hand, the Persian Ahura Mazda became a definitely ethical god who demands pure living and right thinking. At a later date Mithra was revered as the god of truth and loyalty. The Greek Zeus acquired moral functions, and Δικη, or Justice, was proclaimed to be his daughter. The feeling for the moral element in religion appears in the saying of Euripides: "If the gods do aught that is shameful, they are no gods." A profound appreciation of the moral values is seen in the Hebrew prophets who passionately declared that Jahveh is a righteous God who demands righteousness in his people And when men cherish the conviction that the divine Power is righteous, the efficacy of sacrifice is made to depend on moral conditions.

Through the interpenetration of ethics with religion the sphere of the sacred is enlarged, and the moral life becomes an aspect of the religious vocation. Moral laws rank as divine commands, and ethical duty as a religious obligation. On the other hand, when the notion of divine personality is weak or lacking, ethics inevi-

tably assume a worldly or a negative character. Chinese religious ethics, for instance, founds on the idea of Tao or world-order, and man's duty is to reflect this order in his life. The ethical ideal is one of conformity, propriety and measure. A like utilitarianism is present in the Roman *pietas,* the knowledge of the *jus divinum* which enables a man to keep on profitable terms with the divine powers. The negative conception of ethics is strongly marked in Buddhism, which, in its original form, had no deity. The ideal of the Arahat is merely an ascetic discipline by which the dominion of desire and sense may be extinguished and Nirvana attained. In strong contrast is Christian ethics which rests on an ethical monotheism. Here the ideal is positive, the development of man's ethical life as a member of the Kingdom of God.

(2) Eschatology.

The problem of eschatology is the ultimate destiny of man and the world. It is a problem which lies in the background of the religious consciousness, though eschatological motives may powerfully affect the working of religion. Thus eschatology looms large in the old Egyptian, the Christian and the Islamic religions, but it plays a feeble part in the Babylonian, the old Hebrew and the early Greek religions. There is no side of religion where the survival of old ideas is more apparent, or where the presence of inconsistent elements is more conspicuous. This is intelligible; for eschatological ideas do not lend themselves to verification in religious experience, and they offer an ample field for religious imagination.

Primitive eschatological ideas gather round the fate of the dead, and are unleavened by ethical elements. Two factors promote the growth of eschatology in higher religions, a quickened moral consciousness and the sense of the value of the individual. If ethical ideas, however, be cast in a utilitarian mould, the eschatological interest may be slender; and even though they are of a higher order, as in Hebrew Prophetic religion, the merging of the individual in the people as the religious unit has the same result. Post-Exilic Judaism gained a new sense of the value of the individual, and felt the need of retribution, and this led to decided eschatological developments. In Buddhism, where ethics are negative and personality an obstruction rather than a value, eschatological doctrine is nebulous in the extreme.

Of the ethical ideas which promote eschatology the most prominent is that of justice, for it directly suggests the notion of future rewards and punishments. Justice, it is felt, is only imperfectly done on earth. The Osiris-Religion of Egypt figured the soul of the dead man ushered into the judgment-hall of Osiris, where his deeds were weighed in a balance. Those who pass the test go to serve Osiris in the fields of Earu. In the Avesta, Shraoshi, the guide of souls, is said to lead the just over the heavenly bridge to the gate of paradise. Orphism taught that the initiated were rewarded by a happy life in the Elysian Fields, while the wicked were cast into Tartarus. In the Persian, Christian, and Islamic religions, along with the judgment of the individual there is conjoined the idea of a world-judgment and the final separation of the good from the wicked.

The fuller development of eschatological doctrines belongs to the ethical and redemptive religions. But no religion has done this consistently, and eschatology remains the most backward aspect of religion. Here the material and the ethical, the sensuous and the spiritual, are often incongruously blended, and old beliefs survive in an alien environment. The Islamic eschatology, for instance, is on a lower level than that of a religion of salvation. And Christian eschatology, at least in its traditional form, is only imperfectly spiritualized. The problem of a consistent eschatology is a difficult one. *(See* ESCHATOLOGY; IMMORTALITY.)

IX. CLASSIFICATION OF RELIGIONS

Various attempts have been made to classify religions, but with only partial success, and there is no generally accepted scheme. Every religion is a complex of many elements, and there is no one specific feature which adequately characterizes it. One of the earlier classifications is that of Hegel into Nature-Religions, Religions of Spiritual Individuality, and Absolute Religion. But he arbitrarily groups together very disparate materials, and in the light of modern knowledge the scheme is unworkable. Edward Caird's revision into Objective, Subjective, and Absolute or Universal Religion is less open to this objection, but it is too vague and too much dependent on a particular philosophic construction of religion. Tiele adopts a very broad classification into Nature-Religions and Ethical Religions, while Siebeck groups religions into Primitive Religions, Morality-Religions, and Redemptive Religions. The latter scheme is certainly suggestive, though the distinction between ethical religions and redemptive religions can hardly be carried out consistently. Even the broad distinction between natural and ethical religion would have to be applied rather arbitrarily.

In the classification of religions into Tribal, National, and Universal, the line of demarcation is much more distinct and can be more easily used. But it may be objected to this classification that it is based on a principle which gives no clue to the character and content of the religions. Moreover it may be said that no religion is *de facto* universal. And from an evolutionary standpoint it is a defect in a classification that it ignores the principle of valuation.

The complexity and variety of the materials render a complete and consistent classification impracticable. But it is always possible to apply different criteria in surveying the religious field. Religions may be grouped according to their conception of the Divine, according to the types of piety they foster, or according to the ideal after which they strive. But such classifications will be merely provisional: though suitable for the purpose on hand, they cannot claim to be comprehensive and final.

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(c) *Psychology and Philosophy of Religion.*

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RELIGIOUS ARCHITECTURE. This article is concerned with the development of western religious architecture in the 20th century. After a brief introductory account, the countries that have contributed most to this development are examined. For earlier religious architecture of the western world, *see:* BYZANTINE ARCHITECTURE; ROMANESQUE ARCHITECTURE; GOTHIC ARCHITECTURE; RENAISSANCE ARCHITECTURE; BAROQUE ARCHITECTURE; MODERN ARCHITECTURE. For the religious architecture of other parts of the world, *see* appropriate headings; *e.g.,* CHINESE ARCHITECTURE; IBERO-AMERICAN ARCHITECTURE; INDIAN ARCHITECTURE; ISLAMIC ARCHITECTURE. *See* also PAGODA; TEMPLE ARCHITECTURE.

Historical Background. — When Constantine recognized Christianity by the edict of Milan in A.D. 313 a pattern of church architecture as such did not exist. The earliest Christians had worshiped in the houses of wealthier members or in the catacombs,

which in Rome were particularly extensive. A converted house in Doura-Europos (now Salihiyah) in eastern Syria is held to be the first-known Christian church, dating from 232. In both the eastern and western halves of the Roman empire. however, a certain amount of unco-ordinated church building took place.

As Christianity became established throughout the Roman empire a basic building type for sheltering a large congregation was the basilica (*q.v.*), found in Rome and Roman north Africa. This was a sizable rectangular building the interior of which was divided by two rows of columns into a large central hall with side aisles. It was easily roofed in mood. By putting the altar at one end, preferably in a niche with room for suitable circulation in front, and by locating the entrance at the opposite end, a basic church pattern was established. The basilica-inspired old St. Peter's in Rome, which Constantine built in c. 326 and which was substantially replaced by the present St. Peter's in the 16th century, was one of the first of these. The same plan was used later in the 4th century in Rome in S. Clemente. Sta. Maria Maggiore, St. John Lateran and St. Paul's Outside the Walls, to name only the finest extant examples. The long basilica nave was suited to church processionals and produced a stunning spatial impression as, well. At the sanctuary end was a slightly raised platform, or bema, with a semicircular apse, often gloriously covered with mosaics, directly behind.

In the formative days of the Christian church, however, plans other than the basilica were used. The circular church and baptistery. undoubtedly inspired by Greek and Roman temples and tombs, were common. S. Stefano Rotondo in Rome (c. 475) is the largest and best known of these. In the 6th century the Byzantines explored an even more complex geometry. SS. Sergius and Bacchus in Constantinople (523–527) is a domed octagon enclosed in a square. while its contemporary, the sublime Hagia Sophia: is square outside, domed and counterdomed within. Charlemagne's mausoleum chapel at Xix-la-Chapelle (*c.* 790–805) has 16 sides. The opulent St. Mark's in Venice, finished in 1073, has four arms of equal length. making a Greek cross. The geometry that characterized church planning until the beginning of the Romanesque had an ingenious variety.

From the fall of Rome in A.D. 475 to the Romanesque beginnings around 1000. very little building of any type was done in Europe with the exception of the Byzantine work centred around Ravenna and Venice. The golden age of church building, beginning with the Romanesque style and continuing through the Gothic until the 15th and 16th centuries, covered western Europe with some of the greatest monuments to God ever built. It is significant that almost all of these were adaptations of the long-armed Latin cross in plan. Indeed it is this Latin plan, largely as developed in the middle ages. which determined church planning, both Roman Catholic and Protestant. to modern times.

During the baroque and rococo periods of the 17th and 18th centuries, a revolt against the rigid Latin-cross plan occurred, particularly in Italy and southern Germany where a number of extremely interesting freely planned churches evolved. A more intimate atmosphere was wanted, and it is pertinent to note that many of these flowing geometric shapes were revived in modern German churches. But after the late 18th century and particularly during the age of architectural revivals from the 19th century onward. the familiar Latin plan again dominated church design.

20th-Century Developments. — Beginning in the early 20th century. when architects everywhere increasingly questioned the copybook styles that had stultified building for almost 200 years, a new freshness was evident. This was primarily the result of two factors: a reassessment of the basic relationship between clergy and congregation; and revolutionary new materials of steel and reinforced concrete, both of which were introduced in the mid-19th century.

The long nave of the Latin cross isolates much of the congregation from the priest or minister and the sanctuary. Not only is it difficult to hear the sermon throughout many attenuated churches — as the presence of amplifying systems testihes — it is also difficult to feel in touch with the altar and sanctuary, As church processionals largely disappeared, virtually altogether in Protestant churches, the liturgical necessity for a long nave likewise diminished. As a result a more compact planning, evolving toward a one-room ambiance. became evident. The customarily precise divisions of nave, transept. chancel and sanctuary gave way to a more open and intimate interior with the congregation arranged in closer contact with the clergy and altar. Enhanced by the general developments of 20th-century architecture. a general simplification and unity in church architecture of all faiths evolved.

Although the changes in liturgical relationships brought obvious changes to the appearance of modern churches. even greater changes occurred through the use of new materials, such as reinforced concrete, steel, processed (*e.g.*, laminated) wood and new forms of glass.

Concrete had been used in churches since the end of the 19th century, *e.g.*, by Anatole de Baudot in his St. Jean de Montmartre in Paris (1894), but always as a structural means within a largely stylistic framework. It was not until 1923. when Auguste and Gustave Perret built their superb Notre Dame, Le Raincy, near Paris, that reinforced concrete was fully used and expressed in a church. The design for this church, chosen for its economy. not its aesthetics, revolutionized European religious architecture. The interior has few peers.

The first steel and glass church. the Stahlkirche, was built by Otto Bartning in Cologne in 1928. Modeled to a large extent after the famous 13th-century Ste. Chapelle in Paris: this church, later destroyed, had a maximum amount of stained glass and a minimum of structure.

Industrialized or processed wood was another new material that markedly affected the structural design of 20th-century churches. New forms and uses were given to man's most venerable building material. Church architects, especially in the United States, made frequent use of prefabricated laminated wood arches which became readily available. Handsome and economical, wood has a visual and tactile warmth, plus excellent acoustic qualities; which make it well suited for religious work.

Another old material in new guise that had an interesting role in 20th-century religious architecture is a glass technique called *Betonglas* (*i.e.*, "concrete glass") or mosaic glass. It is made from faceted bits of brilliantly coloured glass, approximately an inch thick. Instead of the various sections being supported and separated by lead dividers, as in stained glass (*q.v.*), the thick glass chunks are laid and composed. like a mosaic, on the fat, with wire reinforcing rods laced between and fine concrete poured in the interstices. When the concrete has set the panel is polished; it then forms a self-supporting, weatherproof unit ready to be raised in place.

Betonglas has a depth and richness, a glowing quality, which is almost jewellike in its changing intensities. It became popular in France, where it first evolved in the late 1920s and early 1930s. and its use has spread to much of the continent and to North and South America. One of its most impressive single installations is in Wallace Harrison's First Presbyterian church (1958) in Stamford, Conn.

Through the combination of external forces that have changed all aspects of western life and through the evolution in liturgical thinking and new technical means, nerr church forms irresistibly evolved. The Perrets with Notre Dame. Le Raincy, awakened clergy and architects all over Europe with their fresh approach toward religious architecture. The movement spread throughout the continent. then the world.

France. — France. which had nurtured the Gothic style and taken it to its greatest heights, was also to a large degree instrumental in establishing the classic revival both in architecture and art. France won the cultural dominance of Europe from Italy in the 17th century and established itself in a long-term position of aesthetic authority. The extraordinary archeological discoveries of the late 18th century (particularly J. J. Winckelmann's work in Greece) and Napoleon's imperial leanings set the stage for this neoclassical idiom. The search for ancient prototypes was far more of an architectural atavism at this time than it had been during the Renaissance. Renaissance architects sought inspiration in the glories of Greece and Rome; the neoclassicists sought ancient

models, or authentic ancient elements for new buildings. The movement was epitomized in France by Napoleon's *temple de* la *Gloire,* the Madeleine (1806), by Pierre Vignon.

Interest in the neoclassical style in France, as elsewhere, waned. however. and toward the middle of the 19th century interest revived in the Gothic. E. E. Viollet-le-Duc was the continent's chief champion of the Gothic revival and his *Dictionnaire raisonné* de *l'architecture française* (1854–68). along with his many restorations, including that of Ste. Chapelle, sparked wide enthusiasm throughout Europe. In France more neo-Gothic restoration—in some cases violation—was executed than new construction. but several prominent churches were built, such as. Ste. Clotilde in Paris by F. C. Gau and T. Ballu (begun in 1846); St. Nicolas in Kantes by L. A. Piel and J. B. A Lassus (1854–59); and St. Epvre in Nancy (1864–79). by M. P. Morey.

Following the Gothic revival, architectural uncertainties for almost a century resulted in a combination of styles. The most prominent Parisian example of this period is the Sacré Coeur, begun in 1875 by Paul Abadie and continued by Pierre Daumet and L. Magne The neoclassical and neo-Gothic had a certain "authenticity," although generally cold and lifeless. but the church architecture that folloued in France and elsewhere until after World War I was almost totally undistinguished. Little of the wonderful vitality, originality and daring, which had marked Christian church building almost continually since its beginnings were apparent Little effort was made to use the revolutionary new structural means of the 19th century—cast iron, steel and reinforced concrete. When the Perrets built their Kotre Dame, Le Raincy, in 1923 it was a milestone in the rejuvenation of Christian church architecture. It was the first church to utilize and express fully one of the most important materials of modern times: reinforced concrete The roof is supported by slender concrete columns: the outside walls are pierced panels of concrete. each panel being laced with a series of geometric openings in which are set panes of coloured glass. The interior effect of this small church (it measures only 184 by 66 ft) is one of reverent simplicity and timeless grace It has few equals.

The effect of Kotre Dame, Le Raincy permeated all Europe. The Perrets themselves built Ste. Thérèse, a somewhat similar church at Montmargny (1925), and projected several others. Karl Moser in Snitzerland was inspired to design his excellent St Antonius in Basel (1926–27), and a whole school of new church architecture arose in Germany under Dominikus Bohm, Otto Bartning and Rudolf Schn arz.

After this church renascence, however, a curious and unfortunate mediocrity characterized most French architecture, religious and secular (excluding, of course, the work of the Swiss-born Le Corbusier). After the Perrets' work at Le Raincy and Montmargny, few churches of real architectural merit were built in France until a second church-building movement was initiated after World War II. The revolution that the Perrets began in 1923 was rightly concerned with a fresh sweep in architecture; the new postwar direction was primarily toward employing the finest contemporary artists in the church. As in past centuries of great church building. architect and artist worked hand in hand.

Father M. A. Couturier, O.P., was largely responsible for initiating this movement. and under his aegis a number of the greatest artists in France were invited to work on the church of Notre Dame de Toute Grâce at Assy, near Chamonix (Maurice Novarina, architect). This church was consecrated in 1950. Fernand Léger composed an enormous mosaic for the entrance, Jean Lurçat created a superb tapestry for the chancel. Georges Rouault and Henri Matisse designed the windows, while Jacques Lipchitz. Pierre Bonnard. Marc Chagall. Georges Braque and Henri Laurens were among the other contributors. It is pertinent that many were not religious or even Christian.

The architectural form of the church at Assy, which is somewhat neo-Romanesque, is rather heavy and in no way equal to its art, and there is a lack of co-ordination in the art itself. This church, however. has had an extremely important influence throughout France and Europe, Architecture unaided by art can rarely reach the spiritual heights sought in a church because of its concern with the technrcal requirements of shelter.

After Assy a number of new churches, in which architect and artist actively co-operated, were built in France. One of these is Notre Dame des Pauvres at Audincourt (Doubs). Designed by Novarina. the church proper (dedicated in 1951) is simple and undistinguished. However the continuous band of 17 stained glass windows by Léger and the entrance mosaic and baptistery glass by Jean Bazaine lend importance to this church, in a modest workers' village. The Léger windows are brilliant examples of contemporary thematic glass (they trace the Passions of Christ) while the abstract glass in the baptistery, with its warm, glowing colours, is a superb statement of nonobjective art.

A small semi-private chapel of charm is that of Notre Dame du Rosaire. at Vence near Nice (1948–51), by Matisse. Although the church is of secondary importance architecturally. Matisse decorated it with superb tiles and glass and continued his lovely colours and motifs in the design of the vestments themselves. Thus a complete integration of the visual arts, some fixed, some in motion, was achieved. The chapel at Vence is near the interesting old church at Villefranche-sur-Mer which Jean Cocteau redecorated.

It is generally held that the greatest masterpiece of contemporary French, indeed world, religious architecture is Notre Dame du Haut at Ronchamp (Doubs) (1955), by Le Corbusier. This startlingly original building is thought by many to be the most important church of the past several centuries, so profound is its impact and so creative its force. Although its architecture is almost completely nonderivative, recalling little of the past, the atmosphere within is intensely and very personally religious. It is an interesting contrast to the great Gothic cathedrals which, though incomparable monuments to God, tend to humble the worshiper.

The church exterior is dominated by the enormous upturned eave of the roof which r -ts far over the approach or south side and on the east sic ver the outdoor pulpit and altar. The massive south wal s 12 ft. thick at the bottom and 5 at the top, command! oach with a series of openings of various rectangular sha rsed irregularly across the front. Although these windov appear! both from without and from within, to have be d haphazardly, their total effect is one of careful orchestra

The interior of the ch s likewise dominated by the roof. which according to the ar ct was inspired by the shape of the shell of a crab; it swoops c n toward the middle like the underside of a great tent. The roof is not directly attached to the supporting walls, but rests lightly on blocks atop them so that the feeling of space, flowing over and out, is intensified. Although the physical dimensions of Ronchamp are modest, a mere 84 by 40 ft., with seats for only 50 people, it gives an impression of a very great space. This effect is intensified by the subtle relation of three chapels subsidiary to the nave and by the deeply splayed windows: only a few of which are visible from any one spot. It is necessary to move about the church to appreciate its features. since they cannot be grasped from a fixed position.

Other important postwar churches in France are: a Dominican friary at d'Eveux (Lyons) (1960), by Le Corbusier; St. Rémy, Baccarat (1957), by Nicolas Kazis, with very interesting sculpture and glass; St. Julien, Caen, by Henry Bernard; Kotre Dame. Royan (1958), by Guillaume Gillet; a startling "tower" church (St. Joseph): by Auguste Perret and R. Audigier at Le Havre (1959); St. Agnits Fontaines-les-Grits (Aube) (1956); by Michel Marot; Kotre Dame de Grâce, Morsang-sur-Orge, by Roger Faraut: Ste. Thérèse. Roubaix (1957), by Hermann Baur; and the extraordinary underground basilica for 20.000 at Lourdes (1958) by Pierre Vago (Eugène Freyssinet, engineer).

Germany. — In tracing the background of contemporary German religious architecture the 19th century requires brief mention. Karl Friedrich Schinkel's St, Nicholas in Potsdam. completed in 1849. is the finest neoclassic example, although obviously inspired by J. G. Soufflot's Panthéon in Paris. St. Nicholas in Hamburg (1845–63), by the Englishman Sir George Gilbert Scott. is outstanding among the neo-Gothic. The nave was coinpletely

destroyed in World War II. The Gothic revival also added a top to the ancient tower of Ulm cathedral in 1877–90, making it the highest stone tower in the world (528 ft.).

Church architecture at the opening of the 20th century in Germany was stirring uneasily under the changing styles then prevalent. In the first years of the century several German architects, notably Theodor Fischer, made a tentative effort toward less derivative religious building. primarily by simplifying old clichés rather than attempting a genuinely fresh approach.

The first positive move was by Otto Bartning whose book *Vom neuen Kirchenbau* ("Toward a New Church Architecture") in 1919 was followed three years later by a model of his projected Star church. Although never built, it was a highly original and stimulating design which, together with the Perrets' church at Le Raincy, did much to awaken Germany to new church-building possibilities.

By 1926 several exciting new German churches had been constructed. These were Martin Weber's St. Boniface in Frankfurt am Main, and Dominikus Bohm's War Memorial church in Neu-Ulm and his bold Catholic church at Bischofsheim. Bohm, in the latter church, took the reinforced concrete that the Perrets had confined to rigid boxlike frames and made it dramatically plastic. He built several other distinguished churches, among them St. Joseph at Hindenburg-Oberschlesien (1929) and St. Engelbert in Cologne-Riehl (1931).

Bartning's Protestant Steel church for the Cologne Press exhibition of 1928, the great pioneer in steel, was followed with two larger examples: the Round church at Essen (1930), and the Gustav Adolf church in Berlin-Charlottenburg (1934), later destroyed.

Rudolf Schwarz, who was to become Germany's most impressive church architect, designed a series of starkly simple but notable Catholic churches. The first was his Corpus Christi in Aachen, completed in 1930. Unquestionably one of the greatest religious architects of the 20th century, Schwarz in this, his first mature work (he was 33 at the time), showed promise of the Spartan directness and religious intensity that marked his subsequent designs.

After Hitler came to power in 1933 progressive thinking in architecture was muzzled. Schwarz, Böhm and Bartning were largely inactive for 15 years; during which each thought deeply and maturely on the manifold problems of church building in the mid-20th century. Schwarz, probably the most profoundly religious of the three, published his *Vom* Bau der *Kirche* (1938) in which his architectural-religious concepts are set forth and illustrated by beautiful geometric diagrams.

When conditions finally permitted, all three set to work so actively and so successfully that Germany in a relatively few years became the leader in European religious architecture. Bartning designed a series of 48 emergency churches (*Notkirchen*), made from rubble and standardized salvaged material, while Bohm and Schwarz produced a number of new churches together with many reconstructions. Bohm's son, Gottfried, boldly carries on the church work launched by his father. Postwar German churches are characterized by a daring, a willingness to experiment and a directness which is very powerful.

Among the most impressive examples are: Maria Konigin, Cologne-Marienburg (1954), by D. Bohm; St. Konrad, Neuss (1955), and St. Albert, Saarbrucken (1956), by G. Bohm; St. Mauritius, Saarbrucken (1956), by Albert Dietz; St. Matthews, Pforzheim (1953), by Egon Eiermann; Christ church, Leverkusen-Burig (1958), by Hentrich and Petschnigg; St. Martin, Hanover (1957), and Christ church, Bochum (1959), by Dieter Oesterlen; St. Joseph, Hasloch-am-Main (1958), by Hans Schadel; St. Rochus, Diisseldorf (1955), by Paul Schneider-Esleben; the following by Rudolf Schwarz—St. Joseph, Cologne-Braunsfeld (1954), with Joseph Bernard, St. Michael, Frankfurt am Main (1954). St. Anna, Düren (1956), Holy Cross, Bottrop (1957), and Maria Konigin, Saarbrucken (1959); Trinity church, Mannheim (1959), by Helmut Striffler.

Switzerland. — The contemporary church movement in Switzerland is. after the German and French, the most interesting in Europe. Starting with Karl Moser's superb St. Antonius in Basel (1927) and continuing through the 1930s and '40s when Germany and France built little of merit the Swiss built an impressive number of fine new churches. Having, like Germany, slightly more Protestants than Catholics, Switzerland profited from the stimulating reaction the religious architecture of each group had upon that of the other.

Following the Catholic initiative in Moser's St Antonius, the Protestants, after a competition in 1931, launched their contemporary church building with St. Johannes in Basel (1936). by E. F. Burckhardt and Karl Egender. There followed a number of sensitively designed, handsomely detailed and constructed churches, both Protestant and Catholic.

The outstanding church in the country is the Reformed church at Zurich-Altstetten (1941), by Werner Moser, the son of Karl. Other churches of particular interest are All Saints. Basel (1953), and Bruderklausen, Basel-Birsfelden (1959), by Hermann Baur; Bruderklausen, St. Gall-Winkeln (1959), by Ernest Brantschen; the Chbtelaine church. Geneva (1958), by André Gaillard; First Church, Christ Scientist. Zurich (1938), by Adolf Kellermuller and Hans Hofmann; Liebenfels Cemetery chapel, Baden (1957), by Edi and Ruth Lanners and Res Wahlen; St. Francis, Basel-Riehen (1950), by Fritz Metzger; Village church, Thayngen (1952). and Blessed Virgin (Muttergottes), Solothurn (1954), by Josef Schutz.

Great Britain. — England, combining great scientific and technical progress with conservatism in the arts, produced little religious architecture of outstanding merit in the first half of the 20th century. The intellectual climate was favourable and several promising beginnings were made, but few churches of international merit mere built.

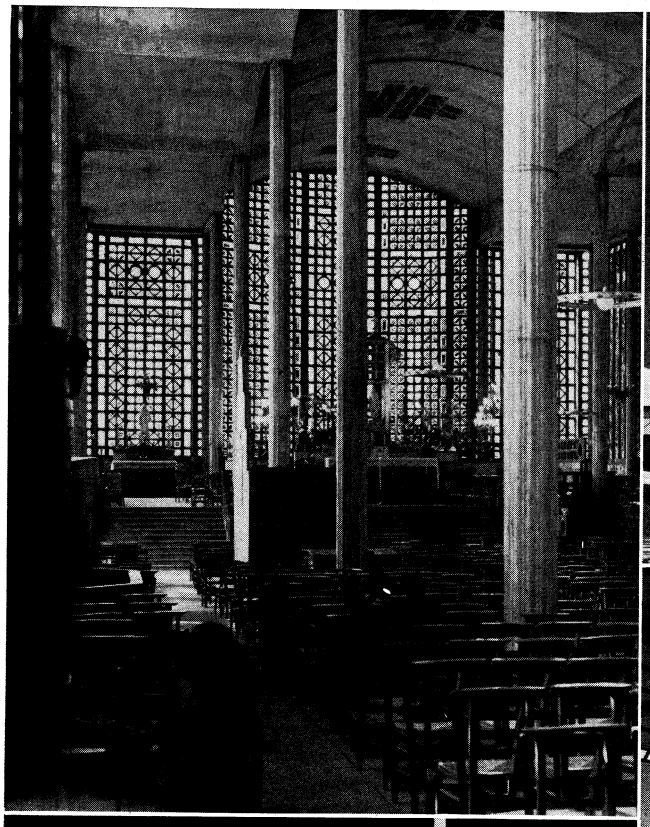
During the 19th and early 20th centuries architecture in England followed the cultural pattern of France. Neoclassicism was strong in England until the mid-19th century, but primarily influenced banks, clubs and public buildings, not church architecture. Even in these it was less purified and more humanized than abroad, as English stylistic adaptations of foreign models have generally been. The Gothic revival enjoyed a more active popularity in England than in any other European country. Because of its almost continuous use in religious work, notably interrupted by Sir Christopher Wren who considered Gothic barbaric, the English Gothic revival has been referred to as the "Gothic survival." Neoclassicists and Gothicists in England fought so heatedly that their controversy was dubbed the "battle of the styles." A compromise of sorts was effected whereby most public buildings were designed in a watered-down classical or Renaissance tradition, while most churches were Gothic.

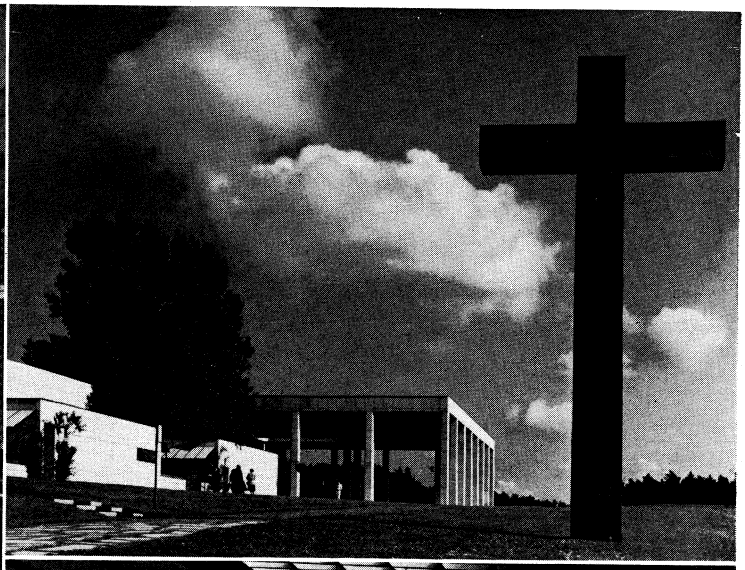
Few churches built in England in the 19th and early 20th centuries were not inspired by the Gothic. The tuo most imposing examples are John Bentley's large Roman Catholic cathedral in Westminster, London (1895–1903), a curious pseudo-Byzantine edifice. and Sir Giles Gilbert Scott's enormous Liverpool cathedral, begun in 1903.

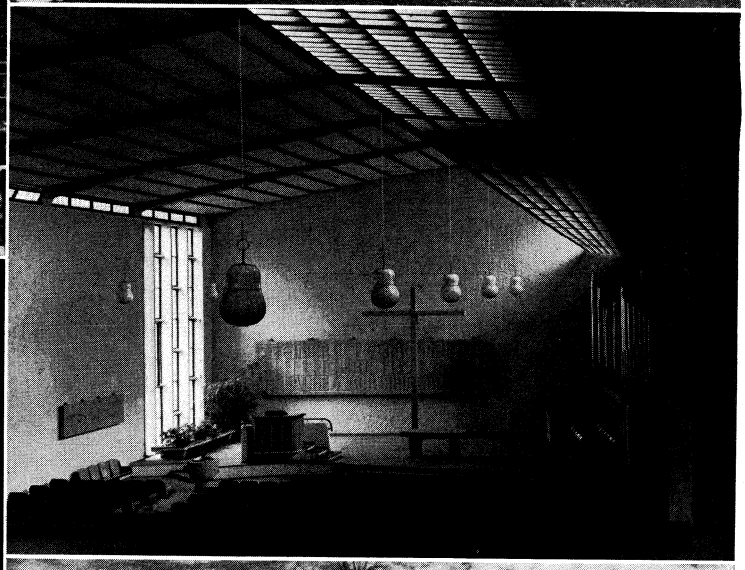
The contemporary church-building movement of the 1920s which took such an exciting hold of the continent had little effect in the British Isles. A number of semitraditional churches were built, but none with either the daring or conviction typical of the religious work in France and Germany.

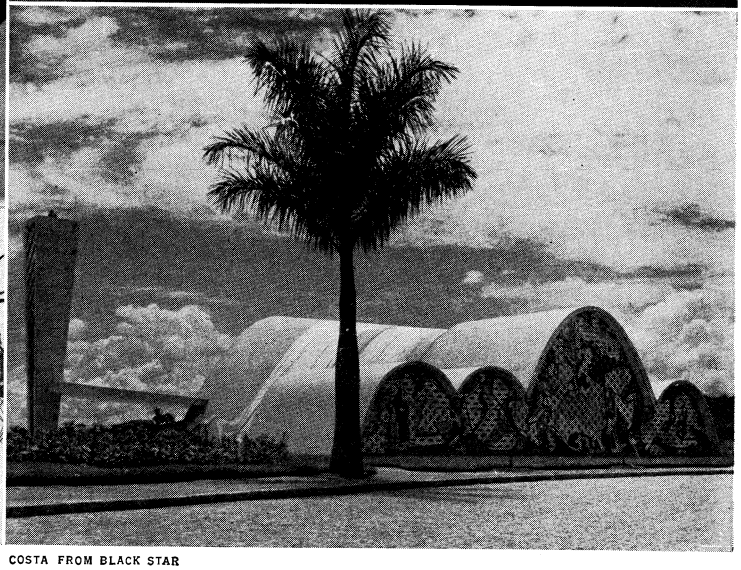
After World War II English church architecture received a decided stimulus from Basil Spence's winning design for the rebuilding of Coventry cathedral. Several other progressive churches should be mentioned, primarily C. C. Handisyde and D. R. Stark's Trinity church at Poplar, London, done in conjunction with the 1951 Festival of Britain; St. Paul's, Bow Common. London (1960), by Robert Maguire; and Edward Mills' fine Methodist church, Mitcham, Surrey (1959).

Scandinavia. — The development of architecture in Scandinavia before the 20th century followed at a discreet distance the fashions of the continent. Few buildings of international distinction were to be found. After Gunnar Asplund's Stockholm exposition of 1930, however. Sweden, Finland, Denmark and Norway contributed greatly to the richness and vocabulary of contemporary architectural thought. In some respects. such as land usage and housing, Scandinavia, and Sweden in particular, led the









PHOTOGRAPHS (ALL EXCEPT BOTTOM RIGHT) G. E. KIDDER SMITH, (BOTTOM RIGHT) J. COSTA FROM BLACK STAR

Top left: Notre Dame du Raincy, near Paris, France. Auguste and Gustave Perret, arch.; 1923

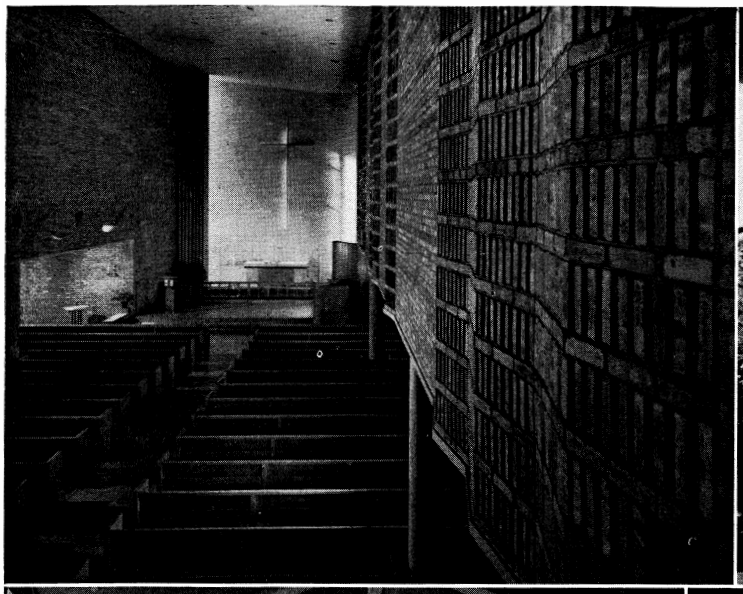
Top right: Woods crematorium, Stockholm, Sweuen. E. Gunnar Asplund, arch.; 1940

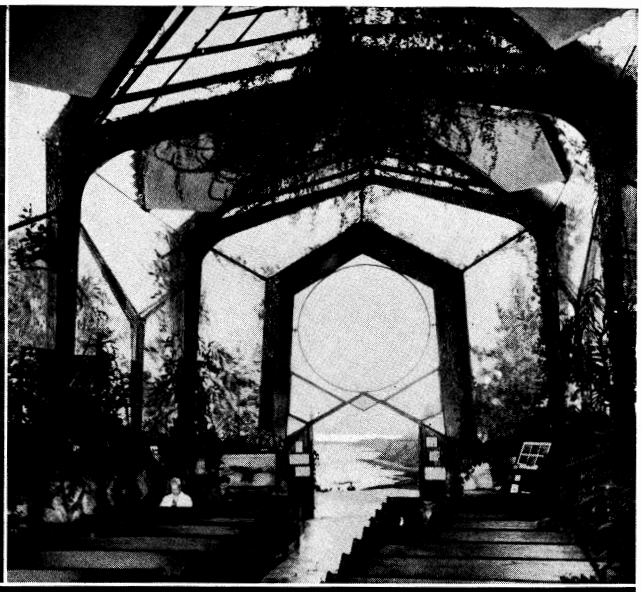
Centre right: Reformed church, Zurich-Altstetten, Switzerland. Werner Moser, arch.; 1941

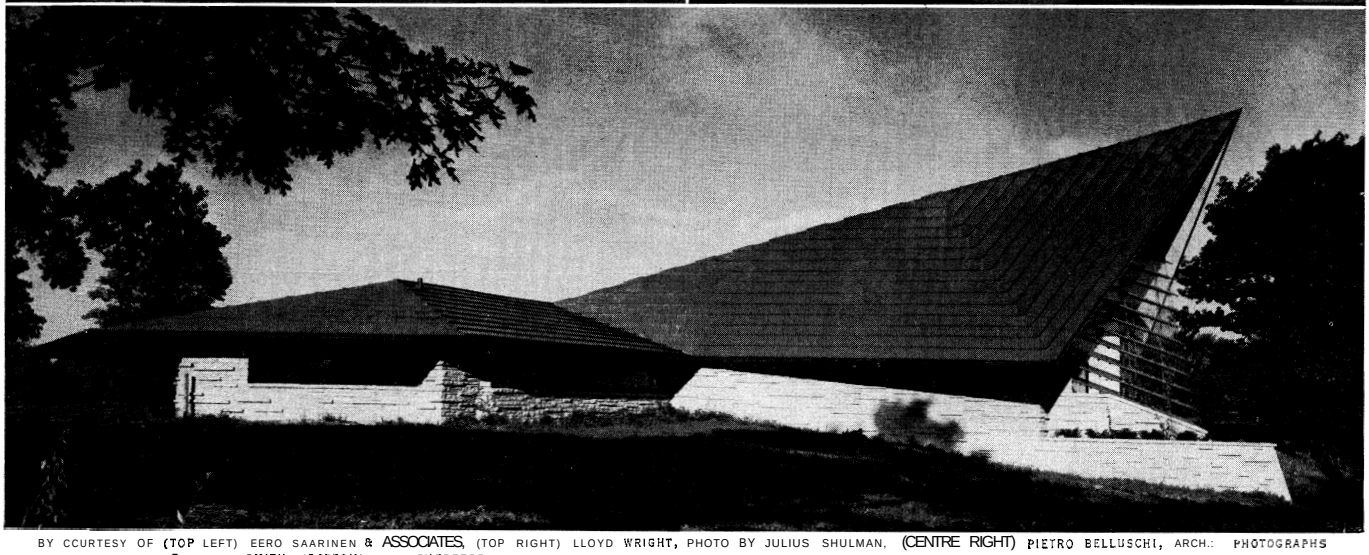
Bottom left: Crematorium chapel, Åbo, Finland. Erik Bryggman, arch.; 1941

Bottom right: Church of San Francisco de Pampulha, Belo Horizonte, Brazil. Oscar Niemeyer, arch.; 1943

RELIGIOUS ARCHITECTURE







BY COURTESY OF (TOP LEFT) EERO SAARINEN & ASSOCIATES, (TOP RIGHT) LLOYD WRIGHT, PHOTO BY JULIUS SHULMAN, (CENTRE RIGHT) PIETRO BELLUSCHI, ARCH.: PHOTOGRAPHS (CENTRE LEFT) G. E. KIDDER SMITH, (BOTTOM) P. E. GUERRERO

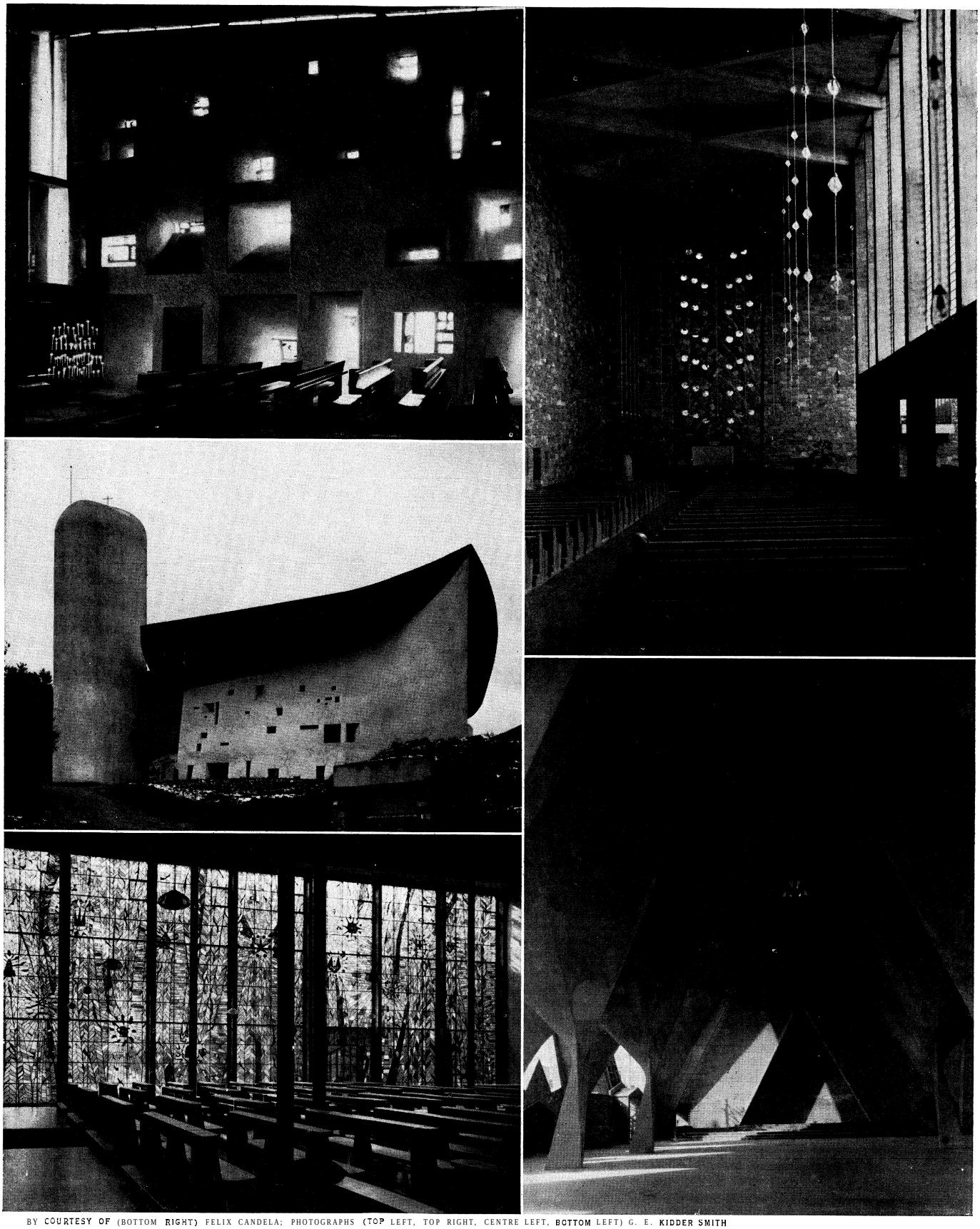
Top left: Christ Lutheran church, Minneapolis, Minn. Eliel and Eero Saarinen. arch.: 1950

Top right: Wayfarer's chapel, Palos Verdes, Calif. Lloyd Wright, arch.; 1951

Centre left: Village church, Thayngen, Switz. Joseph Schutz, arch.; 1952

Centre right: First Presbyterian church, Cottage Grove, Ore. Pietro Belluschi, arch.; 1951

Bottom: First Unitarian church, Madison, Wis. Frank Lloyd Wright, arch.; 1951



BY COURTESY OF (BOTTOM RIGHT) FELIX CANDELA; PHOTOGRAPHS (TOP LEFT, TOP RIGHT, CENTRE LEFT, BOTTOM LEFT) G. E. KIDDER SMITH

Top left: Interior of Notre Dame du Haut, Ronchamp, Fr. Le Corbusier, arch.; 1955

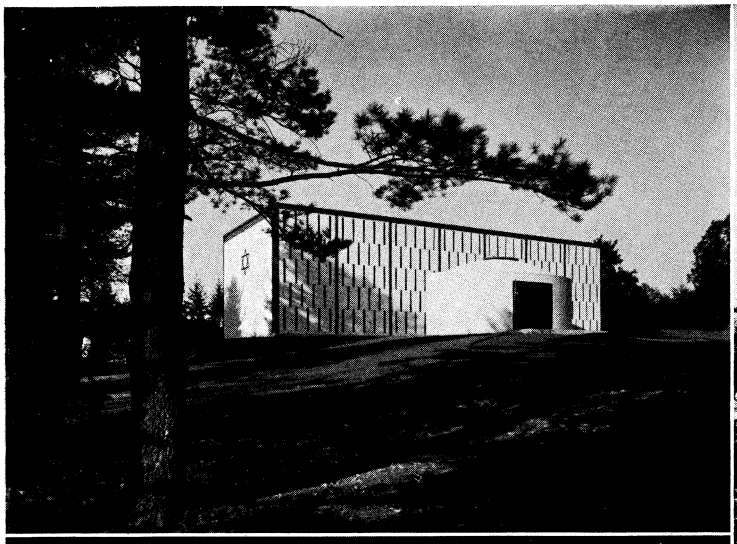
Top right: St. Anna, Düren, Ger. Rudoif Schwarz, arch.; 1955

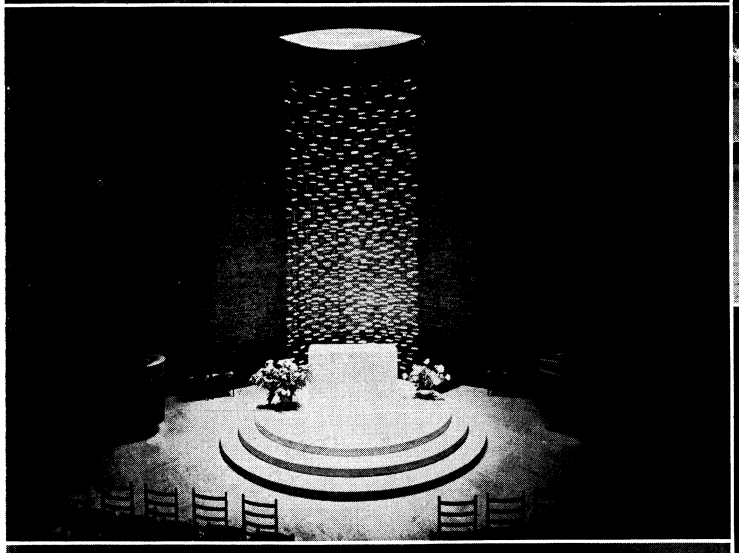
Centre left: Exterior of Notre Dame du Haut

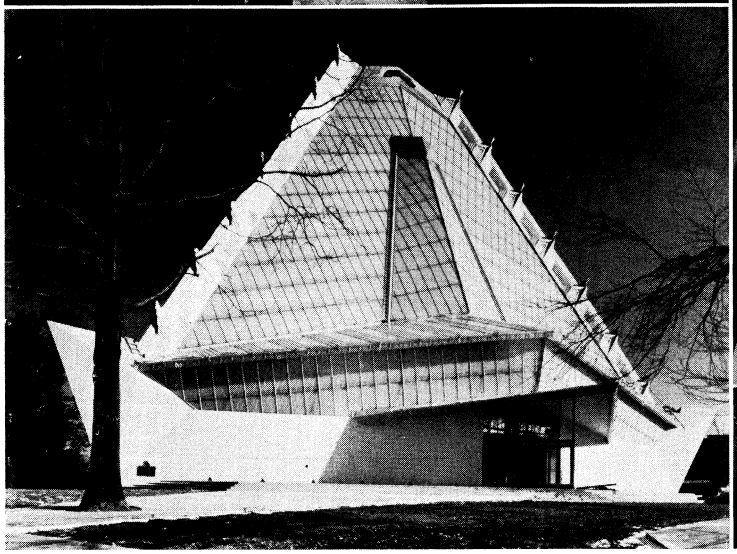
Bottom left: Maria Konigin, Cologne-Marienburg, Ger. Dominikus Böhm, arch.; 1954

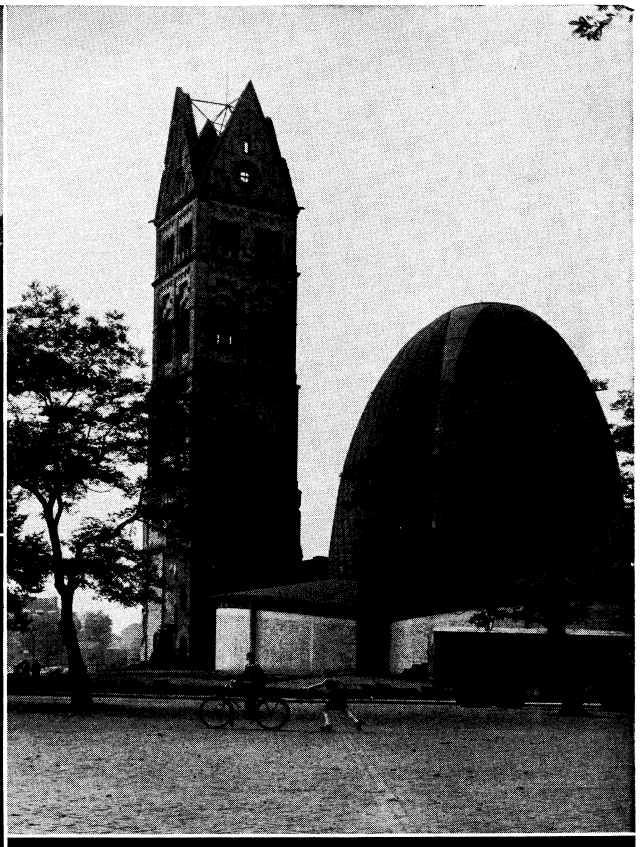
Bottom right: Church of the Virgin of the Miraculous Medal, Mexico City, Mex. Felix Candela, arch.; 1954

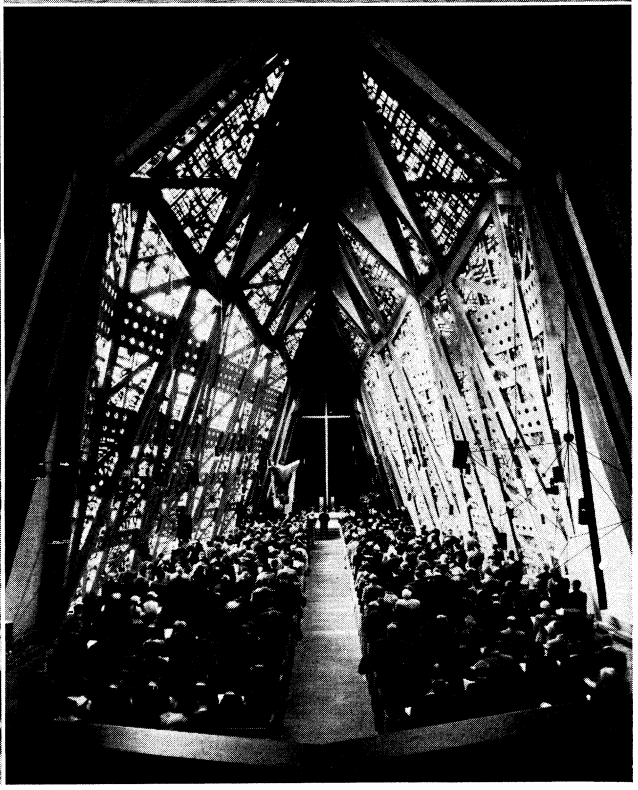
RELIGIOUS ARCHITECTURE











BY COURTESY OF (TOP LEFT) PHILIP C. JOHNSON, PHOTO BY ALEXANDRE GEORGES, (CENTRE LEFT) EERO SAARINEN & ASSOCIATES, (BOTTOM LEFT) BETH SHOLOM SYNAGOGUE; PHOTOGRAPHS (TOP RIGHT) G. E. KIDDER SMITH, (BOTTOM RIGHT) EZRA STOLLER

Top left: Kneses Tifereth Israel synagogue, Port Chester, N.Y. Philip C. Johnson, arch.: 1958

Top right: Rochus church. Düsseldorf, Ger. Paul Schneider-Esleben, arch.; 1955

Centre left: Kresge chapel, Massachusetts Institute of Technology, Cambridge, Mass. Eero Saarlnen, arch.; 1956

Bottom left: Beth Sholom synagogue, Elkins Park, Pa. Frank Lloyd Wright, arch.; 1959

Bottom right: First Presbyterian church, Stamford, Conn. Wallace K. Harrison, arch.: 1958

world.

The religious architecture after 1930 was also significant. Erik Bryggman's cemetery chapel in Åbo, Fin. (1941), is one of the loveliest churches in Europe with its sensitive proportions and its wall of glass opening onto the parklike setting. Other notable Finnish churches are: Technical University chapel, Otaniemi, (Helsinki) (1957), by Kaija and Heikki Siren; Alppila church, Helsinki (1957), by Keijo Ström and Olavi Tuomisto; Cemetery chapel, Jarvenpaa (1958), by Tarja and Esko Toiviainen; and the famous Vuoksenniska church, Imatra (1958), by Alvar Aalto.

In Sweden, although relatively few distinguished urban churches were built in the 20th century, Ivar Tengbom's Hogalid church in Stockholm (1923) being an exception, the Swedes designed several of the world's most beautiful crematoriums. The three most impressive are Asplund's Woods crematorium in Stockholm (1940), one of the great monuments of modern architecture, S. Lewerentz's crematorium in Malmo (1945) and Borje Blomé's St. Michael's chapel in Mora (1954). Some fine churches are: Cyrillus Johansson's ingratiating wood church in Nikkaluokta (1942) and Hakon Ahlberg's semitraditional church at Malmberget (1945), both along the Arctic circle in Lapland; the cemetery chapel in Sater (1954), by Sven Soderholm; Vasterort church at Vallingby, Stockholm (1956), by Carl Nyrén; and St. Botvids at Oxelosund (1957), by Rolf Bergh.

Architecture in Norway has always lagged behind that in the rest of Scandinavia. The most brilliant facet of Norway's contribution to architecture lies in its churches of the middle ages. From the 11th through the 13th centuries there were built, largely in the more remote regions of Norway, 500 to 600 stave churches. Intensely personal and highly carved and painted, these almost pagan wooden churches are unique in ecclesiastical architectural history. Only 22 were extant in modern times. The village church at Gravberget (1955), by Magnus Poulsson is the finest recent example.

Of the 20th-century churches in Denmark, P. V. J. Klint's Grundtvig church in Copenhagen (1913–40) is the most nationalistic in flavour (it recalls the traditionally Danish stepped gables) its façade suggesting a gigantic series of organ pipes in brick. Three other Copenhagen churches should be mentioned: Frits Schlegel's crematorium chapel in Mariebjerb (1937), Erik Moeller's pleasant Church of the Advent and St. Knud Lavard (1957), by Carl R. Frederiksen.

Italy.— The Italians, having the most magnificent inheritance of fine churches in the world, were little disposed to construct more until the unparalled devastation of World War II. Although several churches were built in contemporary style in Italy in the 1930s, none compared to the advanced work done by that time in Germany, Switzerland and France. There are fewer fine new churches in Italy than in the northern countries, but both quantity and quality have improved steadily and the climate for progressive religious architecture is excellent.

Among the impressive postwar churches are: S. Antonio Abate, Recoaro Terme (Vicenza) (1950), by Giuseppe Vaccaro; churches at Matera, and Francavilla al Mare, Pescara (1953, 59), by Ludovico Quaroni; several new churches near Ferrara (1952, 1954), by Pierluigi Giordani; Madonna of the Poor, Milan (1953), by Luigi Figini and Gino Pollini; San Luca, Rome (1956), by V., F. and L. Passarelli, and the stimulating Matri Misericordiae at Baranzate, Milan (1958), by Angelo Mangiarotti and Bruno Morasutti.

Elsewhere in Europe.—Of the remaining countries of Europe few contributed significantly to religious architecture in the 20th century, although some good work was done in most of them. After World War I Czechoslovakia produced several excellent churches, notably St. Wenceslaus in Prague (1930), by Josef Gočár, but after 1939 little work of merit was done.

The Dutch Reformed Church in the Netherlands after World War II constructed a series of good churches. Among the most successful are: Cross church, Amstelveen (1951), by Marius Duintjer; Cross church, Geleen (1956), by B. van Kasteel; church of the Good Shepherd, Oosterbeek (1952), by F. A. Eschauzier; the Resurrection church, Amsterdam, by M. Duintjer; and the Reformed church, Aerdenhout (1958), by Karel L. Sijmons.

The most fantastic church of the 20th century is the church of the Holy Family in Barcelona, Spain (1852–1926). by Antonio Gaudi. Although begun late in the 19th century the church was never completed. Its lofty towers and facade are original and imposing; they recall a child's seaside castle of wet sand drippings. Eduardo Torroja, the brilliant Spanish architect and engineer, built several unusual churches in the Pyrenees, the most striking of which is that at Pont de Suert (1952). The entire nave of this church is built of thin (7-in.) superimposed and staggered cuplike shells of concrete, whose bulbous forms are fully revealed both inside and out. The church of the Holy Rosary, Vallodolid (1954), by Miguel Fisac is also of interest.

Ibero-America.— In spite of the great growth of all Latin-American countries in the 20th century only a few significant churches were built. The best of these are found in two countries, Brazil and Mexico. These two countries also have the richest architectural heritage from their colonial eras. One of the most brilliant churches in the western hemisphere is Oscar Niemeyer's San Francisco in Belo Horizonte, Braz. (1943).

The development of contemporary architecture in Mexico was vigorous. and several churches there had influence beyond Mexico itself. One of these is Enrique de la Mora's Church of La Purisima in Monterrey (1947), constructed of intersecting paraboloids of concrete. Although details and lighting are clumsy, the structure is good. Much more successful is Felix Candela's church of the Virgin of the Miraculous Medal in Mexico City (1954). Candela, one of the world's great experts in thin-shell warped concrete surfaces, or hyperbolic paraboloids, helped pioneer highly promising developments in reinforced concrete. Candela tended to free reinforced concrete from rigid boxlike shapes, rectangular beams and flat slabs like wood and steel, and used it instead in thin very strong curved planes. like eggshells and folded pieces of paper. The church of the Virgin is so refined structurally that the roof is only $1\frac{1}{2}$ in. thick. The aesthetic potential of concrete is enormous and Candela made bold use of it in this church, particularly on the interior. Other churches by Candela's staff, using this material, are La Capilla de Nuestra Señora de la Soledad, outside Mexico City (1957), and San Antonio de las Huertas, Mexico City (Enrique de la Mora. architect).

United States.—The United States has an architectural heritage of some of the loveliest and most appealing small churches ever built. Outstanding among these are the 17th- and 18th-century village churches and meeting houses, primarily Congregational and Unitarian, scattered throughout much of New England and eastern New York state. These simple white wood structures, with their tall spires, have an inherent rightness. a sense of belonging architecturally, which make them one of the country's finest cultural contributions.

The colonists in the south brought to Virginia an established liturgy and church-building program. The program was of necessity modified somewhat by local conditions, but the 17th- and 18th-century churches of southern colonial and Georgian inspiration reflected the old world far more than the churches and meeting houses of New England. Equally reminiscent of Europe were the buildings that the Spaniards built from Florida to California. Their churches, missions and public buildings stem in large part from Iberian models.

As the American Colonies coalesced under English dominance, religious building increasingly reflected the fashions and developments of the British Isles. Sir Christopher Wren and James Gibbs inspired churches from Boston (Christ church, 1723) to New York city (St. Paul's chapel, 1764–66) to Charleston (St, Michael's, 1752–61).

Following the Revolution a self-consciously nationalistic federal architecture arose, strongly abetted by Jefferson's enthusiasm. It evolved directly from the classical revival then sweeping Europe, particularly France, the new nation's important friend. The general classical revival was followed by the specific Greek revival; at mid-19th century came the Gothic revival and after this a potpourri. The cycle of styles was the same as in Europe.

Richard Upjohn's Trinity church (1839–46), James Renwick's Grace church (1845–6) and St. Patrick's cathedral (1858–79), all

in New York city, are among the country's outstanding Gothic revival churches. External form, however, not structural purity, was predominant. St. Patrick's vaults are not self-supporting; its flying buttresses receive no load.

At the end of the 19th century the two largest churches in the U.S. were projected: St. John the Divine, New York (begun in 1892), and the cathedral of SS. Peter and Paul, Washington, D.C. (begun in 1907). Both of these are genuinely in the medieval Gothic, stone-by-stone tradition (although St. John was originally planned as Romanesque-Byzantine). Churches of such enormous size take years to build, and both of these Episcopal churches were put into use before completion.

U.S. architecture in most of the first half of the 20th century lagged far behind that of Europe, except in skyscraper construction. Notable buildings were built, but they were few in number and not widely accepted. After World War II however, the U.S. produced a great many excellent structures in all categories and public acceptance of new work was widespread.

The contemporary tradition in U.S. church building has distinguished roots in Unity temple, Oak Park, Ill., built in 1907 by Frank Lloyd Wright, and in the First Church of Christ Scientist, Berkeley. Calif. (1910), by Bernard Maybeck. Although neither constituted the architectural revolution which the Perrets' church at Le Raincy occasioned, they are unquestionably landmarks in the evolution of contemporary church architecture. Wright maintained his high standard in his chapel at Florida Southern college, Lakeland (1941), the First Unitarian church in Madison. Wis. (1951), and the striking Beth Sholem synagogue in Elkins Park, Pa. (1958). His son. Lloyd Wright, built one of the country's memorable churches in the beautifully situated Wayfarer's chapel at Palos Verdes, Calif. (1951). The design is composed basically of frames of redwood and sheets of clear glass so that the sea and surroundings seem to become an intimate part of the service itself.

Pietro Belluschi, who went from Italy to the U.S. in 1923. designed a number of churches which are models of elegant simplicity, sympathetic scale and carefully considered natural lighting. His Zion Lutheran, Portland, Ore. (1951), First Presbyterian, Cottage Grove, Ore. (1951), First Lutheran church, Boston (1957), Church of the Redeemer, Baltimore (1958), with Rogers. Taliaferro and Lamb, and his Portsmouth Priory, Portsmouth, R.I. (1959), uith Anderson, Beckwith and Haible, greatly encouraged and enriched the U.S. church-building scene.

Eliel Saarinen and his son, Eero, both born in Finland, were among the pioneers in contemporary U.S. church design. Their Tabernacle Church of Christ in Columbus. Ind. (1942), was one of the important earlier ones built in the U.S. They collaborated even more successfully in Christ Lutheran church in Minneapolis, Minn. (1950), which was Eliel Saarinen's last work. The younger Saarinen then designed the nonsectarian cylindrical Kresge chapel at Massachusetts Institute of Technology in Cambridge (1956), a brilliant example of religious architecture, and several college chapels, notably at Stephens college in Columbia, Mo. (1956), and the chapel at Concordia college, Fort Wayne, Ind. (1958). Another university chapel of note is at the Illinois Institute of Technology, Chicago (1952), by the German-born Ludwig Mies van der Rohe.

Two striking religious buildings of large size are the Air Force academy chapel at Colorado Springs, Colo. (1961), and the First Presbyterian church in Stamford, Conn. (1958). The Air Force academy chapel is of aluminum skinned tetrahedral frames. graphically suggesting the daring spirit of the air age. Skidmore, Owings and Merrill (called S.O.M.) were the architects, and Gordon Bunshaft and Walter Netsch the designers. Wallace Harrison's Stamford church is one of the most powerful modern churches in the world. Its exterior is of canted, angular planes, resembling some great fish, with a soaring colour-drenched nave within. A dazzling flood of light fills the interior from windows that rise from the floor to the ceiling ridge. These windows are filled with 20,000 pieces of inch-thick *Betonglas*, designed by Harrison and executed by Gabriel Loire of Chartres, France. The Crucifixion is depicted in abstract style on the north side and the Resurrection on the warmer. south side.

Harrison and his partner, Max Abramovitz, also designed an Interfaith centre for Brandeis university, Waltham, Mass. (1955). Instead of a single convertible building for the three faiths represented. there are three separate, individual chapels. Jewish, Protestant and Catholic, sensitively grouped around a common pool and landscaped setting.

Synagogue architecture in the U.S. is of a very high level. Eric Mendelsohn, who lived in the U.S. after 1942, designed several fine temples, among them Congregation B'nai Amoona, St. Louis (1952), Congregation Emanuel, Grand Rapids, Mich. (1951), Mount Zion temple, St. Paul, Minn., and the Cleveland Park synagogue, Cleveland, O. (1954).

Percival Goodman also designed splendid synagogues: Congregation Beth El, Springfield, Mass. (1953), Temple Beth El. Providence, R.I. (1953), Fairmount temple, Beechwood village, Ohio (1957) and Temple Mishkan Tefila, Newton, Mass. (1958). They are further distinguished by their excellent use of art by some of the finest artists in the country. The co-operation of architect and artist from the beginning achieved superior results.

Two of the handsomest synagogues in the U.S. are the Temple Emanu-el, Dallas. Tex. (1957), by Howard R. Meyer and Max Sandfield. and Philip C. Johnson's elegantly beautiful Kneses Tifereth Israel synagogue in Port Chester, N.Y. (1956). This clean, geometrically precise temple is a sharp contrast to the freer, more rugged design of Wallace Harrison's First Presbyterian church in Stamford, less than ten miles away. Though poles apart architecturally, they are two of the finest religious buildings in the country.

In contrast to its magnificent accomplishments in Europe, the Catholic Church in the U.S., as in Latin America, espoused relatively traditional church forms for new building. In the first half of the 20th century there were few Catholic churches of distinctive contemporary design. Among the most notable Catholic buildings are Robert Anshen and W. S. Allen's Chapel of the Holy Cross, Sedona, Ariz. (1956), and Marcel Breuer's Benedictine Abbey of St. John in Collegeville, Minn. (1961).

Two Protestant churches are of interest in that they illustrate the problems of the automobile age: St. Clement's Episcopal church. Alexandria, Va. (1948), by J. H. Saunders and the former rector, Darby Betts; and the Venice-Nokomis Presbyterian church, Venice, Fla. (1953), by Victor A. Lundy. The first, being flanked by roads with noisy traffic is of nindowless, soundproofed design, artificially lit and air conditioned. The Florida chapel is just the reverse: it is an open-air, drive-in church. *See* also Index references under "Religious Architecture" in the Index volume.

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(G. E. K. S)

REMAGEN, a town in Rhineland-Palatinate. Germany. on the left bank of the Rhine, 12 mi. above Bonn, by the railway from Cologne to Coblenz. and at the junction of the railway to Adenau. Pop (1959 est.) 7.132. Its Roman name was Rigomagus and many Roman remains have been found here. It passed to Prussia from the duchy of Jülich. The (Roman Catholic) parish church is remarkable for a gate dating from the 12th century. Below the town. on a height overlooking the Rhine, stands the Apollinaris church, built 1839–53 on the site of a chapel formerly dedicated

to St. Martin.

The Ludendorff railway bridge across the Rhine, built at Remagen during World War I, played a dramatic part in World War II. On March 7. 1945, elements of the U.S. 1st army captured it intact—the only Rhine bridge to be so taken—and established the first enemy bridgehead on the eastern bank since the time of Napoleon. Ten days later, on March 17. the 1,200-ft. span. weakened by earlier German demolition attempts and a heavy volume of Allied vehicular traffic. collapsed. During its ten days of use, however, five U.S. divisions and thousands of tons of supplies had crossed over it.

REMAINDER, REVERSION. In the view of English law a remainder or reversion is classed either as an incorporeal hereditament or, with greater correctness, as an estate in expectancy. That is to say, it is a present interest subject to an existing estate in possession called the particular estate, which must determine before the estate in expectancy can become an estate in possession. A remainder or reversion is in strictness confined to real estate, whether legal or equitable, though a similar interest may exist in personalty. The particular estate and the remainder or reversion together make up the whole estate over which the grantor has power of disposition. Accordingly a remainder or reversion limited on an estate in fee simple is void. The difference between a remainder and a reversion, stated as simply as possible. is that the latter is that undisposed-of part of the estate which after the determination of the particular estate mill fall into the possession of the original grantor or his representative, while a remainder is that part of the estate which under the same circumstances will fall into the possession of a person other than the original grantor or his representative. The subject is too technical for further treatment, for which reference must be made to legal textbooks.

The state laws of the U.S. affecting remainders will be found in Washburn. Real Property, ii. bk. 2. As a general rule contingent remainders have been rendered of little practical importance by enactments that they shall take effect as executory devises or shall not determine on determination of the particular estate.

REMAINDER THEOREM, a theorem of particular value in the study of polynomials and equations. If we divide

$$2x^2 + 3x + 6 \text{ by } x - 2,$$

for example, the quotient is $2x + 7$ and the remainder is 20. The remainder. however, can be found by substituting 2 for x in the polynomial. This gives:

$$2.2^2 + 3.2 + 6 = 8 + 6 + 6 = 20.$$

More generally, to find the remainder arising from dividing $f(x)$ by $x - r$, substitute r for x in $f(x)$. This evidently amounts simply to evaluating $f(x)$ for some special value (r) of x. This is conveniently done by following the plan shown at the right. This work reveals not only the remainder (20) but also the coefficients $(2 + 7)$ of the quotient $(2x + 7)$. When used for this latter purpose it is known as synthetic division. This method of dividing is very helpful in finding the roots of numerical higher equations.

$2+3+6$		2
	4	14
$2+7;$		20

See also ARITHMETIC: *Theory* of Divisors; COEFFICIENT; DIVISION; EQUATIONS. THEORY OF.

REMAND, a term of English law meaning the return of a prisoner by order of a court to the custody from which he came to the court. Where trials or indictments are not concluded at a single sitting the court of trial has poner to remand the accused into proper custody during any necessary adjournment. If the remand is for more than three days the order must be in writing (Indictable Offences act 1838). Similar poners of remand or committal to prison during adjournments are given to justices in the exercise of their summary criminal jurisdiction (Summary Jurisdiction acts 1848 and 1879). In the case of charges against children or young persons the remand must be to a "place of detention" unless released on bail or certified unfit for such a place of detention (Children act 1908). For this purpose homes have been established under the act.

In the U.S. the term is used in two senses The first is where a prisoner is returned to custody to await the resumption of the preliminary hearing or the commencement of the trial. The second is where a cause of action is returned to the original court after the same had been transferred or appealed.

REMARQUE, ERICH MARIA (1898–), German novelist, was born on June 22, 1898, in Osnabriick. He achieved world fame as author of *Im Westen* nichts Neues (1929; Eng. trans. by A W. Wheen, All *Quiet* on the *Western* Front, 1929), a vehement antiwar novel which, because of its sensational realism, caused a considerable controversy in Germany. Its sequel Der *Weg zurück* (1931: Eng trans. by A. W. Wheen, The Road Back, 1931) describes the collapse of Germany in 1918 and the subsequent political disorders. Remarque fought in World War I and was later a teacher and journalist. He left Germany in 1932 for Switzerland, but in 1939 went to New York where he became a U S citizen. After World War II he returned to Switzerland. Of his many other novels only Arc de *Triomphe* (1946; Eng trans. by W. Sorell and Denver Lindley, 1946) was a world success.

(H. S. R.)

REMBRANDT (REMBRANDT HARMENSZ [or HARMENSZOON] VAN RIJN [or RYN]) (1606–1669), the outstanding genius of the Dutch school of painting in the 17th century, was born in Leiden on July 15. 1606. His father, Harmen Gerritsz van Rijn, was a miller, while his mother, Neeltgen (Cornelia), was the daughter of a baker, Willemsz van Zuytbrouck, and they appear to have been simple, industrious and deeply pious folk, typical of the Dutch lower-middle class of this period. They originally intended him for a scholastic career and at about the age of seven he entered the Latin school in Leiden. In 1620, when not quite 14, he was enrolled in the university but he did not stay there long. In the following year his parents recognized that his talents as well as his inclinations lay in the direction of painting and he was apprenticed for three years to Jacob Isaacsz van Swanenburgh, a minor painter of architectural subjects. Rembrandt can have learned little from Swanenburgh beyond the basic elements of technique, for there is not the least trace of his first master's style in any of his work.

In 1624, having completed his apprenticeship, he went to Amsterdam for six months as a pupil of the historical painter Pieter Lastman, a far more talented artist than Swanenburgh. Lastman was a capable painter, but his somewhat theatrical style lacked any kind of profundity and he cannot have played an important part in developing that depth of human sympathy which is perhaps Rembrandt's most personal and valuable quality. However, at the more superficial level of subject matter and imagery—the visual vocabulary of Rembrandt's art—the influence of Lastman was powerful and enduring. Lastman was one of a small group of Dutch artists who had worked in Italy during the first decade of the century and were associated with the German master Adam Elsheimer (*q.v.*). The work of this group was strongly influenced by the 16th-century masters of Venice, notably Tintoretto, and in this they are quite distinct from the Dutch followers of Caravaggio, such as Gerard van Honthorst, Hendrick Terbrugghen and the other Utrecht painters, who were the principal channel of Italian influences in Holland at the time when Rembrandt was reaching maturity. Tintoretto and Caravaggio were both masters of chiaroscuro. using violent contrasts of light and shade for dramatic effect, but their methods were almost diametrically opposed, and the fact that Rembrandt's early contacts were not with the Utrecht school but with Elsheimer's followers in Amsterdam may well have been an important factor in the formation of his onn chiaroscuro style. The contrast of searching light and deep shadow is one of the central elements of Rembrandt's art, and his employment of it approaches more closely to the spirit of Tintoretto—emotional, mysterious, nonnaturalistic and even arbitrary in treatment of the play of light and its source—than to the almost brutal naturalism and the quasi-scientific handling of light that characterize Caravaggio and his followers The link with Tintoretto via Elsheimer can be traced more clearly through the works of the Pynas brothers (*e.g*, Jan Pynas' "Raising of Lazarus," in Philadelphia) than through Lastman himself, for whom the major Venetian influence

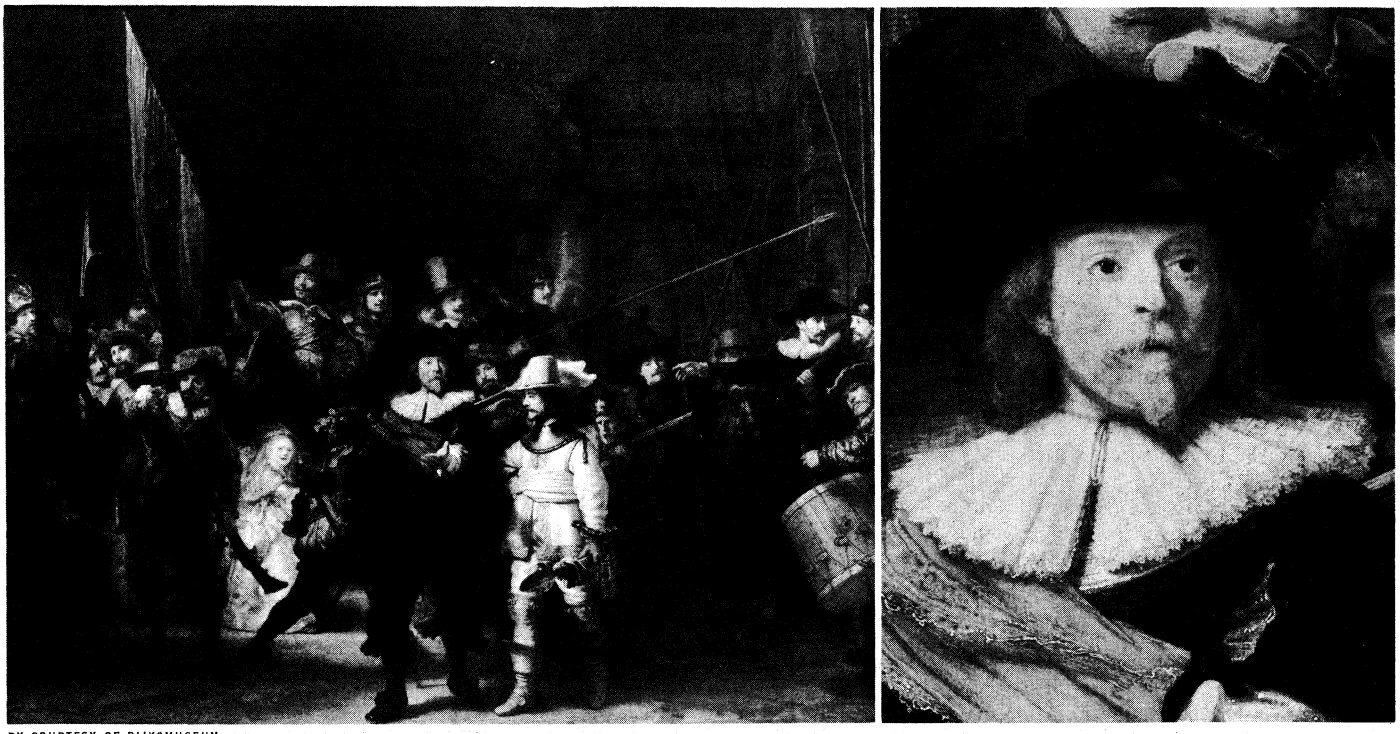
was that of Veronese. In Lastman's biblical and historical compositions the delicate daylight of Veronese takes on a cruder glare, and the cultured urbanity of Veronese's poses and gestures becomes pompous and provincial, but none the less the youthful Rembrandt found Lastman worth imitating and there are many echoes of his master in the historical pictures which he painted in Leiden between 1625–31. Examples of these are: "The Prophet Balaam" (1626; Cognacq-Jay museum, Paris) and "David Presenting the Head of Goliath to Saul" (1627?; Smidt van Gelder collection, Amsterdam), of which the latter is virtually a Lastman in miniature. Other works of these years, such as "The Tribute Money" (1629; Beit collection, London) show his growing interest in the use of expressive chiaroscuro. Rembrandt was naturally very much alive to influences other than the Italianism of the Lastman school. In addition to occasional hints borrowed from such contemporaries as Frans Hals and Adriaen Brouwer (*qq.v.*) one can detect the persistence of the northern genre tradition of the previous century, with its love of elaborate still-life details, in such a picture as "Tobit, His Wife and the Kid" (1626; in the private collection of Baroness Bentinck von Thyssen).

So far Rembrandt has been considered only as a painter of classical and biblical themes, but already in this early period a large proportion of his work consisted of portraits and studies of single figures and he was also making his first experiments in etching, a medium in which he was later to achieve unsurpassed results. The sitters for the portrait studies were frequently members of his own family, the most frequent being himself. These are not portraits in the fashionable sense, but studies in character, expression and lighting that could be (and often were) used in his subject pictures. The borderline between portraiture, genre and historical art is often a shadowy one, as when he paints "The Artist's Mother as the Prophetess Hannah" (1631; Rijksmuseum, Amsterdam), or develops a study of an old man into "The Apostle Paul" (Museum, Nürnberg). Often his homely sitters are given an exotic look by being made to wear some piece of extravagant headgear—a colourful turban, a helmet or a curiously plumed hat—as an exercise in the rendering of textures and effects of light. Most of the pictures of this period are painted on panel, with a predominance of cool, greyish monotone in the colouring, and the technique, though vigorous, is tighter and more constrained than the broad, loose brushwork of his later years. He soon became known in Leiden, where he shared a studio with the almost equally promising Jan Lievens, and before his removal to Amsterdam he was already taking pupils, among whom the most notable was Gerard Dou. More important for his subsequent career, he had roused the interest and admiration of Constantijn Huygens, with whose remarkable family he appears to have remained in contact throughout his life.

In the latter part of 1631 Rembrandt moved from Leiden to Amsterdam, the city which by this time had risen to be the foremost mercantile and artistic centre in Holland. Since he had already received a number of commissions from patrons in Amsterdam, he no doubt felt reasonably assured of a successful future there, and in fact the next ten years were to be—in terms of material reward—the most successful period of his life. He quickly gained a lion's share of the market in middle-class portraiture, in competition with such established and competent masters as Thomas de Keyser, and was commissioned (c. 1633) to paint a series of scenes of the Passion for the stadholder, Frederick Henry, prince of Orange, probably through the good offices of Constantijn Huygens, who was the stadholder's secretary. In 1634 he married Saskia van Uylenburch, a relative of his landlord and business associate, the art dealer Hendrick van Uylenburch. Saskia brought a considerable property of her own as marriage portion, for her family was both wealthy and well connected, and the rise in Rembrandt's fortune and social status is fully reflected in the confident and extrovert mood of much of his aork of the 1630s. In his art as in his life this was a period of growth and expansion, and the centre of both life and art was the personality of his attractive young wife. In the "Self-Portrait With the Artist's Wife" (Dresden museum) Rembrandt, jovial and resplendent in "cavalier" costume, is seated at a richly garnished table, one hand raising a drinking glass while the other clasps the waist of Saskia, who sits perched, rather demurely, on his knees. It would be foolish to regard this as a literal glimpse into their home life, but it is, in its somewhat vulgar exuberance, Rembrandt's most joyful testimony of his own pleasure in the good things of life.

Doubtless he did enjoy life, but he worked hard also, enlarging his achievement as well as his ambition in a splendid succession of portraits, historical pieces, etchings and drawings. He painted on a larger scale than in his Leiden years, with an increasing preference for canvas rather than panel. His colouring grew warmer, with brown and golden tones predominating, and his brushwork began to develop toward the unrivaled breadth and expressiveness of his fullest maturity. His first big portrait commission was in 1632 for the Surgeons' guild in Amsterdam—"The Anatomy Lesson of Professor Nicolaes Tulp" (Mauritshuis, The Hague). The official group portrait, depicting the officers of a guild, civic guard or other corporate body, was an established and important genre in Holland (as nowhere else) and "anatomies" had already been painted by De Keyser and others, although before Rembrandt's time such pictures had tended to be somewhat rigid assemblages of individual portraits, without psychological or pictorial unity in any marked degree. Hals in his earlier groups of the Haarlem civic guards moved toward a more pictorial solution, but Rembrandt penetrates far more deeply into the human situation. Without false overemphasis his "Tulp" reveals the inherent drama of the moment. contriving at the same time to convey the humane and compassionate motives which underlie an otherwise macabre operation, and it was an important step forward in the direction of his own "Night Watch" and "Syndics." In many of his portraits of this period Rembrandt aimed at the neat and highly finished effects which characterized the work of most of his rivals, as can be seen in such pictures as the pair of oval bust-length figures (Boston Museum of Fine Arts) of an "Unknown Man" (1634) and a "Lady in a Lace Collar," or the splendid pair of full-lengths (in the private collection of Baron Robert de Rothschild) also painted in 1634, which were thought to be portraits of Maerten Daey and his first wife Machteld van Doorn, but which more probably represent Marten Soolmans and his wife Oopjen Coppit, who after the death of her husband married Maerten Daey as his second wife. Among many other fine portraits of this phase are: the undated companion pieces of "Jan Pellicorne With His Son" and of Pellicorne's wife "Susanna van Collen With Her Daughter" (Wallace collection. London); "The Shipbuilder and His Wife" (1633; Royal collection at Buckingham palace, London); "The Preacher Eleazar Swalmius" (1637; Antwerp museum); "The Mennonite Preacher Cornelis Anslo and His Wife" (1641; Berlin); "Saskia as Flora" (1634; Hermitage, Leningrad); and the "Self-Portrait" of 1640 (National gallery, London), which shows the artist at the height of his fame and prosperity. In addition Rembrandt continued to produce many studies of a more personal kind, such as heads and single figures of old men, or Jewish types in turbans or colourful robes, that could be of use in his historical paintings.

The biblical subject pictures of these early years in Amsterdam are richly varied and provide evidence that Rembrandt studied almost every contemporary current in European painting. "Christ Appearing to Mary Magdalene" (1638; Buckingham palace) and the "Visitation" (1640; Detroit Institute of Arts) continue and enrich the Elsheimer tradition. The "Sacrifice of Abraham" (1635; Hermitage) is a fully baroque design of spiraling movement. Three illustrations of the story of Samson contrast with the pictures mentioned above and with each other: "Samson Threatening his Father-in-Law" (1635; Berlin) is a straightforward scene of comedy in which the painter's own features can be recognized in the guise of the irate hero; "The Blinding of Samson" (1636; Stadelsches Kunstinstitut, Frankfurt-on-Main) is a piece of savage melodrama and perhaps the most Caravaggesque of all Rembrandt's pictures; while "Samson's Wedding Feast" (1638; Dresden museum) is a sumptuous banqueting scene, in which the composed and charming figure of Saskia (Delilah) forms the central key of the composition. "The Sacrifice of Manoah" (1641; Dresden) gives a foretaste of the simplicity and the depth



BY COURTESY OF RIJKSMUSEUM

LEFT. "NIGHT WATCH" BY REMBRANDT: RIGHT. DETAIL OF CENTRAL FIGURE. IN THE RIJKSMUSEUM. AMSTERDAM

of feeling of Rembrandt's later religious paintings. In spite of the stylistic diversity of these works, they are all deeply impressed with the stamp of Rembrandt's individuality and humanity. Jakob Rosenberg observed that Rembrandt was never inclined to separate the human point of view from the pictorial. In this lies the peculiarly moving quality of his art that no imitator could approach His paintings testify to an intimate and loving knonledge of the Bible stories and he presents their characters always as samples of common humanity, not as remote and superhuman protagonists of legend or fairy tale. For Rembrandt the Bible was simple fact—and to be treated as such. The five pictures of the Passion cycle (1633–39; Altere Pinakothek, Munich) contain all these elements of style and character. In them can be traced echoes of Tintoretto. Caravaggio. Lastman and of Rubens' great "Descent From the Cross" in Antwerp cathedral, but all are fused in the concentrated and forthright power of Rembrandt's own manner, which owes nothing crucial to any of them. All are imbued with the painter's profound compassion, and in the first of the series ("The Raising of the Cross") he painted his own troubled face among the soldiery who heave the cross into position—and who shall be forgiven because "they know not what they do."

From about 1636 onward Rembrandt produced a small number of landscapes, most of them on panel and small, or fairly small, in size. Representative examples are: "Landscape With a Stone Bridge" (1637–38; Rijksmuseum); "Landscape With an Obelisk" (1638; Isabella Stewart Gardner museum. Boston); the comparatively large "River Landscape With Ruins on a Hill" and the tiny "Winter Landscape" (1646; both in the museum, Cassel. Ger.). These pictures strike one almost as being occasional relaxations of the artist from the hard discipline of figure painting, for they are free and spontaneous in design and technique. In general they follow the tradition of such landscape masters as Pieter Molijn, the early Jan van Goyen and Hercules Seghers. painted almost in monochrome but enlivened by spirited brushwork and dramatic tonal contrasts. Rembrandt delighted in painting an overcast or stormy sky, pierced by a single brilliant shaft of sunlight which illumines a building, a bridge or a clump of trees. producing a "spotlight" effect parallel to that of his figure and interior subjects. There is not the space here for a detailed consideration of Rembrandt's etchings, but among the more important plates of this phase are "The Raising of Lazarus" (c. 1632), "Christ Before Pilate" (1636) and "The Death of the Virgin" (1639).

The celebrated picture known as "The Night Watch" (Rijksmuseum), which was completed in 1642, may be regarded with some truth both as the culminating masterpiece of this decade of successes and as representing the transition to Rembrandt's later and less prosperous years. It might more accurately (though less succinctly) be called "The Civic Guard Under Captain Frans Banning Cocq and Lieutenant Willem van Ruytenburch." for the thorough cleaning which it received in 1946–47 proved that it nas not a night scene at all. but that the crowd of figures are emerging into sunlight from the shadows of an arched gateway. It is a huge canvas, about 12 ft. high by 14½ ft. wide, and was originally even larger. Early copies show that the painting has since been cut donn on all sides and especially drastically at its left edge, where two figures have been entirely lost. The composition has suffered from this curtailment, but it remains one of the supreme achievements of European art, baroque in its surging yet unified movement and its dramatic yet unified chiaroscuro, but a baroque which Rembrandt keeps under firm control by the strength of his design. "The Night Watch" also provides a foretaste of the brighter colouring that was to appear in his late style though, characteristically, it is used sparingly and effectively against a dark background. The captain's bright red sash and the lieutenant's yellow uniform provide the principal chord of colour. ahich is echoed in more muted tones in the reds and orange-browns of the figures on each side of them and in the paler yellow of the little girl's dress, nhile in the background and at the sides cooler greenish and yellowish tints predominate. To achieve the splendid unity of this complex composition Rembrandt subordinated the claims of portraiture to those of his own imaginative genius. This may well have dissatisfied some of the sitters nho are placed in such deep shadow as to be almost invisible, but it is surely too much to assume, as many have done, that the decline in his popularity from about this time is directly attributable to the cool reception of this masterpiece. As a body the shooting company of Captain Banning Cocq can hardly have been displeased at acquiring a work of such evident splendour.

From 1640 onward a series of misfortunes overtook Rembrandt. In 1640 his mother died and in 1642 he suffered a still more

grievous loss in the death of Saskia, a few months after the birth of their one surviving child, a son. This boy, christened Titus, was thenceforth the apple of his eye and he painted many portraits of him in childhood and as a young man. His popularity as a painter was on the wane, for patrons were turning their attention to the glossier and more readily comprehensible style of the younger generation, a style to which Rembrandt made no concessions. On the contrary, he followed undeviatingly the path of his genius toward ever broader and less "finished" effects. In 1639 he had bought a large and imposing house in the Jodenbreestraat, which contributed to his troubles for he could not really afford its upkeep, and for several years he sank deeper and deeper into financial difficulties. In 1656 he was declared bankrupt, and by 1660 the fine house and almost all of his possesuions, including valuable pictures and a vast assortment of armour and other curiosities, had been sold to pay what could be paid of his debts and he had moved into a humble lodging in a poorer quarter of the city. With him went Titus, now a youth of about 18, and Hendrickje Stoffels, who had entered his household as a servant girl in about 1645 and remained with him in his years of adversity as his mistress and loyal helper. Hendrickje and Titus formed a business partnership as dealers in works of art, with Rembrandt nominally their employee, bound to hand over to them all that he produced in return for his food and lodging. This ingenious device afforded him some protection from his creditors and permitted him at least to work unmolested as old age drew nearer. But his misfortunes were not ended. Hendrickje died in 1662, and in 1668 Titus died, only a few months after his marriage to Magdalena van Loo. Rembrandt did not long outlive his son. He died on Oct. 4, 1669, and was buried in the Westerkerk on Oct. 8. He was survived by his daughter Cornelia, born to Hendrickje Stoffels in 1654. The hardships of Rembrandt's old age have been much exaggerated by some writers, who have pictured him as almost entirely neglected after his brief period of prosperity. This was not really the case. Although no longer a successful painter in the material sense, he was far from being forgotten, as contemporary accounts fully prove. As late as 1662 he executed an important commission, the superb groups of "The Syndics." The failure of contemporary taste to accept the ultimate achievements of his late style was a fate that other great artists have endured in old age. For Rembrandt, as for them, the fulfillment of his art was more important than the applause that he might gain from it, and his triumph was that he spurned any ignoble compromise.

It is no easy task to single out individual pictures for mention from the wealth of masterpieces which Rembrandt produced in the final phases of his career. The self-portraits, which stretch in an unbroken series from his youth to the end of his life to form an artistic autobiography of the most fascinating and moving kind, take on a more sombre and troubled look. In such examples as the half-length "Self-Portrait" of 1652 (in Vienna) and the magnificent "Self-Portrait With a Palette" (Iveagh bequest, Kenwood house, London), painted about ten years later, he analyzes his own moral and physical progress with the same objective compassion as is seen in his studies of other humble sitters, such as the "Old Man in an Armchair" (which entered the National gallery in 1957 from the duke of Devonshire's collection). Other outstanding single portraits are the "Jewish Merchant" (National gallery), the "Jan Six" (1654; in the possession of the sitter's family) and the hauntingly romantic "Polish Rider" (Frick collection, New York). Among the later portrait groups mention must be made of the superb painting of "The Board of the Clothmakers' Guild" (1662; Rijksmuseum). This group, known usually as the "Staalmeesters," or in English "The Syndics," stands supreme in its own category of Dutch group portraiture, as does "The Night Watch." Perhaps the crowning achievement of his career in portraiture was the even later "Family Group" (Herzog Anton Ulrich museum, Brunswick, Ger.). This displays all the qualities of his last manner—rich yet subdued colour harmonies, firm yet unobtrusive compositional structure, vigorous yet subtle brushwork—and is at the same time a tender expression of all that is meant by the family relationship. The same human understanding is to be found in the biblical subjects of this period. Some recall his style of about 1630, for instance "The Woman Taken in Adultery" (1644; National gallery) and the Elsheimer-like "Susanna and the Elders" (Berlin); but in the 1650s and 1660s he produced works of such unique depth of feeling that they elude comparison with any earlier master. Such are the "Peter Denying Christ" (1660; Rijksmuseum) and the profoundly moving "Return of the Prodigal Son" (Hermitage). Parallel with the development in his painted work is a similar deepening of human values in his etchings, of which the famous large plate of "Christ Healing the Sick" (the "Hundred Guilder Print"), of about 1642–45 is possibly his supreme achievement in the medium. Finally, only the barest mention can be made of Rembrandt's incomparable drawings in pen or brush, or both, of which there are numerous examples in the principal collections on both sides of the Atlantic. *See* PAINTING: *The Netherlands: Rembrandt.* *See* also Index references under "Rembrandt" in the Index volume.

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(R. E. W. J.)

REMEMBRANCER, the name of certain officials who compiled the memoranda rolls and prepared the business for the barons of the exchequer, and so "reminded" them of the matter with which they must deal. There were at one time three clerks of the remembrance, styled king's remembrancer, lord treasurer's remembrancer and remembrancer of first-fruits. The latter two offices have become extinct. At the present moment (1929) the King's remembrancer is required to be a master of the court of exchequer, and by the Supreme Court of Judicature (Officers) act, 1879, he is a master of the supreme court. The office is usually filled by the senior master.

The king's remembrancer still assists at certain ceremonial functions. His duties are set out in the *Second Report of the Legal Departments Commission* (1874).

"Remembrancer" is also the title of an official of the corporation of the City of London, whose principal duty is to represent that body before parliamentary committees and at council and treasury boards.

REMI (REMY, REMIGIUS), **SAINT** (d. c. 530), bishop of Reims and friend of Clovis (*q.v.*), whom he converted to Christianity, was appointed to his see in 459. Clovis, pagan king of northern Gaul, had married Clotilda (daughter of Chilperic, Christian king of Burgundy), whose attempts to convert him he resisted. According to legend, however, during his war against the Alamanni, he promised that he would be converted if Clotilda's God would grant him the victory. He was successful, and Clotilda, therefore, summoned Remi, who with St. Vaast instructed Clovis and baptized him on Christmas day, 506; later his sisters and 3,000 men of his army also were baptized. Sources for Remi's life include only scattered references in Gregory of Tours and a few letters written by Remi and some contemporary bishops. Stories such as that of the dove that brought Remi a vial of oil from heaven for the baptism of Clovis, which was kept at Reims and used at the coronation of French kings, are later legends.

His feastday is Oct. 1.

See A. Van de Vyver, "La victoire contre les Alamans et la conversion de Clovis," *Revue Belge de philologie et d'histoire*, 15:859–914 (1936), 16:35–94 (1937). (J. N. G.)

REMINGTON, ELIPHALET (1793–1861), U.S. fire-arms manufacturer and inventor, was born at Suffield, Conn., on Oct. 28, 1793. In 1800 he traveled with his parents to the Mohawk valley, where they settled 20 mi. from Utica, N.Y. The elder Remington built a smithy and forge powered by a water wheel where he made horseshoes and agricultural implements. In 1816 young Remington built himself a flintlock rifle at his father's forge. It embodied no new inventions, but it was so remarkably accurate that the neighbouring sportsmen ordered similar guns from him, and within two years manufacture of sporting guns and rifle barrels became the main business of the forge. In 1828 Remington built a sizable factory beside the Erie canal at the present site of Ilion, N.Y., and expanded his production. He and his son Philo pioneered many improvements in arms manufacture, including the reflection method of straightening gun barrels, the lathe for cutting gunstocks, and the first successful cast-steel, drilled rifle barrel in the U.S.

In 1847 Remington supplied the U.S. navy with its first breech-loading rifle (Jenks carbine). In 1861, at the beginning of the American Civil War, the federal government placed large orders for small arms with Remington. He died on Aug. 12, 1861 in Ilion.

The Remington Arms company is still a large manufacturer of sporting arms and ammunition. During the American Civil War and World Wars I and II it was an important supplier of small arms and ammunition to the U.S. government.

See Alden Hatch, *Remington Arms in American History (1956).* (AL H.)

REMINGTON, FREDERIC (1861–1909), U.S. painter and sculptor, noted for his realistic portrayals of the American west, was born at Canton, N.Y., on Oct. 4, 1861. He was a pupil of the Yale art school and of the Art Students league, New York, and became known as an illustrator, painter and sculptor. Having spent much time in the west, where he went for his health, and having been with United States troops in warfare, he made a specialty of rendering the Indian and the soldier as seen on the western plains. In the Spanish-American War he was with the army under General Shafter as war correspondent. He died Dec. 26, 1909, near Ridgefield, Conn. His statuettes of soldiers, Indians, cowboys and trappers are full of character, while his paintings have been largely reproduced. He wrote several volumes of stories, including Pony Tracks (1895), Crooked Trails (1898), Sundown *Leflare* (1899) and *John* Ermine of the *Yellowstone* (1902).

REMIREMONT, a town of eastern France, in the *département* of Vosges, 17 mi. S.S.E. of Epinal by rail, on the Moselle, below its confluence with the Moselotte. Pop. (1954) 8,887. Remiremont (*Romarici Mons*) is named after St. Romaric, a companion of St. Columban of Luxeuil, who in the 7th century founded a monastery and a convent on the hills above the present town. In 910 an invasion of the Hungarians drove the nuns to Remiremont, which had grown round a villa of the Frankish kings, and in the 11th century they settled there. Enriched by dukes of Lorraine, kings of France and emperors of Germany, the ladies of Remiremont attained great power. The abbess was a princess of the empire, and received consecration at the hands of the pope. The fifty canonesses were selected from the nobility. On Whit-Monday the neighbouring parishes paid homage to the chapter in a ceremony called the "Kyrioles"; and on their accession the dukes of Lorraine, the immediate suzerains of the abbey, had to come to Remiremont to swear to continue their protection. The "War of the Scutcheons" (Panonceaux) in 1566 between the duke and the abbess ended in favour of the duke, and terminated the abbess's power. The monastery and nunnery were both suppressed in the Revolution. Remiremont is surrounded by forest-clad mountains. The 13th century abbey church has a crypt of the 11th century. The abbatial residence (which now contains the *mairie*, the court-house and the public library) has been twice rebuilt in the original plan in modern times. Some of the houses of the canonesses (17th and 18th centuries) remain Remiremont has a board of trade-arbitrators and a chamber of arts and manufactures.

The town's industries include cotton-spinning and weaving. the manufacture of embroidery, iron and copper founding and the manufacture of brushes.

REMIZOV, ALEXEI (1877–1957), Russian novelist. whose work influenced the modern Russian novel, was born June 24. 1877, in Moscow and brought up amid factory surroundings and in the strict observance of Orthodox Church rites, with frequent pilgrimages to monasteries. He thus gained an intimate knowledge of national habits, monastic life and old religious legends. He studied natural science and economics at Moscow university, took part in revolutionary activities, and was imprisoned and spent years of exile in Vologda.

Remizov subsequently went to live in Paris. The influences of his varying surroundings contributed to the formation of his fantastic personality, uniting the whimsical mischievousness of some fairy-tale sprite with a deep spirit of pity.

The most remarkable of Remizov's works are The Pond (1907), a powerful and gloomy picture of vulgarity, vice and crime among the Moscow bourgeoisie and the monasteries; The Clock (1908, Eng. trans. 1924); The *Fifth* Pestilence, two stories of provincial life (Eng trans. by A. Brown. 1927); *The* Sisters of the Cross (1910), a novel of St. Petersburg life; and The Story of Ivan *Semenovich* Stratilatov (1909). He also wrote stories relating to the revolution of 1905, and several plays. He died in Paris on Nov. 26, 1957.

REMONSTRANTS, those Dutch Protestants who, after the death of Jacobus Arminius, maintained the views associated with his name, and in 1610 presented to the states-general a "remonstrance" formulating their points of departure from stricter Calvinism. The Remonstrants were assailed both by personal enemies and by the political weapons of Maurice, prince of Orange, and in 1618–19 the synod of Dort expelled them and declared Remonstrant theology contrary to Scripture. The movement remains, however, and its liberal school of theology has reacted powerfully on the state church and on other Christian denominations. See ARMINIANISM; DORT, SYNOD OF.

REMORA, a name given generally to fishes of the family Echeneidae, which are remarkable for having the spinous dorsal fin developed into a transversely laminated sucking disc, placed on top of the head; in a more restricted sense the name refers to a particular species, *Remora* remora, other species being given common names such as sharksucker (Echeneis naucrates), slender suckerfish (Plztheirichthys *lineatus*), whalesucker (Remora *australis*), etc. There are about 12 species, found in all tropical and temperate seas.

Remoras attach themselves to whales, porpoises, sharks. sea turtles and large fish; they are not, however, parasitic on these animals but are merely transported by them. They detach themselves and swim when searching for food, frequently bits that fall from the mouths of their "hosts." Each plate in the sucking disc can be elevated to produce a partial vacuum when it is attached to a flat surface.

Attempts to dislodge a remora by pulling merely make the attachment more firm; the fish can be detached, however, by sliding it forward. In some parts of the tropics fishermen have used remoras with a line attached to their tails to catch larger fish and sea turtles. (C. HU.)

REMPHAN (in A.V., *Rephan* in R.V.) a word found in Acts vii. 43 (Ῥομφά, Westcott and Hort). The writer is quoting the Septuagint of Amos v. 26 (Ῥαιφάν), where the Hebrew has *Kiyyùn* (כִּיּוּן). This is probably a mistake for *Kewan*, the Babylonian name for the planet Saturn. The Greek form may be an error of the transliterator.

REMSCHEID, a town in North Rhine-Westphalia, Germany, 6 mi. by rail S. of Barmen, in an industrial area heavily bombed in World War II. Pop. (1959 est.) 123.276. It is a centre of the hardware industry, and makes large quantities of tools, scythes, drills and other small articles in iron, steel and brass.

REMSEN, IRA (1846–1927), U.S. chemist and university president, co-discoverer of saccharin, was born in New York city

on Feb. 10, 1846. He was educated at the Free academy (College of the City of New York; B.A., 1865), College of Physicians and Surgeons, Columbia university (M.D., 1867), and at the universities of Munich and Gottingen (Ph.D., 1870). At the University of Tiibingen (1870–72), where he was the assistant of Rudolph Fittig, he began the investigations into pure chemistry upon which his later fame was chiefly based. He became professor of chemistry at Williams college, Williamstown, Mass. (1872), and was one of the original faculty of Johns Hopkins university, Baltimore, Md., where he was professor of chemistry 1876–1913, director of the chemical laboratory 1876–1908, secretary of the academic council 1881–1901 and president of the university 1901–13 As president of Johns Hopkins he continued to emphasize the primary function of the university as a centre of research. He was president emeritus and professor emeritus 1913–27, during which time he traveled widely and worked on government pure food commissions. Remsen brought to Johns Hopkins many of the German laboratory methods and as a teacher he had many widely scattered and influential students.

He founded the *American Chemical Journal* in 1879. in which most of his papers appeared, and continued to edit it almost to the time of his death. In the first volume he described the preparation and properties of a new compound, subsequently to become widely known as saccharin, which he and a pupil discovered. Another long series of studies led to the discovery and enunciation of Remsen's law, concerning the prevention of oxidation in methyl and other groups. His writings included *Principles of Theoretical Chemistry* (1876), which passed through five editions and has been translated into German, Russian and Italian; *An Introduction to the Study of the Compounds of Carbon* (1885; jth rev.. 1922); *Elements of Chemistry* (1888); *Inorganic Chemistry* (1889); and *A College Text-book of Chemistry* (1901). He died at Carmel, Calif., on March 5, 1927.

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RÉMUSAT, CHARLES FRANÇOIS MARIE, COMTE DE (1797–187j), French politician and man of letters, was born in Paris on March 13, 1797. He was called to the bar, and became an active journalist. He signed the journalists' protest against the ordinances of July 1830, and in October was elected deputy for Haute-Garonne. He then ranked himself with the *doctrinaires,* and supported measures of restriction on popular liberty. Rémusat held office in the reign of Louis Philippe. He took no part in politics under the empire until 1869. In Aug. 1871 he became minister of foreign affairs. He died in Paris on Jan. 6, 187j.

His works include: *Abélard,* 2 vol. (1845); *Saint Anselme de Cantorbéry* (1854); *L'Angleterre au XVIII*ème *siècle* (1856; 2nd ed. enl., 1865); *Bacon, sa vie, son temps* (1858); *Channing,...* (1862); *Histoire de la philosophie en Angleterre depuis Bacon jusqu'à Locke* (1875).

RÉMUSAT, JEAN PIERRE ABEL (1788–1832), French Chinese scholar, was born in Paris on Sept. 5, 1788. He was educated for the medical profession, but a Chinese herbal in the collection of the Abbé Tersan led him to study Chinese. His *Essai sur la langue et la littérature chinoises* (1811) won him the patronage of Silvestre de Sacy, and in 1814 he was appointed to the chair of Chinese founded in that year at the Collège de France. His contributions from Chinese sources to the history of the Tatar nations claims special notice. Rémusat became an editor of the *Journal des savants* in 1818, and founder and first secretary of the Paris Asiatic Society in 1822; he also held various Government appointments. He died at Paris on June 4, 1832. A list of his works is given in Quérard's *France littéraire* s.v. Rémusat.

RENAISSANCE, THE. The "Renaissance" or "Renascence" is a term used to indicate a well-known but indefinite space of time and a certain phase in the development of Europe. On the one hand it denotes the transition from that period of history which we call the middle ages (*q.v.*) to that which we call modern. On the other hand it implies those changes in the intellectual and moral attitude of the Western nations by which the transition was characterized. If we insist upon the iiteral and etymological meaning of the word, the Renaissance was a re-birth; and it is needful to inquire of what it was the re-birth. The metaphor of Renaissance may signify the entrance of the European nations upon a fresh stage of vital energy in general, implying a fuller consciousness and a freer exercise of faculties than had belonged to the mediaeval period. Or it may mean the resuscitation of simply intellectual activities, stimulated by the revival of antique learning and its application to the arts and literatures of modern peoples. Upon our choice between these two interpretations of the word depend important differences in any treatment of the subject. The former has the disadvantage of making it difficult to separate the Renaissance from other historical phases—the Reformation for example—with which it ought not to be confounded. The latter has the merit of assigning a specific name to a limited series of events and group of facts, which can be distinguished for the purpose of analysis from other events and facts with which they are intimately but not indissolubly connected. In other words, the one definition of Renaissance makes it denote the whole change which came over Europe at the close of the middle ages. The other confines it to what was known by our ancestors as the Revival of Learning. Yet, when we concentrate attention on the recovery of antique culture, we become aware that this was only one phenomenon or symptom of a far wider and more comprehensive alteration in the conditions of the European races. We find it needful to retain both terms, Renaissance and Revival of Learning, and to show the relations between the series of events and facts which they severally imply. The Revival of Learning must be regarded as a function of that vital energy, an organ of that mental evolution, which brought into existence the modern world, with its new conceptions of philosophy and religion, its reawakened arts and sciences, its firmer grasp on the realities of human nature and the world, its manifold inventions and discoveries, its altered political systems, its expansive and progressive forces. Important as the Revival of Learning undoubtedly was, there are essential factors in the complex called the Renaissance with which it can but remotely be connected. When we analyse the whole group of phenomena which have to be considered, we perceive that some of the most essential have nothing or little to do with the recovery of the classics. These are, briefly speaking, the decay of those great fabrics, church and empire, which ruled the middle ages both as ideas and as realities; the development of nationalities and languages; the enfeeblement of the feudal system throughout Europe; the invention and application of paper, the mariner's compass, gunpowder, and printing; the exploration of continents beyond the ocean; and the substitution of the Copernican for the Ptolemaic system of astronomy. Europe in fact had been prepared for a thorough-going metamorphosis before that new idea of human life and culture which the Revival of Learning brought to light had been made manifest. It had recovered from the confusion consequent upon the dissolution of the ancient Roman empire. The Teutonic tribes had been Christianized, civilized and assimilated to the previously Latinized races over whom they exercised the authority of conquerors. Comparative tranquillity and material comfort had succeeded to discord and rough living. Modern nationalities, defined as separate factors in a common system, were ready to co-operate upon the basis of European federation. The ideas of universal monarchy and of indivisible Christendom, incorporated in the Holy Roman empire and the Roman Church, had so far lost their hold that scope was offered for the introduction of new theories both of state and church which would have seemed visionary or impious to the mediaeval mind. It is, therefore, obvious that some term, wider than Revival of Learning, descriptive of the change which began to pass over Europe in the 14th and 15th centuries, has to be adopted. That of Renaissance, Rinascimento, or Renascence is sufficient for the purpose, though we have to guard against the tyranny of what is after all a metaphor. We must not suffer it to lead us into rhetoric about the deadness and the darkness of the middle ages, or hamper our inquiry with preconceived assumptions that the re-birth in question was in any true sense a return to the irrecoverable pagan past. Nor must we imagine that there was any abrupt break with the middle ages. On the contrary, the Renaissance was rather the last stage of the middle ages emerging

from ecclesiastical and feudal despotism, developing what was original in mediaeval ideas by the light of classic arts and letters, holding in itself the promise of the modern world. It was, therefore, a period and a process of transition, fusion, preparation, tentative endeavour. And just at this point the real importance of the Revival of Learning may be indicated. That rediscovery of the classic past restored the confidence in their own faculties to men striving after spiritual freedom; revealed the continuity of history and the identity of human nature in spite of diverse creeds and different customs; held up for emulation master-works of literature, philosophy and art; provoked inquiry; encouraged criticism; shattered the narrow mental barriers imposed by mediaeval orthodoxy. Humanism', a word which will often recur in the ensuing paragraphs, denotes a specific bias which the forces liberated in the Renaissance took from contact with the ancient world—the particular form assumed by human self-esteem at that epoch —the ideal of life and civilization evolved by the modern nations. It indicates the endeavour of man to reconstitute himself as a free being, not as the thrall of theological despotism, and the peculiar assistance he derived in this effort from Greek and Roman literature, the *litterae humaniores*, letters leaning rather to the side of man than of divinity.

In this article the Renaissance will be considered as implying a comprehensive movement of the European intellect and will toward self-emancipation, toward reassertion of the natural rights of the reason and the senses, toward the conquest of this planet as a place of human occupation, and toward the formation of regulative theories both for states and individuals differing from those of mediaeval times. The Revival of Learning will be treated as a decisive factor in this process of evolution on a new plan. To exclude the Reformation and the Counter-Reformation wholly from the survey is impossible. These terms indicate moments in the whole process of modern history which were opposed, each to the other, and both to the Renaissance; and it is needful to bear in mind that they have, scientifically speaking, a quite separate existence. Yet, if the history of Europe in the 16th century of our era came to be written with the brevity with which we write the history of Europe in the 6th century B.C., it would be difficult at the distance of time implied by that supposition to distinguish the Italian movement of the Renaissance in its origin from the German movement of the Reformation. Both would be seen to have a common starting-point in the reaction against long dominant ideas which were becoming obsolete, and also in the excitation of faculties which had during the same period been accumulating energy.

Chronology. — The Renaissance, if we try to regard it as a period, was essentially the transition from one historical stage to another. It cannot therefore be confined within strict chronological limits. There is one date, however, which may be remembered with advantage as the starting-point in time of the Renaissance, after the departure from the middle ages had been definitely and consciously made by the Italians. This is the year 1453, when Constantinople, chosen for his capital by the first Christian emperor of Rome, fell into the hands of the Turk.[2] One of the survivals of the old world, the shadow of what had been the Eastern empire, now passed suddenly away. Almost at the same date that visionary revival of the Western empire, which had imposed for six centuries upon the imagination of mediaeval Europe, hampering Italy and impeding the consolidation of Germany, ceased to reckon among political actualities; while its more robust rival, the Roman Church, seemed likely to sink into the rank of a petty Italian principality. It was demonstrated by the destruction of the Eastern and the dotage of the Western empire and by the new papal policy which Nicholas V. inaugurated, that the old order of society was about to be superseded. Nothing remained to check those centrifugal forces in state and church which substituted a confederation of rival European Powers for the earlier ideal of universal monarchy, and separate religious constitutions for the previous Catholic unity. At the same time the new learning introduced by the earlier humanists awakened free thought, encouraged curiosity, and prepared the best minds of Europe for speculative audacities from which the schoolmen would have shrunk, and which soon expressed themselves in acts of cosmopolitan importance. If we look a little forward to the years 1492–1500, we obtain a second date of great importance. In these years the expedition of Charles VIII. to Naples opened Italy to French, Spanish and German interference. The leading nations of Europe began to compete for the prize of the peninsula, and learned meanwhile that culture which the Italians had perfected. In these years the secularization of the papacy was carried to its final point by Alexander VI., and the Reformation became inevitable. The same period was marked by the discovery of America, the exploration of the Indian seas, and the consolidation of the Spanish nationality. It also witnessed the application of printing to the diffusion of knowledge. Thus, speaking roughly, the half-century between 1450 and 1500 may be termed the culminating point of the Renaissance. The transition of the mediaeval to the modern order was now secured if not accomplished, and a rubicon had been crossed from which no retrogression to the past was possible. Looking yet a little farther to the years 1527 and 1530 a third decisive date is reached. In the first of these years happened the sack of Rome, in the second the pacification of Italy by Charles V. under a Spanish hegemony. The age of the Renaissance was now closed for the land which gave it birth. The Reformation had taken firm hold on northern Europe. The Counter-Refomation was already imminent.

'To the humanists themselves "humanitas" meant nothing more nor less than "culture."

[2] Most scholars now deny that the fall of Constantinople had any appreciable influence on the culture of Western Europe. For Symonds' date of 1453 they would substitute the date of the invention of printing about 1440.

THE MIDDLE AGES

It must not be imagined that so great a change as that implied by the Renaissance was accomplished without premonitory symptoms and previous endeavours. In the main we mean by it the recovery of freedom for the human spirit after a long period of bondage to oppressive ecclesiastical and political orthodoxy — a return to the liberal and practical conceptions of the world which the nations of antiquity had enjoyed, but upon a new and enlarged platform. This being so, it was inevitable that the finally successful efforts after self-emancipation should have been anticipated from time to time by strivings within the ages that are known as dark and mediaeval. It is, therefore part of the present inquiry to pass in review some of the claimants to be considered precursors to the Renaissance.

First of all must be named the Frank in whose lifetime the dual conception of universal empire and universal church, divinely appointed sacred and inviolable, began to control the order of European society. Charles the Great (Charlemagne) lent his forces to the plan of resuscitating the Roman empire at a moment when his own power made him the arbiter of Western Europe, when the papacy needed his alliance, and when the Eastern empire had passed under the usurped regency of a female. He modelled an empire, Roman in name, but essentially Teutonic, since it owed such substance as its fabric possessed to Frankish armies and the sinews of the German people. As a structure composed of divers ill-connected parts it fell to pieces at its builder's death, leaving little but the incubus of a memory, the fascination of a mighty name, to dominate the mind of mediaeval Europe. As an idea, the Empire grew in visionary power, and remained one of the chief obstacles in the way of both Italian and German national coherence. Real force was not in it, but rather in that counterpart to its unlimited pretensions, the Church which had evolved it from barbarian night, and which used her own more vital energies for undermining the rival of her creation. Charles the Great, having proclaimed himself successor of the Caesars. was obscurely ambitious of imitating the Augusti also in the sphere of letters. He caused a scheme of humanistic education to be formulated, and gave employment at his court to rhetoricians of whom Alcuin was the most considerable. But very little came of the Revival of Learning which Charles is supposed to have encouraged; and the empire he restored was accepted by the mediaeval intellect in a crude theological and vaguely mystical spirit. We should, how-

ever, here remember that the study of Roman law, which was one important precursory symptom of the Renaissance, owed much to mediaeval respect for the empire as a divine institution. This, together with the municipal Italian intolerance of the Lombard and Frankish codes, kept alive the practice and revived the science of Latin jurisprudence at an early period.

Speculation and Heresy. — Philosophy had tried to free itself from the trammels of theological orthodoxy in the hardy speculations of some schoolmen, notably of Scotus Erigena and Abelard. These innovators found, however, small support, and were defeated by opponents who used the same logical weapons with authority to back them. Nor were the rationalistic opinions of the Averroists without their value, though the Church condemned these deviators from her discipline as heretics. Such mediaeval materialists, moreover, had but feeble hold upon the substance of real knowledge. Imperfect acquaintance with authors whom they had studied in Latin translations made by Jews from Arabic commentaries on Greek texts, together with almost total ignorance of natural laws, condemned them to sterility. Like the other schiomachists of their epoch, they fought with phantoms in a visionary realm. A similar judgment may be passed upon those Paulician, Albigensian, Paterine and Epicurean dissenters from the Catholic creed who opposed the phalanxes of orthodoxy with frail imaginative weapons, and alarmed established orders in the state by the audacity of their communistic opinions. Physical science struggled into feeble life in the cells of Gerbert and Roger Bacon. But these men were accounted magicians by the vulgar; and, while the one eventually assumed the tiara, the other was incarcerated in a dungeon. The schools meanwhile resounded still to the interminable dispute upon abstractions. Are only universals real, or has each name a corresponding entity? From the midst of the Franciscans who had persecuted Roger Bacon because he presumed to know more than was consistent with human humility arose John of Parma, adopting and popularizing the mystic prophecy of Joachim of Flora. The reign of the Father is past; the reign of the Son is passing; the reign of the Spirit is at hand. Such was the formula of the Eternal Gospel, which as an unconscious forecast of the Renaissance, has attracted retrospective students by its felicity of adaptation to their historical method. Yet we must remember that this bold intuition of the abbot Joachim indicated a monastic reaction against the tyrannies and corruptions of the Church, rather than a fertile philosophical conception. The Fraticelli spiritualists, and similar sects who fed their imagination with his doctrine, expired in the flames to which Fra Dolcino Longino and Margharita were consigned. To what extent the accusations of profligate morals brought against these reforming sectarians were justified remains doubtful; and the same uncertainty rests upon the alleged iniquities of the Templars. It is only certain that at this epoch the fabric of Catholic faith was threatened with various forms of prophetic and Oriental mysticism, symptomatic of a widespread desire to grasp at something simpler, purer and less rigid than Latin theology afforded. Devoid of criticism, devoid of sound learning, devoid of a firm hold on the realities of life, these heresies passed away without solid results and were forgotten.

Naturalism. — We are apt to take for granted that the men of the middle ages were immersed in meditations on the other world, and that their intellectual exercises were confined to abstractions of the schools, hallucinations of the fancy, allegories, visions. This assumption applies indeed in a broad sense to that period which was dominated by intolerant theology, and deprived of positive knowledge. Yet there are abundant signs that the native human instincts, the natural human appetities, remained unaltered and alive beneath the crust of orthodoxy. In the person of a pope like Boniface VIII. those ineradicable forces of the natural man assumed, if we may trust the depositions of ecclesiastics, well acquainted with his life. a form of brutal atheistic cynicism. In the person of an emperor, Frederick II., they emerged under the more agreeable garb of liberal culture and Epicurean scepticism. Frederick dreamed of remodelling society upon a mundane type, which anticipated the large toleration and cosmopolitan enlightenment of the actual Renaissance. But his efforts were defeated by the unrelenting hostility of the Church, and by the incapacity of his contemporaries to understand his aims. After being forced in his lifetime to submit to authority, he was consigned by Dante to hell. Frederick's ideal of civilization was derived in a large measure from Provence, where a beautiful culture had prematurely bloomed, filling southern Europe with the perfume of poetry and gentle living. Here, if anywhere, it seemed as though the ecclesiastical and feudal fetters of the middle ages might be broken. and humanity might enter on a new stage of joyous and unimpeded evolution. This was, however, not to be. The Church preached Simon de Montfort's crusade, and organized Dominic's Inquisition; what Quinet calls the "Renaissance sociale par l'Amour" was extirpated by sword, fire, famine and pestilence. Meanwhile the Provencal poets had developed their modern language with incomparable richness and dexterity, creating forms of verse and modes of emotional expression which determined the latest mediaeval phase of literature in Europe. The naturalism of which we have been speaking found free utterance now in the fabliaux of jongleurs, lyrics of minnesingers, tales of trouvères, romances of Arthur and his knights — compositions varied in type and tone, but in all of which sincere passion and real enjoyment of life pierce through the thin veil of chivalrous mysticism or of allegory with which they were sometimes conventionally draped. The tales of Lancelot and Tristram, the lives of the troubadours and the Wachtlieder of the minnesingers, sufficiently prove with what sensual freedom a knight loved the lady whom custom and art made him profess to worship as a saint. We do not need to be reminded that Beatrice's adorer had a wife and children, or that Laura's poet owned a son and daughter by a concubine, in order to perceive that the mystic passion of chivalry was compatible in the middle ages with commonplace matrimony or vulgar illegitimate connections. But perhaps the most convincing testimony to the presence of this ineradicable naturalism is afforded by the Latin songs of wandering students, known as Carmina Burama, written by the self-styled Goliardi. In these compositions, remarkable for their facile handling of mediaeval Latin rhymes and rhythms, the allegorizing mysticism which envelops chivalrous poetry is discarded. Love is treated from a frankly carnal point of view. Bacclius and Venus go hand in hand, as in the ancient ante-Christian age. The open-air enjoyments of the wood, the field, the dance upon the village green are sung with juvenile light-heartedness. No grave note, warning us that the pleasures of this earth are fleeting, that the visible world is but a symbol of the invisible, that human life is a probation for the life beyond, interrupts the tinkling music as of castanets and tripping feet which gives a novel charm to these unique relics of the 13th century. Goliardic poetry is further curious as showing how the classics even at that early period were a fountain-head of pagan inspiration. In the taverns and low places of amusement haunted by those lettered songsters, on the open road and in the forests trodden by their vagrant feet, the deities of Greece and Rome were not in exile, but at home within the hearts of living men. Thus, while Christendom was still preoccupied with the Crusades, two main forces of the Renaissance, naturalism and enthusiasm for antique modes of feeling, already brought their latent potency to light, prematurely indeed and precociously, yet with a promise that was destined to be kept.

The Mediaeval Attitude. — When due regard is paid to these miscellaneous evidences of intellectual and sensual freedom during the middle ages, it will be seen that there were by no means lacking elements of native vigour ready to burst forth. What was wanting was not vitality and licence, not audacity of speculation, not lawless instinct or rebellious impulse. It was rather the right touch on life, the right feeling for human independence, the right way of approaching the materials of philosophy, religion, scholarship and literature that failed. The courage that is born of knowledge, the calm strength begotten by a positive attitude of mind, face to face with the dominant over-shadowing sphinx of theology, were lacking. We may fairly say that natural and untaught people had more of the just intuition that was needed than learned folk trained in the schools. But these people were rendered licentious in revolt or impotent for salutary action by ignorance, hy terror, by uneasy dread of the doom declared for heretics and rebels.

The massive vengeance of the Church hung over them, like a heavy sword suspended in the cloudy air. Superstition and stupidity hedged them in on every side, so that sorcery and magic seemed the only means of winning power over nature or insight into mysteries surrounding human life. The path from darkness to light was lost; thought was involved in allegory; the study of nature had been perverted into an inept system of grotesque and pious parablemongering; the pursuit of truth had become a game of wordy dialectics. The other world, with its imagined heaven and hell, haunted the conscience like a nightmare. However sweet this world seemed, however fair the flesh, both world and flesh were theoretically given over to the devil. It was not worth while to master and economize the resources of this earth, to utilize the good and ameliorate the evils of this life, while everyone agreed, in theory at any rate, that the present was but a bad prelude to an infinitely worse or infinitely better future. ' To escape from these preoccupations and prejudices except upon the path of conscious and deliberate sin was impossible for all but minds of rarest quality and courage; and these were too often reduced to the recantation of their supposed errors no less by some secret clinging sense of guilt than by the Church's iron hand. Man and the actual universe kept on reasserting their rights and claims, in one way or another; but they were always being thrust back again into Cimmerian regions of abstractions, fictions, visions, spectral hopes and fears, in the midst of which the intellect sornnambulistically moved upon an unknown way.

THE REVIVAL OF LEARNING IN ITALY

At this point the Revival of Learning intervened to determine the course of the Renaissance. Mediaeval students possessed a considerable portion of the Latin classics, though Greek had become in the fullest sense of the phrase a dead language. But what they retained of ancient literature they could not comprehend in the right spirit. Between them and the text of poet or historian hung a veil of mysticism, a vapour of misapprehension. The odour of unsanctity clung around those relics of the pagan past. Men bred in the cloister and the lecture room of the logicians, trained in scholastic disputations, versed in allegorical interpretations of the plainest words and most apparent facts, could not find the key which might unlock those stores of wisdom and of beauty. Petrarch first opened a new method in scholarship and revealed what we denote as humanism. In his teaching lay the twofold discovery of man and of the world. For humanism, which was the vital element in the Revival of Learning, consists mainly of a just perception of the dignity of man as a rational, volitional and sentient being, born upon this earth with a right to use it and enjoy it. Humanism implied the rejection of those visions of a future and imagined state of souls as the only absolute reality, which had fascinated the imagination of the middle ages. It involved a vivid recognition of the goodliness of man and nature, displayed in the great monuments of human power recovered from the past. It stimulated the curiosity of latent sensibilities, provoked fresh inquisition into the groundwork of existence and strengthened man's self-esteem by knowledge of what men had thought and felt and done in ages when Christianity was not. It roused a desire to reappropriate the whole abandoned provinces of mundane energy, and a hope to emulate antiquity in works of living loveliness and vigour. The Italians of the 14th century, more precocious than the other European races, were ripe for this emancipation of enslaved intelligence. In the classics they found the food which was required to nourish the new spirit; and a variety of circumstances among which must be reckoned the pride of a nation boasting of its descent from the *populus Romanus,* rendered them apt to fling aside the obstacles that had impeded the free action of the mind through many centuries. Petrarch not only set his countrymen upon the right method of studying the Latin classics, but he also divined the importance of recovering a knowledge of Greek literature. To this task Giovanni Boccaccio addressed himself; and he was followed by numerous Italian enthusiasts, who visited Byzantium before its fall as the sacred city of a new revelation. The next step was to collect manuscripts, to hunt out, copy and preserve the precious relics of the past. In this work of accumulation Guarino da Verona and Francesco Filelfo, Giovanni Aurispa and Poggio took the chief part, aided by the wealth of Italian patricians, merchant princes and despots, who were inspired by the sacred thirst for learning. Learning was then no mere pursuit of a special and recluse class. It was fashionable and it was passionate, pervading all society with the fervour of romance. For a generation nursed in decadent scholasticism and stereotyped theological formulas it was the fountain of renascent youth, beauty and freedom, the shape in which the Helen of art and poetry appeared to the ravished eyes of mediaeval Faustus. It was the resurrection of the mightiest spirits of the past. "I go," said Cyriac of Ancona, the indefatigable though uncritical explorer of antiquities, "I go to awake the dead!" This was the enthusiasm, this the vitalizing faith, which made the work of scholarship in the 15th century so highly strung and ardent. The men who followed it knew that they were restoring humanity to its birthright after the expatriation of ten centuries. They were instinctively aware that the effort was for liberty of action, thought and conscience in the future. This conviction made young men leave their loves and pleasures, grave men quit their countinghouses, churchmen desert their missals, to crowd the lecture rooms of philologers and rhetoricians. When Greek had been acquired, manuscripts accumulated, libraries and museums formed, came the age of printers and expositors. Aldus Manutius in Italy, Joannes Froben in Basle, the Étiennes in Paris committed to the press what the investigators had recovered. Nor were there wanting men who dedicated their powers to Hebrew and Oriental erudition, laying, together with the Grecians, a basis for those biblical studies which advanced the Reformation. Meanwhile, the languages of Greece and Rome had been so thoroughly appropriated that a final race of scholars, headed by Politian, Jovianus Pontanus, Lorenzo Valla, handled once again in verse and prose both antique dialects, and thrilled Europe with new-made pagan melodies. The Church itself at this epoch lent its influence to the prevalent enthusiasm. Nicholas V and Leo X, not to mention intervening popes who showed themselves tolerant of humanistic culture, were heroes of the classical revival. Scholarship became the surest path of advancement to ecclesiastical and political honours. Italy was one great school of the new learning at the moment when the German, French and Spanish nations were invited to its feast.

It will be well to describe briefly, but in detail, what this meeting of the modern with the ancient mind effected over the whole field of intellectual interests. In doing so, care must be taken to remember that the study of the classics did but give a special impulse to pent-up energies which were bound in one way or another to assert their independence. Without the Revival of Learning the direction of those forces would have been different; but that novel intuition into the nature of the world and man which constitutes what we describe as Renaissance must have emerged. As the facts, however, stand, it is impossible to dissociate the rejection of the other world as the sole reality, the joyous acceptance of this world as a place to live in and act in, the conviction that "the proper study of mankind is man," from humanism. Humanism as it actually appeared in Italy was positive in its conception of the problems to be solved, pagan in its contempt for mediaeval mysticism, invigorated for sensuous enjoyment by contact with antiquity, yet holding in itself the germ of new religious aspirations, profounder science and sterner probings of the mysteries of life than had been attempted even by the ancients. The operation of this humanistic spirit has now to be traced.

Dante, Petrarch, Boccaccio and **Villani.**—It is obvious that Italian literature owed little at the outset to the Revival of Learning. The *Divine* Comedy, the *Canzoniere* and the *Decameron* were works of monumental art, deriving neither form nor inspiration immediately from the classics but applying the originality of Italian genius to matter drawn from previous mediaeval sources. Dante showed both in his epic poem and in his lyrics that he had not abandoned the sphere of contemporary thought. Allegory and theology, the vision and the symbol, still determine the form of masterpieces which for perfection of workmanship and for emancipated force of intellect rank among the highest products of the

human mind. Yet they are not mediaeval in the same sense as the song of Roland or the Arthurian cycle. They proved that, though Italy came late into the realm of literature, her action was destined to be decisive and alterative by the introduction of a new spirit, a firmer and more positive grasp on life and art. These qualities she owed to her material prosperity, to her freedom from feudalism, to her secularized church, her commercial nobility, her political independence in a federation of small states. Petrarch and Boccaccio, though they both held the mediaeval doctrine that literature should teach some abstruse truth beneath a veil of fiction, differed from Dante in this, that their poetry and prose in the vernacular abandoned both allegory and symbol. In their practice they ignored their theory; Petrarch's lyrics continue the Provençal tradition as it had been reformed in Tuscany, with a subtler and more modern analysis of emotion, a purer and more chastened style than his masters could boast; Boccaccio's tales, in like manner, continue the tradition of the fabliaux, raising that literary species to the rank of finished art, enriching it with humour and strengthening its substance by keen insight into all varieties of character. The *Canzoniere* and the *Decameron* distinguish themselves from mediaeval literature, not by any return to classical precedents, but by free self-conscious handling of human nature. So much had to be premised in order to make it clear in what relation humanism stood to the Renaissance since the Italian work of Dante, Petrarch and Boccaccio is sufficient to indicate the re-birth of the spirit after ages of apparent deadness. Had the Revival of Learning not intervened, it is probable that the vigorous efforts of these writers alone would have inaugurated a new age of European culture. Yet, while noting this reservation of judgment it must also be remarked that all three felt themselves under some peculiar obligation to the classics. Dante, mediaeval as his temper seems to us, chose Virgil for his guide, and ascribed his mastery of style to the study of Virgilian poetry. Petrarch and Boccaccio were, as we have seen, the pioneers of the new learning. They held their writings in the vernacular cheap, and initiated that contempt for the mother tongue which was a note of the earlier Renaissance. Giovanni Villani, the first chronicler who used Italian for the compilation of a methodical history, tells us how he was impelled to write by musing on the ruins of Rome, and thinking of the vanished greatness of the Latin race. We have, therefore, to recognize that the four greatest writers of the 14th century, while the Revival of Learning was yet in its cradle, each after his own fashion acknowledged the vivifying touch upon his spirit of the antique genius. They seem to have been conscious that they could not give the desired impulse to modern literature and art without contact with the classics; and, in spite of the splendour of their achievements in Italian, they found no immediate followers upon that path.

Scholarship and Literature.— The fascination of pure study was so powerful, the Italians at that epoch were so eager to recover the past, that during the 15th century we have before our eyes the spectacle of this great nation deviating from the course of development begun in poetry by Dante and Petrarch, in prose by Boccaccio and Villani, into the channels of scholarship and antiquarian research. The language of the *Canzoniere* and *Decameron* was abandoned for revived Latin and discovered Greek. Acquisition supplanted invention; imitation of classical authors suppressed originality of style. The energies of the Italian people were devoted to transcribing the codices, settling texts, translating Greek books into Latin, compiling grammars, commentaries, encyclopaedias, dictionaries, epitomes and ephemerides. During this century the best histories—Bruni's and Poggio's annals of Florence, for example—were composed in Latin after the manner of Livy. The best dissertations, Landino's *Camaldunenses,* Valla's *De Voluptate,* were laboured imitations of Cicero's *Tusculans.* The best verse, Pontano's elegies, Politian's hexameters, were, in like manner Latin; public orations upon ceremonial occasions were delivered in the Latin tongue; correspondence, official and familiar, was carried on in the same language; even the fabliaux received, in Poggio's *Facetiae,* a dress of elegant Latinity. The noticeable barrenness of Italian literature at this period is referable to the fact that men of genius and talent devoted themselves to erudition and struggled to express their thoughts and feelings in a speech which was not natural. Yet they were engaged in a work of incalculable importance. At the close of the century the knowledge of Greece and Rome had been reappropriated and placed beyond the possibility of destruction; the chasm between the old and new world had been bridged; mediaeval modes of thinking and discussing had been superseded; the staple of education, the common culture which has brought all Europe into intellectual agreement, was already in existence. Humanism was now an actuality. Owing to the uncritical veneration for antiquity which then prevailed, it had received a strong tincture of pedantry. Its professors, in their revolt against the middle ages, made light of Christianity and paraded paganism. What was even worse from an artistic point of view, they had contracted puerilities of style, vanities of rhetoric, stupidities of wearisome citation. Still, at the opening of the 16th century, it became manifest what fruits of noble quality the Revival of Letters was about to bring forth for modern literature. Two great scholars, Lorenzo de'Medici and Politian, had already returned to the practice of Italian poetry. Their work is the first absolutely modern work—modern in the sense of having absorbed the stores of classic learning and reproduced those treasures in forms of simple, natural, native beauty. Boiardo occupies a similar position by the fusion of classic mythology with chivalrous romance in his *Orlando Innamorato.* But the victor's laurels were reserved for Ariosto whose *Orlando Furioso* is the purest and most perfect extant example of Renaissance poetry. It was not merely in what they had acquired and assimilated from the classics that these poets showed the transformation effected in the fields of literature by humanism. The whole method and spirit of the mediaeval art had been abandoned. That of the *cinque cento* is positive, defined, mundane. The deity, if deity there be, that rules in it, is beauty. Interest is confined to the actions, passions, sufferings and joys of human life, to its pathetic, tragic, humorous and sentimental incidents. Of the state of souls beyond the grave we hear and are supposed to care nothing. In the drama the pedantry of the Revival which had not injured romantic literature made itself perniciously felt. Rules were collected from Horace and Aristotle. Seneca was chosen as the model of tragedy; Plautus and Terence supplied the groundwork of comedy. Thus in the plays of Rucellai, Trissino, Sperone and other tragic poets, the nobler elements of humanism, considered as a revelation of the world and man, obtained no free development. Even the comedies of the best authors are too observant of Latin precedents, although some pieces of Machiavelli, Ariosto, Aretino, Cecchi and Gelli are admirable for vivid delineation of contemporary manners.

Fine Arts.—The relation of the plastic arts to the Revival of Learning is similar to that which has been sketched in the case of poetry. Cimabue started with work which owed nothing directly to antiquity. At about the same time Niccola Pisano (d. 1278) studied the style of sculpture in fragments of Graeco-Roman marbles. His manner influenced Giotto, who set painting on a forward path. Fortunately for the unimpeded expansion of Italian art, little was brought to light of antique workmanship during the 14th and 15th centuries. The classical stimulus came to painters, sculptors and architects chiefly through literature. Therefore there was narrow scope for imitation; and the right spirit of humanism displayed itself in a passionate study of perspective, nature and the nude. Yet we find in the writings of Ghiberti and Alberti, we notice in the masterpieces of these men and their compeers Brunelleschi and Donatello, how even in the 15th century the minds of artists were fascinated by what survived of classic grace and science. Gradually, as the race became penetrated by antique thought, the earlier Christian motives of the arts yielded to pagan subjects. Gothic architecture, which had always flourished feebly on Italian soil, was supplanted by a hybrid Roman style. The study of Vitruvius gave strong support to that pseudo-classic manner which, when it had reached its final point in Palladio's work, overspread the whole of Europe and dominated taste during two centuries. But the perfect plastic art of Italy, the pure art of the *cinque cento,* the painting of Raphael, Da Vinci, Titian and Correggio the sculpture of Donatello, Michel-

angelo and Sansovino, the architecture of Bramante, Omodeo, and the Venetian Lombardi, however much imbued with the spirit of the classical revival, take rank beside the poetry of Ariosto as a free intelligent product of the Renaissance. That is to say, it is not so much an outcome of studies in antiquity as an exhibition of emancipated modern genius fired and illuminated by the masterpieces of the past. It indicates a separation from the middle ages, inasmuch as it is permanently natural. Its religion is joyous, sensuous, dramatic, terrible, but in each and all of its many-sided manifestations strictly human. Its touch on classical mythology is original, rarely imitative or pedantic. The art of the Renaissance was an apocalypse of the beauty of the world and man in unaffected spontaneity, without side thoughts for piety or erudition, inspired by pure delight in loveliness and harmony for their own sakes.

Science and Philosophy. — In the fields of science and philosophy humanism wrought similar important changes. Petrarch began by waging relentless war against the logicians and materialists of his own day. With the advance made in Greek studies scholastic methods of thinking fell into contemptuous oblivion. The newly aroused curiosity for nature encouraged men like Alberti, Da Vinci, Toscanelli and Da Porta to make practical experiments, penetrate the working of physical forces, and invent scientific instruments. Anatomy began to be studied, and the time was not far distant when Titian should lend his pencil to the epoch-making treatise of Vesalius. The middle ages had been satisfied with absurd and visionary notions about the world around them, while the body of man was regarded with too much suspicion to be studied. Now the right method of interrogating nature with patience and loving admiration was instituted. At the same time the texts of ancient authors supplied hints which led to discoveries so far-reaching in their results as those of Copernicus, Columbus and Galileo. In philosophy, properly so called, the humanistic scorn for mediaeval dullness and obscurity swept away theological metaphysics as valueless. But at first little beyond empty rhetoric and clumsy compilation was substituted. The ethical treatises of the scholars are deficient in substance, while Ficino's attempt to revive Platonism betrays an uncritical conception of his master's drift. It was something, however, to have shaken off the shackles of ecclesiastical authority; and, even if a new authority, that of the ancients, was accepted in its stead, still progress was being made toward sounder methods of analysis. This is noticeable in Pomponazzo's system of materialism, based on the interpretation of Aristotle, but revealing a virile spirit of disinterested and unprejudiced research. The thinkers of southern Italy, Telesio, Bruno and Campanella, at last opened the two chief lines on which modern speculation has since moved. Telesio and Campanella may be termed the predecessors of Bacon. Bruno was the precursor of the idealistic schools. All three alike strove to disengage their minds from classical as well as ecclesiastical authority, proving that the emancipation of the will had been accomplished. It must be added that their writings, like every other product of the Renaissance, except its purest poetry and art, exhibit a hybrid between mediaeval and modern tendencies. Childish ineptitudes are mingled with intuitions of maturest wisdom and seeds of future thought germinate in the decaying refuse of past systems.

Criticism. — Humanism in its earliest stages was uncritical. It absorbed the relics of antiquity with omnivorous appetite and with very imperfect sense of the distinction between worse and better work. Yet it led in process of time to criticism. The critique of literature began in the lecture-room of Politian, in the printing house of Aldus, and in the school of Vittorino. The critique of Roman law started under Politian's auspices, upon a more liberal course than that which had been followed by the powerful but narrow-sighted glossators of Bologna. Finally, in the court of Naples arose that most formidable of all critical engines, the critique of established ecclesiastical traditions and spurious historical documents. Valla by one vigorous effort destroyed the False Decretals and exposed the Donation of Constantine to ridicule, paving the way for the polemic carried on against the dubious pretensions of the papal throne by scholars of the Reformation. A similar criticism, conducted less on lines of erudition than of persiflage and irony, ransacked the moral abuses of the Church and played around the foundations of Christianity. This was tolerated by men who repeated the witty epigram, attributed to Leo X, "What profit has not that fable of Christ brought us!" The same critical and philosophic spirit working on the materials of history produced a new science, the honours of which belong to Machiavelli. He showed, on the one side, how the history of a people can be written with a recognition of fixed principles, and at the same time with an artistic feeling for personal and dramatic episodes. On the other side, he addressed himself to the analysis of man considered as a political being, to the anatomy of constitutions and the classification of governments, to the study of motives underlying public action, the secrets of success and the causes of failure in the conduct of affairs. The unscrupulous rigour with which he applied his scientific method, and the sinister deductions he thought himself justified in drawing from the results it yielded, excited terror and repulsion. Nevertheless a department had been added to the intellectual empire of mankind, in which fellow-workers, like Guicciardini at Florence, and subsequently Sarpi at Venice, were not slow to follow the path traced by Machiavelli.

Education. — The object of the foregoing paragraphs has been to show in what way the positive, inquisitive, secular, exploratory spirit of the Renaissance, when toned and controlled by humanism penetrated the regions of literature, art, philosophy and science. It becomes at this point of much moment to consider how social manners in Italy were modified by the same causes, since the type developed there was in large measure communicated together with the new culture to the rest of Europe. The first subject to be noticed under this heading is education. What has come to be called a classical education was the immediate product of the Italian Renaissance. The Universities of Bologna, Padua, and Salerno had been famous through the later middle ages for the study of law, physics and medicine; and during the 15th and 16th centuries the first two still enjoyed celebrity in these faculties. But at this period no lecture-rooms were so crowded as those in which professors of antique literature and language read passages from the poets and orators, taught Greek, and commented upon the systems of philosophers. The mediaeval curriculum offered no defined place for the new learning of the Revival, which had indeed no recognized name. Chairs had therefore to be founded under the title of rhetoric, from which men like Chrysoloras and Guarino, Filelfo and Politian expounded orally to hundreds of eager students from every town of Italy and every nation of Europe their accumulated knowledge of antiquity. One mass of Greek and Roman erudition, including history and metaphysics, law and science, civic institutions and the art of war, mythology and magistracies, metrical systems and oratory, agriculture and astronomy, domestic manners and religious rites, grammar and philology, biology and numismatics, formed the miscellaneous subject-matter of this so-styled rhetoric. Notes taken at these lectures supplied young scholars with hints for further exploration; and a certain tradition of treating antique authors for the display of general learning, as well as for the elucidation of their texts, came into vogue, which has determined the method of scholarship for the last three centuries in Europe. The lack of printed books in the first period of the Revival, and the comparative rarity of Greek erudition among students, combined with the intense enthusiasm aroused for the new gospel of the classics, gave special value to the personal teaching of these professors. They journeyed from city to city, attracted by promises of higher pay, and allured by ever-growing laurels of popular fame. Each large town established its public study, academy or university—similar institutions under varying designations—for the exposition of the *literae humaniores*. The humanists, or professors of that branch of knowledge, became a class of the highest dignity. They were found in the chanceries of the republics, in the papal curia, in the council chambers of princes, at the headquarters of condottieri, wherever business had to be transacted, speeches to be made and the work of secretaries to be performed. Furthermore, they undertook the charge of private education, opening schools

which displaced the mediaeval system of instruction and taking engagements as tutors in the families of despots, noblemen and wealthy merchants. The academy established by Vittorino da Feltre at Mantua under the protection of Gian Francesco Gonzaga, for the training of pupils of both sexes, might be chosen as the type of this Italian method. His scholars who were lodged in appropriate buildings met daily to hear the master read and comment on the classics. They learned portions of the best authors by heart, exercised themselves in translating from one language to another and practised composition in prose and verse. It was Vittorino's care to see that while their memories were duly stored with words and facts their judgment should be formed by a critical analysis, attention to style and comparison of the authors of a decadent age with those who were acknowledged classics. During the hours of recreation suitable physical exercises, as fencing, riding, and gymnastics, were conducted under qualified trainers. From this sketch it will be seen how closely the educational system which came into England during the reign of the Tudors, and which has prevailed until the present time, was modelled upon the Italian type. English youths who spend their time at Eton between athletic sports and Latin verse, and who take a first class in Literae Humaniores at Oxford are pursuing the same course of physical and mental discipline as the princes of Gonzaga or Montefeltro in the 15th century.

The humanists effected a deeply penetrating change in social manners. Through their influence as tutors, professors, orators and courtiers, society was permeated by a fresh ideal of culture. To be a gentleman in Italy meant at this epoch to be a man acquainted with the rudiments at least of scholarship, refined in diction, capable of corresponding or of speaking in choice phrases, open to the beauty of the arts, intelligently interested in archaeology, taking for his models of conduct the great men of antiquity, rather than the saints of the Church. He was also expected to prove himself an adept in physical exercises and in the courteous observances which survived from chivalry. The type is set before us by Castiglione in that book upon the courtier which went the round of Europe in the 16th century. It is further emphasized in a famous passage of the *Orlando Innamorato* where Boiardo compares the Italian ideal of an accomplished gentleman with the coarser type admired by nations of the north. To this point the awakened intelligence of the Renaissance, instructed by humanism, polished by the fine arts, expanding in genial conditions of diffused wealth, had brought the Italians at a period when the rest of Europe was comparatively barbarous.

Defects of the Renaissance. — This picture has undoubtedly a darker side. Humanism in its revolt against the middle ages was, as we have seen already, mundane, pagan, irreligious, positive[1]. The Renaissance can, after all, be regarded only as a period of transition in which much of the good of the past was sacrificed while some of the evil was retained, and neither the bad nor the good of the future was brought clearly into fact. Beneath the surface of brilliant social culture lurked gross appetites and savage passions, unrestrained by mediaeval piety, untutored by modern experience. Italian society exhibited an almost unexampled spectacle of literary, artistic and courtly refinement crossed by brutalities of lust, treasons, poisonings, assassinations, violence. A succession of worldly pontiffs brought the Church into flagrant discord with the principles of Christianity. Steeped in pagan learning, desirous of imitating the manners of the ancients, thinking and feeling in harmony with Ovid and Theocritus, and at the same time rendered cynical by the corruption of papal Rome, the educated classes lost their grasp upon morality. Political honesty ceased almost to have a name in Italy. The Christian virtues were scorned by the foremost actors and the ablest thinkers of the time, while the antique virtues were themes for rhetoric rather than moving springs of conduct. This is apparent to all students of Machiavelli and Guicciardini, the profoundest analysts of their age, the bitterest satirists of its vices, but themselves infected with its incapacity for moral goodness. The Italians were not only vitiated; they had also become impotent for action and resistance. At the height of the Renaissance the five great Powers in the peninsula formed a confederation of independent but mutually attractive and repellent states. Equilibrium was maintained by diplomacy, in which the humanists played a foremost part, casting a network of intrigue over the nation which helped in no small measure to stimulate intelligence and create a common medium of culture, but which accustomed statesmen to believe that everything could be achieved by wire-pulling. Wars were conducted on a showy system by means of mercenaries, who played a safe game in the field and developed a system of bloodless campaigns. Meanwhile the people grew up unused to arms. When Italy between the years 1494 and 1530 became the battlefield of French, German and Spanish forces, it was seen to what a point of helplessness the political, moral and social conditions of the Renaissance had brought the nation.

Spread of the New Learning. — It was needful to study at some length the main phenomena of the Renaissance in Italy, because the history of that phase of evolution in the other Western races turns almost entirely upon points in which they either adhered to or diverged from the type established there. Speaking broadly, what France, Germany, Spain and England assimilated from Italy at this epoch was in the first place the new learning as it was then called. This implied the new conception of human life, the new interest in the material universe, the new method of education, and the new manners, which we have seen to be inseparable from Italian humanism. Under these forms of intellectual enlightenment and polite culture the renascence of the human spirit had appeared in Italy, where it was more than elsewhere connected with the study of classical antiquity. But that audacious exploratory energy which formed the motive force of the Renaissance as distinguished from the Revival of Learning took, as we shall see, very different directions in the several nations who now were sending the flower of their youth to study at the feet of Italian rhetoricians.

The Renaissance ran its course in Italy with strange indifference to consequences. The five great Powers, held in equilibrium by Lorenzo de' Medici, dreamed that the peninsula could be maintained in *statu quo* by diplomacy. The Church saw no danger in encouraging a pseudo-pagan ideal of life, violating its own principle of existence by assuming the policy of an aggrandizing secular state, and outraging Christendom openly by its acts and utterances. Society at large was hardly aware that an intellectual force of stupendous magnitude and incalculable explosive power had been created by the new learning. Why should not established institutions proceed upon the customary and convenient methods of routine, while the delights of existence were augmented, manners polished, arts developed and a golden age of epicurean ease made decent by a state religion which no one cared to break with because no one was left to regard it seriously? This was the attitude of the Italians when the Renaissance, which they had initiated as a thing of beauty, began to operate as a thing of power beyond the Alps.

GERMANY

Germany was already provided with universities, seven of which had been founded between 1348 and 1409. In these haunts of learning the new studies took root after the year 1440, chiefly through the influence of travelling professors, Peter Luder and Samuel Karoch. German scholars made their way to Lombard and Tuscan lecture-rooms, bringing back the methods of the humanists. Greek, Latin and Hebrew erudition soon found itself at home on Teutonic soil. Like Italian men of letters, these pioneers of humanism gave a classic turn to their patronymics: unfamiliar names, Crotus Rubeanus and Pierius Graecus, Capnion and Lupambulus Ganymedes, Oecolampadius and Melanchthon, resounded on the Rhine. A few of the German princes, among whom Maximilian, the prince cardinal Albert of Mainz, Frederick the Wise of Saxony, and Eberhard of Wiirttemberg deserve mention, exercised a not insignificant influence on letters by the foundation of new universities and the patronage of learned men. The cities of Strasbourg, Nuremberg, Augsburg, Basle, became centres of learned coteries which gathered round scholars like Wimphel-

[1] But there was also a great school of Christian humanists intent upon reconciling the gospel with the Greek philosophers.

ing, Brant, Peutinger, Schedel, and Pirckheimer, artists like Diirer and Holbein, painters of the eminence of Froben. Academies in imitation of Italian institutions came into existence, the two most conspicuous named after the Rhine and the Danube, holding their headquarters respectively at Heidelberg and Vienna. Crowned poets, of whom the most eminent was Conrad Celtes Protucius (Pickel!) emulated the fame of Politian and Pontano. Yet though the Renaissance was thus widely communicated to the centres of German intelligence, it displayed a different character from that which it assumed in Italy. Gothic art, which was indigenous in Germany, yielded but little to southern influences. Such work as that of Durer, Vischer, Cranach, Schongauer, Holbein, consummate as it was in technical excellence, did not assume Italian forms of loveliness, did not display the paganism of the Latin races. The modification of Gothic architecture by pseudo-Roman elements of style was incomplete. What Germany afterwards took of the Palladian manner was destined to reach it on a circuitous route from France. In like manner the new learning failed to penetrate all classes of society with the rapidity of its expansion in Italy, nor was the new ideal of life and customs so easily substituted for the mediaeval. The German aristocracy, as Aeneas Sylvius had noticed, remained for the most part barbarous, addicted to gross pleasures, contemptuous of culture. The German dialects were too rough to receive that artistic elaboration under antique influences which had been so facile in Tuscany. The doctors of the universities were too wedded to their antiquated manuals and methods, too satisfied with dullness, too proud of titles and diplomas, too anxious to preserve ecclesiastical discipline and to repress mental activity, for a genial spirit of humanism to spread freely. Not in Cologne or Tübingen but in Padua and Florence did the German pioneers of the Renaissance acquire their sense of liberal studies. And when they returned home they found themselves encumbered with stupidities, jealousies and rancours. Moreover the temper of these more enlightened men was itself opposed to Italian indifference and immorality; it was pugnacious and polemical, eager to beat down the arrogance of monks and theologians rather than to pursue an ideal of aesthetical self-culture. To a student of the origins of German humanism it is clear that something very different from the Renaissance of Lorenzo de' Medici and Leo X. was in preparation from the first upon Teutonic soil. Far less plastic and form-loving than the Italian, the German intelligence was more penetrative, earnest, disputative, occupied with substantial problems. Starting with theological criticism, proceeding to the stage of solid studies in the three learned languages, German humanism occupied the attention of a widely scattered sect of erudite scholars; but it did not arouse the interest of the whole nation until it was forced into a violently militant attitude by Pfefferkorn's attack on Reuchlin. That attempt to extinguish honest thought prepared the Reformation; and humanism after 1518 was absorbed in politico-religious warfare.

Humanism and the German Reformation. — The point of contact between humanism and the Reformation in Germany has to be insisted on; for it is just here that the relation of the Reformation to the Renaissance in general makes itself apparent. As the Renaissance had its precursory movements in the mediaeval period, so the German Reformation was preceded by Wycliffe and Huss, by the discontents of the Great Schism, and by the councils of Constance and Basel. These two main streams of modern progress had been proceeding upon different tracks to diverse issues, but they touched in the studies stimulated by the Revival, and they had a common origin in the struggle of the spirit after self-emancipation. Johann Reuchlin, who entered the lecture-room of Argyropoulos at Rome in 1482, Erasmus of Rotterdam, who once dwelt at Venice as the house guest of the Aldi, applied their critical knowledge of Hebrew and Greek to the elucidation and diffusion of the Bible. To the Germans, as to all nations of that epoch, the Bible came as a new book, because they now read it for the first time with eyes opened by humanism. The touch of the new spirit which had evolved literature, art and culture in Italy sufficed in Germany to recreate Christianity. This new spirit in Italy emancipated human intelligence by the classics; in Germany it emancipated the human conscience by the Bible. The indignation excited by Leo X.'s sale of indulgences, the moral rage stirred in Northern hearts by papal abominations in Rome were external causes which precipitated the schism between Teutonic and Latin Christianity. The Reformation, inspired by the same energy of resuscitated life as the Renaissance, assisted by the same engines of the printing-press and paper, using the same apparatus of scholarship, criticism, literary skill, being in truth another manifestation of the same world-movement under a diverse form, now posed itself as an irreconcilable antagonist to Renaissance Italy. It would be difficult to draw any comparison between German and Italian humanists to the disparagement of the former. Reuchlin was no less learned than Pico; Melanchthon no less humane than Ficino; Erasmus no less witty and far more trenchant than Petrarch; Ulrich von Hutten no less humorous than Folengo; Paracelsus no less fantastically learned than Cardano. But the cause in which German intellect and will were enlisted was so different that it is difficult not to make a formal separation between that movement which evolved culture in Italy and that which restored religion in Germany, establishing the freedom of intelligence in the one sphere and the freedom of conscience in the other. The truth is that the Reformation was the Teutonic Renaissance. It was the emancipation of the reason on a line neglected by the Italians, more important indeed in its political consequences, more weighty in its bearing on rationalistic developments than the Italian Renaissance, but none the less an outcome of the same ground-influences. We have already in this century reached a point at which, in spite of stubborn Protestant dogmatism and bitter Catholic reaction, we can perceive how the ultimate affranchisement of man will be the work of both.

The Counter-Reformation. — The German Reformation was incapable of propagating itself in Italy, chiefly for the reason that the intellectual forces which it represented and employed had already found specific outlet in that country. It was not in the nature of the Italians, sceptical and paganized by the revival, to be keenly interested about questions which seemed to revive the scholastic disputes of the middle ages. It was not in their external conditions, suffering as they were from invasions, enthralled by despots, to use the Reformation as a lever for political revolution. Yet when a tumultuary army of so-called Lutherans sacked Rome in 1527, no sober thinker doubted that a new agent had appeared in Europe which would alter the destinies of the peninsula. The Renaissance was virtually closed so far as it concerned Italy, when Clement VII. and Charles V. struck their compact at Bologna in 1530. This compact proclaimed the principle of monarchial absolutism, supported by papal authority, itself monarchially absolute, which influenced Europe until the outbreak of the Revolution. A reaction immediately set in both against the Renaissance and the Reformation. The Council of Trent, opened in 1545 and closed in 1563, decreed a formal purgation of the Church, affirmed the fundamental doctrines of Catholicism, strengthened the papal supremacy, and inaugurated that movement of resistance which is known as the Counter-Reformation. The complex onward effort of the modern nations, expressing itself in Italy as Renaissance, in Germany as Reformation, had aroused the forces of conservatism. The four main instruments of the reaction were the papacy, which had done so much by its sympathy with the revival to promote the humanistic spirit it now dreaded, the strength of Spain, and two Spanish institutions planted on Roman soil — the Inquisition and the Society of Jesus. The principle contended for and established by this reaction was absolutism as opposed to freedom — monarchial absolutism, papal absolutism, the suppression of energies liberated by the Renaissance and the Reformation. The partial triumph of this principle was secure, in as much as the majority of established powers in Church and State felt threatened by the revolutionary opinions afloat in Europe. Renaissance and Reformation were, moreover, already at strife. Both, too, were spiritual and elastic tendencies toward progress, ideals rather than solid organisms.

SPAIN

The part played by Spain in this period of history was deter-

mined in large measure by external circumstance. The Spaniards became one nation by the conquest of Granada and the union of the crowns of Castile and Aragon. The war of national aggrandizement being in its nature a crusade, inflamed the religious enthusiasm of the people. It was followed by the expulsion of Jews and Moors, and by the establishment of the Inquisition on a solid basis, with powers formidable to the freedom of all Spaniards from the peasant to the throne. These facts explain the decisive action of the Spanish nation on the side of Catholic conservatism, and help us to understand why their brilliant achievements in the field of culture during the 16th century were speedily followed by stagnation. It will be well, in dealing with the Renaissance in Spain, to touch first upon the arts and literature, and then to consider those qualities of character in action whereby the nation most distinguished itself from the rest of Europe. Architecture in Spain, emerging from the Gothic stage, developed an Early Renaissance style of bewildering richness by adopting elements of Arabic and Moorish decoration. Sculpture exhibited realistic vigour of indubitably native stamp; and the minor plastic crafts were cultivated with success on lines of striking originality. Painting grew from a homely stock, until the work of Velasquez showed that Spanish masters in this branch were fully abreast of their Italian compeers and contemporaries. To dwell here upon the Italianizing versifiers, moralists and pastoral romancers who attempted to refine the vernacular of the *Romancero* would be superfluous. They are mainly noticeable as proving that certain coteries in Spain were willing to accept the Italian Renaissance. But the real force of the people was not in this courtly literary style. It expressed itself at last in the monumental work of *Don Quixote,* which places Cervantes beside Rabelais, Ariosto and Shakespeare as one of the four supreme exponents of the Renaissance. The affectations of decadent chivalry disappeared before its humour; the lineaments of a noble nation, animated by the youth of modern Europe emerging from the middle ages, were portrayed in its enduring pictures of human experience. The Spanish drama, meanwhile untrammelled by those false canons of pseudo-classic taste which fettered the theatre in Italy and afterwards in France, rose to an eminence in the hands of Lope de Vega and Calderon which only the English, and the English only in the masterpieces of three or four playwrights, can rival. Camoens in the *Lusiad,* if we may here group Portugal with Spain, was the first modern poet to compose an epic on a purely modern theme, vying with Virgil, but not bending to pedantic rules, and breathing the spirit of the age of heroic adventures and almost fabulous discoveries into his melodious numbers. What has chiefly to be noted regarding the achievements of the Spanish race in arts and letters at this epoch is their potent national originality. The revival of learning produced in Spain no slavish imitation as it did in Italy, no formal humanism, and, it may be added, very little of fruitful scholarship. The Renaissance here, as in England, displayed essential qualities of intellectual freedom, delight in life, exultation over rediscovered earth and man. The note of Renaissance work in Germany was still Gothic. This we feel in the penetrative earnestness of Diirer, in the homeliness of Hans Sachs, in the grotesque humour of *Eulenspiegel,* and the *Narrenschiff,* the sombre pregnancy of the Faust legend, the almost stolid mastery of Holbein. It lay not in the German genius to escape from the preoccupations and the limitations of the middle ages, for this reason mainly that what we call mediaeval was to a very large extent Teutonic. But on the Spanish peninsula, in the masterpieces of Velasquez, Cervantes, Camoens, Calderon, we emerge into an atmosphere of art definitely national, distinctly modern, where solid natural forms stand befcre us realistically modelled, with light and shadow on their rounded outlines, and where the airiest creatures of the fancy take shape and weave a dance of rhythmic, light, incomparable intricacy. The Spanish Renaissance would in itself suffice, if other witnesses were wanting, to prove how inaccurate is the theory that limits this movement to the revival of learning. Touched by Italian influences, enriched and fortified by the new learning, Spanish genius walked firmly forward on its own path. It was crushed only by forces generated in the nation that produced it, by the Inquisition and by despotic Catholic absolutism.

In the history of the Renaissance, Spain and Portugal represent the exploration of the ocean and the colonization of the other hemisphere. The voyages of Columbus and Vespucci to America, the rounding of the Cape by Diaz and the discovery of the sea road to India by Vasco da Gama. Cortés's conquest of Mexico and Pizarro's conquest of Peru, marked a new era fo- the human race and inaugurated the modern age more decisively than any other series of events has done. It has recently been maintained that modern European history is chiefly an affair of competition between confederated states for the possession of lands revealed by Columbus and Da Gama. Without challenging or adopting this speculation, it may be safely affirmed that nothing so pregnant of results has happened as this exploration of the globe. To say that it displaced the centre of gravity in politics and commerce, substituting the ocean for the Mediterranean, dethroning Italy from her seat of central importance in traffic, depressing the eastern and elevating the western Powers of Europe, opening a path for Anglo-Saxon expansiveness, forcing philosophers and statesmen to regard the Occidental nations as a single group in counterpoise to other groups of nations, the European community as one unit correlated to other units of humanity upon this planet, is truth enough to vindicate the vast significance of these discoveries. The Renaissance, far from being the re-birth of antiquity with its civilization confined to the Mediterranean and the Hercules' Pillars beyond which lay Cimmerian darkness, was thus effectively the entrance upon a quite incalculably wider stage of life on which mankind at large has since enacted one great drama. While Spanish navies were exploring the ocean, and Spanish paladins were overturning empires, Charles V headed the reaction of Catholicism against reform. Stronger as king of Spain than as emperor, for the Empire was little but a name, he lent the weight of his authority to that system of coercion and repression which enslaved Italy, desolated Germany with war, and drowned the Low Countries in blood. Philip II, with full approval of the Spanish nation, pursued the same policy in an even stricter spirit. He was powerfully assisted by two institutions in which the national character of Spain expressed itself, the Inquisition and the Society of Jesus. Of the former it is not needful to speak here. But we have to observe that the last great phenomenon of the Spanish Renaissance was Ignatius Loyola, who organized the militia by means of which the Church worked its Counter-Reformation. His motto. *Perinde ac cadaver,* expressed that recognition of absolutism which papacy and monarchy demanded for their consolidation. (*See* JESUS, SOCIETY OF and LOYOLA, ST. IGNATIUS OF.)

FRANCE

The logical order of an essay which attempts to show how Renaissance was correlated to Reformation and Counter-Reformation has necessitated the treatment of Italy, Germany and Spain in succession; for these three nations were the three main agents in the triple process to be analysed. It was due to their specific qualities, and to the diverse circumstances of their external development that the re-birth of Europe took this form of duplex action on the lines of intellectual and moral progress, followed by reaction against mental freedom. We have now to speak of France, which earliest absorbed the influence of the Italian revival, and of England which received it latest. The Renaissance may be said to have begun in France with Charles VIII.'s expedition to Naples, and to have continued until the extinction of the house of Valois. Louis XII. and Francis I. spent a considerable portion of their reigns in the attempt to secure possession of the Italian provinces they claimed. Henry II.'s queen was Catherine of the Medicean family; and her children, Charles IX. and Henry III., were Italianated Frenchmen. Thus the connection between France and Italy during the period 1494–1589 was continuous. The French passed to and fro across the Alps on military and peaceful expeditions. Italians came to France as courtiers, ambassadors, men of business, captains and artists. French society assumed a strong Italian colouring, nor were the manners of the court very different from those of an Italian city, except that

externally they remained ruder and less polished. The relation between the crown and its great feudatories, the military bias of the aristocracy, and the marked distinction between classes which survived from the middle ages, rendered France in many vital points unlike Italy. Yet the annals of that age, and the anecdotes retailed by Brantôme, prove that the royalty and nobility of France had been largely Italianized.

Architecture. — It is said that Louis XII. brought Fra Giocondo of Verona back with him to France and founded a school of architects. But we need not have recourse to this legend for the explanation of such Italian influences as were already noticeable in the Renaissance buildings on the Loire. Without determining the French style, Italian intercourse helped to stimulate its formation and development. There are students of the 15th century in France who resent this intrusion of the Italian Renaissance. But they forget that France was bound by inexorable laws of human evolution to obey the impulse which communicated itself to every form of art in Europe. In the school of Fontainebleau, under the patronage of Francis I., that Italian influence made itself distinctly felt; yet a true French manner had been already formed, which, when it was subsequently applied at Paris, preserved a marked national quality. The characteristic of the style developed by Bullant, De l'Orme and Lescot, in the royal or princely palaces of Chenonceaux, Chambord, Anet, Écouen, Fontainebleau, the Louvre and elsewhere is a blending of capricious fancy and inventive richness of decoration with purity of outline and a large sense of the beauty of extended masses. Beginning with the older castles of Touraine, and passing onward to the Tuileries, we trace the passage from the mediaeval fortress to the modern pleasure-house, and note how architecture obeyed the special demands of that new phenomenon of Renaissance civilization, the court. In the general distribution of parts these monumental buildings express the peculiar conditions which French society assumed under the influence of Francis I. and Diane de Poitiers. In details of execution and harmonic combinations they illustrate the precision, logic, lucidity and cheerful spirit of the national genius. Here, as in Lombardy, a feeling for serene beauty derived from the study of the antique has not interrupted the evolution of a style indigenous to France and eminently characteristic of the French temperament.

Painting and Sculpture. — During the reign of Francis I. several Italian painters of eminence visited France. Among these Del Rosso, Primaticcio, Del Sarto and Da Vinci are the most famous. But their example was not productive of a really great school of French painting. It was left for the Poussins and Claude Lorraine in the next century, acting under mingled Italian and Flemish influences, to embody the still active spirit of the classical revival. These three masters were the contemporaries of Corneille, and do not belong to the Renaissance period. Sculpture, on the contrary, in which art, as in architecture, the mediaeval French had been surpassed by no other people of Europe, was practised with originality and power in the reigns of Henry II. and Francis I. Ponzio and Cellini, who quitted Italy for France, found themselves outrivalled in their own sphere by Jean Goujon, Cousin and Pilon. The decorative sculpture of this epoch, whether combined with architecture or isolated in monumental statuary, ranks for grace and suavity with the best of Sansovino's. At the same time it is unmistakably inspired by a sense of beauty different from the Italian — more piquant and pointed, less languorous, more mannered perhaps, but with less of empty rhythmical effect. All this while the minor arts of enamelling, miniature, glass-painting, goldsmith's work, jewellery, engraving, tapestry, wood-carving, pottery, etc., were cultivated with a spontaneity and freedom which proved that France, in the middle point between Flanders and Italy, was able to use both influences without a sacrifice of native taste. It may indeed be said in general that what is true of France is likewise true of all countries which felt the artistic impulses of the Renaissance. Whether we regard Spain, the Netherlands, or Germany at this epoch, we find a national impress stamped upon the products of the plastic and the decorative arts, notwithstanding the prevalence of certain forms derived from the antique and Italy. It was only at a later period that the formalism of pseudo-classic pedantry reduced natural and natronal originality to a dead unanimity.

Literature. — French literature was quick to respond to Renaissance influences. De Comines, the historian of Charles VIII.'s expedition to Naples, differs from the earlier French chroniclers in his way of regarding the world of men and affairs. He has the perspicuity and analytical penetration of a Venetian ambassador. Villon, his contemporary, may rather be ranked, so far as artistic form and use of knowledge are concerned, with poets of the middle ages, and in particular with the Goliardi. But he is essentially modern in the vividness of his self-portraiture, and in what we are wont to call realism. Both De Comines and Villon indicate the entrance of a new quality into literature. The Rhétoriqueurs, while protracting mediaeval traditions by their use of allegory and complicated metrical systems, sought to improve the French language by introducing Latinisms. Thus the Revival of Learning began to affect the vernacular in the last years of the 15th century. Marot and his school reacted against this pedantry. The Renaissance displayed itself in their effort to purify the form and diction of poetry. But the decisive revolution was effected by Ronsard and his comrades of the Pléiade. It was their professed object to raise French to a level with the classics, and to acclimatize Italian species of verse. The humanistic movement led these learned writers to engraft the graces of the antique upon their native literature, and to refine it by emulating the lucidity of Petrarch. The result of their endeavour was immediately apparent in the new force added to French rhythm, the new pomp, richness, colouring and polish conferred upon poetic diction. French style gradually attained to fixity, and the alexandrine came to be recognized as the standard line in poetry. D'Aubigné's invective and Régnier's satire, at the close of the 16th century, are as modern as Voltaire's. Meanwhile the drama was emerging from the mediaeval mysteries; and the classical type, made popular by Garnier's genius, was elaborated, as in Italy, upon the model of Seneca and the canons of the three unities. The tradition thus formed was continued and fortified by the illustrious playwrights of the 17th century. Translation from Greek and Latin into French progressed rapidly at the commencement of this period. It was a marked characteristic of the Renaissance in France to appropriate the spoils of Greece and Rome for the profit of the mother tongue. Amyot's *Plutarch* and his *Daphnis and Chloe* rank amongst the most exquisite examples of beautiful French prose. Prose had now the charm of simplicity combined with grace. To mention Brantôme is to mention the most entertaining of gossips. To speak of Montaigne is to speak of the best as well as the first of essayists. In all the literary work which has been mentioned, the originality and freshness of the French genius are no less conspicuous than its saturation with the new learning and with Italian studies. But the greatest name of the epoch, the name which is synonymous with the Renaissance in France, has yet to be uttered. That, of course, is Rabelais. His incommensurable and indescribable masterpiece of mingled humour, wisdom, satire, erudition, indecency, profundity, levity, imagination, realism, reflects the whole age in its mirror of hyper-Aristophanic farce. What Ariosto is for Italy, Cervantes for Spain, Erasmus for Holland, Luther for Germany, Shakespeare for England, that is Rabelais for France. The Renaissance cannot be comprehended in its true character without familiarity with these six representatives of its manifold and many-sided inspiration.

The Reformation. — The French Renaissance, so rich on the side of arts and letters, was hardly less rich on the side of classical studies. The Revival of Learning has a noble muster-roll of names in France: Turnebus, the patriarch of Hellenistic studies, the Étiennes of Paris, equalling in numbers, industry and learning their Venetian rivals; the two Scaligers; impassioned Dolet; eloquent Muret; learned Cujas; terrible Calvin; Ramus, the intrepid antagonist of Aristotle; De Thou and De Bèze; ponderous Casaubon; brilliant young Saumaise. The distinguishing characteristics of French humanism are vivid intelligence, critical audacity and polemical acumen, perspicuity of exposition, learning directed in its applications by logical sense rather than by artistic ideals of

taste. Some of the names just mentioned remind us that in France, as in Germany and Holland, the Reformation was closely connected with the revival of learning. Humanism has never been in the narrow sense of that term Protestant; still less has it been strictly Catholic. In Italy it fostered a temper of mind decidedly averse to theological speculation and religious earnestness. In Holland and Germany with Erasmus, Reuchlin and Melanchthon it developed types of character, urbane, reflective, pointedly or gently critical, which left to themselves would not have plunged the north of Europe into the whirlpool of belligerent reform. Yet none the less was the new learning, through the open spirit of inquiry it nourished, its vindication of the private reason, its enthusiasm for republican antiquity, and its proud assertion of the rights of human independence, linked by a strong and subtle chain to that turbid revolt of the individual consciousness against spiritual despotism draped in fallacies and throned upon abuses. To this rebellion we give the name of Reformation. But while the necessities of antagonism to papal Rome made it assume at first the form of narrow and sectarian opposition, it marked in fact a vital struggle of the intellect towards truth and freedom, involving future results of scepticism and rationalistic audacity from which its earlier champions would have shrunk. It marked, moreover, in the condition of armed resistance against established authority which was forced upon it by the Counter-Reformation, a firm resolve to assert political liberty, leading in the course of time to a revolution with which the rebellious spirit of the Revival was sympathetic. This being the relation of humanism in general to reform, French learning in particular displayed such innovating boldness as threw many of its most conspicuous professors into the camp at war with Rome. Calvin, a French student of Picard origin, created the type of Protestantism to which the majority of French Huguenots adhered. This too was a moment at which philosophical seclusion was hardly possible. In a nation so tumultuously agitated one side or the other had to be adopted. Those of the French humanists who did not proclaim Huguenot opinions found themselves obliged with Muret to lend their talents to the Counter-Reformation, or to suffer persecution for heterodoxy like Dolet. The Church, terrified and infuriated by the progress of reform, suspected learning on its own account. To be an eminent scholar was to be accused of immorality, heresy and atheism in a single indictment; and the defence of weaker minds lay in joining the Jesuits as Heinsius was fain to do. France had already absorbed the earlier Renaissance in an Italianizing spirit before the Reformation made itself felt as a political actuality. This fact, together with the strong Italian bias of the Valois, serves to explain in some degree the reason why the Counter-Reformation entailed those fierce entangled civil wars, massacres of St. Bartholomew, murders of the Guises, regicides, treasons and empoisonments, that terminated with the compromise of Henry IV. It is no part of the present subject to analyse the political, religious and social interests of that struggle. The upshot was the triumph of the Counter-Reformation, and the establishment of its principle, absolutism, as the basis of French government. It was a French king who, when the nation had been reduced to order, uttered the famous word of absolutism, *"L'État,* c'est *moi."*

THE NETHERLANDS

The Renaissance in the Low Countries, as elsewhere, had its brilliant age of arts and letters. During the middle ages the wealthy free towns of Flanders flourished under conditions not dissimilar to those of the Italian republics. They raised miracles of architectural beauty, which were modified in the 15th and 16th centuries by characteristic elements of the new style. The Van Eycks, followed by Memling, Metsys, Mabuse, Lucas van Leyden, struck out a new path in the revival of painting and taught Europe the secret of oil-colouring. But it was reserved for the 17th century to witness the flower and fruit time of this powerful art in the work of Porbus, Rubens and Vandyck, in the Dutch schools of landscape and home-life, and in the unique masterpieces of Rembrandt. We have a right to connect this later period with the Renaissance, because the distracted state of the Netherlands during the 16th century suspended, while it could not extinguish, their aesthetic development. The various schools of the 17th century, moreover, are animated with the Renaissance spirit no less surely than the Florentine school of the 15th or the Venetian of the 16th. The animal vigour and carnal enjoyment of Rubens, the refined Italianizing beauty of Vandyck, the mystery of light and gloom on Rembrandt's panels, the love of nature in Ruysdael, Cuyp and Van Hooghe, with their luminously misty skies, silvery daylight and broad expanse of landscape, the interest in common life displayed by Ter Borch, Van Steen, Douw, Ostade and Teniers, the instinct for the beauty of animals in Potter, the vast sea spaces of Vanderveldt, the grasp on reality, the acute intuition into character in portraits, the scientific study of the world and man, the robust sympathy with natural appetites, which distinguish the whole art of the Low Countries, are a direct emanation from the Renaissance.

The vernacular in the Netherlands profited at first but little by the impulse which raised Italian, Spanish, French and English to the rank of classic languages. But humanism, first of all in its protagonist Erasmus, afterwards in the long list of critical scholars and editors, Lipsius, Heinsius and Grotius, in the printers, Elzevir and Plantin, developed itself from the centre of the Leyden university with massive energy, and proved that it was still a motive force of intellectual progress. In the fields of classical learning the students of the Low Countries broke new ground chiefly by methodical collection, classification and comprehensive criticism of previously accumulated stores. Their works were solid and substantial edifices, forming the substratum for future scholarship. In addition to this they brought a philosophy and scientific thoroughness to bear on studies which had been pursued in a more literary spirit. It would, however, be uncritical to pursue this subject further; for the encyclopaedic labours of the Dutch philologers belong to a period when the Renaissance was overpast. For the same reason it is inadmissible to do more than mention the name of Spinoza here.

The Netherlands became the battlefield of Reformation and Counter-Reformation in even a stricter sense than France. Here the antagonistic principles were plainly posed in the course of struggle against foreign despotism. The conflict ended in the assertion of political independence, as opposed to absolute dominion. Europe in large measure owes the modern ideal of political liberty to that spirit of stubborn resistance which broke the power of Spain. Recent history, and, in particular, the history of democracy, claims for its province the several stages whereby this principle was developed in England and America, and its outburst in the frenzy of the French Revolution. It is enough here to have alluded to the part played by the Low Countries in the genesis of a motive force which may be described as the last manifestation of the Renaissance striving after self-emancipation.

ENGLAND

The insular position of England combined with the nature of the English has allowed the country to feel the vibration of European movements later and with less of shock than the continental nations. Before a wave of progress has reached its shores there has been the opportunity of watching it as spectators, and of considering how to receive it. Revolutions have passed from the tumultuous stages of their origin into some settled and recognizable state before we have been called upon to cope with them. It was thus that England took the influences of the Renaissance and Reformation simultaneously, and almost at the same time found herself engaged in that struggle with the Counter-Reformation which, crowned by the defeat of the Spanish Armada, stimulated the sense of nationality and developed the naval forces of the race. Both Renaissance and Reformation had been anticipated by at least a century in England. Chaucer's poetry, which owed so much to Italian examples, gave an early foretaste of the former. Wycliffe's teaching was a vital moment in the latter. But the French wars, the Wars of the Roses and the persecution of the Lollards deferred the coming of the new age; and the year 1536, when Henry VIII. passed the Act of Supremacy through parliament, may be fixed as the date when England entered definitely upon a career of intellectual development abreast

with the foremost nations of the continent. The circumstances just now insisted on explain the specific character of the English Renaissance. The Reformation had been adopted by consent of the king, lords and commons; and this change in the state religion, though it was not confirmed without reaction, agitation and bloodshed, cost the nation comparatively little disturbance. Humanism, before it affected the bulk of the English people, had already permeated Italian and French literature. Classical erudition had been adapted to the needs of modern thought. The hard work of collecting, printing, annotating and translating Greek and Latin authors had been accomplished. The masterpieces of antiquity had been interpreted and made intelligible. Much of the learning popularized by the poets and dramatists was derived at second hand from modern literature. This does not mean that England was deficient in ripe and sound scholars. More, Colet, Ascham, Cheke, Camden were men whose familiarity with the classics was both intimate and easy. Public schools and universities conformed to the modern methods of study; nor were there wanting opportunities for youths of humble origin to obtain an education which placed them on a level with Italian scholars. The single case of Ben Jonson sufficiently proves this. Yet learning did not at this epoch become a marked speciality in England. There was no class corresponding to the humanists. It should also be remembered that the best works of Italian literature were introduced into Great Britain together with the classics. Phaer's *Virgil,* Chapman's *Homer,* Harrington's *Orlando,* Marlowe's *Hero and Leander,* Fairfax's *Jerusalem Delivered,* North's *Plutarch,* Hoby's *Courtier* —to mention only a few examples — placed English readers simultaneously in possession of the most eminent and representative works of Greece, Rome and Italy. At the same time Spanish influences reached them through the imitators of Guevara and the dramatists; French influences in the versions of romances; German influences in popular translations of the Faust legend, *Eulenspiegel,* and similar productions. The authorized versions of the Bible had also been recently given to the people — so that almost at the same period of time England obtained in the vernacular an extensive library of ancient and modern authors. This was a privilege enjoyed in like measure by no other nation. It sufficiently accounts for the richness and variety of Elizabethan literature, and for the enthusiasm with which the English language was cultivated.

Art, Letters, and the Drama. — Speaking strictly, England borrowed little in the region of the arts from other nations, and developed still less that was original. What is called Jacobean architecture marks indeed an interesting stage in the transition from the Gothic style. But, compared with Italian, French, Spanish, German and Flemish work of a like period, it is both timid and dry. Sculpture was represented in London for a brief space by Torrigiani; painting by Holbein and Antonio More; music by Italians and Frenchmen of the Chapel Royal. But no Englishman rose to European eminence in these departments. With literature the case was very different. Wyat and Surrey began by engrafting the forms and graces of Italian poetry upon the native stock. They introduced the sonnet and blank verse. Sidney followed with the sestine and terza rima and with various experiments in classic metres, none of which took root on English soil. The translators handled the octave stanza. Marlowe gave new vigour to the couplet. The first period of the English Renaissance was one of imitation and assimilation. Academies after the Italian type were founded. Tragedies in the style of Seneca, rivalling Italian and French dramas of the epoch, were produced. Attempts to Latinize ancestral rhythms, similar to those which had failed in Italy and France, were made. Tentative essays in criticisms and dissertations on the art of poetry abounded. It seemed as though the Renaissance ran a risk of being throttled in its cradle by superfluity of foreign and pedantic nutriment. But the natural vigour of the English genius resisted influences alien to itself, and showed a robust capacity for digesting the varied diet offered to it. As there was nothing despotic in the temper of the ruling classes, nothing oppressive in English culture, the literature of that age evolved itself freely from the people, It was under these conditions that Spenser gave his romantic epic to the world, a poem which derived its allegory from the middle ages, its decorative richness from the Italian Renaissance, its sweetness, purity, harmony and imaginative splendour from the most poetic nation of the modern world. Under the same conditions, the Elizabethan drama, which in its totality is the real exponent of the English Renaissance, came into existence. This drama very early freed itself from the pseudo-classic mannerism which imposed on taste in Italy and France. Depicting feudalism in the vivid colours of an age at war with feudal institutions, breathing into antique histories the breath of actual life, embracing the romance of Italy and Spain, the mysteries of German legend, the fictions of poetic fancy and the facts of daily life, humours of the moment and abstractions of philosophical speculation, in one homogeneous amalgam instinct with intense vitality, this extraordinary birth of time, with Shakespeare for the master of all ages, left a monument of the Renaissance unrivalled for pure creative power by any other product of that epoch. To complete the sketch, we must set Bacon, the expositor of modern scientific method, beside Spenser and Shakespeare, as the third representative of the Renaissance in England. Nor should Raleigh, Drake, Hawkins, the semi-buccaneer explorers of the ocean, be omitted. They, following the lead of Portuguese and Spaniards, combating the Counter-Reformation on the seas, opened for England her career of colonization and plantation. All this while the political policy of Tudors and Stuarts tended towards monarchial absolutism, while the .Reformation in England, modified by contact with the Low Countries during their struggles, was narrowing into strict reactionary intolerance. Puritanism indicated a revolt of the religious conscience of the nation against the arts and manners of the Renaissance, against the encroachments of belligerent Catholicism, against the corrupt and Italianated court of James I., against the absolutist pretensions of his son Charles. In its final manifestation during the Commonwealth, Puritanism won a transient victory over the mundane forces of both Reformation and Renaissance, as these had taken shape in England. It also secured the eventual triumph of constitutional independence. Milton, the greatest humanistic poet of the English race, lent his pen and moral energies during the best years of his life to securing that principle on which modern political systems at present rest. Thus the geographical isolation of England, and the comparatively late adoption by the English of matured Italian and German influences, give peculiar complexity to the phenomena of Reformation and Renaissance simultaneously developed on our island. The period of our history between 1536 and 1642 shows how difficult it is to separate these two factors in the re-birth of Europe, both of which contributed so powerfully to the formation of modern English nationality.

THE NEW EUROPE

It has been impossible to avoid an air of superficiality and the repetition of facts known to every schoolboy in this sketch of so complicated a subject as the Renaissance — embracing many nations, a great variety of topics, and an indefinite period of time. Yet no other treatment was possible upon the lines laid down at the outset, where it was explained why the term Renaissance cannot now be confined to the Revival of Learning and the effect of antique studies upon literary and artistic ideals. The purpose of this article has been to show that, while the Renaissance implied a new way of regarding the material world and human nature, a new conception of man's destiny and duties on this planet, a new culture and new intellectual perceptions penetrating every sphere of thought and energy, it also involved new reciprocal relations between the members of the European group of nations. The Renaissance closed the middle ages and opened the modern era — not merely because the mental and moral ideas which then sprang into activity and owed their force in large measure to the revival of classical learning were opposed to mediaeval modes of thinking and feeling, but also because the political and international relations specific to it as an age were at variance with fundamental theories of the past. Instead of empire and church, the sun and moon of the mediaeval system, a federation of peoples, separate in type, and divergent in interests, yet bound

together by common tendencies, common culture and common effortscame into existence. For obedience to central authority was substituted balance of power. Henceforth the hegemony of Europe attached to no crown, imperial or papal, but to the nation which was capable of winning it, in the spiritual region by mental ascendancy, and in the temporal by force.

That this is the right way of regarding the subject appears from the events of the first two decades of the 16th century, those years in which the humanistic revival attained its highest point in Italy. Luther published his thesis in 1517, 64 years after the fall of Constantinople, 23 years after the expedition of Charles VIII. to Naples, ten years before the sack of Rome, at a moment when France, Spain and England had felt the influences of Italian culture but feebly. From that date forward two parties wrestled for supremacy in Europe, to which may be given the familiar names of Liberalism and Conservatism, the party of progress and the party of established institutions. The triumph of the former was most signal among the Teutonic peoples. The Latin races championed by Spain and supported by the papacy fought the battle of the latter, and succeeded for a time in rolling back the tide of revolutionary conquest. Meanwhile that liberal culture which had been created for Europe by the Italians before the contest of the Reformation began continued to spread, although it was stifled in Italy and Spain, retarded in France and the Low Countries, well-nigh extirpated by wars in Germany and diverted from its course in England by the countermovement of Puritanism. The *autos da fé* of Seville and Madrid, the flames to which Bruno, Dolet and Paleario were flung, the dungeon of Campanella and the seclusion of Galileo, the massacre of St. Bartholomew and the faggots of Smithfield, the desolated plains of Germany and the cruelties of Alva in the Netherlands, disillusioned Europe of those golden dreams which had arisen in the earlier days of humanism, and which had been so pleasantly indulged by Rabelais. In truth the Renaissance was ruled by no *Astraea redux* but rather by *a* severe spirit which brought no peace but a sword, reminding men of sternest duties, testing what of moral force and tenacity was in them, compelling them to strike for the old order or the new, suffering no lukewarm halting between two opinions. That, in spite of retardation and retrogression, the old order of ideas should have yielded to the new all over Europe — that science should have won firm standing-ground and political liberty should have struggled through those birth-throes of its origin — was in the nature of things. Had this not been, the Renaissance or re-birth of Europe would be a term without a meaning. (J. A. S.)

While Symonds' article on the Renaissance, originally contributed to the 9th edition of the *Encyclopædia Britannica* remains the classical exposition of a certain view of the subject, more recent research has brought out other aspects of the matter. It is noteworthy, however, that in some important points the very latest investigators have returned to Symonds' conception of the Renaissance, from which historians of the generation immediately following him had departed.

Our continually growing knowledge of the middle ages has thrown the Renaissance into a very different perspective from that in which it was once viewed. Less and less are the centuries preceding the 15th seen as the "Dark Ages" in contrast to the sudden sunrise of modern times. Indeed, many scholars now speak of a Carolingian Renaissance in the 8th century, an Ottonian Renaissance in the 10th, and of the Renaissance of the 12th century, in order to emphasize the constant stream of light and progress throughout the millennium once regarded as a long night of gloom and decadence. On the other hand, many scholars have emphasized even more than did Symonds the extreme gradualness of the efflorescence of the Italian Renaissance and the long persistence in it of mediaeval and Germanic elements. The extreme position is taken by Mr. Henry O. Taylor, who is so impressed by the slowness of the transition from mediaeval to modern times that he would abolish the term "Renaissance" altogether. This proposal, however, has commended itself to few other scholars; there *was* a re-birth of the human mind in the 11th century, though it was not so sudden and decisive as once thought.

In another way our view of the Renaissance has been greatly modified by the economic historians who have stressed the material antecedents of the great political and intellectual movements of the 14th, 15th and 16th centuries. Symonds, like nearly all his contemporaries, wrote almost as if the change in the mental habit of the race were a first cause, unexplained by any alteration in social conditions. But it is now generally accepted that the intellectual change was but the natural result of material conditions altered by the growth of wealth, of commerce, and of city communities. The humanists and artists were dwellers in the cities and in the marts of trade; their patrons were largely found in the newly powerful bourgeoisie of the Italian and German cities. Of course the Renaissance had its intellectual as well as its material antecedents; it was produced by the happy creation in the commercial revolution of a wealthy and leisured class just at a time when discoveries and inventions were thrilling the mind of Western Europe with interest and curiosity. It was no accident that individualism, humanism, and Italian painting attained their majority in the age which saw the invention of printing and the great geographical discoveries of Diaz, of Vasco da Gama, and of Columbus.

Of all the positions taken by Symonds that most subject to attack has been his assertion of the close connection and similar purpose of the Renaissance and Reformation. Like most historians of the 19th century, Symonds regarded them both as liberal movements, emancipations of reason so nearly alike that the Reformation might be called "the Teutonic Renaissance." Just as he was writing, however, Friedrich Nietzsche, basing his opinion on Janssen's *Geschichte des deutschen Volkes seit dem Ausgang des Mittelalters*, which represented the Reformation as a blight on German Catholic civilization, proclaimed that "the Reformation was a reaction of backward minds against the Italian Renaissance": and this view gained ground until it was adopted by Catholic historians like Lord Acton, Protestant historians like Ernst Troeltsch, and generally by the majority of scholars. They have pointed out that the humanists and Reformers came to blows, that the spirit of the Renaissance was largely secular and that of the Reformation intensely religious, that the former was tolerant and often indifferent and sceptical and that the latter was usually intolerant, devout, and sometimes superstitious, that the humanists were aristocratic and the Reformers democratic in method, and that Puritanism proved hostile to and often destructive of the artistic and pleasure-seeking interests of the Renaissance. In criticism of this view, however, it has been contended that the Renaissance was not, any more than the Reformation, consciously progressive; rather did both movements find their ideal in the past, the one in the golden age of Rome and the other in the primitive age of Christianity. It has been further shown that the humanists did little in principle to emancipate the reason from authority; they were closely bound by their own authorities in the classical poets and orators, and could only attack the schoolmen on the basis of the ancient pagans as the Reformers attacked them from the standpoint of the ancient Fathers. In conclusion one may say that neither movement was a conscious appeal to reason or an intentional step forward and away from the past, but that each accomplished, undesignedly, a great work of emancipation and that each created new cultural values.

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(P. S.)

RENAISSANCE ARCHITECTURE. The Renaissance style of architecture originated in Florence, Italy, during the early 15th century and from there spread throughout most of the Italian peninsula; by the 16th century the new style pervaded almost all of Europe, gradually replacing the Gothic style of the middle ages. The name Renaissance *(rinascimento* in Italian) dates from the period itself, whose goal was the rebirth or re-creation of ancient classic culture.

In architecture there was a revival of classic forms and ornament, such as the column and round arch, the tunnel vault and dome; but from this classic vocabulary the Renaissance architects made a completely original architecture.

This article is organized as follows:

The periods of European architecture before the Renaissance are discussed in BYZANTINE ARCHITECTURE; ROMANESQUE ARCHITECTURE; and GOTHIC ARCHITECTURE. European architecture after the Renaissance is discussed in BAROQUE ARCHITECTURE and MODERN ARCHITECTURE. The classic antecedents of Renaissance architecture are treated in GREEK ARCHITECTURE and ROMAN ARCHITECTURE. *See* also ARCHITECTURE.

I. INTRODUCTION

The Renaissance knowledge of the classic style was derived chiefly from two sources: (1) the ruins of ancient classic buildings, particularly in Italy, but some in France and Spain, and (2) the treatise, *De architectura,* by the ancient Roman architect Vitruvius from the late 1st century B.C. The theory of Vitruvius was drawn to a great extent from Hellenistic Greek architectural theory, although this was not realized during the Renaissance and it was assumed that the theory was purely Roman. As a result the Renaissance architects were often disturbed by the apparent discrepancies between Vitruvius and the actual Roman ruins.

The Orders.—The Renaissance architects considered the classic orders one of the basic elements of their architecture; the orders were organized on a system of proportions, and proportion was the essence of their theory of beauty. *(See* ORDER.) During the Renaissance five orders were used, the Tuscan. Doric, Ionic, Corinthian and Composite, but various ones were prevalent in the different periods of the Renaissance. For example. the ornate, decorative quality of the Corinthian order was embraced during the early Renaissance. while the masculine simplicity and strength of the Doric was preferred during the Italian High Renaissance. Following ancient Roman architecture (*e.g.,* the Colosseum or the Theatre of Marcellus) Renaissance architects often superimposed the orders, that is, used a different order for each of the several stories of a building, commencing with the heavier, stronger Tuscan or Doric order below, then rising through the lighter, more decorative Ionic, Corinthian and Composite.

For all the Renaissance arts proportion tended to be the most important predetermining factor of beauty. The great Italian humanist and architect, Leon Battista Alberti, defined beauty in architecture as "a Harmony of all the Parts in whatsoever Subject it appears, fitted together with such Proportion and Connection, that nothing could be added, diminished or altered, but for the Worse" (*Ten Books on Architecture,* trans. by J. Leoni, book vi, ch. 2, 1755).

The Renaissance architect worked from a fixed unit of proportion, the module, which was usually half the diameter of the column of the order and which determined the size and location of the various parts of his elevation or plan. There was even a relationship between architectural proportions and the leading Renaissance device of perspective (*q.v.*); the Italian painter Piero della Francesca said that perspective represented objects seen from afar "in proportion according to their respective distance." In fact. it was an Italian Renaissance architect. Filippo Brunelleschi, who apparently was the first to formulate perspective. Many Renaissance architects were as concerned with perspective as the painters were, for most Renaissance architecture was meant to be seen from a fixed visual viewpoint, like a painting in perspective, and not from a moving viewpoint as were baroque and modern architecture.

Architecture as a Liberal Art.—It was during the Renaissance that architecture was raised to the level of a liberal art (or a fine art), in part because of the interest in proportion. During the preceding middle ages, architecture, along with the other arts, was simply a mechanical art and the artists and architects were basically anonymous craftsmen, their anonymity only occasionally dispelled by the fortunate preservation of building accounts. For the Renaissance the varying systems of proportion were dependent on a knowledge of geometry. Architecture became the materialization in space of the principles of geometry and, thereby, an equal of geometry, which had been a liberal art during the middle ages.

Renaissance architecture was produced no longer by craftsmen but by educated men of some social standing. In Italy during the 15th and 16th centuries the architect gradually acquired this social standing through his knowledge and education which were concerned with the theory and principles of design more than with the craft of building. The Renaissance architect was, therefore, known as an individual. His life and his ideas have been preserved, and he is not merely another name in a building record.

Architectural Theory.—The Renaissance was the great moment in the history of architecture for the expression of architectural theory. Inspired by the rediscovery or re-evaluation of the ancient Roman treatise by Vitruvius, many architects recorded their theories of architecture; some were preserved in manuscript, (*e.g.,* those of the architects Francesco di Giorgio and Antonio Filarete), but most were published. In the middle of the 15th century the humanist and architect Alberti wrote his treatise, *De re aedificatoria* (published 1485), modeled on Vitruvius. However, it was during the last three-quarters of the 16th century, the period of Mannerism, that architectural theory flourished. The Italians Serlio, Vignola and Palladio published famous books on architecture at that time. Elsewhere, works were published by the Frenchmen Androuet du Cerceau, Delorme and Jean Bullant; the Fleming Vredeman de Vries; the German Wendel Dietterlin; and John Shute in England.

II. ITALY

Renaissance architecture commenced in Italy about 1420 and flourished until the end of the 16th century, when it was gradually superseded by the baroque style. In Italy there were three principal periods in the development of the Renaissance: (1) the early Renaissance, from the appearance of the new style early in the 15th century to the end of the century; (2) the High Renaissance, approximately the first quarter of the 16th century; and (3) mannerism. the remaining portion of the 16th century.

The Renaissance began in Italy, where there was always a residue of classic feeling in architecture. A Gothic building such as the Loggia dei Lanzi in Florence continued to use the large round arch instead of the usual Gothic pointed arch. and preserved the simplicity and monumentality of classic architecture. The Renaissance might have been expected to appear first in the city of Rome, where there was the greatest quantity of ancient Roman

ruins, but during the 14th and early 15th centuries, when the Italians were impelled to renew classicism, the political situation at Rome was very unfavourable for artistic endeavour. This was the time of a schism in the church, with the papacy located at Avignon in south France and no central power at Rome. Florence, however, under the leadership of the Medici family, was economically prosperous and politically stable.

A. Early Renaissance

In 1401 a competition was held between sculptors and goldsmiths to design a pair of doors for the old baptistery at Florence. The sculptor Ghiberti won, and a losing goldsmith, Filippo Brunelleschi, resolving to be the leader in one of the arts, then turned to the study of architecture. Brunelleschi spent the period between 1402 and 1418 alternately in Florence and Rome. During this time he studied mathematics intensively and formulated linear perspective, which was to become a basic element of Renaissance art. At the same time Brunelleschi investigated ancient Roman architecture and acquired the knowledge of classic architecture and ornament, which he used as a foundation for Renaissance architecture. His great opportunity came in 1418 with the competition for the completion of the duomo, or cathedral, of Florence. The medieval architects had intended a great dome over the crossing of the cathedral, but it had never been created, and no one knew how to accomplish it. Winning the competition, Brunelleschi began the great dome in 1420 (the finishing touches were applied in 1467, after Brunelleschi's death). The Florentine dome is really not in the Renaissance style since it was built with rib construction and a pointed arch form which were medieval. But the dome was raised on a drum, which the medieval architects had not intended; the idea of a dome being made more prominent by the added stature of a drum became characteristic of the Renaissance style. (See Dome.)

While he was erecting the dome, Brunelleschi produced in Florence other notable examples of the Renaissance style. The loggia of the Ospedale degli Innocenti (1419–51) was the first building in the Renaissance manner; a very graceful arcade was designed with Composite columns, and windows with classic triangular pediments were regularly spaced above each of the arches. This style was more fully exploited in the church of S. Lorenzo (1419 to c. 1470). Using the traditional basilica (*q.v.*) plan (*i.e.*, a long rectangle with the sanctuary at one end], the plan and elevations were organized on a system of proportions with the. height of the nave, or central aisle, equal to twice its width. All the ornament is classic with Corinthian columns, pilasters and classic moldings. Brunelleschi used almost exclusively the Corinthian order with the decorative elements cut in a very crisp manner. All the moldings, door and window frames, and orders are of a soft blue-gray stone (pietm serena) contrasted against a light stucco wall. The ornamental features have very little projection, being rather lines on a surface. Colour was used in Florentine architecture as a contrast to stress the linear relationships rather than for over-all patternistic use as in north Italian architecture.

The traditional plan for medieval churches was the Latin cross plan, as at S. Lorenzo, with one arm of the cross longer than the others so as to form the nave or main body of the church. During the middle ages this cross plan was considered a symbolic reference to the cross of Christ.

During the Renaissance the ideal church plan tended to be centralized, that is, it was symmetrical about a central point, as is a circle, a square or a Greek cross which has four equal arms. Many Renaissance architects came to believe that the circle was the most perfect geometrical form and, therefore, most appropriate in dedication to a perfect God. Brunelleschi also worked with the central plan. In the Pazzi chapel (1430–42), set down in the medieval cloister of Sta. Croce at Florence, the plan approaches the central type. On the interior it is actually a rectangle, slightly wider than it is deep; at its rear is a square bay for the sanctuary and at the front is a porch. There are three domes, a large one over the centre of the chapel, a small one over the sanctuary and a small one over the centre of the porch on the exterior. Its plan, but not its interior space, resembles a Greek cross. On the exterior the large dome is covered by a conical roof with a lantern at the top. The porch has a horizontal entablature supported by six Corinthian columns but broken in the centre by a semicircular arch which centralizes the composition, repeats the shape of the dome in the porch behind it and gives a lift to the horizontal façade. Above the columns and hiding the tunnel vault over the porch is a lovely paneled wall comparted by coupled Corinthian pilasters. The architecture is very ornate and decorative with medallions of cherub heads on the entablature and a wave pattern (the ancient strigil pattern) on the upper entablature.

Soon after the commencement of the Pazzi chapel, Brunelleschi began a true central plan church, that of Sta. Maria degli Angeli (begun 1434) at Florence, which was never completed. It was very important because it was the first central plan church of the Renaissance, the type of plan which dominates Renaissance thinking. The plan is an octagon on the interior and 16 sided on the exterior with a dome probably intended to cover the centre.

One of the outstanding examples of secular architecture was the Medici palace (1444–59) at Florence by Michelozzo Michelozzi, a follower of Brunelleschi. Created for Cosimo de' Medici, the great political leader and art patron of Florence. the palace had extensive additions in the 17th century. Arranged around a central court, the traditional Florentine palace plan, the Medici palace (now Medici-Riccardi palace) is a tremendous block on the exterior.

Medieval Florentine palaces were built of great rusticated blocks of stone, as if they had just been hacked out of the quarry, giving the impression of fortification, a desirable effect in that tumultuous time. With the Renaissance some fundamental changes appeared. Michelozzo crowned his palace with a massive horizontal cornice in the classic style and regularized the window and entrance openings. Even the rustication of the stonework was differentiated in each of the three stories. The ground floor has the usual heavy rustication; the second story is marked by drafted stonework with smooth blocks outlined by incised lines; and the third story has smooth ashlar stonework with no indications of the blocks. Unlike medieval patternistic rustication, the rustication of the Renaissance, while carefully distinguished between the stories, set up a logical relationship among them.

This Renaissance treatment of a palace façade was carried further in the Palazzo Rucellai (1447–51) at Florence following the design of the great humanist and architect Leon Battista Alberti. For the first time during the Renaissance Alberti applied classic orders to a palace elevation, using pilasters of the different orders superimposed on the three stories, so that there was another relationship established among the differentiated stories, from the short, strong Tuscan pilaster on the ground floor to the tall, decorative Corinthian at the top. About 1450 Alberti began a book on architecture, De re aedificatoria, printed in 1485, but with numerous later editions and translations. The Italian treatise was obviously modeled upon the ancient Roman one of Vitruvius, even to its organization into ten books. For Alberti the beauty of architecture consisted of a harmonious relationship among the parts, with ornament, including the classic orders, being auxiliary to the proportion.

The culmination of Alberti's style is seen in two churches at Mantua. The earlier, S. Sebastiano (begun 1460, never fully completed), was built on a Greek cross plan and was intended to have in its first design an ancient temple front of six pilasters and a dominating triangular pediment. Even more important was Alberti's other church at Mantua, S. Andrea (begun 1470, completed in the 18th century). Both in plan and interior elevation this church was very influential on later architecture. The plan is a Latin cross, with one long arm for the nave flanked by side chapels, but the crossing at the eastern end was treated almost as if it were of a central plan with the nave added to it. This plan became a favourite for churches of the late 16th and early 17th century. The façade is of square proportion, with a wide bay at the centre twice the width of each of the side bays. The interior elevation was organized on this same alternating system, the so-called "rhythmic bay" which was to be popularized in the early

16th century by the architect Bramante. As a result of this system there is a close correspondence between the interior and exterior composition of S. Andrea.

From Florence the early Renaissance style spread gradually over Italy, becoming prevalent in the second half of the 15th century. In the architecture of north Italy there was a greater interest in pattern and colour. Colour was emphasized by the use of variegated marble inlays, as in the facade of the Church of the Certosa at Pavia (begun 1491) or in most Venetian architecture. The favourite building material of north Italy was brick with terracotta trim and decoration with which a pattern of light and dark was created over the entire building. On occasions when stone was used, as at the Palazzo Bevilacqua in Bologna (1479–84), the blocks were cut with facets forming a diamond pattern on the facade. This was actually a decorative treatment of rustication. Even the classic orders were affected by this decorative approach. Classic pilasters often had panels of candelabra and arabesque decoration in delicate relief on the surfaces of their shafts; the lower third of a column was often carved with relief sculpture. Florentine artists such as Filarete with his project for the Ospedale Maggiore at Milan (begun 1457) brought to Lombardy in northern Italy classic decoration and a slight knowledge of Renaissance architecture.

From Lombardy the style was transferred to Venice by such Lombard architects as Pietro Lombardo and Mauro Coducci. The church of Sta. Maria dei Miracoli (1481–89) at Venice with its facade of coloured marble revetment is a typical example of Lombardo's work. The Venetian palace, such as the Palazzo Corner-Spinelli (late 15th century) and Palazzo Vendramin-Calergi (1501–09), both of which are by Coducci, with large and numerous windows, was more open than the palaces of central Italy.

At Rome in the second half of the 15th century there were several notable Renaissance palaces, principally derived from the style of Alberti, who spent extensive periods in Rome as a member of the papal court. The Palazzo Venezia (1455–91) has a rather medieval exterior, but set within the palace is a characteristically Renaissance court (1468–71), of which only two sides forming an angle were completed. It has been suggested without definite proof that Alberti may have furnished the design for this court; it at least reveals his influence in its full understanding of the classic style. The court consists of two stories of semicircular arches supported by piers on which are attached superimposed classic half columns, Tuscan below and Ionic above. The model for this arcade is the ancient Colosseum (*q.v.*) of Rome. The sense of mass created by the heavy piers contrasts with the lighter effect of the early Renaissance court typical of Florence, which has arches supported on columns. The Palazzo della Cancelleria (1485–1511) shows its dependence upon Alberti's style in its facade, which resembles in part his Palazzo Rucellai in Florence. The lower story simply has drafted stonework, but the two upper stories have rather flat Corinthian pilasters as well as the drafted stone. Unlike the Rucellai palace the bays composed by the pilasters alternate wide and narrow, but this alternation had been used by Alberti already in S. Andrea at Mantua. Alberti's influence is also visible in the facades of the churches of S. Agostino (1479–83) and Sta. Maria del Popolo (1472–77) at Rome.

These examples of the early Renaissance in Rome were rapidly approaching the simplicity, monumentality and massiveness of the High Renaissance of the early 16th century. The architect Donato Bramante, who was to create this new style, was active in Lombardy in north Italy, but his work in Milan, as at Sta. Maria presso S. Satiro (about 1480–86), was still completely in the Lombard early Renaissance manner. However, he was in contact at this time with the great Florentine artist Leonardo da Vinci, who was active at the Milanese court. Leonardo was then considering the concept of the central plan church and filling his notebooks with sketches of such plans, which Bramante must have studied. When Bramante moved to Rome at the very end of the 15th century, his study of ancient ruins combined with the ideas of Leonardo and the growing classicism of Roman early Renaissance architecture resulted in the flourishing of the High Renaissance.

B. High Renaissance

High Renaissance architecture first appeared at Rome in the work of Donato Bramante at the beginning of the 16th century. The period was a very brief one, centred almost exclusively in the city of Rome; it ended with the political and religious tensions that shook Europe during the third decade of the century, culminating in the disastrous sack of Rome in 1527 and the siege of Florence in 1529. The High Renaissance was a period of harmony and balance in all the arts, perhaps the most classic moment in this respect since the 5th century B.C. in Greece. It was an idealistic age in which individual characteristics or idiosyncrasies tended to be eliminated. As a result, although the architects are known as individuals, it is sometimes difficult to identify on a stylistic basis the particular architect of a High Renaissance building. The problem of attribution is further complicated by the fact that the style was confined to a small group of architects centring around Bramante in Rome.

Political and cultural leadership shifted from Florence to Rome, particularly because of a group of powerful popes who were interested in developing the papacy as a secular power. The greatest of all was Julius II (1503–13), who was likewise a fabulous patron of the arts. Almost all the leading Florentine and other Italian artists were attracted to Rome. With the exception of Giulio Romano none of the important artists active in Rome at this time were Roman by birth.

Donato Bramante, the leader of this new manner, had already acquired an architectural reputation at Milan. Almost immediately after his arrival in Rome in 1499, there was an amazing change in Bramante's work, as he became the exemplar of the High Renaissance style and lost his Lombard early Renaissance qualities. The Tempietto (1502), or small chapel, next to S. Pietro in Montorio typifies the new style. Erected on the supposed site of the martyrdom of St. Peter, the Tempietto is circular in plan with a colonnade of 16 columns surrounding a small cella. The chapel was meant to stand in the centre of a circular court which was likewise to be surrounded by a colonnade, so that the whole structure was to be self-contained and centralized. The enclosing circular court has never been erected. The ultimate inspiration of the Tempietto was a Roman circular temple, like the temples of Vesta at Rome or Tivoli, but so many notable changes were made that the Renaissance chapel was an original creation. On the exterior it was organized in two stories. the Doric colonnade forming the first story. Above is a semicircular dome raised high on a drum. The present large finial on the dome is of a later date and destroys some of the simplicity of the massing. Niches cut into the wall of the drum help to emphasize the solidity and strength of the whole, as does the heavy Doric order that Bramante was so fond of, in contrast to Brunelleschi who had a predilection for the ornate Corinthian. The monument is very simple, harmonious and comprehensible.

Several churches by other architects present the same qualities as the Tempietto on a larger physical scale. The church of Sta. Maria della Consolazione (1508–34) at Todi by a minor architect, Cola da Caprarola, is likewise centralized in plan, being square with a semicircular or polygonal apse opening off each side. The mass is built up of simple geometric forms, with a cube at the centre surrounded by half cylinders and capped above by the cylinder of a drum and a hemispherical dome. The Florentine architect. Antonio da Sangallo the elder, influenced by Bramante, created his church of S. Biagio at Montepulciano (1518–45) on a Greek cross plan. On the facade in the two recesses of the arms of the cross were to rise two towers, the right one never completed. Otherwise the massing is similar to that of Todi with dome and drum above. All the moldings and ornamental elements were carved with strong projection, so that on the interior heavy Roman arches, with deep coffers containing rosettes, define the tunnel vaults rising over the arms of the church. The sense of solid yet harmonious mass is enhanced by the travertine stone of which it is built.

Sangallo's church at Montepulciano reflects Bramante's greatest undertaking, the rebuilding of S. Pietro in Vaticano at Rome.

Early in 1505 Pope Julius II began to consider the question of a tomb for himself appropriate to his idea of the power and nobility of his position. The sculptor Michelangelo soon presented a great project for a freestanding tomb, but such a monument required a proper setting. The Renaissance biographer Vasari claimed that the question of an appropriate location for this projected tomb brought to the pope's mind the idea of rebuilding St. Peter's, which was in very poor condition. Bramante, therefore, prepared plans for a monumental church late in 1505, and in April 1j06 the foundation stone was laid. The projected church was a Greek cross in plan, with towers at the four corners and over the crossing a tremendous dome. inspired by that of the ancient Roman Pantheon but raised in this case on a drum. In elevation there was a very careful definition of all the parts of the church, so that one could visualize the plan from the composition of the elements of the elevation At his death in 1514 Bramante had completed only the four main piers which were to support the dome. but these piers determined the manner in which later architects attempted the completion of the church.

As important as the central plan churches of this period were several notable secular buildings. At the papal palace of the Vatican next to St. Peter's, Bramante added two important features. The great Belvedere court (begun 1503) was planned to bring together the two disparate elements of the older palace attached to the church and the Belvedere villa of Innocent VIII on the hill above the palace. The new court was terraced up the hillside on three levels joined by monumental stairs. It was enclosed on the two long sides by arcaded loggias with superimposed orders. This large court was completed in the latter 16th century with some minor changes. and in 1587 the whole concept was destroyed by the building of the present Vatican library across the centre of the court. Just before his death Bramante also began a series of superimposed loggias attached to the face of the old Vatican palace looking out over the city and river. Completed by Raphael, there are two superimposed arcades with Tuscan and Ionic orders and a colonnade with Composite columns.

The largest palace of the High Renaissance is the Farnese palace (1518–66) at Rome designed and commenced by a follower of Bramante, Antonio da Sangallo the younger, nephew of the older Sangallo. At Sangallo's death in 1546 Michelangelo carried the palace toward completion. making important changes in the third story. On the exterior Sangallo gave up the use of the classic orders as a means of comparting the facade into a number of equal bays; he used instead a facade more like the Florentine, but with quoins or rough cut blocks of stone at the edges of the elevation to confine the composition in a High Renaissance fashion. The façade is composed in proportions as a double square. On the interior the central square court is more classic using superimposed orders. Based on the ancient Roman Theatre of Marcellus or the Colosseum, the two first floors have an arcade supported by rectangular piers against which are set half columns. On the third story Michelangelo eliminated the arcade and used pilasters flanked by half pilasters which destroyed the High Renaissance idea of the careful separation and definition of parts.

One of the most charming buildings of the period is the Villa Farnesina (rjog–21) at Rome by Bramante's finest pupil. Baldassare Peruzzi. who came from Siena. Designed for the fabulously wealthy Sienese banker Agostino Chigi, the villa was the scene of numerous fantastic banquets. A suburban villa, the Farnesina was planned in relation to the gardens around it with two small wings projecting from the central block toward the gardens. Originally there were tno open loggias facing the gardens from two sides of the villa; one loggia is now completely walled in. The elevation appears as two stories comparted into equal bays by Tuscan pilasters. Other important buildings were designed by the painter Raphael, such as the Villa Madama (begun 1517) at Rome or the Palazzo Pandolfini (1j16–20) at Florence.

C. Mannerism

From the third decade of the 16th century political and religious tensions erupted violently in Italy, particularly in Rome, which was sacked in 1527 by imperial troops. The school of Bramante and Raphael, which had produced the High Renaissance style, was dispersed throughout Italy as the artists fled from devastated Rome. Two years later another imperial army, with the backing of the Medici, besieged the city of Florence, imposing upon Michelangelo the difficult choice of supporting his native city or the family which had protected and patronized him. The Medici were soon established in Florence not merely as a leading family but as the outright rulers. In such a period of insecurity, the harmonious and self-sufficient manner of the High Renaissance could not survive. It was gradually replaced by a complex style, sometimes called mannerism, which continued until the end of the 16th century when the baroque style developed. Mannerism was antithetical to most of the principles of the High Renaissance. In place of harmony, clarity and repose it was characterized by tension. complexity and novelty. Mannerist architects were no less interested in ancient classic architecture than their predecessors; in fact. they displayed an even greater knowledge of antiquity. However they found other qualities in Roman architecture to exploit.

The change in style can be seen in the work of an architect, Baldassare Peruzzi, who was active in both periods. Unlike his High Renaissance Villa Farnesina, Peruzzi's design for the Palazzo Massimo alle Colonne (about 1535) in Rome shows indications of mannerism. The facade of the palace was curved to fit the site on which it was erected; instead of remaining the passive form it had been in the earlier phases of Renaissance architecture, the wall surface was beginning to assert itself. The classic order is limited to the ground floor of the palace; the upper three stories have imitation drafted stonework made of brick covered with stucco. inscribed to feign stone coursing. Under these three stories in the centre of the facade is a loggia or colonnade, which seems of questionable adequacy as a support for the apparent load. The second story has classic rectangular windows crowned by Peruzzi's usual neat lintel supported on volutes, but the windows of the upper two stories are set horizontally with rather elaborate curvilinear moldings about them. There is, therefore, no longer a harmonious balance between the various stories. The architecture shows a greater emphasis on decorative qualities than on the expression of structural relationships.

In its earlier phase, until about 1550, mannerism presented a strong reaction against the High Renaissance. In the latter half of the century the free treatment of the classic vocabulary, which was typical of early mannerism became somewhat restrained. In central Italy, because of the impact of the sack of Rome, the quantity of early mannerist architecture was limited. A typical example is the project which Antonio da Sangallo the younger prepared for the completion of St. Peter's at Rome. A wooden model (begun 1539), still preserved in St. Peter';. reveals that Sangallo's plan is a combination of a central plan church with a large vestibule which makes the whole scheme approach a Latin cross. As a result, the exterior of the church resembles a Latin cross, but the interior space denies this by being centralized. In the same way the exterior elevation, unlike Bramante's project, does not express clearly the disposition of the interior of the church. The number of the architectural elements is increased so that the simplicity and clarity of the High Renaissance is lost. The dome of Sangallo's project has two superimposed arcades around its base and a double lantern above, so that the dome form is almost completely lost in a many-tiered, wedding-cake effect.

One of the great figures of the mannerist period was the Florentine artist Michelangelo. He executed some extreme examples of mannerist architecture at Florence. In his Laurentian library (1523–71) the vestibule fully illustrates his manner. Spatially it is a tall box set on end rising three stories. The large columns that line the wall of the main story are set into recesses so that a question arises as to whether the column or the wall is the supporting element. This treatment enlivens the expressive quality of the wall, for unlike its rather passive expression in the High Renaissance the wall now seems to be pressing forward between the columns. The small decorative pilasters were designed to taper toward the base in contrast to the usual classic and Renaissance pilaster. The small floor area of the vestibule is almost

completely filled with the staircase leading up to the reading room. The stairs are an extreme example of the freedom of mannerism; the function of the stairs is subordinate to their design. Commencing as three flights of stairs. the side flights at the top divert their traffic into the middle one, which was designed with curved steps so that the total effect resembles moving lava. The stairway dominates the vestibule instead of remaining a neutral. functional form. The whole atmosphere of the vestibule is that of an architectural space in tension, which contrasts with the quiet monotony of the long horizontal reading room above.

Michelangelo's later architecture in Rome was more restrained but still reveals some of the qualities of mannerism. At the death of Sangallo in 1546 Michelangelo was commissioned to complete the great church of St. Peter's at Rome. During the next 18 years he was able to complete most of his design for the church, except the faqade and great dome above. In plan he returned to a central plan church reminiscent of Bramante's idea but with fewer parts. His elevation, still visible at the rear or sides of the church, is composed of gigantic pilasters with a rather high attic story. Between the pilasters are several stories of windows or niches. Unlike the harmonious orders and openings of the High Renaissance, these are constricted by the pilasters so that a tension is created in the wall surface. Michelangelo planned a tremendous semicircular dome on a drum as the climax of the composition. Engravings of his original project suggest that this dome would have been overwhelming in relation to the rest of the design if the church had been completed in accordance with his concept. The great central dome was executed toward the end of the 16th century by Michelangelo's follower Giacomo della Porta who gave a more vertical expression to the dome by raising it about 25 ft higher than a semicircle. This resulted in a slightly pointed profile which became the prototype for the baroque dome, whereas the semicircular dome had been typical of the Renaissance. In the early 17th century Carlo Maderno added a large nave and faqade to the front of the church, converting it into a Latin cross plan and destroying the dominating quality of the dome, at least from the exterior front.

Early mannerism in north Italy developed out of the dissolution of the school of Bramante after the death of Raphael in 1520 and the sack of Rome in 1527. Giulio Romano, the chief assistant of Raphael, became court artist and architect in the city of Mantua, while Michele Sanmicheli, a pupil of Bramante and Antonio da Sangallo the younger, returned to practise in his native town of Verona and at nearby Venice. Romano's Palazzo del Te at Mantua has a formal exterior with imitation drafted stonework and Doric pilasters, but the pilasters were not spaced in the High Renaissance manner, with an absolute regularity or an alternate rhythm of wide and narrow bays. The pilaster bays instead have a much more complex rhythm of several different widths. Mannerist tension was expressed in the court by the designing of every third triglyph of the Doric frieze to drop slightly, deliberately giving a sense of insecurity that tended to deny the structural expression of the order.

The leading early mannerist architect in Venice was the Florentine sculptor Jacopo Sansovino. who fled to the north from Rome after the sack. Sansovino's architecture, as represented by the loggetta (1537–40) at the foot of St Mark's campanile or by the Library of St. Mark's (Libreria Vecchia; 1536–88), is an example of the very decorative side of mannerism. The library has t o stories of arcades; the upper story is much taller than the lower. It has no basement, merely three low steps, so as to match the Gothic Palazzo Ducale opposite it. The upper entablature is extremely heavy, equaling half the height of the Ionic columns on which it rests. The decorative nature of the building is indicated by the fact that relief sculpture has been applied universally to the entablature and spandrels of the arches, with no unadorned wall surfaces.

This period of free and decorative mannerism was folloaed by the more restrained, classic phase of late mannerism seen to perfection in the architecture of one of the greatest architects of the Renaissance, Andrea Palladio. His native city. Vicenza, on the mainland not far from Venice, was almost completely rebuilt with edifices after his design; the Venetian mainland around Vicenza was profuse with his villas. The Villa Capra or Rotonda (1550–53; with later changes) near Vicenza is magnificent in its simplicity and massing. In the centre of a cubelike block (a cube is typical of most Palladian villas) is a circular hall, and on all four sides are projecting classic temple fronts as porticoes. There is an absolute classic rigidity in the plan which, when applied to domestic architecture is even more abstract than High Renaissance architecture. In Venice Palladio built several churches, all with the Latin cross plan and rather similar faqades. S. Giorgio Maggiore (1565–1610) has a Roman temple front, on four giant half columns, applied to the centre of the faqade; abutting the sides are two half temple fronts with smaller coupled pilasters. The resulting composition suggests the interpenetration of two complete temple fronts in a mannerist way, since the elements of the composition are less independent than they would be in High Renaissance architecture, although the details are fully classic. Also typical of mannerism is the way in which the interior space, instead of being classically confined, is permitted to escape through a colonnaded screen behind the sanctuary into a large choir at the rear.

Palladio's greatest fame in the history of architecture rests on his treatise. I *Quattro libri dell'urchitettura* (1570). The book promulgates a very classic theory of architecture; in fact, one chapter (I. xx) on the abuses in architecture decries some of the characteristics of mannerism. In the 17th century Palladio's writings played an important role in the formulation of the French Academic theory of architecture.

In England there were at least two waves of Palladianism (*q.v.*), one centred around Inigo Jones in the early 17th century and another around Lord Burlington in the 18th century, which later spread to America.

Late mannerism at Rome and Florence was more varied. Pirro Ligorio's Casino of Pius IV (1558–63) at the Vatican is extremely decorative, with its faqade covered with rich stucco relief and pebble mosaic ornament. In Florence the Uffizi palace (1560–74) by Giorgio Vasari and others was built about a very long, narrow court that seems to have been created by the compression of the tall side walls. It has a more dynamic spatial expression than the harmonious passive courts of the High Renaissance, which are generally square or circular. The most important architect of this period is Giacomo da Vignola, who wrote a treatise, *Regole delle cinque ordini d'architettura* (1562), devoted solely to a consideration of the architectural orders and their proportions. Like Palladio's book, Vignola's *Rules* became a textbook for later classic architecture. Of his many buildings the project for the church of Gesù (1568–75) at Rome, the central church of the Jesuit order, was very influential on the later history of architecture. The plan is a Latin cross with side chapels flanking the nave, but the eastern end is a central plan, capped by a dome. The plan was derived from Alberti's early Renaissance plan of S. Andrea at Mantua. The Gesu plan was imitated throughout Europe, but especially in Italy, during the early baroque period of the 17th century. Vignola built the church except for its faqade, which was executed by Giacomo della Porta. Della Porta, inspired by Vignola's original design, created a faqade concentrated toward its centre. which, like the plan, was the prototype for most early baroque façades of the late 16th and early 17th century.

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III. FRANCE

The Renaissance style of architecture appeared in France at the very end of the 15th century and flourished until the end of the 16th century. As in other north European countries and Spain the new Renaissance manner did not completely oust the older Gothic style, which survived in many parts of France throughout the 16th century. French Renaissance architecture is divided into two periods: (1) the early Renaissance, from the end of the 15th century until about 1530, and (2) mannerism, from about 1530 to the end of the 16th century.

A. Early Renaissance

The. many invasions of Italy from 1494 until 1525 by French armies acquainted the French kings and nobles with the charms of Renaissance art. During the reigns of Louis XII and Francis I the French possessed the city of Milan for the first 25 years of the 16th century. It was in Lombardy, therefore. that contact was made between French art and the Renaissance, and it was the Lombard Renaissance style that appeared in France during the early Renaissance.

The new style had a certain prestige since it was imported by the nobility and aristocracy, while the middle class burghers continued to support their native Gothic style. This social difference also applied to the artists themselves. The French aristocracy imported Italian architects and artists who had been influenced by the Italian Renaissance, in which artists were considered to have a higher social level than artisans. The French builders and craftsmen who executed the designs of the Italians still belonged to the social level of medieval artisans. This created a friction between the two groups, which was, of course, furthered by the French resentment toward imported foreign artists.

With the exception of a few brief outcroppings of classicism in such centres as Marseilles and Gaillon, French early Renaissance architecture was centred in the Loire valley, since the capital of France was at Tours during the reign of Louis XII and the early part of the reign of Francis I. Most of the new architecture was secular, such as the chbteau (*q.v.*), which was descended from the medieval feudal castle, combined with the idea of an Italian villa. A characteristic example is the chbteau at Blois, where two wings in the early Renaissance manner replaced parts of the 13th-century chbteau. The first wing, erected for Louis XII (1498–1503), is almost completely in the Flamboyant style (*q.v.*) and structure, with high roofs, an asymmetrical elevation, depressed arches and ogee arches. The only hint of the Renaissance is the occasional use of a bit of classic decoration, such as the egg and dart molding, mingled with the Gothic. The second wing, built by Francis I (1515–24), is more nearly in the Renaissance style. The structure remained Gothic with a high roof and dormers and the irregular spacing of the vertical windows, but all the ornament was in the classic mode, although its handling was often nonclassic. Classic pilasters were used to divide the elevation into bays, but there is no consistency in the proportions of the pilasters. The most notable feature of the interior elevation of the wing of Francis I is a great octagonal open staircase, five sides of which project into the court. Within is a spiral staircase set on a continuous tunnel vault that is supported by radiating piers. On the surface of the piers are panels in low relief of arabesque decoration, of a type which is found often in Lombard Renaissance architecture. The richness of the Lombard style blends very well with Flamboyant Gothic, which had always been characterized by intricate and rich decoration. The exterior elevation of the wing of Francis I consists of a series of open loggias, the two lower ones arched, the upper one with a straight entablature, reminiscent of the famous series of loggias that had just been completed by Bramante and Raphael at the Vatican palace in Rome. However, the Italian High Renaissance concept was expressed in France in early Renaissance terms with squat pilasters, irregularly spaced bays and somewhat depressed arches.

The finest example of the early Renaissance style is the château or hunting lodge erected for Francis I at Chambord (1519–47). The Italian architect Bernabei Dornenico da Cortona presumably made the basic model for the chbteau, but the designs of Italian architects were usually executed by French builders, in this case Pierre Nepveu, often with many changes. Chambord is a tremendous structure, about 500 ft. wide, with a plan showing the gradual breakdown of the old castle plan. There is a rectangular court surrounded by walls with round towers at the corners, but on three sides of the court there are only low curtain walls. The old donjon developed into the chbteau proper as a blocklike building aith round towers at each corner. The flat passageways over the curtain walls and on top of the central block were intended to form galleries from which the ladies of the court could observe the hunt. The plan of the main block of the chbteau reveals Italian influence in its symmetrical organization on cross-axes with a double spiral staircase at the centre. In the four corners left by the cross-axes are four identical apartments, each of which consists of three basic rooms (chamber. antechamber and cabinet); this form of apartment was from this time the favourite unit of French domestic planning. Typically for this period, the silhouette and structure remained Gothic in elevation, with strip windows, a multiplicity of elements and a general vertical expression. However all the ornament is in the classic vocabulary of pilasters, round arches, and at times a geometric decoration of slate panels set in the cream coloured stone.

B. Mannerism

Commencing about 1530 Francis I imported numerous Italian artists, such as Il Rosso, Primaticcio, Serlio, Vignola and Cellini. Most of these artists were mannerist in style. followers of Michelangelo or Raphael, so that the new period of French architecture partook of Italian mannerism. The relations between the French and Italian artists became more strained, in part as a result of factions in the royal patronage. Francis I and his Italian daughter-in-law Catherine de Médicis favoured the imported Italians, while the son and successor of Francis I, Henry II, and the latter's mistress Diane de Poitiers supported the French artists. The style that resulted from this tension lasted until about 1590 and is sometimes known as the style of Henry II, although it actually was produced under five different kings, beginning late in the reign of Francis I.

The full influence of the new Italian style can best be seen in the chbteau at Fontainebleau. In 1528 Francis I began to make revisions and additions to his medieval chateau, the exterior architecture being carried out by French builders under Gilles Le Breton, and. therefore, belonging to the French early Renaissance manner. The Italian mannerist painter, Il Rosso, after his arrival in 1530, was placed in charge of the interior decoration of the Gallery of Francis I (1535–37). The gallery is a long, narrow room covered by a wooden ceiling with rather intricate coffering. On each side of the room is a high dado of carved walnut with rich decoration above of stucco relief sculpture and painting. As Rosso was a mannerist painter it meant that France went directly from the early Renaissance style of the Loire chbteaux to mannerism. This was natural for the French since mannerism has affinities with the early Renaissance and late Gothic styles; it appealed to the French whose traditional native style was Gothic. Rosso, aho died in 1540, was succeeded by another Italian, Primaticcio, who decorated the ballroom or gallery of Henry II (1548–56) and added the wing called the Aile de la Belle Cheminée (1568) at Fontainebleau.

The most important Italian architect to build in France was Sebastiano Serlio, a pupil of Baldassare Peruzzi, who arrived in 1541 to take Rosso's place as court srchitect. Serlio prepared plans for the rebuilding of the royal palace of the Louvre at Paris, but his ideas seem to have been too grandiose for Francis I. He did manage to build two chateaux, the casino of the Cardinal of Ferrara at Fontainebleau (about 1546), now destroyed, and the château of Ancy-le-Franc (about 1545–55) in Burgundy. Encountering opposition to his architecture from the French builders, Serlio devoted most of his time to an architectural treatise which he had begun in Italy. Various books of the treatise were published during his lifetime from 1537 on, but the collected work was published after his death with the title *Tutte l'opere d'archi-*

tettura et prospetiva (1584). This treatise was quite influential in spreading the Renaissance style in France, England, and the Low Countries.

The influx of Italian artists soon compelled the French architects to adopt Renaissance principles of design as well as Renaissance ornamental details. No longer content to be builders following the guild tradition, many of the French architects began to study the theory of design and often went to Italy as the source of the Renaissance style. A typical example was Jacques Androuet du Cerceau the elder, who was in Rome probably in the 1540s and was more important for his writings on architecture than for executed building. In addition to several treatises on architecture, Androuet du Cerceau published *Les plus excellents bastiments de France* (1576–79), two volumes of engravings of the most notable buildings in France in the Renaissance manner. As many of the buildings have been destroyed or radically changed, his book is an indispensable source for a knowledge of the architecture.

After Serlio's failure with the palace of the Louvre in Paris, a French gentleman of the court, Pierre Lescot, was ordered to design and build a Renaissance palace to replace the medieval castle of the Louvre. During the latter part of his reign Francis I centred the capital of France at Paris rather than in the Loire valley. Lescot in collaboration with the famous sculptor Jean Goujon designed a palace in 1546 set around a square court about 175 ft. wide. Only two sides, the west and south, of Lescot's court were built (1546–51). The execution and amplification of this design extended to the middle of the 19th century. The small section carried out under Lescot, the gallery of Francis I, reveals a thorough understanding of the principles of Italian design, but is expressed in French terms. The classic elements are used as low-relief surface decoration with little emphasis on mass.

The two leading architects of the second half of the 16th century, Philibert Delorme and Jean Bullant, studied in Rome. Delorme was trained as a builder before going to Rome and, therefore, was always interested in the constructive side of architecture as well as in the theory of design. About 1546 Delorme was commissioned by Henry II's mistress, Diane de Poitiers, to design her chbteau at Anet. The original château (about 1546–52) formed three sides of a court closed at the front by a screen wall and entrance gateway. Much of the chdteau has been destroyed; only the left wing of the house, the screen wall and the chapel which formed part of the right wing survive. The entrance gateway, which originally contained Cellini's bronze relief of Diana (now in the Louvre), is very mannerist with a complicated superstructure, a semicircular arch with raised bands cutting across the moldings, and, at the top, a bronze group of a stag which strikes the hour with his hoof as the accompanying hounds bay mechanically. The chapel at Anet has a centralized Greek cross plan with a large circle capped by a dome at the crossing. The exterior of the chapel is mannerist with the windows cutting through the entablature and half pediments abutting the main block.

Delorme commenced in 1564 a large palace called the Tuileries, since it was situated on the site of tileworks in front of the Louvre. It was originally conceived as a very large building, but the architect was able to carry out only a very small section, which was destroyed in 1871.

Again elements of mannerism were visible. On the first story Delorme used his own so-called French order, consisting of Ionic half columns and pilasters with decorative bands across the shafts, but this order was actually an Italian mannerist treatment of the classic order. Delorme also wrote on architecture. His most important publication, the *Premier tome d'architecture* (1567), was based on Vitruvius and Alberti, but it is much more practical in its approach than Alberti's work, since it was largely drawn from Delorme's own practice.

Jean Bullant also wrote a book on architecture, *Règle générale d'architecture des cinq manières de colonnes* (1564), inspired by the Italian Vignola's treatise which was issued two years previously. In fact, Bullant's architecture was rather like that of Vignola in that it was very classic in details but often mannerist in relationships. His early and best preserved works were for Anne, duc de Montmorency and constable of France: part of the chbteau of Ecouen (about 1555) and the chatelet (about 1560) at the chbteau of Chantilly. The last shows many mannerist qualities. For example, the main block of the chatelet is two stories high, but it is comparted by a series of pilasters that are higher than one story, yet not as high as the two stories. This is typical of Bullant's work; it results in the upper windows cutting through the cornice and ending as dormers in the roof. He was also very fond of penetrating the lower part of his window pediments, either with the arch of the window or with a separate little window.

The architecture of the second half of the 16th century was typically mannerist; numerous architectural treatises appeared, as they had in mannerist Italy. The mannerist style died out in the early 17th century as slight hints of the baroque style blended with a renewed classicism to form gradually the Academic style prevalent in the 17th century.

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IV. SPAIN

The unification of Spain in 1492, with the final expulsion of the Moors, was accompanied by the appearance of Italian Renaissance decorative elements in Spanish architecture. There were three phases of Spanish Renaissance architecture: (1) the early Renaissance or Plateresque, from the late 15th century until about 1560; (2) a brief classic period, coexistent with the Plateresque from about 152j to 1560; and (3) the Herreran style from 1560 until the end of the 16th century.

A. Plateresque

The earliest phase of Renaissance architecture in Spain is usually called the Plateresque (*q.v.*) (from *platero,* "silversmith") because its rich ornament resembles silversmith's work. There has always been a long tradition in Spain of elaborate decoration, explained in part as an influence from Moorish art. The Moors, of course, possessed almost all of Spain during the middle ages and left this decorative heritage to the Spaniards. During the early 16th century minor north Italian sculptors and artisans, particularly from Lombardy and Genoa, were imported into Spain to execute tombs and altars for the Spanish nobles and ecclesiastics. These artisans introduced the north Italian Renaissance vocabulary of classic decoration, such as the pilaster paneled with arabesque or rinceau strips or the candelabrum shaft. Spanish architects soon picked up these decorative elements and applied them to their buildings.

The Renaissance Plateresque style is purely one of architectural ornament. There was no change in structure; heavy malls mere used aith either Gothic ribbed vaults or intricately carved wooden ceilings, indicating Moorish influence. Many of the elements of decoration also preserved the influence of Gothic and Moorish art, such as the Flamboyant Gothic pinnacle and pierced balustrade, or coats of arms and bits of heraldry used as ornamental motifs. Richly coloured tiles created decorative patterns on the walls as in Moorish art. The richness of the classic decoration imported from north Italy blended effectively with the elements of the Moorish and Flamboyant Gothic styles to form the new Plateresque style. The luxuriance of its ornament was a fitting expression of the splendour-loving culture that Spain developed as the wealth of the Americas began to pour in during the early 16th century.

In most cases the new Plateresque decoration was confined to rich spots or panels of ornament around the portals and windows of the buildings. These ornamental areas were relieved by large expanses of bare wall, as in the façade of the Royal hospital at Santiago de Compostela (begun 1501) by Enrique de Egas, or his Hospital of Santa Cruz at Toledo (1504–14).

The greatest centre of the Plateresque style was the town of Salamanca, with buildings such as the university (about 1516–29) and the Monterey palace (1539). Perhaps the most outstanding

example of the style is the Ayuntamiento, or town hall, of Seville (1534–72) by Diego de Riaño, with Lombard paneled pilasters on the ground floor and half columns completely covered with relief sculpture on the second floor. Also in the Lombard manner are the numerous medallions spotted over the wall under the windows or between the pilasters.

B. Classic

Although the exuberant Plateresque style lingered in some regions until about 1560, it was soon superseded by a much more classic style, which appeared in 1526 in the palace of Charles V within the Alhambra (*q.v.*) at Granada. The palace of Charles V was the first Italian classical building in Spain, in contrast to Plateresque buildings whose classicism, was limited to a few elements of Italian Renaissance decoration. Charles V as king of Spain and the Holy Roman emperor was the most powerful political figure in Europe. It was his army that invaded Italy and sacked the city of Rome in 1527 as Pope Clement VII cowered in the Castel San Angelo. As a result of his political and military power. his wealth (which was enhanced by the gold of Mexico and Peru) and his adroit diplomacy, Charles V dominated Italy, as well as Spain, the Low Countries and Austria. His palace in the Alhambra reflected the increasing contact with Italy. Designed by the Spaniard Pedro de Machuca. who had studied in Italy, the work on the palace of Charles V continued through most of the 16th century. but it has never been completed.

The palace is square in plan with a huge central circular court (100 ft. in diameter), which was intended for bullfights and tournaments. The plan is, therefore, fully Renaissance, being centralized and symmetrical; it is organized on cross-axes formed by the four entrances. one in the centre of each side. The façade shows a full understanding of the principles of Italian Renaissance design in its superimposition of orders (*i.e.,* Ionic pilasters or half columns above Tuscan, and Corinthian above Ionic), and in the alternating rhythm of the triangular and segmental pediments above the windows of the second story. The interior court is surrounded by a colonnade with a similar superimposition of Doric and Ionic.

C. Herreran

The classicism of the palace of Charles V was succeeded by an extremely austere and cold style named after the greatest Spanish architect of the 16th century, Juan de Herrera. Perhaps more important than the architect was the social and cultural atmosphere in which the Herreran style developed, from about 1560 to the end of the 16th century. Charles V had been a true Renaissance prince; his only son Philip II. who came to the throne in 1556, was one of the most typical representatives of the age of Mannerism as it was manifested in Spain. Philip II was morbid and melancholic, a religious fanatic, against whose strict rule the Low Countries soon rose in revolt, beginning the difficulties that gradually dispelled Spanish political and cultural power in Europe.

The finest example of the Herreran style illustrates clearly the change in cultural atmosphere under Philip II. This is the palace-monastery of the Escorial (*q.v.*) (1563–84), which Philip II had built as a retreat on a rather dreary plain outside Madrid. It is a great contrast to the worldly palace of Charles V with its tournament court set in the luxurious, sensuous Alhambra. The Escorial was more than a royal palace, as it also contained provisions for a monastery and college within its great complex. A city in itself, the Escorial was planned as a tremendous rectangle (675 ft. by 525 ft.), with a large church at the centre dominating the whole. The orientation toward religion is indicative of the age of the growing Counter-Reformation, which was in part opposed to the secularism of the classic Italian Renaissance.

The Escorial was begun by the architect Juan Bautista de Toledo. who may be responsible for the planning, but the execution and architectural style was that of his assistant and successor, Herrera. Philip II himself reviewed the drawings for the palace, removing anything ornamental or ostentatious. On the exterior the architecture is very simple, a plain wall with a monotonous series of unadorned windows expressing the general monastic character of the whole. The only element of the classic Renaissance on the exterior is at the central portal with two stories of giant Doric half columns supporting a classic triangular pediment. The church, at the centre of the complex, has two bell towers and a great dome set on a drum, which surmount the whole. The austerity is enhanced by the cold, gray granite of which the Escorial was built. On the interior a similar severity of manner is indicated by the lack of decoration. Except for the classic Doric order, which is the least ornamental of the orders, there is no architectural decoration. Plain arches of stone were used under the vaults without any coffering. Occasional raised panels on the wall surface suggest where Plateresque ornament would be located normally, but instead of relief sculpture, there are only starkly smooth panels. Even the Doric order was handled severely; the pilasters on the interior show no entasis (*i.e.,* an upward taper of the width of the pilaster to give a sense of lightness and to relieve the strict verticals). The Escorial is impressive in its size and mass and in the consistency of its austerity, but it has a forbidding quality that no other building can match. Other examples of Herrera's design are the cathedral at Valladolid (begun 1585, completed in the 18th century) and the court of the Lonja, or Exchange, of Seville (1583–98).

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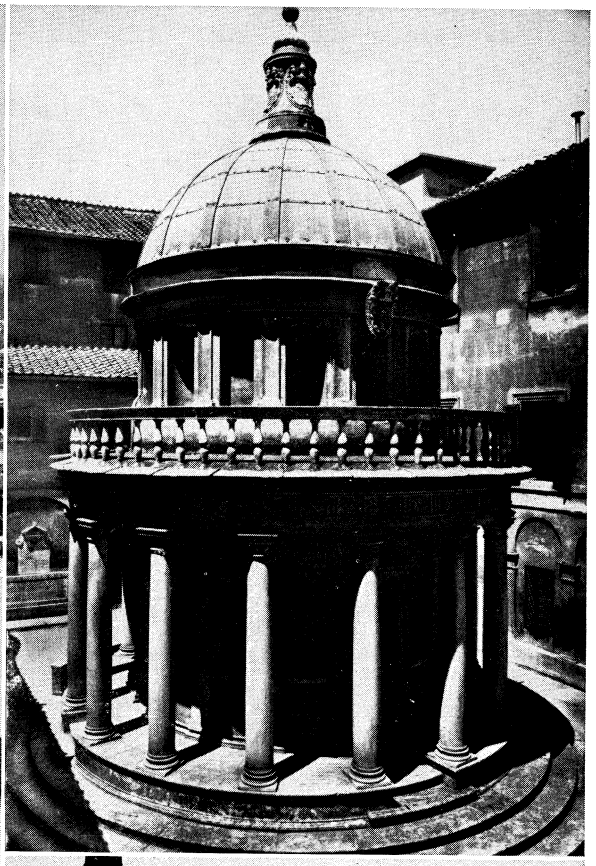
V. GERMANY AND THE LOW COUNTRIES

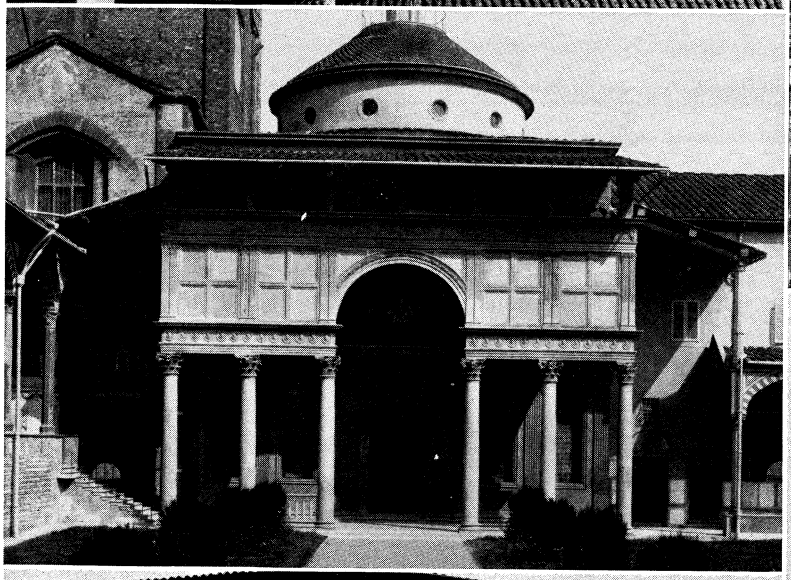
A. Germany

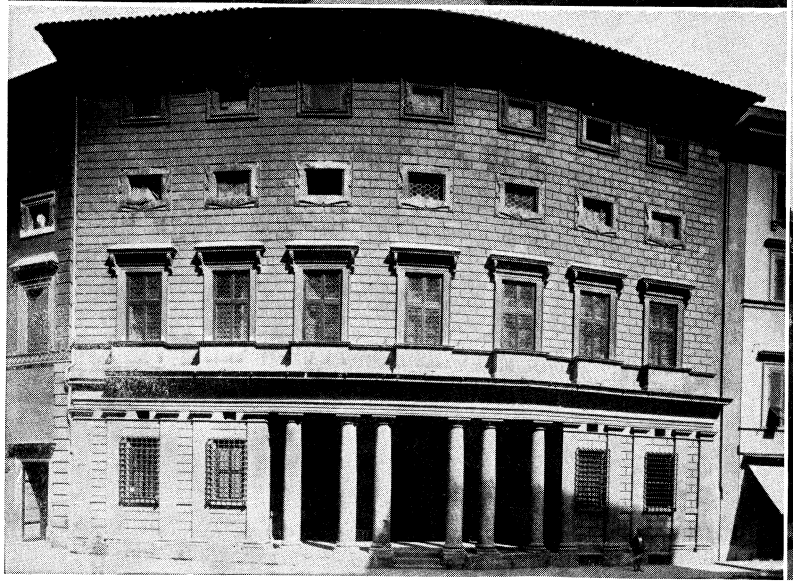
The burgeoning of Italian Renaissance architectural forms in Germany was even slower than in other north European countries. Only by the middle of the 16th century was the Renaissance style manifestly important. generally in those regions in closest contact aith Italy such as southern Germany or the trade route along the Rhine river leading from the south to the Low Countries. The style lingered in Germany until about the middle of the 17th century. The few hints of classicism in Germany prior to the mid-16th century can be considered the early Renaissance phase. They were limited to minor architectural monuments, such as the Fugger chapel in St. Anna at Augsburg (1509–18), which was the first Renaissance building in Germany. or they consisted of bits of Renaissance decoration attached to Gothic structures. An example of the latter is the Schloss Hartenfels at Torgau (1532–44) by Konrad Krebs, which is completely medieval in structure but has occasional fragments of classic ornament, arabesque pilaster strips, candelabra and medallions applied to the surface. A great staircase in the court was somehow derived from that of the French chbteau at Blois, indicating that the Renaissance influence was fourth hand, passing from its source in central Italy through Lombardy, and then to France and eastern Germany.

After 1550 Renaissance style architecture in Germany often had mannerist details derived from Italian ornamental engravings. German architecture of this period was abundant with medallions, herms (*i.e.,* architectural elements topped by human busts) and caryatids and atlantes (*i.e.,* human figures used as columns or pilasters). The German treatise on the five orders by Wendel Dietterlin entitled *Architectura* (1593) is profuse with mannerist ornament. An architectural example is the Otto Heinrichsbau (1556–59) added to the Gothic castle at Heidelberg (burned by the French in 1689). The three tall stories presented the usual verticality of northern architecture, but there was an understanding of the classic superimposition of the orders with Corinthian above Ionic. However, there was a certain freedom in the treatment of the orders, for a Doric frieze was supported by the Ionic pilasters.

From Italian mannerism came the rustication of the lower order, the use of herms as window mullions and the caryatids flanking the portal. Other examples of the German Renaissance are the porch of the Rathaus, or town hall, at Cologne (1569–73) by the Dutchman Wilhelm Vernuiken and the Friedrichsbau (1601–04) added to the castle at Heidelberg by Johannes Schoch.







PHOTOGRAPHS (TOP LEFT) EWING GALLOWAY, (TOP RIGHT, CENTRE LEFT, BOTTOM LEFT) ALINARI

THE RENAISSANCE IN ITALY

***Top* left:** The cathedral of Florence: the dome was begun in 1420 by Filippo Brunelleschi

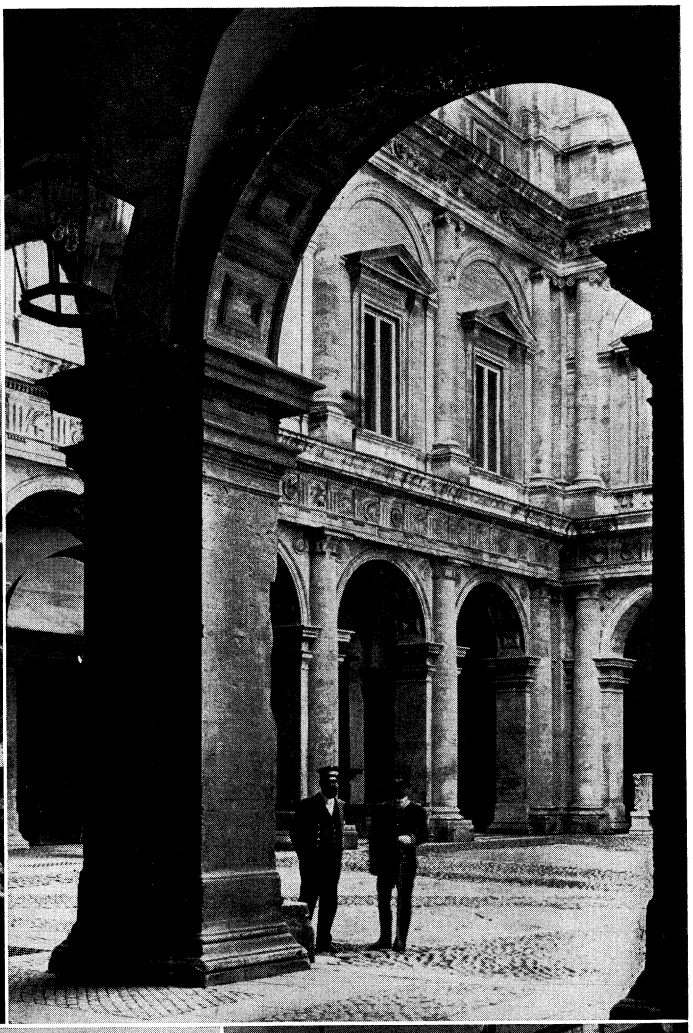
Top ***right:*** The Tempietto, or small chapel, near San Pietro in Montorio, Rome, by Donato Bramante, 1502

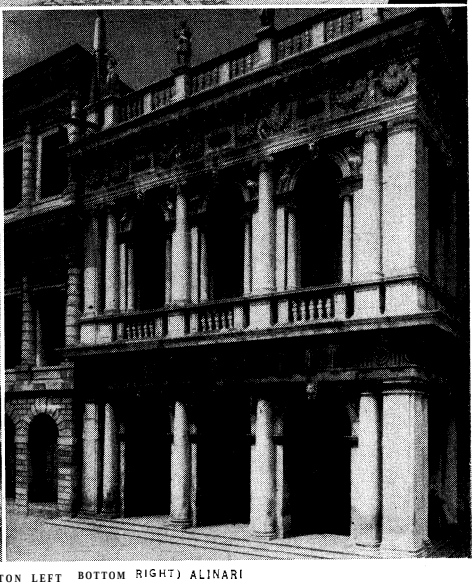
Centre left: Pazzi chapel, Florence, by Brunelleschi, 1430–43

Bottom left: Palazzo Massimi alle Colonne, about 1535–37, Rome, by Baldassare Peruzzi

Bottom ***right:*** S. Andrea, Mantua, by Leon Battista Alberti. Begun 1470; completed 18th century

RENAISSANCE ARCHITECTURE





BY COURTESY OF (TOP LEFT) ITALIAN STATE TOURIST OFFICE, LONDON, PHOTOGRAPHS (TOP RIGHT) F. R. YERBURY, (BCTTON LEFT BOTTOM RIGHT) ALINARI

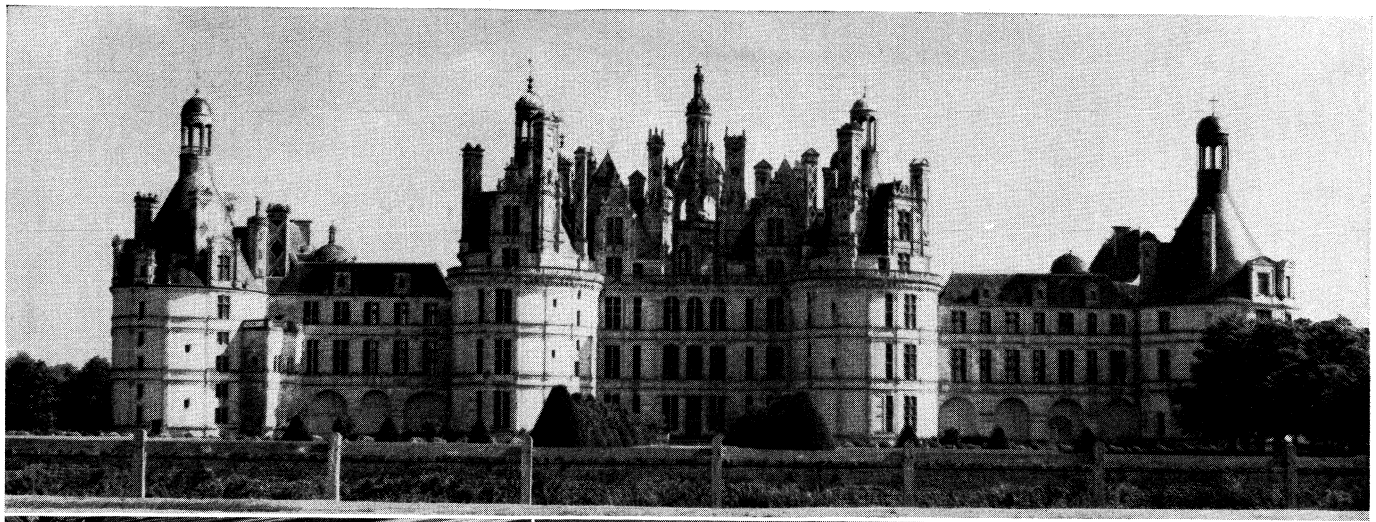
ITALIAN RENAISSANCE

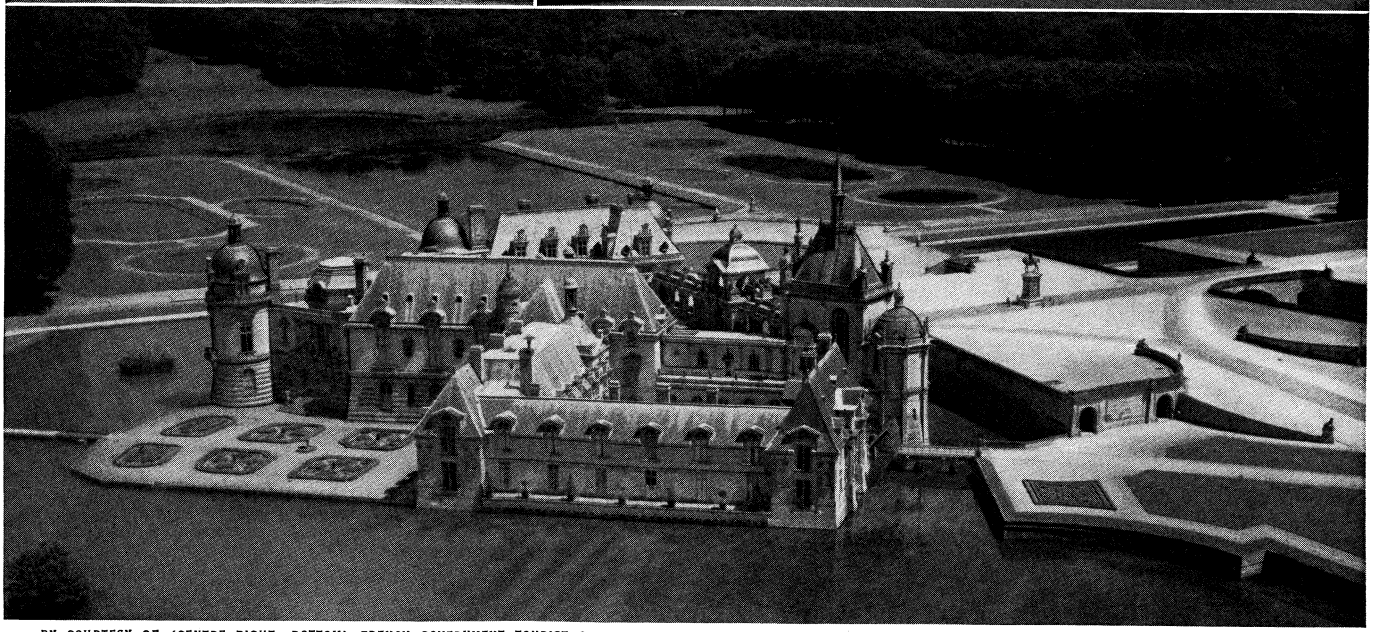
Top left: Rear of St. Peter's, Rome. Rebuilding begun in **1506** from plans by Bramante; later architects who assisted in its completion included Michelangelo, Giacomo della Porta and Carlo Maderna

Top right:-Courtyard *of* the Farnese palace, Rome, **1517-66,** begun by Antonio da Sangallo, the Younger and completed by Michelangelo

Bottom right: Library of St. Mark's (Libreria Vecchia), Venice, by Jacopo Sansovino, 1536–88

Bottom left: San Giorgio Maggiore, Venice, begun in **1566** by Andrea Palladio



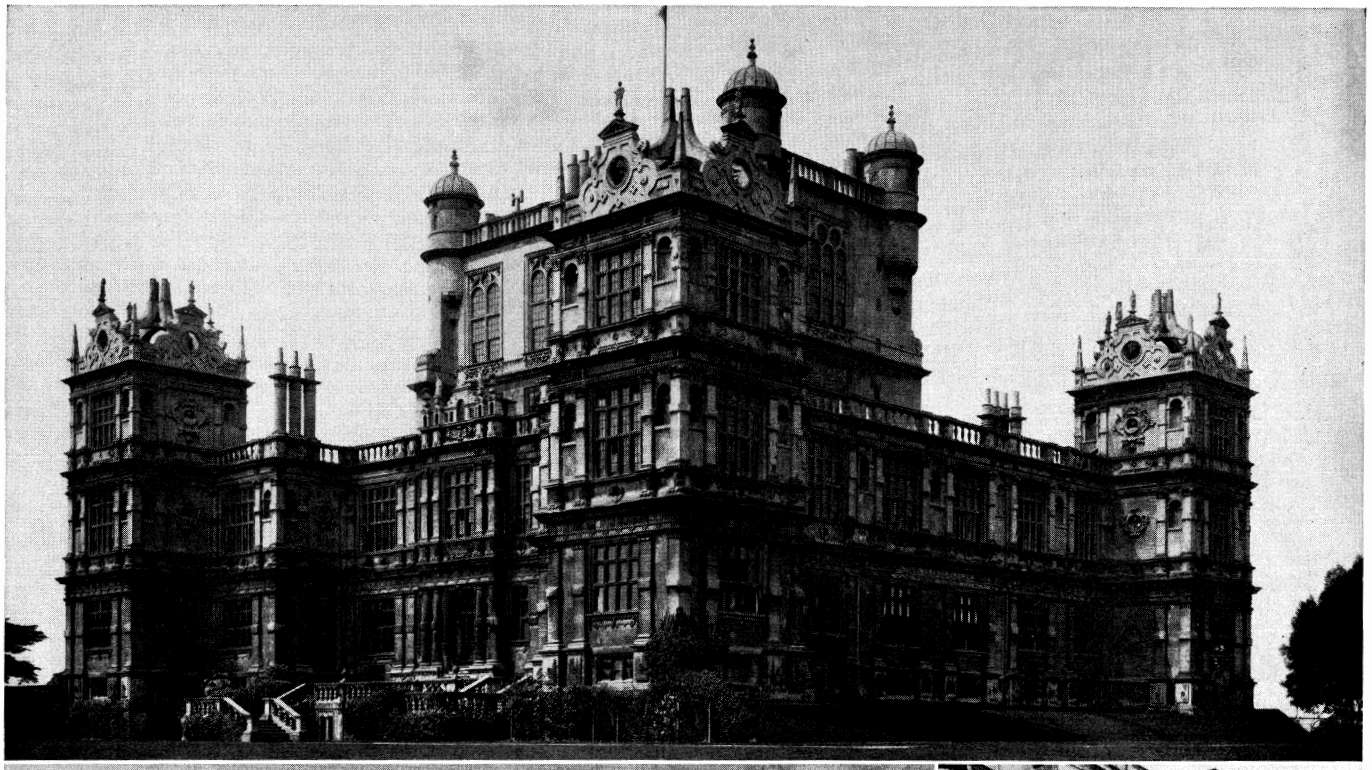


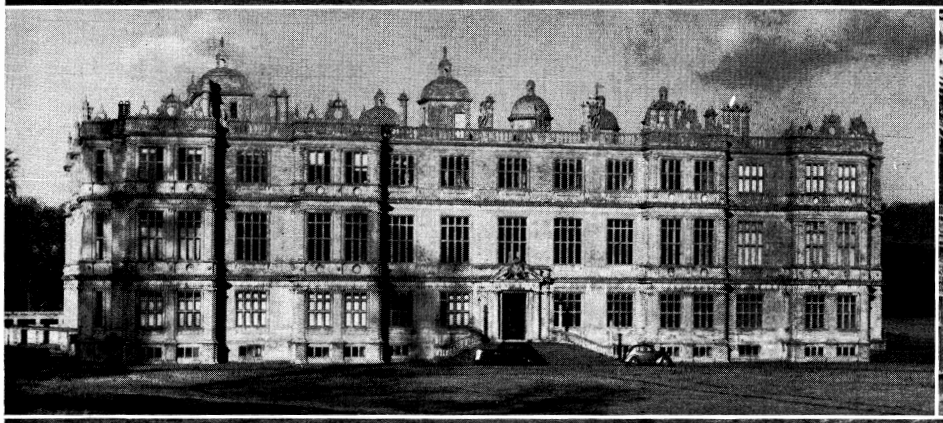
BY COURTESY OF (CENTRE RIGHT, BOTTOM) FRENCH GOVERNMENT TOURIST OFFICE, LONDON; PHOTOGRAPH (TOP) WAYNE ANDREWS

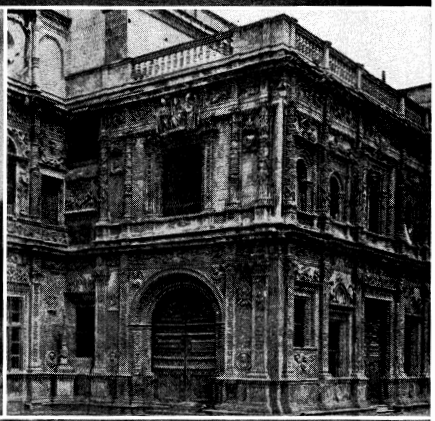
FRANCE

Top: Rear elevation of Charnbord chlteau, Loir-et-Cher; 16th century
Centre left: Gallery of Francis I, Fontainebleau château, Seine-et-Marne; 19th century restoration
Centre right: Chateau d'Anet, Eure-et-Loire; 16th century
Bottom: Chantilly château, Oise. The chltelet (foreground) was built in the 16th century

RENAISSANCE ARCHITECTURE







ENGLISH AND SPANISH RENAISSANCE ARCHITECTURE

Top: Wollaton Hall, Nottinghamshire, Eng., by Robert Smythson, 1580–88

Centre left: Longleat house, Wiltshire, Eng., by Sir John Thynne and Smythson, 1568–*c.* 1580

Centre right: Ayuntamiento, or town hall, Seville, Spain, 1534–72, by Diego de Riaño

Bottom: The palace-monastery of the Escorial, 1563–84, near Madrid. By Juan Bautista and Juan de Herrera

B. The Low Countries

Flanders in the Low Countries, because of trade and finance, was in close communication with Italy from the 15th century. As a result there are slight hints of the Renaissance style in the architecture of the early 16th century, as in the palace of Marguerite of Austria, now the Palais de Justice (1507–25), at Malines completed by Rombout Keldermans.

The most important building of the Flemish Renaissance style was the Stadhuis, or town hall, at Antwerp (1561–65), designed by Loys du Foys and Nicolo Scarini and executed by Cornelis de Vriendt (Floris). It was decided to replace Antwerp's small medieval town hall with a large structure, 300 ft. long, in the new style, as a reflection of its prosperity as the leading northern port of the 16th century. As with many northern buildings there is a lack of monumentality, for its physical hugeness is not expressed in the way that it would be in an Italian building. There is a low basement with a rusticated arcade, originally used by traders during fairs. Above are two principal stories with superimposition of Doric and Ionic pilasters, between which large windows almost completely open each bay.

The advent of the baroque style early in the 17th century replaced the Renaissance in Flanders much sooner than it did in Germany. There were a few examples of the 16th century Renaissance style in the northern Low Countries, such as the town hall at Leyden (1579) and the town hall of The Hague (1565). It was during the 17th century, when Holland was independent of Spain, that architecture flourished.

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VI. ENGLAND

The Renaissance style of architecture made a very timid appearance in England during the first half of the 16th century, and it was only from about 1550 that it became a positive style with local qualities. In fact, the Gothic style continued in many parts of England throughout most of the 16th century, and English Renaissance architecture was a very original fusion of the Tudor Gothic (see Tudor Period) and classic styles. This style flourished until the early 17th century when the architect Inigo Jones created a much more Italianate style that replaced the English Renaissance style.

During the reign of Henry VIII (1509–47) some elements of Italian Renaissance decoration were imported by England through a few minor Italian artists, such as Pietro Torrigiano who executed the tomb of Henry VII (1511–18) in Westminster abbey. At the great palace of Hampton Court, begun by Cardinal Wolsey in 1514 and continued by Henry VIII until 1540 a few bits of Italian Renaissance decoration have been added, although the structure is completely in the Tudor manner. On the gateways are several terra-cotta medallions by the Italian Giovanni da Maiano, and there is a symmetry and regularity in the plan of the palace that hints of the Renaissance. (*See* also Elizabethan Style.)

The Renaissance style really begins in England in the middle of the 16th century in architecture built for the circle of the Lord Protector Somerset, who served as regent after Henry VIII's death. During the 16th century the patron played a much greater role in the development of English Renaissance architecture than did the architect; there were almost no professional architects who were trained as the Italians were in the theory of design and building. Most of the building was executed by mason- or carpenter-designers. A typical example of the role of the patron in introducing the Renaissance style to England is to be found in the quadrangle which John Caius added to Gonville college, now Gonville and Caius, at Cambridge (*q.v.*). Caius had spent a long time in Italy as well as elsewhere in Europe. The architecture of the new court was basically Tudor Gothic, but Caius planned three gateways in connection with the court, two of which were in the Italian style. The three gates were to mark the progress of the student through the university. At the entrance was the Gate of Humility, an unadorned doorway, now destroyed. The Gate of Virtue. opening into the new quadrangle, is a fine classic portal with Ionic pilasters, but with a Tudor Gothic many centred arch for the opening. Finally the Gate of Honour is a separate tiny triumphal arch leading out toward the schools for the final disputation and degree. Caius probably designed these gates with the aid of the Flemish architect Theodore de Have.

There was no religious architecture created in England during the 16th century, in part because of the break of Henry VIII with Rome. It is in the great country houses of the nobility that the Renaissance style is visible. Sir John Thynne, steward to the Lord Protector Somerset, designed several notable examples. The finest of these was his own house Longleat (1568–about 1580), on which he had the assistance of the mason Robert Smythson, who was to be the leading architect of the late 16th century. Except for the symmetry of the plan, arranged around two courts, there was little new in planning at Longleat, for the Tudor house was usually organized about a court. The typical English great hall at Longleat, was an element derived from the hall (*q.v.*) of the medieval castle, and retained in English architecture through the 16th century. The main entrance of the house opens directly into one end of the great hall, but a low screen at the end of the hall, topped by a musicians' gallery, forms a passageway. In elevation Longleat is a long horizontal building with a wealth of windows; it is one of the most open secular buildings in Europe of the 16th century. There is a rectangular quality about the whole exterior, which is characteristic of English architecture; it is augmented by the repeated use of the bay-window unit. There are now three stories on the exterior, with the correct classic superimposition of the Doric order on the ground floor and Ionic and Corinthian orders above, but the third story was probably added after Thynne's death in 1580, replacing a pitched roof and dormers.

Robert Smythson, who aided Sir John Thynne at Longleat, went on to design and build several notable houses, the finest being Wollaton hall (1580–88) near Nottingham. On his tomb Smythson is called "architector and surveyor," not merely a mason. Wollaton has a magnificent site set up on a small hill overlooking a large park. The plan of the house is a square with four, square, corner towers, resembling a plan in the treatise on architecture by the Italian architect Serlio, whose book was influential in English Renaissance architecture. The great hall is in the centre of the square; it rises an extra story above the whole building. The house has a low basement story that contained the kitchens and service rooms; it is one of the first buildings to use this arrangement, which became common in the history of later English and American architecture. On the exterior the massing is that of rectangular blocks, whose rectilinear quality is further emphasized by the numerous many-mullioned rectangular windows. The decoration is completely classic with superimposed pilasters, round arched niches and classic balustrades, but it shows touches of Italian mannerism, which came into England primarily from Flanders. The pilasters and half columns have raised bands across their middles, and the gables crowning the corner towers are decorated with Flemish strapwork (*i.e.*, bands raised in relief assuming curvilinear forms suggestive of leather straps).

Other examples of this style are Hardwick hall (1590–97) in Derbyshire probably by Smythson, Kirby hall (about 1570–78) in Northamptonshire perhaps by the mason Thomas Thorpe, and Montacute house (1588–1601) in Somerset.

With the possible exception of Robert Smythson, there are no important professional architects in England during the latter half of the 16th century. Once the surveyor John Thorpe mas considered the most prominent architect of the period, Wollaton hall and Kirby hall being attributed to him as well as most of the other notable houses. This opinion was based on the discovery in the 18th century of his notebook of 280 drawings illustrating all these houses, but investigation of his life proved that he was too young to be concerned with most of the buildings and that his notebook was merely a collection of representations of all the famous buildings of the time. It is possible that Thorpe intended

to prepare a book with representative examples of English architecture very much in the manner of the book prepared in France by Androuet du Cerceau. There were, however, some designs by Thorpe himself. One for his own house, presumably never built, was based in plan on his own initials I and T, and has the playful, abstract, unreal quality of mannerism.

John Shute, a miniaturist. published the first English treatise on architecture during this period of the English Renaissance. Entitled *The First and Chief Groundes of Architecture* (1563), the book is primarily concerned with the five orders and was derived from Vitruvius and Serlio but had almost no influence on the architecture of the time.

See also JACOBEAN STYLE.

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(D. R. CN.)

RENAISSANCE ART. The period extending roughly from 1300 to 1600 was, with much fanfare, declared by Italian historians of the time to mark the Renaissance, or rebirth, of the humanistic spirit of classical antiquity. The "barbaric and benighted" centuries that intervened were then designated the middle ages. These three centuries did indeed witness a change in the intellectual and aesthetic climate of Europe, spanning as they did the time from Thomas Aquinas to Descartes, Dante to Tasso, Chaucer to Milton, Giotto to Michelangelo, Gothic to baroque. According to these humanistic writers the Renaissance originated in Italy and later spread throughout Europe whenever and wherever Italian influence was felt; the period marked a revival of classical learning in the Greco-Roman manner; and there was a sharp shift from otherworldly religiosity to worldly psychology.

To accept such assertions uncritically would be highly misleading. All of Europe was undergoing a conscious departure from the prevailing standards of the middle ages. In the north the transition was not so abrupt as in Italy, but it came about none the less decisively as the age of scientific discovery overcame the medieval heritage of mysticism and superstition and brought about a new attitude toward life. Through the works of such artists as Grunewald, Durer, Cranach and Holbein men saw their environment through different eyes. If the change occurred more suddenly and explosively in Italy than elsewhere, it was perhaps because that country was closest to the Roman tradition in letters, building and crafts, all of which had never really died out, and because the Gothic, a northern style, was never particularly compatible with the sunny south and the volatile temperament of its people. Virgil and other Roman authors had continued to be read during the middle ages, and scholarship and learning can hardly be said to have languished in medieval universities. Ionic and Corinthian capitals appear quite regularly in Romanesque and Gothic architecture. classical molding ornaments (egg-and-dart, leaf-and-tongue) are frequently found, and Gothic sculptural figures are clothed in graceful classical flowing drapery (*see* GOTHIC ART).

While an increasingly secular spirit was apparent in the Renaissance, the majority of important buildings were still churches; statuary, paintings and music continued to be mainly religious in orientation.

In longer perspective, then, the Renaissance appears to be more a fermentation of ideas and a reorientation of scholarly and aesthetic thought than a rediscovery of ancient values and viewpoints. The period expressed itself in new ways, created new forms, invented new modes of representation and eventually arrived at a new understanding of the world. For convenience these tendencies can be grouped in such categories as Renaissance humanism. individualism and scientific naturalism.

Humanism.— It is a truism that every era finds what it wants in the classics. In literature and philosophy western Europe during the Renaissance veered away from a largely Roman orientation toward an inclusion of Greek studies, particularly the works of Homer and Plato. In Latin, however, humanists sought inspiration and models in the classical style of Cicero, Lucretius, Virgil and Tacitus rather than in the writings of the medieval church fathers. More broadly the humanists placed increasing emphasis on man and his values especially the dignity of man as realized in the study of the humanities rather than scholastic theology.

In architecture. humanism resulted in the study of Vitruvius' ancient treatises and in the careful measurement and observation of the surviving ancient monuments. The consequences can be seen in Brunelleschi's Pazzi chapel in Florence, which is a model of spatial clarity, crisp contours and the elegant use of classical decorative detail. The new architecture, as exemplified in the works and writings of Alberti, Bramante and Palladio reveals the correct yet imaginative use of the classical orders and an eye for just proportions. In design, humanism resulted in the turning away from medieval variants of such classical motives as acanthus leaves, Ionic volutes, bead-and-reel patterns toward more authentic versions based on the study of ancient examples. In painting it resulted in the study of Euclid's geometry for the mathematical laws of linear perspective, as well as the exploration of themes drawn from classical literary and mythological sources.

In sculpture humanism resulted in calm classical stances, figures clothed in authentic Roman togas and the rediscovery of the expressive power of the nude as revealed in the works of Donatello and Michelangelo.

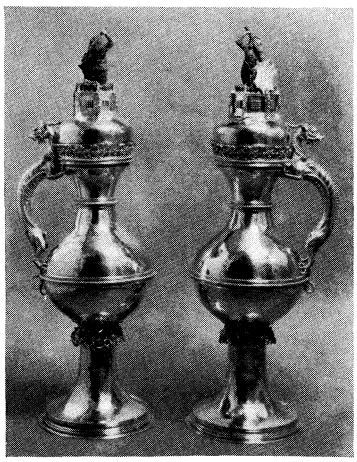
Individualism.— One manifestation of humanism was the establishment of man as the measure of all things. Such works as Pico della Mirandola's essay on the *Dignity of Man,* Machiavelli's *Prince* and Castiglione's *Courtier* emphasized the personal, political and social importance of man. Churches began to come under the direct patronage of individual families and to bear the names of their donors, as, for instance, the Scrovegni chapel in Padua, built and decorated by Giotto; the Brancacci chapel in Florence with murals by Masolino da Panicale and Masaccio; and the Church of S. Lorenzo in Florence with the Medici chapel by Michelangelo. Portraiture in painting assumed a position of major importance, and self-portraits by artists often were given considerable prominence in their religious and historical pictures. The social position of major individual artists was upgraded from that of an artisan to a place almost on a plane with that of their patrons.

Leonardo da Vinci insisted that painting, sculpture and architecture were truly liberal arts. and Michelangelo took pains to point out that he worked more with his brains than his hands. Individual artists became acutely conscious of their personal fame, and many achieved sufficient renown to become the subjects of biographies, such as those in Vasari's *Lives of the Most Eminent Painters, Sculptors and Architects* and the *Autobiography of Benvenuto Cellini.*

Scientific Naturalism.— In late Gothic sculpture, manuscript illuminations and tapestry designs there was a decreasing interest in allegory and moral preachments and an awakening to the beauties and delights of nature for their own sake. Artists began thinking more in terms of aesthetic problems than religious revelations. As with the nominalistic philosophy of William Ockham, personal observation was in ascendancy over the authoritarian view of scholasticism, interest in the natural world began to override that in the supernatural, and symbolism was superseded by accurate representation. A plant, in other words, was a plant, not a symbol of the a priori universal idea of plant as it existed in the mind of God, and the rendering of particular flora and fauna was based on nature. This visual revolution opened new vistas to Renaissance artists who proceeded to investigate optics, the mathematical bases of perspective drawing, the rational proportions of the human body, all with the idea of achieving a more natural way of representing the world of appearances. This phase of the Renaissance reached a climax in the scientific studies of Antonio Pollaiuolo and Verrocchio, who dissected cadavers in order to render more accurately the bone and muscle structure of the human body in action. It was this heritage they bequeathed to Leonardo da Vinci, whose *Notebooks* give evidence of his over-

RENAISSANCE ART

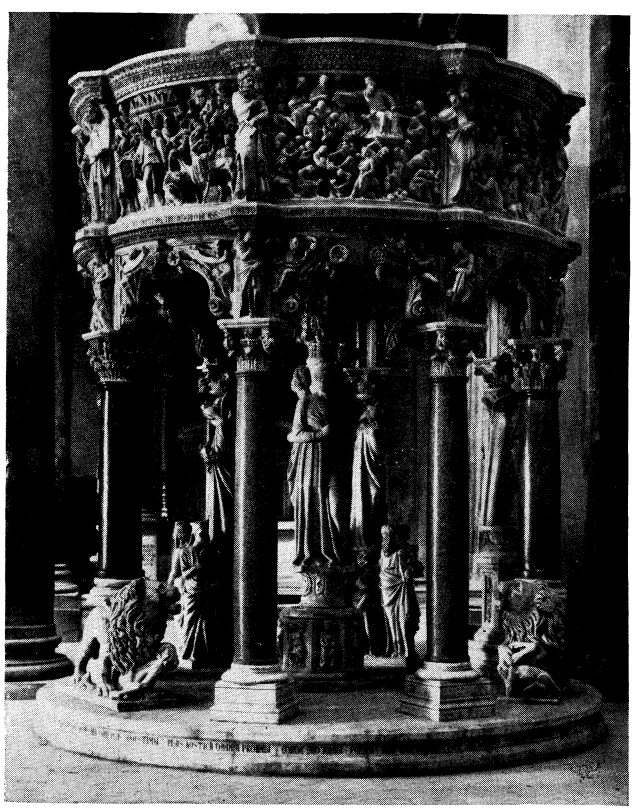
"Abraham Sacrificing Isaac," bronze relief by Filippo Brunelleschi (1377–1446); Italian. This bronze was entered in the competition for the design of the doors of the baptistery of San Giovanni, Florence (see picture at right). In the National museum, Florence



Silver gilt ewers with painted enamels; 25 in. high, 8¼ in. wide. German, 15th century. In the Metropolitan Museum of Art, New York

"Abraham Sacrificing Isaac," bronze relief by Lorenzo Ghiberti (1378–1455) which won for him the contract for the second bronze door of the baptistery of San Giovanni, Florence. In the National museum, Florence

Terra cotta bust of Lorenzo de' Medici by Andrea del Verrocchio (1435–1488); Italian. In the National Gallery of Art, Washington, D.C.



Marble pulpit in the baptistery, Pisa cathedral, completed in 1259, by Niccolò Pisano (*c.* 1220–c. 1283); Italian

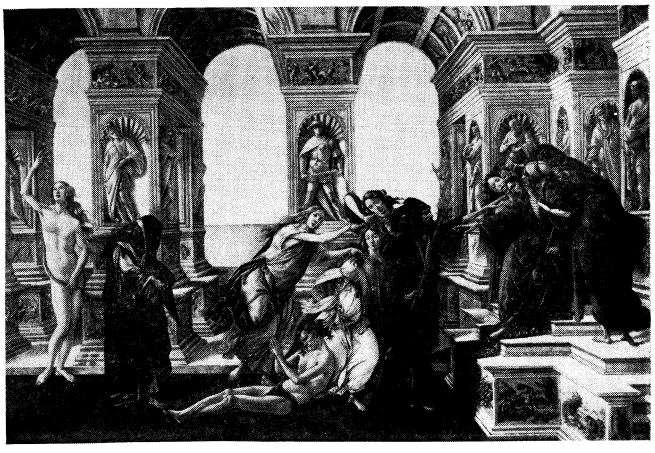
Court of the Medici-Riccardi palace, Florence, by Bartolommeo di Michelozzo (1396–1472); Italian

RENAISSANCE SCULPTURE, ARCHITECTURE AND SILVERWORK

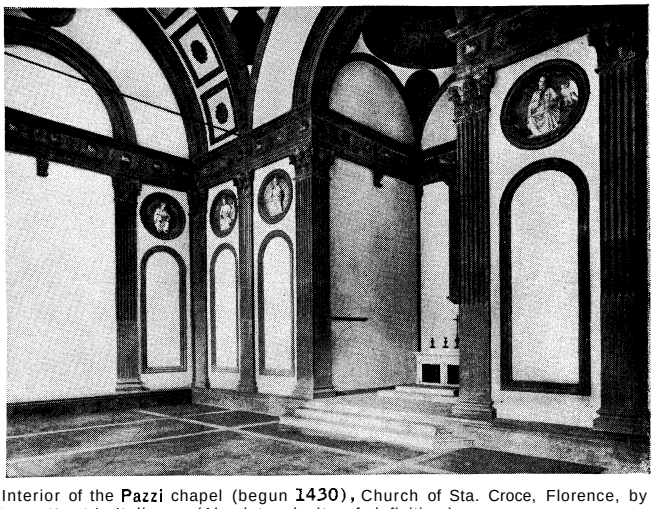
BY COURTESY OF (TOP CENTRE) THE METROPOLITAN MUSEUM OF ART, THE CLOISTERS COLLECTION, PURCHASE, 1953, (CENTRE) NATIONAL GALLERY OF ART, WASHINGTON, D.C., SAMUEL H. KRESS COLLECTION; PHOTOGRAPHS, (TOP LEFT, TOP RIGHT, BOTTOM LEFT, BOTTOM RIGHT) ALINARI

RENAISSANCE ART

"The Adoration of the Magi," woodcut by Albrecht Durer (1471–1528); German. (Linear technique.) In the Metropolitan Museum of Art, New York



"Calumny of Apelles" by Sandro Botticelli (1444–1510); Florentine. (Multiplicity of forms.) In the Uffizi gallery, Florence



Interior of the Pazzi chapel (begun 1430), Church of Sta. Croce, Florence, by Brunelleschi; Italian. (Absolute clarity of definition.)

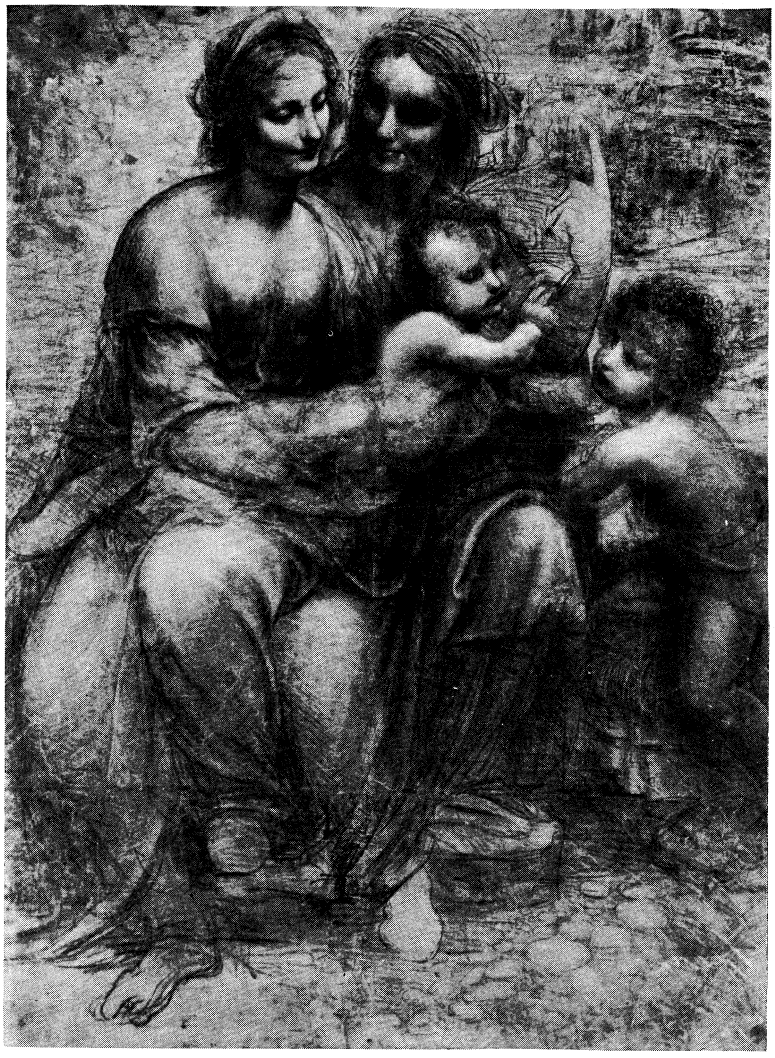
"The Last Supper" by Fra Angelico (Giovanni da Fiesole, 1387–1455); Italian. (Organization in planes.) In the Museum of S. Marco, Florence

"Birth of St. John" by Ghirlandajo (1449–1494); Florentine. (Closed, balanced form.) In the Church of Sta. Maria Novella, Florence

EXPRESSIONS OF THE RENAISSANCE STYLE

"Pietà" by Michelangelo Buonarroti **(1475-1564).** St. Peter's, Rome

"Death of St. Francis" by Giotto (1266/67?–1337). Bardi chapel, Sta. Croce, Florence



Study for "Madonna and Child with St. Anne," black-and-white chalk drawing by Leonardo da Vinci **(1452–1519).** Royal Academy of Arts, London

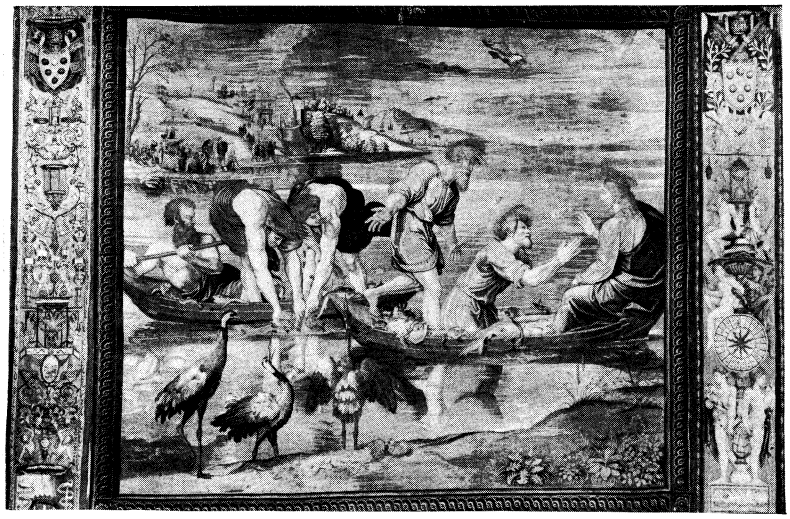
Detail of St. Peter and the tax collector from "The Tribute Money" by Masaccio **(1401–1428).** Brancacci chapel, Sta. Maria del Carmine, Florence

Detail of the second story of the Medici-Riccardi palace, Florence, by Bartolommeo di Michelozzo **(1396–1472)**

ITALIAN RENAISSANCE ART

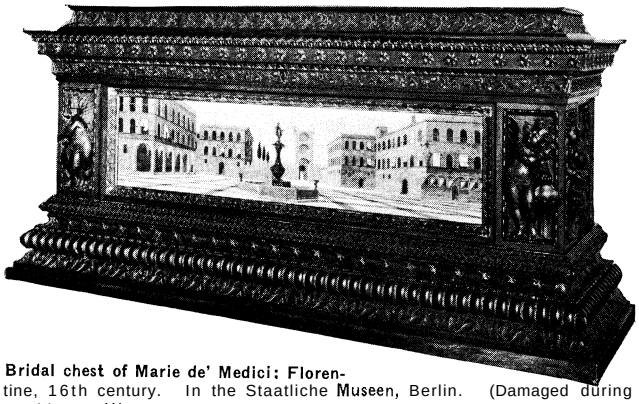
PHOTOGRPHS, (ALL EXCEPT BOTTOM LEFT) ALINARI (BOTTOM LEFT) ROYAL ACADEMY OF ARTS, LONDON

RENAISSANCE ART



"The Miraculous Fish," 16th century Belgian tapestry, probably woven by Pieter van Aeist, from the "Acts of the Apostles," a cartoon series by Raphael (1483–1520). In the Vatican gallery, Rome

"Prudence." sculptured plaque of enameled terra cotta by Luca della Robbia (*c.* 1399–1482); Florentine. In the Metropolitan Museum of Art, New York



Bridal chest of Marie de' Medici; Florentine, 16th century. In the Staatliche Museen, Berlin. (Damaged during World War II)

Triptych of The Deposition. Gilt and polychromed carved wood, with St. John the Baptist and donor (left) and St. Mary Magdalen and donor (right). Flemish, late 15th century. In the Waiters Art gallery, Baltimore, Md.

"St. Paul in Prison," tapestry woven from Raphael's series, "Acts of the Apostles"; Belgian, 16th century. In the Vatican gallery, Rome

MINOR ARTS OF THE RENAISSANCE

BY COURTESY OF (TOP RIGHT) THE METROPOLITAN MUSEUM OF ART, JOSEPH PULITZER BEQUEST, 1921, (CENTRE LEFT) STAATLICHE MUSEEN BERLIN, KUNSTGEWERBE-MUSEUM, (BOTTOM LEFT) WALTERS ART GALLERY, BALTIMORE PHOTOGRAPHS (TOP LEFT) ANDERSON ROME, (BOTTOM LEFT) ALINARI

whelming interest in science.

The disintegration of Renaissance art is first apparent in the work of the mannerists of the middle and late 16th century. The term Mannerism (*q.v.*) was coined to describe the work of certain artists who departed from accepted Renaissance ideals and emulated the manner rather than the spirit of the great masters — Leonardo, Michelangelo and Raphael. Mannerism had its origin in the psychological conflicts of the later works of the masters themselves, especially Michelangelo, who was torn between the pagan, Platonic ideal of classical beauty and the vigorous reaffirmation of traditional Christianity as exemplified in the Counter-Reformation movement.

Michelangelo's mannerism is expressed in the twisting. turning, writhing bodies of his slave figures for Julius II's tomb and in the implausible positions of the figures atop the Medici tombs, as well as in the brooding melancholy and resignation of the late "Pietà." In his architecture it is found in the Laurentian library where the eye is led simultaneously in divergent directions, where a juxtaposition of discordant elements prevails rather than a harmonious reconciliation of opposites and where there is a deliberate violation of the canons of proportion.

Later mannerist artists became the first to work largely within the shadow of the giants of the immediate past. Since they could not excel their predecessors either in technique or in grandeur of expression, they could only adopt some of their vocabulary and use it to startle the spectator and produce the unexpected. Tintoretto and Caravaggio performed daring feats of foreshortening, devised surprising multiple-perspective effects,and used chiaroscuro to create dramatic spotlighting. Parmigianino's "Madonna With the Long Neck," reveals human figures uith exaggerated oval faces, tapering fingers and willowy bodies. The sculptural equivalent is seen in the elegant elongation and winsome stance of Benvenuto Cellini's "Nymph of Fontainebleau," and in the airy grace and precarious balance of Giovanni da Bologna's bronze figure of "Mercury in Flight," whose winged foot is poised for a brief instant in his swift course. The stage was thus set for the emergence of a new style, the baroque. *See* BAROQUE ART.

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RENAIX (Flem. *Ronse*), town, province of East Flanders, Belgium, 8 mi. S. of Oudenarde, at the foot of the hills of Flanders. It has yielded many pre-Roman and Roman finds. There are manufactories for woollen and linen goods. Pop. (1955) 25,442.

RENAN, ERNEST (1823–1892), French philosopher and orientalist, was born on Feb. 27, 1823, at Tréguier. His father's people were of the fisher-clan of Renans or Ronans. He was only 5 years old when his father died, and his sister Henriette, 12 years older than Ernest, a girl of remarkable character, was henceforth morally the head of the household. Ernest was educated in the ecclesiastical college at Tréguier. In the summer of 1838 he carried off all the prizes at the college. Through his sister, who was teaching in Paris, Felix Dupanloup heard of him. and sent for him at once, and placed him in the new ecclesiastical college of St. Nicolas du Chardonnet. He then proceeded to study for the priesthood at the Seminary of Issy, then at St. Sulpice, and finally he found his way to Stavistas, a lay college of the Oratorians. He soon found himself torn between his desire to lead the life of a Catholic priest and his intellectual inability to accept in its entirety the ordinary presentation of Catholic doctrine, or to submit to ecclesiastical authority. Even at Stavistas he found himself too much under the domination of the church, and, after a few weeks there, he reluctantly broke the last tie which bound him to the religious life, and entered M. Crouzet's school for boys as an usher. There he made the acquaintance, in 1846, of the chemist Marcellin Berthelot, then a boy of 18. To the day of Renan's death their friendship continued. Renan was occupied as usher only in the evenings. In the daytime he continued his researches in Semitic philology. In 1847 he obtained the Prix Volney for his *General History of Semitic Languages.*

The revolution of 1848 confronted him with the problems of democracy. The result was an immense volume, *The Future of Science,* which remained in manuscript until 1890. *L'Avenir de la science* is an attempt to conciliate the privileges of a necessary *élite* with the diffusion of the greatest good of the greatest number. In 1849 the French government sent him to Italy on a scientific mission. In Italy the artist in him awoke and triumphed over the savant and the reformer. On his return to Paris Renan lived with his sister Henriette. A small post at the National library, together with his sister's savings, furnished him with the means of livelihood. In the evenings he wrote for the *Revue des deux mondes* and the *De'bats* the exquisite essays which appeared in 1857 and 1859 under the titles *Études d'histoire religieuse* and *Essais de morale et de critique.* In 1852 his book on *Averroès* had brought him not only his doctor's degree, but his first reputation as a thinker. In his two volumes of essays Renan shows himself a liberal, but no longer a democrat. Nothing, according to his philosophy, is less important than prosperity. The greatest good of the greatest number is a theory as dangerous as it is illusory. Man is not born to be prosperous, but to realize, in a little vanguard of chosen spirits, an ideal superior to the ideal of yesterday. Only the few can attain a complete development. Yet there is a solidarity between the chosen few and the masses which produce them; each has a duty to the other. The acceptance of this duty is the only foundation for a moral and just society. The aristocratic idea has seldom been better stated.

Renan now began to frequent more than one Parisian salon, and especially the studio of Ary Scheffer, whose niece and adopted daughter, Cornélie, he proposed to marry in 1856. Henriette consented not only to the marriage, but to make her home with the young couple, whose housekeeping depended on the sum that she could contribute. The history has been told by Renan in the memorial essay, *Ma Soeur Henriette.* In 1859 appeared his translation of the *Book of Job* with an introductory essay, followed in 1859 by the *Song of Songs.*

Renan was now a candidate for the chair of Hebrew and Chaldaic languages at the Collège de France. The Catholic party upheld by the empress, would not appoint an unfrocked seminarist, a notorious heretic, to a chair of Biblical exegesis. Yet the emperor wished to conciliate Ernest Renan. He offered to send him on an archaeological mission to Phoenicia. Leaving his wife at home with their baby son, Renan left France, accompanied by his sister, in the summer of 1860. Madame Renan joined them in January 1861, returning to France in July. The mission proved fruitful in Phoenician inscriptions which Renan published in his *Mission de Phénicie.* They form the base of his *Corpus Inscriptionum Semiticarum.* At Amshit, near Byblos, Henriette Renan died of intermittent fever on Sept. 24, 1861. Her brother, himself at death's door, was carried unconscious on board a ship waiting in harbour and bound for France. On Jan. 11, 1862, the Minister of Public Instruction ratified Renan's election to the chair of Hebrew. But his opening lecture, in which, amid the applause of the students, Renan declared Jesus Christ "an incomparable Man," alarmed the Catholic party. Renan's lectures were pronounced a disturbance of the public peace, and he was suspended. He refused the librarian's post he was offered in exchange, and thenceforth lived by his pen.

Vie de Jésus.—Henriette had told him to write the life of Jesus. They had begun it together in Syria, she copying the pages as he wrote them, with a New Testament and a *Josephus* for all his library. The book is filled with the atmosphere of the East. It is the work of a man familiar with the Bible and theology, and no less acquainted with the inscriptions, monuments, types and landscapes of Syria But it is scarcely the work of a great scholar. Renan still used his literary gifts to pursue a scientific ideal. He produced the *Apostles* in 1866, and *St. Paul* in 1869, after having visited Asia Minor with his wife. His object was "to evoke from the past the origins of Christianity." In *St. Paul,* as in the *Apostles,* Renan shows his concern with the larger social life, his

sense of fraternity, and a revival of the democratic sentiment which had inspired *L'Avenir de la science.*

The Franco-German War was a turning-point in Renan's history. Germany had always been to him the asylum of thought and disinterested science. Now his heart turned to France. In *La Re'forme intellectuelle ef morale* (1871) he endeavoured at least to bind her wounds, to safeguard her future. At the same time the irony always perceptible in his work grows more bitter. His *Dialogues philosophiques,* written in 1871, his *Ecclesiastes* (1882) and his *Antichrist* (1876) (the fourth volume of the *Origins of Christianity,* dealing with the reign of Nero) show a disenchanted and sceptical temper. Gradually he aroused himself from his disillusioned mood, and observed with genuine interest the struggle for justice and liberty of a democratic society. The fifth and sixth volumes of the *Origins of Christianity* (the *Christian Church* and *Marcus Aurelius*) show him reconciled with democracy, confident in the gradual ascent of man.

Later Works and Death. — In 1883 he .published *Souvenirs d'enfance et de jeunesse,* which have the Celtic magic of ancient romance and the simplicity, naturalness and veracity prized in the 19th century. But his *Ecclesiastes,* published a few months earlier, his *Drames philosophiques,* collected in 1888, give a more adequate image of his fastidious, critical, disenchanted, yet not unhopeful spirit. They show the attitude towards uncultured Socialism of a philosopher liberal by conviction, by temperament an aristocrat. We learn in them how Caliban (democracy), the mindless brute, educated to his own responsibility, makes after all an adequate ruler; how Prospero (the aristocratic principle, or, if we will, the mind) accepts his dethronement for the sake of greater liberty in the intellectual world: since Caliban proves an effective policeman, and leaves his superiors a free hand in the laboratory; how Ariel (the religious principle) acquires a firmer hold on life, and no longer gives up the ghost at the faintest hint of change. Religion and knowledge are as imperishable as the world they dignify. Thus out of the depths rises unvanquished the essential idealism of Ernest Renan.

At sixty years of age, having finished the *Origins of Christianity,* Renan began his *History of Israel (3* vol., 1887–91) based on a lifelong study of the Old Testament and on the *Corpus Inscriptionum Semiticarum,* published by the Académie des Inscriptions under his direction from the year 1881 till the end of his life. He died on Oct. 12, 1892.

There is no collected edition of Renan's works. There is an English translation of the *Vie de Jésus* in Everyman's Library (1927). His *Correspondance* has been edited in 2 vol. (Paris, 1926–28). For Henriette Renan *see* Prof. Giraud, *Soeurs de grands hommes* (1926) and Renan's *Lettres Intimes* (1923).

See Desportes and Bournand, *E. Renan, sa vie et son oeuvre* (1892); E. Grant Duff, *Ernest Renan, in memoriam* (1893); Séailles, *E. Renan, essai de biographie psychologique* (1894); *G.* Monod, *Les maîtres de l'histoire* (1894); Allier, *La Philosophie d'E. Renan* (1895); *M.* J. Darmesteter, *La vie de E. R.* (1898); Platzhoff, *E. Renan, ein Lebensbild* (1900); Brauer, *Philosophy of Ernest Renan* (1904); *W.* Barry, *Renan* (1905); Sorel, *Le Système historique de R.* (1905–06); J. M. Robertson, *Ernest Renan* (1924).

RENARD, ALPHONSE FRANÇOIS, (1842–1903), Belgian geologist, was born at Renaix on Sept. 27, 1842. His first work (with Charles de la Vallée-Poussin, 1827–1904) was the *Mémoire sur les caractères mineralogiques et stratigraphiques des roches dites plutoniennes de la Belgique et de l'Ardenne française* (1876). In later essays and papers he dealt with the structure and mineral composition of many igneous and sedimentary rocks, and with the phenomena of metamorphism in Belgium and other countries.

Still more important were Renard's later researches connected with the "Challenger" expedition (*q.v.*). The various rock specimens and oceanic deposits were submitted to him for examination in association with Sir John Murray, and their detailed observations were embodied in the *Report on the Scientific Results* of *the Voyage of H.M.S. ('Challenger." Deep Sea Deposits* (1891). The more striking additions to our knowledge included "the detection and description of cosmic dust, which as fine rain slowly accumulates on the ocean floor; the development of zeolitic crystals on the sea bottom at temperatures of 32° and under; and the distribution and mode of occurrence of manganiferous concretions and of phosphatic and glauconite deposits on the bed of the ocean" (Geikie). Renard was professor at the Jesuit College of Louvain and then at the University of Ghent.

Renard died at Brussels on July 9, 1903.

RENARD THE FOX: *see* REYNARD THE FOX.

RENAUD DE MONTAUBAN (Rinaldo di Montalbano), one of the most famous figures of French and Italian romance. His story was attached to the *geste* of Doon of Mayence by the 13th-century *trouvère* who wrote the *chanson de geste* of *Renaus de Montauban,* better known perhaps as *Les quatre fils Aymon.* The four sons of Aymon give their name to inns and streets in nearly every town of France, and Renaud's sword Floberge, and his horse Bayard passed with him into popular legend. The poem opens with the dissensions between Charlemagne and the sons of Doon of Mayence, Beuves d'Aigremont, Doon de Nanteuil and Aymon de Dordone.

The rebellious vassals are defeated by the imperial army near Troyes, and, peace established, Aymon rises in favour at court, and supports the emperor, even in his persecution of his four sons, Renaud, Alard, Guichard and Richard. At the end of the usual series of violent adventures and catastrophes, Renaud gives himself up to religion, working as a mason on the church of St. Peter at Cologne. where he receives martyrdom at the hands of his jealous fellow labourers.

The connection of the four brothers with Moritessor, Dortmund, Mayence and Cologne, and the abundant local tradition, mark the heroes as originating from the region between the Rhine and the Meuse. Nevertheless, their adventures in Gascony, with the king of which they take service against the Saracens, are corroborated by historical evidence. and this section of the poem is the oldest. The enemy of Renaud was Charles Martel, not Charlemagne; King Ton was Odo of Gascony; the victory over the Saracens at Toulouse, in which the brothers are alleged to have taken part, was won by him in 721, and in 719 he sheltered refugees from the dominions of Charles Martel, Chilperic II, king of Neustria, and his mayor of the palace, Raginfred, whom he was compelled to abandon.

In a local chronicle of Cologne it is stated that St. Reinoldus died in 697, and in the Latin rhythmical *Vita* his martyrdom is said to have taken place under Bishop Agilolf (d. 717). Thus the romance was evidently composite before it took its place in the Carolingian cycle.

In Italy Renaud had his greatest vogue, and many episodes were added, as well as the personage of the hero's sister, Bradamante. Rinaldo di Montalbano had been the subject of many Italian poems before *Il Rinaldo* of Tasso.

BIBLIOGRAPHY.—The *chanson* of *Maugis d'Aigremont* and the prose romance of the *Conqueste de Trebizonde* belong to the same cycle. The prose *Ystoire de Regnault de Montauban* (Lyons, *c.* 1480) had a great vogue. It was generally printed as *Les quatre fils Aymon,* and was published in English, *The Foure Sonnes of Aymon,* by William Caxton, and subsequently by Wynkyn de Worde and William Copland. See *Hist. litt. de la France,* xxii., analysis by Paulin Paris; *Renaus de Montauban* (Stuttgart, 1862), ed. H. Michelant; *Storia di Rinaldino,* ed. C. Minutoli (Bologna, 1865); F. Wulff, *Recherches sur les sagas de Magus et de Geirard* (Lund, 1873); *Renout von Montalbaen,* ed. J. C. Matthis (Groningen, 1873); *Magus saga,* ed. *G.* Cederschiöld (Lund, 1876); A. Longnon, in *Revue des questions historiques* (1879); R. Zwick, *Uber die Sprache des Renaut von Montauban* (Halle, 1884); *The Four Sonnes of Aimon* (E. E. Text Soc., ed. Octavia Richardson, 1884); F. Pfaff, *Das deutsche Volksbuch von den Heymonskindern* (Freiburg im Breisgau, 1887), with a general introduction to the study of the saga; a special bibliography of the printed editions of the prose romance in L. Gautier's *Bibl. des chansons de geste* (1897); reinventions of the story by Karl Simrock (Frankfurt, 1845), and by Richard Steele (1897).

RENAUDOT, THÉOPHRASTE (1586?–1653), French physician, philanthropist, journalist, founder of the first French newspaper and friend of Richelieu, was born at Loudun (Poitou). He studied surgery in Paris and, when only 19, he received, by favour apparently, the degree of doctor at Montpellier.

In 1612 Renaudot was summoned to Paris by Richelieu and was appointed to organize a scheme of public assistance. Many difficulties were put in his way, however, and until 1625 he spent most of his time in Poitou. In 1630 Renaudot. as commissary general of the poor, opened in Paris a *bureau d'adresse,* a com-

bined labour bureau, intelligence department, exchange and charity organization, which directed indigent sick persons to doctors prepared to give them free treatment. Renaudot established (1635) a free dispensary, despite the opposition of the ultra-conservative medical faculty in Paris, which refused to accept the new medicaments he proposed and restricted themselves to the old prescriptions of bloodletting and purgation. Under the protection of Richelieu, Renaudot started the first French newspaper, the *Gazette* (1631; *see* NEWSPAPER). In 1637 he was authorized to add pawnbroking to the activities of the bureau, and the first pawn shops were opened.

The medical faculty campaign against Renaudot, headed by Guy Patin, was prosecuted with increased vigour after the deaths of Richelieu and Louis XIII, and eventually he was denied the right to practise medicine in Paris. The *Gazette* remained to him, however, and in 1646 he was appointed by Mazarin historiographer to the king.

Renaudot died on Oct. 25, 1653.

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RENAULT, BERNARD (1836–1904), French paleobotanist who made many fundamental contributions to knowledge of the structure of Carboniferous plants, was born on March 4, 1836, at Autun. After graduating from Autun college in 1855, he entered the Institut Brenot at Dijon, where he became professor of chemistry and physics. He received the degree of doctor of physical science at Paris in 1867. Meanwhile, Renault had begun as a hobby the study of plant fossils.

In 1872 Renault became *préparateur* in the Paris Natural History museum and, in 1876, assistant naturalist, a post he held until his death in Paris on Oct. 16, 1904.

One of his early papers described the remarkable anatomy of the stem of *Sphenophyllum* (wedge grass). He discovered the fern genus *Botryopteris* and established the family Botryopteridaceae. He discovered *Poroxylon* and, in 1879, published an account of cordaitean (ancient seed plant) structure in *Structure comparée de quelques tzges de la flore carbonifère*. Renault hypothesized that certain Paleozoic seed plants had motile sperm, structures thought at the time to be exclusively cryptogamic (nonseed-bearing). He also investigated fossil microorganisms. Renault's larger works include *Bassin houiller et permien d'Autun et d'Épinac: flore fossile* (1893–96), treating, especially, the internal structure of all groups of Paleozoic plants, and *Cours de botanique fossile fait au Muséum d'histoire naturelle* (1881–85), a series of lectures.

Accounts of Renault are given by D. H. Scott in *Jour. Roy. Micro. Soc.*, pp. 129–145 (1906), and in A. Roche, *Biographie de Bernard Renault* (1905), the latter listing Renault's more than 200 publications. (J. W. TT.)

RENAULT, LOUIS (1843–1918), French jurist who in 1907 was awarded a Nobel peace prize for his services to international law, was born on May 21, 1843, at Autun. From 1868 to 1873 he was professor of Roman and commercial law at the University of Dijon. From 1873 until his death he was professor in the faculty of law at the University of Paris, where in 1881 he became professor of international law. In 1890 he was appointed jurisconsult of the ministry of foreign affairs, a post specially created for him, and thereafter French foreign policy was scrutinized by him in the light of international law. He served at numerous conferences in this capacity, notably at the two Hague conferences in 1899 and 1907, and at the London naval conference of 1908–09.

Renault was prominent as an arbitrator, his more famous cases being the Japanese House Tax case of 1905, the Casa Blanca case of 1909, the Sawarkar of 1911, the Carthage of 1913 and the Manouba of the same year. Among his writings are numerous articles and monographs on the specialized topics of international law. Together with his friend and colleague, C. Lyon-Caen, he produced a compendium of commercial law in two volumes, a treatise in eight volumes, and a manual which ran to many editions.

In 1879 Renault published his *Introduction to the Study of International Law*, and in 1917 *The First Violations of International Law by Germany*, concerning the invasion of Belgium and Luxembourg in breach of Germany's treaty obligations. He died on Feb. 7, 1918, at Barbizon. (E. H. LD.)

RENDERING, ARCHITECTURAL: *see* ARCHITECTURAL RENDERING.

RENDSBURG, a town in *Land* of Schleswig-Holstein, Germany, on the Eider and on the Kaiser Wilhelm canal, 20 mi. W. of Kiel, on the Altona-Flensburg railway. Pop. (1950) 36,991. Rendsburg came into existence under the shelter of a castle founded by the Danes about the year 1100 and was an object of dispute between the Danish kings and the counts of Holstein. In 1252 it was adjudged to the latter and the town was surrounded with ramparts in 1539. The war of 1848–50 began with the capture of Rendsburg by the Holsteiners and it formed the centre of the German operations. In Nov. 1863 the town was occupied by the Saxon troops acting as the executive of the German Confederation, and it was the base of the operations of the Austrians and Prussians against Schleswig in the spring of the following year. Rendsburg was jointly occupied by Austrian and Prussian military until 1866, when it fell to Prussia. It consists of three parts—the crowded Altstadt, on an island in the Eider; and new towns on the north and south banks of the river. Its importance rests on the commercial facilities afforded by its connection with the North sea and the Baltic through the Kaiser Wilhelm canal, by which transit trade is carried on in grain, timber, Swedish iron and coals. The principal products are dyes, iron, artificial manures, machines and tobacco.

RENÉ I (1409–1480), duke of Anjou, of Lorraine and Bar, count of Provence and of Piedmont, king of Naples, Sicily and Jerusalem, was born at Angers on Jan. 16, 1409, the second son of Louis II, king of Sicily, duke of Anjou, count of Provence, and of Yolande of Aragon. By his marriage treaty (1419) with Isabella, elder daughter of Charles II, duke of Lorraine, the comte de Guise, as he then was, became heir to the duchy of Bar, which was claimed as the inheritance of his mother Yolande, and in right of his wife, heir to the duchy of Lorraine. René, then only ten, was to be brought up in Lorraine under the guardianship of Charles II and Louis, cardinal of Bar, both of whom were attached to the Burgundian party, but he retained the right to bear the arms of Anjou. When Louis of Bar died in 1430 René came into sole possession of his duchy; and in the next year, on Charles II's death, he succeeded to the duchy of Lorraine. But the inheritance was claimed by the heir-male Antoine de Vaudémont, who with Burgundian help defeated René at Bulgnéville in July 1431. The duchess Isabella effected a truce with Antoine de Vaudémont, but the duke remained a prisoner of the Burgundians until April 1432, when he recovered his liberty on parole on yielding up as hostages his two sons, John and Louis of Anjou. His title as duke of Lorraine was confirmed by his suzerain, the emperor Sigismund, at Basle in 1434. This proceeding roused the anger of the Burgundian duke Philip the Good, who required him early in the next year to return to his prison, from which he was released two years later on payment of a heavy ransom. He had succeeded to the kingdom of Naples through the deaths of his brother Louis III and of Joanna II (of Durazzo), queen of Naples, the last heir of the earlier dynasty. Louis had been adopted by her in 1431, and she now left her inheritance to René.

The marriage of Mary, daughter of Charles I of Bourbon and niece of Philip of Burgundy, with John, duke of Calabria, René's eldest son, cemented peace between the two princes. After appointing a regency in Bar and Lorraine, he visited his provinces of Anjou and Provence and in 1438 set sail for Naples, which had been held for him by the duchess Isabella. In 1441 Alphonso of Aragon laid siege to Naples, which he sacked after a six months' siége. René returned to France in the same year; and though he retained the title of king of Naples his effective rule was never recovered.

René took part in the negotiations with the English at Tours in 1444, and peace was consolidated by the marriage of his younger daughter, Margaret, with Henry VI at Nancy. René now made over the government of Lorraine to John, duke of Calabria, who

was, however, only formally installed as duke of Lorraine on the death of Queen Isabella in 1453. René had the confidence of Charles VII of France (who had married his sister, Mary of Anjou) and is said to have initiated the reduction of the men-at-arms set on foot by the king. with whose military operations against the English he was closely associated. He entered Rouen with him in Nov. 1449 and was also with him at Formigny and Caen.

After his second marriage (1454) with Jeanne de Laval. daughter of Guy XIV, count of Laval, and Isabella of Brittany, René took a less active part in public affairs and devoted himself more to artistic and literary pursuits. In 1453 he made an unsuccessful attempt on northern Italy. In 1467 his son John took Barcelona from John II of Aragon and held it till his death in 1470 *(see* ANJOU).

The king of Sicily's fame as an amateur of painting has led to the attribution to him of many old paintings in Anjou and Provence, in many cases simply because they bear his arms. These works are generally in the Flemish style and were probably executed under his patronage and direction, so that he may be said to have formed a school of fine arts in sculpture, painting, gold work and tapestry. Two of the most famous works once attributed to René are the triptych, the "Burning Bush," in the cathedral of Aix, showing portraits of René and his second wife, Jeanne de Laval, and an illuminated Book of Hours in the Bibliothèque Nationale, Paris. The "Burning Bush" was in fact the work of Nicolas Froment of Avignon. Among the men of letters attached to René's court was Antoine de la Sale, whom he made tutor to his son, the duke of Calabria. He encouraged the performance of mystery plays: On the performance of a mystery of the Passion at Saumur in 1462 he remitted four years of taxes to the town; and the representations of the Passion at Angers were carried out under his auspices. He exchanged verses with his kinsman Charles of Orléans. The best of his poems is the idyll of Regnault and Jeanneton, representing his courtship of Jeanne de Laval. Le *Livre des tournois,* a book of ceremonial, and the allegorical romance, *Conqueste qu'un chevalier nommé le Cuer d'amour espris feist d'une dame appelée Doulce Mercy,* with other works, were perhaps dictated to his secretaries or compiled under his direction. He died on July 10. 1480.

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RENEE OF FRANCE (1510–1575), second daughter of Louis XII and Anne of Brittany. was born at Blois on Oct. 25, 1510. After being betrothed successively to Gaston de Foix, Charles of Austria (the future emperor Charles V), his brother Ferdinand, Henry VIII of England, and the elector Joachim II of Brandenburg, she married in 1528 Hercules II of Este, son of the duke of Ferrara, who succeeded his father six years later. Renée's court became a rendezvous of men of letters and a refuge for the persecuted French Calvinists. She received Clément Marot and Calvin at Ferrara, and finally embraced the reformed religion. Her husband, however. who viewed these proceedings with disfavour, banished her friends, took her children from her, threw her into prison. and eventually made her abandon at any rate the outward forms of Calvinism. After his death in 1559, Renée returned to France and turned her duchy of Montargis into a centre of Protestant propaganda. During the wars of religion she was several times molested by the Catholic troops, and in 1j6z her château was besieged by her son-in-law, Francis, duke of Guise. She died at Montargis.

See B. Fontana, *Renata di Francia* (Rome, 1889 *seq.)*; and *E.* Rodocanachi, *Renée de Prance* (Paris, 1896).

RENFREW, a royal and small burgh and the county town of Renfrewshire, Scot., near the south bank of the Clyde, 5½ mi. W. by N. of Glasgow by road. A small part of the parish of Govan is included in the burgh boundaries. Pop. (1951) 17,091. Industries include large shipbuilding works, engineering and the manufacture of rubber and paint. The Clyde trust has constructed a large dock and there is a ferry to Yoker. South of the town is the municipal aerodrome and civil airport. Robert III gave a charter in 1396, but it was a burgh (Renifry) at least 250 years earlier. Close to the town, on the site of Elderslie house, Somerled. lord of the Isles, was defeated and slain in 1164 by the forces of Malcolm IV. against whom he had rebelled. Robert III bestowed upon his son James (afterward James I of Scotland) the title of baron of Renfrew, still borne by the eldest son of the sovereign.

RENFREWSHIRE, a southwestern county of Scotland, bounded north by the river and Firth of Clyde, east by Lanarkshire. south, southwest and west by Ayrshire and northwest by the Firth of Clyde. The county has an area of 224.7 sq mi. The surface is low and undulating, except toward the Ayrshire border on the west, where the principal height is the hill of Stake (1,711 ft.) and the confines of Lanarkshire on the southeast, where a few points attain a height of 1,100 ft. The southwestern hills are formed of volcanic rocks, basalts, porphyrites, tuffs and agglomerates of the age of the Calciferous Sandstone series. Practically all the area west of these rocks is occupied by the Carboniferous Limestone series. Boulder clays and glacial gravels and sands cover extensive areas. Much of the higher land in the centre is well wooded. In the northwest Loch Thom and Gryfe reservoir provide Greenock with water, and southeast of Barrhead Balgray reservoir and Glen reservoir reinforce the water supply of the Glasgow area. Castle Semple loch and other lakes are situated in the south and southeast. Strathgryfe is the only large vale in the shire; the scenery at its head is wild and bleak, but the lower reaches are pasture land. The wooded ravine of Glenkilloch, to the south of Paisley, is watered by Killoch burn, on which are three falls.

Greenock. Gourock, Wemyss bay and Inverkip are holiday resorts on the northwestern coast of the county.

History.—At the time of the Roman advance from the Solway the land was peopled by the British tribe of Damnonii. To hold the natives in check the conquerors built in 84 the fort of Vanduara on high ground now covered by houses and streets in Paisley; but after the Romans retired (410) the territory was overrun by Cumbrian Britons and formed part of the kingdom of Strathclyde, the capital of which was situated at Alclyde, the modern Dumbarton. In the 7th and 8th centuries the region practically passed under the supremacy of Northumbria, but in the reign of Malcolm Canmore became incorporated with the rest of Scotland. During the first half of the 12th century, Walter Fitzalan, high steward of Scotland, ancestor of the royal house of Stuart, settled in Renfrewshire on an estate granted to him by David I. Until their accession to the throne the Stuarts identified themselves with the district, which, however, was only disjoined from Lanarkshire in 1404. In that year Robert III erected the barony of Renfrew and the Stuart estates into a separate county, which, along with the earldom of Carrick and the barony of King's Kyle (both in Ayrshire), was bestowed upon his son, afteruard James I. From their grant are derived the titles of earl of Carrick and baron of Renfrew, borne by the eldest son of the sovereign. Apart from such isolated incidents as the defeat of Somerled near Renfrew in 1164, the battle of Langside in 1568 and the capture of the 9th earl of Argyll at Inchinnan in 1685, the history of the shire is scarcely separable from that of Paisley or the neighbouring county of Lanark.

Agriculture **and** Industries.— The hilly tract contains much peat moss and moorland, but over those areas which are not thus covered the soil. which is a light earth on a substratum of gravel, is deep enough to produce good pasture. In the undulating central region the soil is better. particularly in the basins of the streams, while on the flatlands adjoining the Clyde there is a rich alluvium which, intensively used for arable and horticultural cropping as well as dairying, yields heavy crops. Near the populous centres some orchards and market gardens are found, and an increasing acreage is under wood. Most of the cattle are maintained in connection with dairying. Sheep farming, though on the increase, is

not so important as in the other southern counties of Scotland and pig raising is on the decline.

In point of commercial and manufacturing importance Renfrewshire is second only to Lanark. Granite. limestone and sandstone are quarried. The thread industry at Paisley is very extensive. Cotton and flax spinning, printing, bleaching and dyeing are carried on at Paisley, Renfrew, Barrhead and elsenhere; noollens and worsteds are produced at Greenock and Renfrew. Engineering works and iron foundries are at Greenock, Port Glasgow, Paisley. Renfrew. Barrhead and Johnstone Sugar is a staple article of trade in Greenock and there are chemical works at Cathcart. Paisley, Hurlet and Nitshill. Tin boxes are manufactured and tin is printed at Greenock Jams and preserves are processed at Paisley. Shipbuilding is especially important at Greenock and Port Glasgoxv. Paper mills are established in Johnstone and Linwood There are tanning industries at Paisley, Bridge of Weir and Barrhead. Numerous miscellaneous industries — such as the making of starch, cornflour, earthenware and soap are important in Paisley and elsenhere.

Trade and fisheries are centred at Greenock. Barytes and fireclay are mined and there are limestone and sandstone quarries.

The trading estate at Hillington. 2½ mi. east of Paisley. nas the first to be established in Scotland as part of a plan to attract new industries to the area. The municipal aerodrome and civil airport, near Renfrew and about 7 mi. west of central Glasgow, serves all parts of the world.

Population and Administration. — The population in 1961 was 338.815 Thus. though the shire is only 27th in point of size of the 33 Scottish counties, it is fourth in population. The large burghs are Paisley (1961 pop 95,753), Greenock (74,578), Port Glasgow (22 551) (*qq.v.*). The small burghs are Johnstone (*q.v.;* 18 369). Barrhead (14,442), Gourock (*q.v.;* 9,609) and Renfrew (*q v ;* 1'7.946). which is the only royal burgh. There are five county districts.

The shire returns one member to parliament for the eastern, and another for the western division. Paisley and Greenock each return one member. Renfrewshire forms a sheriffdom with Argyll. and there is a resident sheriff-substitute at Paisley and one at Greenock.

RENI, GUIDO (1575–1642), painter and engraver of the Bolognese school, the great precursor of neoclassicism, was born on Nov. 4. 1575, at Bologna. At the age of ten he entered the studio of Denis Calvaert, a Flemish painter. At 20 he was attracted by the anti-Manneristic novelty of the Carracci family and joined their "Academy of the Natural." In his early years Guido was not precocious. He trained himself by copying from Annibale Carracci, from plaster reproductions of classical pieces and from the St. Cecilia of Raphael. In 1599 he was received into the guild of painters. Between 1600 and 1601 Guido mas in Rome, where a few years later he opened a studio of his own. The most important work to survive from this first period in Rome is the "Crucifixion of St. Peter" (Vatican). In 1604 Guido was in Bologna, collaborating in the painting of frescoes in the cloisters of S. Michele in Bosco In 1607 he was back in Rome, sent for by Pope Paul V to paint the Vatican frescoes of the "Nozze Aldobrandine" and "Le Dame" (1608). He entered the service of Scipione Cardinal Borghese and painted for him the fresco "St. Andrew's Progress to the Gallons" (1608) in the chapel of S. Gregorio Magno al Celio and "The Eternal Father and the Minstrel Angels" in the chapel of S. Silvia. Guido surrounded himself with helpers — Lanfranco. Albani. Gessi, Antonio Carracci, Cavedone. Sementi—who were fascinated by his noble if somenhat tyrannical personality. The frescoes illustrating the stories of the Virgin in the pontifical chapel in Montecavallo (Palazzo Quirinale) date from 1610 and. though not the best knonn, are perhaps the most poetic of his frescoes. Following some quarrels with the pope's treasurer. Guido returned to Bologna; but. recalled to Rome by the pope himself in 1612. he finished some frescoes in the pontifical chapel of Sta. Maria Maggiore. Between 1613 and 1614 followed the celebrated fresco "Phoebus and the Hours preceded by Aurora' in the Borghese garden house (now Palazzo Rospigliosi). In 1614 Guido was again in Bologna and painted the fresco "The Glory of St. Domenic" in the church of the same name. From 1617 to 1621 he worked at the Mantuan court of Duke Ferdinand Gonzaga (four paintings of the "Labours of Hercules," non at the Louvre, Paris). In' 1622 he went to Naples to paint the frescoes of the treasury of S. Gennaro, but. having quarreled with his patrons he returned to Rome almost at once, leaving behind his pupils Gessi and Sementi, whom he had employed the previous year for the painting of the frescoes in the Chapel of the Sacrament of Ravenna cathedral. The last documented visit to Rome is in 1627. He settled down in Bologna, mhere from around the year 1630 began a decade in which his art was shown to the greatest perfection, starting with the famous "Madonna With Rosary" (Bologna) He died on Aug. 18, 1642. in Bologna and is buried in S. Domenico.

Highly praised by his contemporaries and subsequently by all defenders of the Academy up to the neoclassicists, above all in France. Guido, like Raphael and the classicists, came under the condemnation of the romanticists and the epoch of Ruskin. By the middle of the 20th century art criticism had studied afresh Guido's personality, making a better appraisal of 17th-century "Academism." in a new historical perspective. In Rome, the main inspiration for Guido's art was the Raphael frescoes and the

CULVER SERVICE

"PHOEBUS AND THE HOURS, PRECEDED BY AURORA." FRESCO BY GUIDO RENI. IN THE PALAZZO ROSPIGLIOSI, ROME

archaeological marbles, the Niobe and the Laocoon, and he stands apart from the baroque art of his day. His striving is toward a harmony of statuary, classical and elusive at the same time, in which reality is presented in idealized proportions. But since Guido works toward classicism in a period from which classical traits are absent, he remains isolated, far removed from the realistic optimism in Rome from which were to spring the baroque forms of art.

For Guido, the classical ideal becomes a feeling for beauty as the very stuff of poetry. The greatness of Guido lies in the manner in which he evokes the musical harmony of this myth of beauty, filling it with the altogether modern sentiment of nostalgia. The creative process is calm and serene, just as are the studied softness of colour and form. Guido's feeling of melancholy was, however, soon to become debased into sentimentalism and mannerized religiosity.

Other major works by Guido Reni are to be found in the galleries and churches of Bologna, Rome, Naples, Siena and Crema in Italy, in the Louvre, Paris, in the National gallery, London, at Dulwich, London, and in the Kunsthistorisches museum, Vienna.

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RENKUM, a municipality of the Netherlands, situated 2½ mi. W. of Arnhem (*q.v.*) on the Utrecht road and comprising the villages of Oosterbeek (the local government centre), Renkum, Doorwerth, Heelsum and Wolfheze. Pop. (1947) 11,458; (1957) 27,382 (mun.). Area 18½ sq.mi.

A tourist and international conference centre in beautiful surroundings, it was especially associated with the battle of Arnhem in World War II; on the Oosterbeek village green is the Airborne memorial put up by the Dutch in memory of the British airborne forces. The Arnhem-Oosterbeek war cemetery is outside the town and Castle Doonverth is now the Airborne museum. Renkum is linked by road and rail with main towns. Local industries include rubber, paper and brickmaking.

RENNELL, JAMES RENNELL RODD, 1ST BARON (1858–1941), British diplomatist, ambassador in Rome when Italy entered World War I, was born in London on Nov. 9, 1858. He was educated at Haileybury and Balliol college, Oxford, where he won the Newdigate prize (1880) for English verse. He entered the diplomatic service in 1884 and was sent to Berlin, where he wrote a biography of the German emperor Frederick III. The accuracy of this, when published in 1888, much annoyed the new emperor William II. In spite of this, Rodd's career was highly successful. After holding appointments in Rome, Paris and Zanzibar, he became in 1894 second-in-command to Lord Cromer in Cairo, Egy. For his work there, particularly during the Fashoda crisis, he was knighted in 1899. He was ambassador in Rome from 1908 to 1919, retiring from the diplomatic service in 1921. He was Conservative member of parliament for St. Marylebone, 1928–32, and was raised to the peerage in 1933. He died at Shamley Green, Surrey, July 26, 1941. He published works on classical Greece and Renaissance Italy, and *Social and Diplomatic Memories,* 3 vol. (1922–25). (R. N. W. B.)

RENNENKAMPF, PAUL (1854–1918), Russian general, was born on April 17, 1854. He entered the army in 1873 and in 1882 was appointed to the general staff. Promoted to the rank of general in 1900, he distinguished himself in the Russo-Japanese War (1904–05). In 1913 he was appointed to command of the troops in the Vilna military district. In Aug. 1914, he commanded the northern army which invaded East Prussia. His inaction during the battle of Tannenberg, where the southern army under Alexander Samsonov was destroyed on Aug. 26–29. was a bitter disappointment, and he was even suspected of treachery.

Personally brave, Rennenkampf, as an army commander, showed himself in the strategic sphere alternately rash and timid, because of his inability to grasp the situation as a whole. At the beginning of 1915 he was recalled, and later under pressure of public indignation was dismissed from the service. Rennenkampf was killed at Taganrog by the Bolsheviks in 1918.

RENNER, KARL (1870–1950), Austrian politician, was born on Dec. 14. 1870, the son of a peasant, at Dolni-Dunajovice (Unter-Tannowitz), Moravia.

Renner studied law at the University of Vienna and early attached himself to the Social Democratic party. He advocated the transformation of the Habsburg empire into a federal democratic commonwealth based on equal political and cultural rights for all nationalities. He was elected deputy to the Austrian *reichsrat* (parliament) in 1907 and, after the collapse of the empire, he became, on Nov. 12, 1918, the first chancellor of the Austrian republic. He then supported the idea of a union of Austria with a democratic federal Germany.

Renner was largely responsible for the decrees of the *nationalrat* (lower chamber) which called for the dethronement of the dynasty of Habsburg-Lorraine and the banishment of all members of this house if they did not submit entirely to the laws of the republic, and he was in charge of the negotiations which led to the former emperor Charles's leaving Austria in March 1919.

On May 12, 1919, Renner went to Paris as head of the Austrian delegation to receive the conditions of peace. As the foreign minister, Otto Bauer (*q.v.*), resigned rather than take the responsibility for certain provisions of the treaty, Renner took over the conduct of foreign affairs and on Sept. 10, 1919, signed the Treaty of St. Germain by which Austro-German union *(Anschluss)* was prohibited.

The first coalition ministry had been succeeded in Oct. 1919 by a second, in which Renner was again chancellor and secretary for foreign affairs. Relations between the Austrian government and Hungary, which since the regime of the revolution had been succeeded by a reaction, were very strained. Renner, who as a Social Democrat, was inimical to the nationalist Hungarian government, refused to grant demands put forward to extradite the Hungarian revolutionaries who had fled to Vienna. This brought him into conflict with the Christian Democrats and their representatives in the cabinet. The coalition dissolved in June; but Renner remained in charge of foreign affairs until Oct. 1920. When in 1930 the Social Democrats became the stronger party, Renner was elected president of the *nationalrat;* he resigned in 1933.

After the annexation of Austria to Germany in 1938, Renner remained unmolested. In a public statement a few days before the plebiscite of April 10, 1938, he had recalled that he had already supported the *Anschluss* idea in 1918.

After the occupation of Vienna by the Soviet army, Renner obtained approval from, the Russians for the formation of an Austrian democratic government and on April 29, 1945, became chancellor of the second Austrian republic. On Dec. 20, 1945, the newly elected *nationalrat* nominated him president of the republic. He died at Doebling, near Vienna, on Dec. 31, 1950.

His principal works are *Grundlagen und Entwicklungsziele der Österreichisch-ungarischen Monarchie* (1906); *Oesterreichs Erneuerung* (1919); *Die Wirtschaft als Gesamtprozess und die Sozialisierung* (1924). (A. F. P.; X.)

RENNES, a town in the *département* of Ille-et-Vilaine, western France, formerly the capital of Brittany, lies at the confluence of two rivers, the Ille and the Vilaine, in the centre of a basin that opens widely on the outer reaches of Normandy, Maine, Anjou and lower Brittany. Pop. (1954) 112,553.

The town is built on a regular plan, the main axis running east and west along the canalized Vilaine. The plan originated in the reconstruction after the great seven-day fire of 1720 which destroyed the best part of the old town, but spared the magnificent house of the parliament of Brittany, the work of Salomon de Brosse, finished in 1654. It was to the credit of Jacques III Gabriel, the king's architect (whose son designed the Place de la Concorde in Paris) sent down to supervise the plans, that he achieved the harmony of the centre with the house of parliament, with a remarkable austere coherence. Also by Gabriel is

the town hall, a very gracious edifice in the Louis XV style. The cathedral was partly rebuilt at the beginning of the 19th century, its most interesting element being a 15th-century gilt carved wood altarpiece of German work.

Other interesting architectural remains, all on the northern bank of the river, are the Mordelaise gate (15th century) and the cluster of 16th-century houses and 17th-century mansions in the narrow, crooked streets round the cathedral. No building of architectural value suffered from the extensive damage caused by World War II, except the interesting late Gothic church of Saint-Germain. The museum building, destroyed by enemy action in 1944, may now be considered one of the most modern provincial museums in France, the most interesting exhibit being a Nativity by Georges de La Tour (1593–1652). The recent extensions of the city, especially since 1945, have taken place mainly in the south, beyond the railway lines and yards.

Rennes, which is the seat of an archbishop, is also the seat of a prefect (an ***inspecteur*** *général* supervising the whole region of Brittany), the headquarters of the 3rd Army corps, and the centre of a university (founded in Nantes in 1461 and transferred to Rennes in 1735) with faculties of law, arts, sciences and medicine. It is also the seat of a court of appeal and a court of assize. The town, a centre of communications. is an important railway junction on the Paris-Brest line, with lines to Saint-Malo and Nantes. The French railways have extensive workshops east of the town. Rennes is a nexus of roads and road transport, where two main axes meet, Paris-Brest and St.-Malo-Bordeaux. The large airport of Rennes-St.-Jacques was still partly under military control in the early 1960s.

Rennes. originally an agricultural centre, was before World War II a food-producing town with a few light industries. Postwar developments have led important industrial firms to establish themselves in the town, the main example being the large Citroen automobile works. Other factories include furniture, agricultural implements, chemicals, fertilizers and printing presses.

In Celtic times, Rennes was the capital of the Redones. The Romans made it the centre of communications of the province of Armorica. It was only in the 10th century, when the count of Rennes subdued the province, that the town became pre-eminent as the seat of the dukes of Brittany, and the place of their coronation. In 1356 Bertrand du Guesclin saved the town from capture by the English under the duke of Lancaster. The parliament of Brittany, founded in 1551, held its sessions at Rennes from 1561, they having been previously shared with Nantes. Henry IV entered the city in state in May 1598. In 1675 an insurrection broke out against tobacco and stamp duties. In the repression that followed parliament was transferred to Vannes where it remained until 1689. During the French Revolutionary Wars, Rennes at first opposed the decrees of the constituent assembly: then, reconciled with the revolution, it became the headquarters of the Republican army against the Vendéens. (C. F. L.)

RENNET, a milk-clotting preparation from calf stomachs, used in making junket, cheese and casein (*q.v.*).

If the fourth stomach (abomasum) of a calf is cut up and covered for several days with 10% brine and a preservative (*e.g.*, thymol), the extract so prepared will contain the enzyme rennin and will curdle many times its own volume of warm milk. This is a result of the action of the rennin upon one of the several kinds of casein present in the milk. A large fragment of the molecule is split off. Rennin is secreted by the gastric mucosa of the calf in the form of an inactive substance prorennin, which is changed into rennin by contact with dilute acid. Rennin, like pepsin, digests proteins but it differs from pepsin in requiring only a mildly acid reaction and in breaking fewer bonds in the protein molecule.

The clotting of milk does not necessarily indicate the presence of rennin since most, if not all, proteolytic enzymes including those from plants can clot milk. When sufficiently purified, rennin crystallizes as microscopic cubes, capable when re-dissolved of coagulating about 10,000,000 times their own weight of milk. (N. J. BE.)

RENNIE, JOHN (1761–1821), Scottish civil engineer, who built or improved many canals, bridges, docks and harbours, was born at Phantassie, East Lothian, June 7, 1761. He worked under Andrew Meikle, millwright, and attended classes at Edinburgh university, though he did not graduate. His first major work was the Albion mills, Blackfriars, London (built 1784–88, destroyed by fire 1791). Rennie greatly extended the use of iron for gears and other parts of machinery. After John Smeaton (*q.v.*) retired, Rennie carried out work on the Kennet and Avon, Rochdale, Lancaster and other canals.

From about 1800 Rennie carried out extensive drainage improvements in the Lincolnshire fens. He constructed or improved many harbours including Wick, Grimsby, Holyhead and Hull and built the London and East India docks on the Thames, and many bridges including Waterloo, Southwark and London bridges. He carried out extensive improvements to naval dockyards at Plymouth, Portsmouth, Chatham and Sheerness; he also began to build the breakwater that shelters Plymouth sound. Rennie died in London on Oct. 4, 1821, and was buried in St. Paul's cathedral.

After his death his business was divided between his sons. George, the elder, ran the mechanical engineering side and John (later Sir John) the civil, including the completion of London bridge and Plymouth breakwater.

See S. Smiles, ***Lives of the Engineers*** (1904). (S. B. HN.)

RENO, a city of Nevada, U.S., the seat of Washoe county, is situated on the Truckee river, 14 mi. from the western boundary of the state. at an elevation of 4,500 ft. The city lies near the foot of the Sierra Nevada range amid magnificent and varied scenery. It has a moderate climate throughout the year.

Reno received its start in 1859 when a settler named M. C. Fuller built an inn on the south side of the Truckee river to accommodate travelers and freight teams from the Virginia City mines. When the Central Pacific railroad reached the spot in 1868, a land auction was held and homes were built almost overnight. The new town was named after Gen. Jesse Reno of Virginia, a federal officer in the American Civil War who was killed in the battle of South Mountain. Reno received a charter as an incorporated city in 1879.

Until 1900 Reno's business activity centred around its value as a distribution point. Then after several well-known people were granted divorces under the liberal state law, the town became famous as a divorce centre. (The state recognizes seven grounds for an absolute decree and requires only six weeks' residence before bringing suit.) Another attraction is the "no-waiting" period for marriages in Nevada. In an average year during the 1950s, for example, almost 20,000 marriages were performed in Washoe county compared with about 4.500 divorces granted.

Being close to the Sierra Nevada, Reno is a recreation centre during all seasons of the year. Good skiing, hunting and fishing areas are located nearby. With the full legalization of gambling in the state in 1931, the city began to attract tourists and weekend visitors to its many gambling casinos, most of which also furnish musical entertainment. The gambling combined with the fact that three federal highways run through the city account for the flourishing motel trade.

There are some small manufacturing plants in the area and Reno also continues to be an important warehousing and distribution centre because of Nevada's "Free Port" law under which merchandise originating in either the east or the west and moving in interstate commerce may be stored and assembled in transit free of taxation.

The University of Nevada is located on a beautiful 60-ac. campus overlooking the city from the north.

Immediately adjacent to Reno is the city of Sparks, founded in 1903 by the Southern Pacific Railroad company and named in honour of the state's incumbent governor at that time. For many years most of the town's residents were railroad employees. However, in the 1950s new housing developments constructed to meet the demands of people employed in Reno caused a sharp jump in population. The business district is centred along one main street which also serves as a federal highway. Gambling and the motel trade are also important businesses in Sparks.

The population of Reno in 1960 was 51,470. For comparative

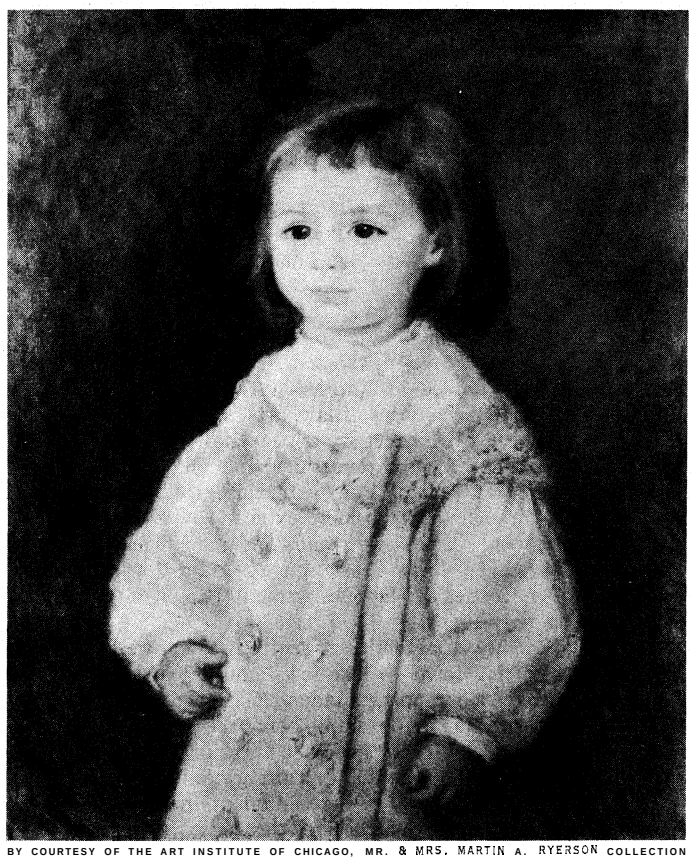
population figures for both Reno and Sparks see table in NEVADA: Population. (D. W. Ds.)

RENOIR, PIERRE AUGUSTE (1841–1919), French painter, one of the greatest of the Impressionists, was born at Limoges on Feb. 25, 1841, the son of a tailor who moved to Paris about 1845. After working as a painter of porcelain and as a painter of fans and banners, in 1862 Renoir entered the studio of C. G. Gleyre. where he made the acquaintance of Monet, Sisley and Bazille (with whom he frequently shared a studio until 1870). In 1864 and 1865 Renoir first exhibited at the Salon, but his entries were rejected in 1866 (despite the intervention of J. B. C. Corot and C. F. Daubigny) and again in 1867. With the closure of Gleyre's studio in 1864, Renoir spent some time of each year up to 1867 working in the region of Fontainebleau, frequently in the company of one or another of his friends. Although his studies in the Louvre had been devoted largely to the French painters of the 18th century, some landscapes of this period show the influence of the Barbizon school, while the influence of Courbet is more evident in the figure work (*e.g.*, "Diana," National gallery, Washington). In the years immediately following, Renoir worked in close contact with Monet both in Paris (1866–67) and at Bougival (1869), and the pictures executed (*e.g.*, "The Skaters," 1868; "La Grenouillère," 1869) represent one of the earliest stages of the concerns and techniques of Impressionism and were developed from the example set by Manet. The Salon of 1870 included however. the "Bather," which is still reminiscent of Courbet, and the "Woman of Algiers." which gives clear evidence of Renoir's enthusiasm for Delacroix.

During the Franco-German War of 1870–71 Renoir served with a regiment of cavalry, returning to Paris during the period of the Commune in 1871. In the years immediately following, he resumed the practice of working with Monet, particularly at Argenteuil, near Paris. In these years (c. 1872–76) there developed, mainly by these two artists working in close collaboration, the form of painting known as Impressionism, a term usually understood to refer to a system of painting in which there is a far greater concern with the representation of light and atmosphere than with the representation of the physical characteristics of things and people. Renoir became a member of the "Société anonyme des artistes peintres, sculpteurs et graveurs," founded in 1874, and exhibited at four of the eight so-called "Impressionist" exhibitions organized by that society between 1874 and 1886. Characteristic examples of his work during the 1870s are "La Loge" ("The Box at the Theatre") 1874; "Portrait of Monet," 1875; "Paris Boulevards." 1875; "Mme. Charpentier and Her Daughters," 1878; and "Boating Party at Chatou." 1879.

During the course of 1881–82, Renoir visited Algeria. Guernsey and Italy (where he admired the work of Raphael and the wall paintings of Pompeii), and worked with Cézanne at L'Estaque. It was about this time that Renoir, in common with the majority of the Impressionists, began to modify his style. "I had gone to the end of Impressionism," he said later. "and I was coming to the conclusion that I did not know either how to paint or draw." The characteristic work of this period is the large "Bathers" (1884–87, C. S. Tyson collection, Philadelphia), which illustrates the renewed importance given to the representation of volume and structure defined principally by line. with colour (which tends to be acid) and brush strokes playing a subordinate role. A key work for the comparison of the style of the "dry period" with that of the preceding Impressionist phase is "The Umbrellas" (National gallery, London), which seems to have been painted over a number of years from about 1881–82 to 1885–86.

The work of the late 1880s is varied in character, but by the early 1890s the characteristics of the late style had begun to appear. In the late works the subject matter and the compositional devices of Impressionism are frequently used (*e.g.*, "Lunch at Berneval"), but the range of colour (usually based upon warm, earthy reds and yellows) is arbitrary and personal and the paint is applied in a manner derived from the traditional system of glazing. The most frequent theme of the late years was that of the female nude characterized by a monumentality of proportions comparable to that found in Rubens, and by considerable stylization of features. Examples of this period are "Bather With a Hat" (c. 1904, Vienna); "Seated Bather" (1914, Chicago); "Woman Tying Her Shoe" (c. 1918, Courtauld Institute of Art, London) and "Rest After Bathing" (1919, Louvre, Paris).



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"CHILD IN WHITE" BY AUGUSTE RENOIR. IN THE ART INSTITUTE OF CHICAGO

In his late years Renoir undertook sculpture, but since he was crippled with arthritis almost all the works were executed by assistants working under close supervision. Renoir died at Cagnes in Provence on Dec. 17, 1919.

See also PAINTING: *France: 19th Century.*

For a comprehensive bibliography see M. Drucker, Renoir etc. (1951); J. Rewald, ***The*** *History of Impressionism* (1949).

(R. A. Dy.)

RENOUF, SIR PETER LE PAGE (1822–1897), British Egyptologist. was born in Guernsey on hug. 23, 1822. He was educated at Elizabeth college there, and proceeded to Oxford, uhich he left without taking a degree, upon his becoming a Roman Catholic under the influence of Newman He took an active part in church controversy and his treatise (1868) upon the condemnation of Pope Honorius for heresy by the council of Constantinople in A D 680 was placed upon the index of prohibited books. After holding various educational posts Renouf became in 1866 keeper of oriental antiquities in the British museum. succeeding Samuel Birch.

Renouf was also elected in 1887 president of the Society of Biblical Archaeology, to whose Proceedings he contributed. among other important papers, the translation of The Book of the Dead nith a commentary. He retired in 1891. and died in London on Oct 14, 1897.

RENOUVIER, CHARLES BERNARD (1815–1903), French philosopher. leading exponent of the neocritical modification of Kantianism, was born at Montpellier. Jan. 1, 1815. He went to Paris in 1831 and attached himself at first to the comte de Saint-Simon and his group. He studied mathematics at the École Polytechnique (1834–36) and then devoted himself to the study of social science and philosophy.

Renouvier's first works were handbooks of philosophy, ancient

(1842) and modern (1844); he contributed several articles to Pierre Leroux's *Encyclopédie* nouvelle. The revolution of Feb. 1848 led him to write his Manuel *républicain* de *l'homme* et du citoyen (1848) and his Gouvernement direct (1851), the latter in collaboration with a group of democratic socialists. After the coup d'e'tat of Dec. 1851, he confined himself to philosophical and religious speculation.

Renouvier became the declared enemy of any doctrine that explained man's moral life in terms of a necessary though passing manifestation of a universal law or reality. His philosophical theories were related to three parallel themes. The first, derived from his study of Augustin Cauchy's work on the infinitesimal calculus, is the law of numbers: any real group must be finite. The second theme is liberty: free will is the root not only of moral life but also of intellectual life and no certainty is ever attainable without it. The third theme is idealistic relativism, derived from Kant and from Auguste Comte: only phenomena have any real existence and each phenomenon is relative in that it can only be apprehended as a component or a compound in relation to another given phenomenon. Renouvier claimed that all known systems of philosophy could be classified in one of two categories: (1) those maintaining the infinite, necessity, substance, the "thing in itself," historical fatalism and pantheism; and (2) those maintaining the finite, liberty, phenomenalism and theism. A choice had to be made between the two, but could not be determined on purely intellectual grounds. Renouvier's own option was determined by his belief that man has a moral destiny: a philosopher, he claimed, does not believe in death. He shared Leibniz's belief in the indissolubility of the monad. Thus Renouvier's universe is built around the destiny, not of humanity itself as with Comte, but of the individual. God, for him, is not a substance or an absolute, but the moral order itself, infinite only as the infinity of moral perfection.

Renouvier refused to believe in the inevitability of progress. His Uchronie (1876, anonymous; 2nd ed., 1901) gives an outline of the development of European society such as it might have been if Christian preaching had failed and Europe thus had had no middle ages. Later, his concept of the evolution of the physical world echoed Herbert Spencer's evolutionist naturalism. Renouvier died at Prades on Sept. 1, 1903.

His works include Essais de critique *générale,* 4 vol. (1854–64); Science de la morale (1869); *Esquisse d'une* classification systkmatique des doctrines philosophiques, 2 vol. (1885–86); Philosophie analytique de l·histoire, 4 vol. (1896–97); La Nouvelle monadologie, with L. Prat (1899); Les *Dilemmes* de la *méta*physique pure (1900); Le *Personnalisme* (1903); and Critique de la doctrine de Kant, edited by L. Prat (1906).

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RENT. Various species of rent appear in Roman law (*q.v.*). In English law rent is a certain and periodical payment or service made or rendered by the tenant of a corporeal hereditament and issuing out of (the property of) such hereditament. Its characteristics, therefore, are (1) certainty in amount; (2) periodicity in payment or rendering; (3) the fact that rent is yielded and is, therefore, said "to lie in render," as distinguished from profits *à* prendre in general, which are taken, and are, therefore, said to lie in prendre; (4) that it must issue out of (the profits of) a corporeal hereditament. A rent cannot be reserved out of incorporeal hereditaments. But rent may be reserved out of estates in reversion or remainder (see LAWS OF REAL PROPERTY AND CONVEYANCING) which are not purely incorporeal. It is not essential that rent should consist in a payment of money. Apart from the rendering of services, the delivery of hens, horses, wheat, etc., may constitute a rent. But at the present day, rent is generally a sum of money paid for the occupation of land. It is important to notice that this conception of rent was attained at a comparatively late period in the history of the law. The earliest rent seems to have been a form of personal service, and was fixed by custom. Rent service is the oldest kind of existing rent.

It is the only one to which the power of distress attaches at common law, giving the landlord a preferential right over other creditors exercisable without the intervention of judicial authority (see DISTRESS). The increasing importance of socage tenure, arising in part from the convenience of paying a certain amount, whether in money or kind, rather than comparatively uncertain services, led to the gradual evolution of the modern view of rent as a sum due by contract between two independent persons.

Classes of Rents.—Rents, as they now exist in England, are divided into two great classes—rent service and rent charge. A rent service is so called because by it a tenure by means of service is created between the landlord and the tenant. The service is now represented by fealty, and is nothing more than nominal. Rent service is said to be incident to the reversion—that is, a grant of the reversion carries the rent with it (see REMAINDER). A power of distress is incident at common law to this form of rent. A rent charge is a grant of an annual sum payable out of lands in which the grantor has an estate. It may be in fee, in tail, for life—the most common form--or for years. A rent charge may also be granted out of another rent charge (Law of Property Act, 1925, s. 7, 122 [1]). A rent charge must be created by deed or will, and might be either at common law or under the Statute of Uses (1536). As from Jan. 1, 1926, a rent charge may be created or reserved without the intervention of a use (Law of Property Act, 1925, ss. 65, 187). The grantor has no reversion, and the grantee had at common law no power of distress, though such power was given him by the instrument creating the rent charge. Annual sums charged on land by way of rent charge may be recovered (a) if unpaid for 21 days, by distress; (b) if unpaid for 40 days, by entry into possession of the land and a p propriation of income, and/or demise. by s. 45 of the Conveyancing Act, 1881, a power of redemption of certain perpetual rents in the nature of rent charges is given to the owner of the land out of which the rent issues. Rent charges granted since April 26, 1855, otherwise than by marriage settlement or will for a life or lives or for any estate determinable on a life or lives were required, in order to bind lands against purchasers, mortgagees or creditors, to have been registered in the Land Registry in Lincoln's Inn Fields (Judgments Act, 1855). After 1925, however, rent charges of this character became equitable interests only, and as such are overreached by conveyances to purchasers of a legal estate in lands (Law of Property Act, 1925, s. 2). There was no need, therefore, to provide for the registration of such rent charges, and the Land Charges Act, 1925, enacted that after Jan. 1, 1926, they should not be entered in the register of annuities (s. 4 [1]). Rent charges in possession charged on land perpetually or for a term of years absolute are "legal estates," registrable as such under the Land Registration Act, 1925 (ss. 2, 3, viii., xxv.); and certain classes of rent charge may be entered in the register of land charges under the Land Charges Act, 1925 (s. 10). Rent charges are barred by nonpayment or non-acknowledgment for 12 years (Limitation Act, 1874). The period of limitation for arrears of rent is six years. As to the colonies see Burge, Col. and For. Laws (by Bewes, iv., pt. 2, 460).

Forms of rent charge of special interest are tithe rent charge (see TITHES), and the rent charges formerly used for the purpose of creating "faggot votes." The device was adopted of creating parliamentary voters by splitting up freehold interests into a number of rent charges of the annual value of 40s., so as to satisfy the freeholders' franchise. But such rent charges were rendered ineffective by the Representation of the People Act, 1884, s. 4, which enacted (subject to a saving for existing rights and an exception in favour of owners of tithe rent charge) that a man should not be entitled to be registered as a voter in respect of the ownership of any rent charge.

A rent charge reserved without power of distress is termed a rent-seck (*reditus siccus*) or "dry rent," from the absence of the power of distress. But, as power of distress for *rents-seck* was given by the Landlord and Tenant Act, 1730, the legal effect of such rents has been since the act the same as that of a rent charge.

Other Varieties **of** Rent.—Rents of assize or quit rents are a

relic of the old customary rents. They are presumed to have been established by usage, and cannot be increased or diminished. Provision was made in 1922 for the extinction after 1925 of quit rents and other manorial incidents (Law of Property Act, 1922, ss. 138, 144).

Fee farm rents are rents reserved on grants in fee. They, like quit rents, now occur only in manors, unless they existed before the statute of Quia Emptores was enacted or created by the Crown. A rent which is equivalent or nearly equivalent in amount to the full annual value of the land is a rack rent. As to ground rent, see GROUND RENT. A dead rent is a fixed annual sum paid by a person working a mine or quarry, in addition to royalties varying according to the amount of minerals taken.

The object of a dead rent is twofold—first, to provide a specified income on which the lessor can rely; secondly (and this is the more important reason), as a security that the mine will be worked, and worked with reasonable rapidity. Rents in kind still exist to a limited extent. All peppercorn, or nominal, rents seem to fall under this head. The object of the peppercorn rent is to secure the acknowledgment by the tenant of the landlord's right. In modern building leases a peppercorn rent is sometimes reserved as the rent for the first few years.

Labour rents are represented by those cases. not unfrequent in agricultural leases, where the tenant is bound to render the landlord a certain amount of team work or other labour as a part of his rent.

Payment of Rent.—Rent is due in the morning of the day appointed for payment, but a tenant is not in arrears until after midnight on that day. Rent made payable in advance by agreement between a landlord and his tenant is called *forehand* rent. It is not uncommon in letting a furnished house, or as to the last quarter of the term of a lease of unfurnished premises, to stipulate that the rent shall be paid in advance. As soon as such rent is payable under the agreement the landlord has the same rights in regard to it as he has in the case of ordinary rent. Where a cheque in payment of rent is lost in the course of transmission through the post, the loss falls on the tenant, unless the landlord has expressly or impliedly authorized it to be forwarded in that way. and the landlord s consent to take the risk of such transmission will not be inferred from the fact that payments were ordinarily made in this manner in the dealings between the parties

A tenant may deduct from his rent (i.) the "landlord's property tax" (on the annual value of the premises for income tax purposes), which is paid by the tenant, if the statute imposing the tax authorizes the deduction (which should be made from the rent next due after the payment); (ii.) taxes or rates which the landlord had undertaken to pay but had not paid, payment having thereupon been made by the tenant; (iii.) payments made by the tenant which ought to have been made by the landlord, *e.g.*, rent due to a superior landlord; (iv.) compensation under the Agricultural Holdings Act, 1923 (s. 37), and Landlord and Tenant Act, 1927 (s. 11 [2]).

A landlord's main remedy for non-payment of rent is distress (*q.v.*). Besides distress the landlord has his ordinary remedy by action. In addition, special statutory remedies are given in the case of tenants holding over after the expiration of their tenancy (see EJECTMENT). Under the Rent Restriction Acts, 1920–25, landlords of dwelling houses to which these statutes apply were prevented during their continuance from effectually raising the rents above specified limits, and except in certain cases from recovering possession on the termination of the tenancy. The act of 1920 expired in England on Dec. 2j, 1927, and in Scotland on May 28, 1928. The provisions of Pt. II. of the act of 1923 continue in force for five years from the expiration of the act of 1920. (*See* further LANDLORD AND TENANT.)

Under the Landlord and Tenant Act, 1927, the landlord of trade premises may offer a renewal of the tenancy at such rent as, failing agreement, the statutory tribunal may consider reasonable, as an alternative to compensation for improvements (s. 2 [1] [d]) or goodwill (s. 4 [1]). The tenant of such premises may also apply for a new lease at a rent similarly approved (s. 5).

Scotland.—Rent is properly the payment made by the tenant to the landlord for the use of lands held under lease (see LANDLORD AND TENANT). In agricultural tenancies the legal terms for the payment of rent are at Whit Sunday after the crop has been sown, and at Martinmas after it has been reaped. But a landlord and tenant may substitute conventional terms of payment, either anticipating (fore or forehand rent) or postponing (back or backhand rent) the legal term. The rent paid by vassal to superior is called feu-duty (see FEU). Its nearest English equivalent is the fee farm rent. The remedy of distress does not exist in Scots law. Rents are recovered (i.) by summary diligence, proceeding on a clause, in the lease, of consent to registration for execution; (ii.) by an ordinary petitory action; (iii.) by an action of "maills and duties" (the rents of an estate in money or grain: "mails" was a coin at one time current in Scotland) in the Sheriff Court or the Court of Session; and (iv.) in non-agricultural tenancies by procedure under the right of hypothec, where that still exists; the right of hypothec over land exceeding two acres in extent let for agriculture or pasture was abolished as from Nov. 11, 1881; it was also excluded, by the House-letting and Rating (Scotland) Act, 1911 (s. 10), in lets to which that act applies, from all bedding material and all implements of trade used by the occupier and his family and from furniture selected by him up to £10 value (see DISTRESS; HYPOTHEC); (v.) by action of removing (see EJECTMENT). Arrears of rent prescribe after the expiration of a period of five years reckoned from the time of the tenant's removal from the land.

Labour or service rents were at one time very frequent in Scotland. The events of 1715 and 1745 showed the vast influence over the tenantry that the great proprietors acquired by such means. Accordingly acts of 1716 and 1746 provided for the commutation of services into money rents. Such services may still be created by agreement, subject to the summary power of commutation by the sheriff given by the Conveyancing Act, 1874 (ss. 20, 21). They will no longer be eligible from and after Jan. 1, 1935 (Conveyancing [Scotland] Act, 1924, s. 12 [7]). The Conveyancing (Scotland) Act, 1924, provides (s. 12) for the abolition or commutation of feu-duties payable in grain or other fungibles.

United States.—The law is in general accordance with that of England, apart from statute. The tendency of modern State legislation is unfavourable to the continuance of distress as a remedy. In the New England States, attachment on mesne process has, to a large extent, superseded it. Alabama, Colorado, Missouri, Montana, North Carolina and Oklahoma have refused to recognize the right of distress upon the ground that the landlord's rights have been secured by the substitution of other remedies. In the District of Columbia, Indiana, Minnesota, New York and Wisconsin it has been abolished by statute. "In those (states) in which it still exists, it has been modified by statutes, the general tendency of which is more or less to withdraw the control of the proceedings from the landlord and to rest it in public officials, thus assimilating it to the process of attachment." (2 Tiffany, Landlord and Tenant, section 325.)

Other Countries.—Under the French Code Civil (art. 2,102) the landlord is a privileged creditor for his rent. If the lease is by authentic act, or under private signature for a fixed term, he has a right over the year's harvest and produce, the furniture of the house and everything employed to keep it up, and (if a farm) to work it, in order to satisfy all rent due up to the end of the term. If the lease is not by authentic act nor for a specified term, the landlord's claim is limited to the current year and the year next following (see law of Feb. 12, 1872). The goods of a sub-lessee are protected: and goods bailed or deposited with the tenant are in general not liable to be seized. The French law is in force in Mauritius, and has been reproduced in substance in the Civil Codes of Quebec (arts. 2,005 seq.) and St. Lucia (arts. 1,888 seq.). There are analogous provisions in the Spanish Civil Code (art. 1,922). The subject of privileges and hypothecs is regulated in Belgium by a special law of Dec. 16, 1851; and in Germany by ss. 1,113 seq. of the Civil Code. The law of British India as to rent (Transfer and Property Act, 1882) and distress

(*cf., e.g.,* Act 15 of 1882) is similar to English law. The British dominions generally tend in the same direction. See, *e.g.,* New South Wales (the consolidating Landlord and Tenant Act, 1899, and Act 66 of 1915); Union of South Africa (Act 30 of 1921); Newfoundland (Act 4 of 1899); Ontario (Act 1 of 1902, s. 22, giving a tenant five days for tender of rent and expenses after distress); Jamaica (Law 17 of 1900, certification of landlord's bailiffs); Queensland (Act 1j of 1904). English rent restriction legislation was followed in British India (*e.g.,* Bombay, No. 3 of 1925; Burma, No. 1 of 1925) and in many of the colonies and dominions (*e.g.,* Hongkong, No. 8 of 1925; Malta, No. 1 of 1925; New Zealand, No. 3 of 1925).

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RENT: IN ECONOMICS. In economics, rent is the name given to the income which the owner of a productive instrument gets by using it himself or by exacting a payment from another user. Much of the importance of the general theory of rent in economics comes from its application to the special case of income derived from land ownership. In the case of the incomes yielded by the ownership of reproducible instruments of production the principle of rent is subordinate, in the long run, to the principles which govern the rate of interest on capital, for the supply of such instruments will be maintained and increased if, but only if, the prospective return is sufficient to induce the investment of capital. At any given time, however, the income-yielding power of reproducible instruments of production is determined, not by what they cost, but by the value of their productive uses. That is, it is governed by the laws of rent. The specific hypothesis upon which the significance of the principle of rent depends is that the supply of the productive instruments which yield rent may be assumed to be given or fixed, so that the question remains only of how they may best be used.

Rent is generally held to have two distinguishing characteristics: first, it is a differential or graded return; second it is a surplus above costs. That it is a differential return depends upon the circumstance that productive instruments are described or measured in units (*e.g.,* acres) which are not themselves units of productive efficiency. It is obvious that if one acre of agricultural land is better (more fertile or nearer to the market) than another it will command a larger rent. It is also obvious that the rent which any given piece of land commands may be taken to be a measure of its differential superiority over land which just falls short of being good enough to be worth using. That rent may be regarded as a surplus over costs is a consequence of the circumstance that the supply of rent-yielding instruments is taken as given. Even if they were produced or improved (as land is improved) at a cost in the past, their past costs have no relevance to the practical question of how and for what purposes the instruments shall be used. The only costs which need to be taken into account are the costs of using them.

Rent's Relation to Product.— why, then, should rent be paid? The reason is that rent-yielding productive instruments, including rent-yielding land, exist in limited quantities, in the sense that if any one unit of them were withdrawn from use the aggregate product would be smaller. The rent of a given piece of land or of a given farm tends to be approximately equal to the value of the amount of product which is dependent upon using it. This amount can be determined by comparing the product which the given piece of land or farm will yield under proper cultivation with the product which could be got by employing the same amount of capital and labour on the best land which is not good enough to yield a rent (*i.e.,* at the "extensive margin of cultivation") or by employing it in cultivating rent-yielding lands more intensively (*i.e.,* at the "intensive margin of cultivation"). When the supply of a particular class of rent-yielding productive agents cannot be increased as rapidly as the demand for the products which they yield increases, they will command higher rents. Furthermore, unless there are compensating improvements in productive technique, production can be increased under such circumstances only by using instruments which had previously been below the level of profitable use or by making more intensive use of the latter instruments, *i.e.,* by increasing the labour and other types of instruments used in conjunction with them. Whichever method is followed, increasing costs are encountered. This circumstance is the basis of the doctrine that with a fixed supply of land an increased agricultural product can be had only at the expense of a more than proportionate outlay of labour and capital—a doctrine to which the name, "law of diminishing returns," has been given.

When economists refer to some other form of income or gain, not derived from the ownership of land or of other productive instruments, as rent, they generally mean either that it may be looked upon as a differential return or that it may be conceived to be a surplus above costs. Thus, "rent of ability" is a name sometimes given to the differential element in personal earnings. "Entrepreneur's rent" denotes the profits of an ably-managed and successful enterprise, conceived of as a differential above the return secured by a marginal undertaking which is barely able to meet its costs. "Consumer's rent" is the difference between the amount which the consumer pays and the value which he attaches to what he buys, as measured by the maximum amount which he would have been willing to pay if required. Similarly, "producer's rent" is the difference between what the state of the market enables the producer to get for his goods and the amount which would have sufficed to induce him to produce them. (See also ECONOMICS and LAND.) (A. Yo.)

RENTON, a manufacturing town in Cardross civil parish, Dunbartonshire. Scot. Pop. (1951) 5,170. It is on the Leven, about 2 mi. N.N.W. of Dumbarton. The leading industry is dyeing. with calico printing and bleaching.

A parish church stands on the site of Dalquhurn House, the birthplace of Tobias Smollett the novelist, to whose memory a Tuscan column was erected in 1774, the inscription for which was revised by Dr. Samuel Johnson when he visited Bonhill in that year with Boswell. The town was founded in 1782 by Jean Smollett (previously Telfer) of Bonhill (sister of Tobias Smollett), who resumed her maiden name when she succeeded to the Smollett estates.

Renton was named after Cecilia Renton, daughter of John Renton of Blackadder, who had married Mrs. Smollett's son Alexander Telfer.

RENTON, a city in King county, western Washington, U.S., on the south shore of Lake Washington, is located about 12 mi. S.E. of Seattle. It can be reached by deepwater vessels from Puget sound via the Ballard locks and Lake Washington.

A large airplane plant. devoted especially to the manufacture of jet transports, is located there. Lumber, shingles, steel and clay products, railroad freight and passenger cars, logging machinery and stokers are also produced. Coal mines, near Renton, exploited since the 1860s, played an important role in the history of the Pacific northwest. Truck and poultry farming are the chief agricultural activities of the area.

The city was named for William Renton, one of the founders of a coal-mining company, and was incorporated in 1901. For comparative population figures see table in WASHINGTON: Population. (R. E. Bu.)

RENTSCHLER, HARVEY CLAYTON (1881–1949), U.S. physicist, was born at Hamburg, Pa., on March 26, 1881. He was graduated from Princeton university, Princeton, N.J., in 1903 and took his master's degree there the following year. He received the Ph.D. degree from Johns Hopkins, Baltimore, Md., in 1908. Immediately afterwards, he became an instructor in physics at the University of Missouri, Columbia, Mo., and remained there until 1917, rising to the rank of associate professor.

He then accepted the position of director of research in the lamp division of the Westinghouse Electric and Manufacturing Co. at Bloomfield, N.J. There, out of experimental work in photochemistry on the case hardening of steel came his important contribution to medicine and food preservation, the sterilamp ("Bactericidal Effect of Ultraviolet radiation," *J.Bact.* 41:745–774, 1941). The lamp is a gaseous-conductor tube generating radiant energy, *i.e.*, ultra-violet rays with a wave length of 2,537 angstrom units. Such irradiation prevents spoilage through mould and yeast spores, and after tests proved satisfactory, lamps were installed in the processing and storage places of meat, bakery, dairy and brewing establishments. Although the work, which was done in association with Dr. Robert F. James, a biochemist at Westinghouse, was carried on with food preservation in mind, its medical application was also considered. In surgery, though the staff and materiel be germfree, the air contains bacteria which may infect the patient. Lamps were installed experimentally in the operating room of the Duke university hospital. Results proved postoperative infection and temperatures to be lower, and the lamps were subsequently installed at the Mayo Clinic, the N.Y. Medical Center and elsewhere. Dr. Rentschler also developed an ultra-violet light meter and conducted researches on the photoelectric emission from metals, the preparation and properties of ductile thorium and uranium, and the resonance and ionization of monatomic gases. He was made honorary D.Sc. by Princeton university in 1941, and the following year the honorary degree of doctor of laws was conferred on him at Ursinus college, Collegeville, Pa. His early researches with the refinement of uranium were credited with Westinghouse Electric's ability to provide the first batches of that element for atom bomb experiments in 1943. He died March 23, 1949, at East Orange, N.J.

RENWICK, EDWARD SABINE (1823–1912), U.S. inventor, was born in New York city on Jan. 3, 1823, the youngest son of James Renwick (*q.v.*) (1792–1863). He was graduated from Columbia college in 1839 and took his master's degree there in 1842. After several years of employment as an engineer, he went to Washington, D.C., where in 1849 he became associated with Peter H. Watson as patent expert in the U.S. circuit courts. Six years later he returned to New York where he worked independently in the same field. Renwick was also an inventor of some note. Among his accomplishments were a self-binder to improve the McCormick reaper (1851–53), an automatically heated and ventilated incubator for the raising of chicks and a chicken brooder (1877–86). He died at Short Hills, N.J., on March 19, 1912.

RENWICK, JAMES (1662–1688), Scottish covenanting leader, was born at Moniaive in Dumfriesshire, on Feb. 15, 1662, the son of a weaver, Andrew Renwick. Educated at Edinburgh university, he joined the section of the Covenanters known as the Cameronians about 1681 and soon became prominent among them. Afterwards he studied theology at the university of Groningen and was ordained a minister in 1683. Returning to Scotland "full of zeal and breathing forth threats of organized assassination," says Andrew Lang, he became one of the field-preachers and was declared a rebel by the privy council. He mas largely responsible for the "apologetical declaration" of 1684 by which he and his followers disowned the authority of Charles II; the privy council replied by ordering every one to abjure this declaration on pain of death. Unlike some of his associates, Renwick refused to join the rising under the earl of Argyll in 1685; and in 1687, when the declarations of indulgence allowed some liberty of worship to the Presbyterians, he and his followers, often called Renwickites, continued to hold meetings in the fields, which were still illegal. A reward was offered for his capture, and early in 1688 he was seized in Edinburgh. Tried and found guilty of disowning the royal authority and other offenses, he refused to apply for a pardon and was hanged on Feb. 17, 1688. Renwick was the last of the covenanting martyrs.

See R. Wodrow, *History of the Sufferings of the Church of Scotland,* vol. iv (Glasgow, 1838); and *A.* Smellie, *Men of the Covenant* (1904); also Renwick's life by Alexander Shields in the *Biographia Presbyteriana* (1827).

RENWICK, JAMES (1792–1863), educator and engineer, was born in Liverpool, England on May 30, 1792, of Scottish descent. He emigrated to the United States with his parents in 1794. Two of his sons, Henry Brevoort (1817–1895) and Edward Sabine (*q.v.*) were also engineers, and his second son, James (*q.v.*), a distinguished architect. Renwick was graduated from Columbia college in New York city in 1807 and then travelled through Europe with his good friend Washington Irving. Three years later he earned his master's degree from Columbia. In 1812 he taught natural philosophy there during the illness of Prof. John Kemp, serving without pay. He entered government service as topographical engineer with the rank of major and three years later was commissioned colonel of engineers in the state militia. In 1820 he was appointed to the chair of natural philosophy and experimental chemistry at Columbia, which position he held until his retirement in 1853 to become the first emeritus professor of that college. In addition to his regular courses at Columbia, he also lectured on geology, mineralogy, practical mechanics and astronomy. While teaching he was also active in many public engineering projects on which his expert advice was increasingly sought. President Van Buren appointed him in 1838 to the commission of three which tested inventions designed to safeguard steam engine boilers against explosions. Two years later he was a member of the commission appointed to survey the northeast boundary between the United States and New Brunswick; these findings were later incorporated in the Webster-Ashburton treaty. Prof. Renwick was a frequent contributor to the best current periodicals and wrote a number of books on scientific and mechanical problems including *Outlines of Natural Philosophy* (2 vols., 1822–23); *Treatise on the Steam-Engine* (1830); and biographies of David Rittenhouse (1839), Robert Fulton (1845), and Count Rumford (1848) for Sparks's *Library of American Biography.* He also translated from the French, Lallemand's *Treatise on Artillery* (2 vols. 1820) and edited American editions of books on chemistry and mechanics. He died on Jan. 12, 1863.

RENWICK, JAMES (1818–1895), U.S. architect, was born in the section of New York city then known as Bloomingdale, on Nov. 1, 1818, the second son of James Renwick (*q.v.*) (1792–1863). He was graduated from Columbia college in 1836 at the precocious age of 17, and became an engineer for the Erie railroad. Later, as assistant engineer on the Croton aqueduct, he supervised the construction of a distributing reservoir in what is now the midtown area of Manhattan. His career in architecture began in 1843 when his plans won in the competition for the design and erection of Grace church at Broadway and 10th street. By the time of its completion in 1846, Renwick, still a very young man, had established his reputation as an architect. His early commissions were mainly for churches, including Calvary, St. Stephen's, and St. Bartholomew's. In 1853 the plans he entered in the competition for the designing of the Roman Catholic St. Patrick's cathedral were chosen, and in 1858 the work of more than 20 years was begun. This example of Gothic revival in the heart of the city is now one of its landmarks and occupies the square block bounded by Fifth and Madison avenues, and 50th and 51st streets. In addition to his ecclesiastical designs, Renwick was also architect for many public and private structures, the most outstanding being the Smithsonian institution and Corcoran gallery in Washington, Vassar college at Poughkeepsie, and numerous hotels, theatres and fashionable residences in New York city and elsewhere. As architect for the Board of Governors of Charities and Correction of New York city, he also built a number of asylums and hospitals. Renwick's early work was mainly Gothic or Romanesque. Later his designs took on a more eclectic character with occasional bad results, but he had imagination and his planning was usually sound. He was a noted connoisseur and acquired a fine collection of paintings and *objets d'art.* He died in New York city on June 23, 1895.

REP, REPP or **REPS,** cloth made of silk, wool or cotton. The name is said to have been adopted from the French *reps,* a word of unknown origin; it has also been suggested that it is a corruption of "rib." It is woven in fine cords or ribs across the width of the piece. In various forms it is used for dresses, and to some extent for ecclesiastical vestments. In wool and cotton it is alsc used for upholstery purposes

REPARATIONS. In their customary meaning reparations are a levy on a defeated nation forcing it to pay some of the war costs of the winning countries. They were levied on the Central Powers after 1918 to compensate the Allies for some of their war costs, and reparations were meant to replace mar indemnities which had been levied earlier as a punitive measure as well as to compensate for economic losses. The United Nations (UN) levied reparations after World War II. principally on Germany, Italy, Japan and Finland. In the decade following the war, the meaning of the term became more inclusive; it was applied to the payments undertaken by the Federal Republic of (west) Germany to the state of Israel for crimes against the Jews in territory controlled by the Hitler regime and to individuals in Germany and outside it to indemnify them for their persecution. The term was also applied to the obligations of Israel to the Arab refugees who suffered property losses after Israel's victory over the Arab states in 1948.

There are two practicable ways in nhich a defeated country can make reparation. It can pay over in cash or kind a portion of the goods and services it is currently producing; *i.e.,* a part of its national income. Or it can pay over in cash or kind some of its capital in the form of machines, tools, rolling stock. merchant shipping and the like, which is a part of its national wealth. The payment of gold or other universal money is not a practicable method of paying reparations. The supposed consequence of reparations is a decrease in the income, and hence level of living, of the defeated nation, and an increase in the income of the victorious nation, the capitalized value of the increase being equal to its war costs. However. there is no warrant for these suppositions in either the economics of reparations or in historical experience with them. Experience suggests that the smaller the reparations levy the more likely it is to be paid, and conversely that large levies are unlikely to be collected. In both World Wars I and II the failure to obtain desired reparations was unmistakable. Indeed, some of the victorious nations eventually had to make payments to the defeated in the interests of restoring economic and political stability.

Magnitude of Reparations.—The size of the defeated nation's liability cannot be determined by the war costs for which it is directly or indirectly responsible. These costs are of two kinds, economic and social. The economic cost of war is the value of civilian goods and services which must be foregone in order that resources can be used for war production, plus the capital destruction resulting from war. The social cost is the burden created by loss of life and disorder in social institutions. The loss of life has economic implications, but its cost cannot be measured because the labour value of human life is not capitalized as, say, the income value of equipment can be. Estimates can be made of the economic costs of war, and they are usually much in excess of the capacity of the defeated nation to make reparation. For example, after World War II the principal belligerents submitted claims of $320,000,000,000 against Germany. This sum was more than ten times the preuar national income of Germany (at constant prices) and an even greater multiple of income after the war.

Since the magnitude of reparations cannot be determined by war costs. it must be determined by the defeated nation's ability to pay, and this is much less than its imputed liability. Its ability to pay is dependent on three factors: (1) its national wealth or alternatively its national income: (2) the ability of either the occupying powers or the government of the defeated nation to organize the economy for the payment of reparations; and (3) the capacity of the victors to organize their economies for the productive use of reparation receipts. The first of these is most important.

The political instability which usually follows a war makes it difficult to organize the defeated economy for the payment of reparations. Authority is diffuse and uncertain; there are conflicts among the victorious nations, and the populace of the defeated country is, to say the least, unco-operative, particularly in the matter of transferring its capital or income to recent enemies. Finally, the payment of reparations depends on the willingness and ability of the victorious countries to accept the new economic structure attendant upon transfers of income or capital. Here occurred the paradoxes of reparations history in the 20th century. Following World War I, some of the Allied Powers were able to conceive of no limit to a justifiable tribute from Germany, but when payments out of income began the Allies found the imports competing with domestically produced goods and services and thereupon took measures which prevented Germany from honouring its obligations. After World War II, the transfers of capital from Germany and Japan so threatened to dislocate the economic structure of Europe and Asia that measures were taken to reduce reparation liabilities.

METHODS OF PAYMENT

The payment of reparations in kind or cash out of income or capital constitutes an export surplus; *i.e.,* the paying nation sends out of the country more goods and services than it imports. Reparations are impossible without this surplus, and it is for practical purposes more dependent on increasing exports than on decreasing imports. The fact that reparations are possible only via an export surplus should not be obscured by the financial mechanics of reparations. The defeated nation usually compensates the private owners of capital for the export of the goods which constitute reparations, and to do this it taxes or borrows from its citizens. But reparations cannot be paid out of revenue raised internally; the revenue must be converted into income or capital for transfer to the victor nation or into the currency of that nation. After World War I, reparations were designed to be paid mainly in cash out of income. After World War II, they were meant to be paid in kind. mainly out of capital.

Payments in Kind.—If payments in kind are made out of capital, the defeated nation pays over to the victors specific assets within the defeated economy and titles to assets held abroad. After 1918, the Allies obtained the largest vessels in the German merchant marine and a small amount of additional capital. After 1945, the United Nations seized merchant vessels and industrial equipment in Germany and Japan, acquired German and Japanese owned assets within the victor countries and sought to obtain axis-owned assets within neutral countries. Most of the owners of this property were compensated by revenue raised within the defeated nations, the effect being to distribute the burden of the loss among enemy nationals whether property owners or not.

Reparations in the form of capital transfers in kind have certain, though limited, advantages. They avoid some of the more complex monetary problems of cash payments. They are adaptable to a general program of economic disarmament whereby victor nations dismantle and remove industrial equipment of actual or potential military value. Some of this equipment may be of immediate peacetime value to the victorious economies, relieving critical shortages and assisting in reconstruction. Against these advantages must be set the complex economic problems created by the transfers. It is difficult if not impossible to distinguish between industrial equipment of military value and that which can be used only to produce peacetime goods. The steel industry may be used for peaceful purposes or it may become the centre of the munitions industry. The war potential of an industry may be reduced by limiting its capacity but this also limits its peaceful uses. An even greater problem is the dislocation of economic structure which capital removals produce. Reducing plant capacity or eliminating it is a complex technical and economic undertaking. A slight error in removing too much of one kind of equipment can produce a great loss in another industry which in consequence must operate at undercapacity. Even with complete technical consistency in scaling down plant facilities there can be unnecessary losses when the reduced output is measured in monetary (*i.e.,* economic) units. The removal and transportation of capital is expensive, and if any of the labour is done by enemy nationals there is likelihood of additional expense through sabotage. Capital removals require a reallocation of resources in both the defeated and victorious countries. During the process there is a loss of income resulting from installation costs and partial unemployment. Meanwhile the defeated country may become a charge on its conquerors, requiring relief of various kinds until it

can become self-supporting. These problems are present in the most ideal circumstances which can be supposed.

In the conditions likely to be present, capital reparations mean a long-term reduction in income for the victorious nations as well as the defeated. This is probable because capital is removed from an economy where it has been used efficiently with trained labour to one where it must be used less efficiently for a considerable time. The net effect is then a lower income for all countries, victorious as well as defeated. This consequence is avoidable only by the creation of a perfect mechanism for the transfer of capital and by supposing that the recipient nations will be able to use it as efficiently as the paying nation. Such conditions are improbable. This being so, reparations are apt to produce quite the opposite of their intended effect. This was the experience after World War II.

Following World War I there was some payment of reparations in kind out of income. There mere other instances of this method. Out of its annual production, a paying country exports certain commodities to its creditors or performs certain services for them. It can, for example, ship specified quantities of raw material, fuel or manufactured goods, and it may perform transportation and labour services. It may send numbers of its workers to the victorious nation to restore areas damaged by the war and repatriate them when the work is completed. The difficulties encountered in a scheme of capital reparations are present here also but on a lesser scale. The excessive export of current output may force a reduction in plant operations uithin the defeated countries. The receipt of these goods and services by the victors disturbs their normal exchange pattern. After World War I, the immigration of German workers into France to restore the devastated areas caused French workers to protest that their wages were being reduced by the increased labour supply. After World War II, some British trade unions resisted the attempt of the Labour government to use German prisoners of war to relieve critical labour shortages. Similarly, some U.S. manufacturers complained that the import of Japanese goods on reparations account was driving down prices in the U.S.

Cash Payments. — Prior to World War II. reparations were more often made as cash payments than as transfers in kind. It was believed that such a method was easier to organize and more productive of a successful settlement (a viewpoint which was reversed after World War II). Cash payments can be made out of accumulated capital, in which case the paying country sells certain of its assets held either at home or abroad, converts the proceeds into the currency of the victorious nation and pays it over to the latter's government. The effect of capital transfers via cash payments need not be quite as disturbing as that of capital transfers in kind, though in practice both may produce much the same result. A conceivable advantage of the former is the greater opportunity given the paying nation to dispose of its capital at a minimum loss; it may sell it on the highest paying market and convert the receipts into the currency of the victor nation, uhile capital transfers in kind must be made directly to the victor nation and valued realistically at the worth to it.

After World War I, the bulk of reparations levied on Germany was to consist of cash payments out of income over a period of years. The successful execution of this plan called for an export surplus in the paying country and conversion of the surplus into the currency of the receiving nations. The effect was a reduction in the income of the paying nation and an increase in that of the recipients. Cash payments produce distinctive effects which are not present when reparation is made in kind; they arise because the debtor country must obtain the currency of the creditor nation. The nature and importance of the effects depend on the size of reparations in relation to the national income of the debtor and creditor countries, on the sensitivity of their price levels to expenditures and receipts from imports and exports, on the flexibility of their foreign exchange rates and on the money supply together with the rate at which it is spent. If any one result is more probable than others, it is a fall in the foreign value of the paying nation's currency and a concomitant rise in that of the receiving country. This in turn increases the real cost of reparations to the debtor and creates a corresponding gain to the creditor. Because its money buys less of the money of the creditor, the debtor must offer a greater quantity of exports in order to obtain a given quantity of the creditor's money. It is to be repeated that this is a probable, not an invariable, consequence.

There are two major conditions for the successful settlement of cash reparations. Payments must be within the defeated nation's ability to pay after full account is taken of their monetary effects. and payments must be acceptable to the receiving country. The latter must either increase its net imports from the paring nation or from a third nation which is in debt to the paying nation. The inherent complexities of a reparations program of any kind usually have been made more troublesome by the imposition of controls over the economies of the defeated and victorious nations. This was significant after World War II when the German and Japanese economies were closely regulated and when there was regulation in every important victorious nation excepting the U.S. Control over prices, the movement of goods and labour represent a comprehensible wish to soften the rigours of reconstruction and of readjustment from war. This, however, does not alter the fact that control removes from the economy the price mechanism whereby gains and losses from alternative lines of action can be compared. This was recognized after 1945 nhen an effort was made to remove Japanese industrial equipment to non-industrial nations of Asia and the Pacific. As the Japanese economy was controlled there was no realistic way of appraising the final results of the transfer, nor was there any method of measuring the usefulness of the equipment to the recipient nations because they too controlled their economies. Eventually it was concluded that the transfers had no economic justification.

REPARATIONS AND WORLD WAR I

Germany's Liability. — Without specifying the exact amount, the treaty of Versailles held Germany responsible for all damages to civilians and their dependents; for losses caused by the maltreatment of prisoners of war; for pensions to veterans and their dependents; and for the destruction of all nonmilitary property. Following a series of conferences in 1920, Germany's liability mas fixed tentatively at a minimum of 3,000,000,000 gold marks annually for 35 years with maximum payments not to exceed 269,000,000,000 marks. Germany immediately declared it was unable to pay even the minimum, and there followed successive reductions culminating in the decision of the London conference of 1921, which fixed the liability at 132,000,000,000 (all figures in gold marks) to be paid in annuities, or annual instalments, of 2,000,000,000 marks plus an amount equal to 26% of Germany's annual exports. Germany's default brought the occupation of the Ruhr in 1923 by French and Belgian troops in order to collect reparations by force. Dispossessed of this' important area, Germany was unable to make payments and each attempt to convert marks into foreign currency drove down their value. The result was the disastrous inflation of 1923 when the mark fell to a billionth of its par value.

In 1924 the Allies sponsored the Dawes plan which stabilized the nation's internal finances by a reorganization of the Reichsbank; a transfer committee was created to supervise reparations payments. The total liability was left to later determination, but standard annuities of 2,500,000,000 marks were set subject to increase. The plan was initiated by a loan of 800,000 marks to Germany. The Dawes plan worked so well that by 1929 it was believed that the stringent controls over Germany could be removed and total reparations fixed. This was done by the Young plan, which set reparations at 121,000,000,000 marks to be paid in 59 annuities. But hardly had the Young plan started operation than the world depression of the 1930s began and Germany's ability to pay dwindled to the vanishing point. In 1932 the Lausanne conference proposed to reduce reparations to the token sum of 3,000,000,000 marks, but the proposal was never ratified. Adolf Hitler came to power in 1933, and within a few years all important obligations under the treaty — political as well as economic — were repudiated.

Obstacles to Settlement. — Two circumstances were mainly responsible for the failure of reparations. One was the political

instability of Germany and its refusal to accept responsibility for the war. A more fundamental circumstance was the unwillingness of the creditor nations to accept reparation payments in the only practicable way they could be made—by the transfer of goods and services. The attitude of the creditors had its origin in the notion that a nation is injured by importing more than it exports. Through the 1920s the creditor nations tried to exclude Germany from world trade and simultaneously to increase their exports to Germany (on credit, of course).

Germany's Actual Payments.— The total of reparations paid is not exactly known because of uncertainty over payments between 1918 and 1924, their probable value being, however, 25,000,000,000 marks. From 1924 to 1931 Germany paid 11,100,000,000 marks. making total payments about 36,100,000,000 marks. During the postwar period. however. Germany borrowed 33,000,000,000 marks from abroad; it's net payments to the rest of the world were therefore 3,100,000,000 marks. The reparations program was most successful during the period of greatest borrowing, between 1924–31, when Germany paid 11,100,000,000 marks on reparations account and borrowed 18,000,000,000 marks, the net transfer being 6,900,000,000 marks to Germany. Although reparations often were called the cause of Germany's postwar difficulties, their direct effects were actually negligible. Reparations never were a sizable proportion of any important economic magnitude, being only a small fraction of government expenditures, exports, or national income.

In 1952. the Federal Republic accepted responsibility for the external debts of Germany (except those of the eastern zone), including the Dawes and Young plan loans which stabilized Germany in the 1920s in order to facilitate reparation payments. But the Federal Republic did not assume the reparations debt.

REPARATIONS AND WORLD WAR II

Reparations for the second war were viewed in two distinct ways. In one they were made incidental to a program of economic disarmament and were to be paid out of capital of: (1) actual or potential military value; and (2) that in excess of the amount permitted the defeated nations by the victorious powers. In the other view, reparations were regarded in the conventional way as payments in compensation for the costs of war and were to be made in kind out of capital and income.

The two conceptions are not wholly consistent, and the attempt to apply both of them created confusion and conflict. Removals of capital reduce the economic power of the defeated nation but they do not necessarily increase the power of the recipient nation correspondingly, so that the loss of income by the defeated nation may be (and usually is) greater than the gain to the victors. With each removal of capital, the ability to pay and receive reparations is lessened. If, on the other hand, maximum reparations are wanted by the victorious nations they cannot disarm the defeated nation of its economic power. These difficulties of the Allied reparations program were later complicated by two additional factors: the disagreement between the U.S.S.R. and U.S., which prevented the conclusion of peace treaties with the major defeated nations; and the establishment by the U.S. of the Economic Cooperation administration (ECA) for the purpose of capital reconstruction and development in Europe and Asia.

German Reparations.— The express policy was formulated at Potsdam in 1945. Uniform control was to be established over the entire German economy and administered jointly by four powers in their zones of occupation. The purpose was to dismantle German industry in order that the nation never again could engage in war. Dismantlement was to be limited by two considerations: the German level of living was not to be less than the average living level of other European countries excepting Britain and Russia; and Germany was to be left with sufficient capital in order to pay for its essential imports and so be self-supporting. Reparations were to be paid out of the difference between total German capital and the permissible amount. The distribution of reparations was to be made by the Inter-Allied Reparations agency established in 1945. A "level of industry" plan was formulated to specify the kind and amount of reparations available to claimant nations. It soon was recognized that the initial claims of $320,000,000,000 could not be satisfied, and the Allies announced their satisfaction with reparations which would "compensate in some measure for the loss and suffering caused by Germany."

Shortly after the end of the war, the political disagreement between eastern and western Allies made unified control impossible over the German economy. Its division into eastern and western areas curtailed the useful exchange of agricultural for industrial products and removed the possibility of Germany's supporting itself.

The division also increased the difficulties of capital removals since there was no way of appraising their effect on the total economy. The western powers sought to unify control over their zones in order to advance the reparations program. but here too there was disagreement over the amount of capital to be removed, France insisting on maximum removals in order to disarm Germany completely and Britain and the United States maintaining that Germany should be allowed enough industrial power to assist in the recovery of the entire economy of western Europe. In 1947 the U.S. offered large loans to European countries if they in turn would co-operate by increasing their output and by reducing trade barriers. The conditions were accepted and the ECA (originally called the Marshall plan) was begun. It was quickly discovered that European reconstruction would be assisted by allowing the Germans to retain the capital in their western areas (no assistance was given to the eastern area). There was then a conflict between the program for reparations and that for reconstruction. This was resolved by reducing reparations to a token amount, and by 1950 payments stopped. Moreover, west Germany had become so important by this time that the Allies made loans to it for reconstruction.

In 1953 the U.S.S.R. stopped collecting reparations from east Germany and stated it would return capital goods worth 3,000,000,000 ost marks.

After World War II, reparations from Germany probably were less than occupation costs and loans to it. The U.S.S.R. and Poland secured about a quarter of Germany's arable land and $500,000,000 in reparations out of income. Reparations in kind out of capital were extremely valuable to some of the receiving countries because of the world shortage of equipment after 1945.

Italy and Finland.— Italy's reparations debt was $100,000,000 to the U.S.S.R. to be paid in kind out of capital and income. Against this should be set relief payments by the western countries of a larger but unknown amount.

Finland's reparations payments were the most remarkable. By the armistice of 1944 with the U.S S.R., its liability was set at 300,000,000 gold dollars to be paid in kind out of income. the goods to be valued at 1938 prices. Valued at 1944 prices, the liability was $800,000,000, or 15% to 17% of Finland's national income, the heaviest burden on record. (Germany's World War I liability was never more than 3.5% of its national income.) One-third of the reparations was to be paid in wood products, a traditional export of Finland, and about two-thirds in metal and engineering products, most of which Finland had never made before. The penalty for late deliveries was equal to 80% of the value of the goods. The U.S.S.R. later reduced the bill one-fourth, but the reduction was in wood products. Finland completed its payments by 1952, on schedule, and thereafter sold many of the goods to the U.S.S.R. which it earlier had paid on reparations account.

Japanese Reparations.— The initial policy was identical with that for Germany and the consequences quite similar. Japan was to be disarmed of its economic power but left with enough capital to become self-supporting and to maintain a living level equal to that of other Asiatic countries. Reparations were to consist of capital in excess of the permissible amount. To this end an inventory of surplus capital was taken in 1945 and large-scale removals were planned. The Pauley report embodying the program was challenged and its conclusions were later modified, reducing Japan's liability. The major recipients were to be Asiatic countries which Japan had occupied during the war.

As in Germany, the collection of reparations was more expensive than expected and their value to the recipients less than expected. The claimant nations were unable to agree on their proper shares, which delayed execution of the program. Meanwhile, reparations capital in Japan was allowed to deteriorate, and Japan continued as a deficit economy supported mainly by the U.S. as the major occupying power. The continued deficit caused the U.S. to suspend all reparations deliveries in May 1949 To that date, total reparations paid out of assets held within Japan were 153,000,000 yen or $39,000,000 (at 1939 values). In addition. an unspecified sum was paid out of Japanese assets held in foreign countries. Offsetting total receipts from reparations u-as a considerably larger sum representing relief and occupation costs of the victor nations. As in Germany. occupation costs in Japan were not allocated as reparations receipts were. Some nations therefore obtained net reparations. Taken together, however, Allied reparations from Japan were also negative; net payments were made to Japan as well as to Germany. That these payments might have been still larger had no reparations whatever been collected is a moot question; it is to be noted that some of the payments were necessitated by the reparations program itself.

INDEMNITY PAYMENTS

At the close of its occupation, west Germany assumed liabilities of about $2,000,000,000 (8,000,000,000 DM) to make amends to the victims of nazi persecution. The internal restitution law of 1953, based on the restitution principles applied by the Americans in their zone, provided $952,000,000 to indemnify persons for bodily loss, loss of liberty and property, and injury to professional careers because of racial, religious and political persecution. It provided for paying persons who had been in concentration camps $3 5.70 for each month's imprisonment and for pensions to the survivors of victims. In 1953 also, west Germany agreed to pay the state of Israel $820,000,000 for the cost of resettling 500,000 Jews who to the end of 1951 had emigrated from countries formerly controlled by the Hitler government. The reparations did not cover restitution of Jewish property or claims against the government of east Germany.

After the war between Israel and the Arab states, the United Nations Conciliation Commission for Palestine estimated that $336,000,000 in land and movable property had been lost by the Arabs who became refugees from Palestine. The UN recommended Israel accept the liability and make reparation. Israel refused to accept responsibility on the ground that the losses were caused by the Arab states which started the war but agreed to make compensation through the UN if it received a loan or other assistance.

The agreement was a rare instance of a victorious country making compensation for war losses.

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REPEAL, the abrogation, revocation or annulling of a law. The word is particularly used in the United States for the repeal of the 18th (prohibition) amendment of the constitution, and in English history for the movement led by Daniel O'Connell (*q.v.*) for the repeal of the Act of Union. *See* PROHIBITION; LIQUOR LAWS AND LIQUOR CONTROL.

REPERTORY THEATRE: *see* **DRAMA.**

REPHAIM (Heb. shades, ghosts), a race of reputed giants mentioned in the Bible as the prehistoric inhabitants of Canaan before the land was conquered by the Israelites. Rephaim are often held to be inclusive of the other Biblical giants, namely the Emim, Zuzim, Anakim and Horim. The giant legend, as well as that of longevity, is common in ethnic myths which tend to ascribe extraordinary powers and qualities to extinct forbears. The concept of larger than human proportions is also held to have arisen from the sight of ancient ruins and tombs. For example, the sarcophagus of Og, the king of "Bashan which was called the land of the giants" (Deut. 3:11) is described as being giant sized. In the later books of the Bible (Psalms 88:11; Job 26:j, etc.) Rephaim is the Hebrew word used to denote the shades of the dead which dwell in Sheol. similar to the ghosts (gigim, gidim) of Sumerian mythology. The valley of the Rephaim was a plain in Judah where David twice conquered the Philistines (II Sam. 5: 17–25).

REPIN, ILYA EFIMOVICH (1844–1930), Russian historical painter, was born in 1844 at Chuguyev in the department of Kharkov, the son of parents in straitened circumstances. He learned the rudiments of art under a painter of saints named Bunakov, for three years gaining his living at this humble craft. In 1863 he obtained a studentship at the Academy of Fine Arts of St. Petersburg, where he remained for six years, winning the gold medal and a traveling scholarship that enabled him to visit France and Italy. He returned to Russia after a short absence and devoted himself to episodes from Russian history. In 1894 he became professor of historical painting at the St. Petersburg academy. Repin's paintings are powerfully drawn. with not a little imagination and with strong dramatic force and characterization. He died at Kuokkala in Finland on Sept. 29, 1930.

His chief pictures are "Procession in the Government of Kiev," "The Arrest," "Ivan the Terrible's Murder of His Son" and, his best-known painting, "The Reply of the Cossacks to Sultan Mahmoud IV."

REPINGTON, CHARLES A'COURT (1858–1925), British military critic, was born on Jan. 29, 1858, and commissioned in the Rifle Brigade in 1878. After serving nith distinction in the Afghan War, the Sudan and South Africa, he was appointed military attach6 at Brussels and The Hague in 1900, being then a lieutenant colonel. Two years later his military career ended abruptly through domestic causes. and he took up journalism, becoming military correspondent of the *Times* in 1904. In 191j, after staying with the British commander in chief in France, he went home to call attention to the shell shortage. In Jan. 1918 a divergence of views caused him to leave the *Times* for the *Morning* Post, and after World War I he became military correspondent of the *Daily Telegraph,* a post which he held until his death at Hove, Sussex, on May 25, 1925.

His works include *Vestigia* (1919); *The First World War, 1914–18; Personal Experiences* (1920); *After the War; A Diary* (1922); *Policy and Arms* (1924).

REPINGTON (or REPYNGDON), **PHILIP** (d. 1424), English bishop and cardinal, u-as educated at Oxford and became an Augustinian canon at Leicester before 1382. A man of some learning, he came to the front as a defender of the doctrines taught by John Wycliffe; for this he was suspended and afterwards excommunicated, but in a short time he was pardoned and restored by Archbishop William Courtenay, and he appears to have completely abandoned his unorthodox opinions. In 1394 he was made abbot of St. Mary de Pré at Leicester, and after the accession of Henry IV to the throne in 1399 he became chaplain and confessor to this king, being described as "clericus specialissimus domini regis Henrici."

In 1404 Repington was chosen bishop of Lincoln, and in 1408 Pope Gregory XII made him a cardinal. He resigned his bishopric in 1419. Some of his sermons are in manuscript at Oxford and at Cambridge.

REPLEVIN, a term in English law signifying the recovery by a person of goods unlawfully taken out of his possession by means of a special form of legal process, this falls into two divisions — (I) the "replevy," the steps which the owner takes to secure the physical possession of the goods, by giving security for prosecuting the action and for the return of the goods if the case goes against him, and (2) the "action of replevin" itself. The jurisdiction in the first case is in the county court (*q.v.*); in the second case the supreme court has also jurisdiction in certain circumstances. At common law, the ordinary action for the recovery of goods wrongfully taken would be one of detinue; but no means of immediate recovery was possible till the action was tried, and until the Common Law Procedure Act 1854 the defendant

might exercise an option of paying damages instead of restoring the actual goods.

United States.—In the United States the action of replevin is almost entirely regulated by statute in each jurisdiction, and is materially different from the use and construction of the common law action of replevin in England. The action is laid upon a wrongful taking and a wrongful detaining or a wrongful detaining alone. It is a proceeding *in rem* to recover goods and chattels, *i.e.*, every kind of personal property to which the plaintiff has the right to present possession, and also, by statute, a proceeding in *personam*, to recover damages for either the detention or both the caption and detention, according to the wording of the statute. It is a possessory action, the gist of which is the right of possession in the plaintiff, but in nearly all cases the title is determined since the owner is entitled to possession, and possession by verdict where the title is in question awards title. It will not lie to recover real property or fixtures attached to the freehold, nor can it be maintained in any case in which the object sought is the determination of title to land. In some jurisdictions all damages growing out of the wrongful taking and detention may be assessed in the replevin action; in others, where the statute limits the recovery of damages to detention only, a separate subsequent action may be brought to recover compensatory and punitive damages sustained by a malicious wrongful taking (*Crockett* v. *Miller*, 112 Federal 729; *Petrie* v. *Wardman-Justice Motors*, Sup. Ct. *D. C.* No. 71,338). This is a rule peculiar to replevin, where so regulated by statute, and is at variance with the general rule of law requiring the adjudication in one cause of action of all claims and demands growing out of a single tort.

REPNIN, ANIKITA IVANOVICH, PRINCE (1668–1726), Russian general, and one of the collaborators of Peter the Great. He took part in all the principal engagements of the Great Northern War. Defeated by Charles XII. at Holowczyn, he was degraded to the ranks, but was pardoned as a reward for his valour at Lyesna and recovered all his lost dignities. At Poltava he commanded the centre. From the Ukraine he was transferred to the Baltic Provinces and was made the first governor-general of Riga after its capture in 1710. In 1724 he succeeded the temporarily disgraced favourite, Menshikov, as war minister. Catherine I. created him a field-marshal.

See A. Bauman, *Russian Statesmen* of *the Olden Time* (Rus.), vol. i. (St. Petersburg, 1877).

REPNIN, NIKOLAI VASILIEVICH, PRINCE (1734–1801), Russian statesman and general, grandson of the preceding, served during the Rhenish campaign of 1748 and subsequently studied in Germany. Peter III. sent him as ambassador in 1763 to Berlin. The same year Catherine transferred him to Warsaw, with instructions to form a Russian party in Poland from among the dissidents, who were to receive equal rights with the Catholics. Repnin convinced himself that the dissidents were too poor and insignificant to be of any real support to Russia, and that the whole agitation in their favour was factitious. At last, indeed, the dissidents themselves even petitioned the empress to leave them alone. The attempt had failed, and Repnin went to fight the Turks. At the head of an independent command in Moldavia and Walachia, he prevented a large Turkish army from crossing the Pruth (1770); distinguished himself at the actions of Larga and Kagula; and captured Izmail and Kilia. In 1771 he received the supreme command in Walachia and routed the Turks at Bucharest. A quarrel with the commander-in-chief, Rumyantsev, then induced him to send in his resignation, but in 1774 he participated in the capture of Silistria and in the negotiations which led to the peace of Kuchuk-Kainarji. In 1775–76 he was ambassador at the Porte. On the outbreak of the war of the Bavarian Succession he led 30,000 men to Breslau, and at the subsequent congress of Teschen, where he was Russian plenipotentiary, compelled Austria to make peace with Prussia. During the second Turkish war (1787–92) Repnin was, after Suvarov, the most successful of the Russian commanders He defeated the Turks at Salcha, captured the whole camp of the *seraskier*, Hassan Pasha, shut him up in Izmail, and was preparing to reduce the place when he was forbidden to do so by Potemkin (1789). On the retirement of Potemkin (*q.v.*) in 1791, Repnin succeeded him as commander-in-chief, and immediately routed the grand vizier at Machin, a victory which compelled the Turks to accept the truce of Galatz (July 31, 1791). In 1794 he was made governor-general of the newly acquired Lithuanian provinces. The emperor Paul raised him to the rank of field-marshal (1796), and, in 1798, sent him on a diplomatic mission to Berlin and Vienna in order to detach Prussia from France and unite both Austria and Prussia against the Jacobins. He was unsuccessful, and on his return was dismissed from the service.

See A. Kraushar, *Prince Repnin in Poland, 1764–8* (Pol.) (Warsaw, 1900); "Correspondence with Frederick the Great and others" (Rus. and Fr.), in *Russky Arkhiv* (1865, 1869, 1874, Petersburg); M. Longinov, *True Anecdotes of Prince Repnin* (Rus.) (St. Petersburg, 1865).

REPORTING, the business of reproducing, mainly for newspapers, but also for such publications as the *Parliamentary* or *Law Reports*, the words of speeches, or of describing the events in contemporary history by means of the notes made by persons known generally as reporters. There was no systematic reporting until the beginning of the 19th century, though there was parliamentary reporting of a kind almost from the time when parliaments began, just as law reporting in the middle ages began in the form of notes taken by lawyers of discussions in court. The first attempts at parliamentary reporting, in the sense of seeking to make known to the public what was done and said in parliament, were made by the *Gentleman's Magazine* in 1736. Access to the houses of parliament was obtained by Edward Cave (*q.v.*), the publisher of this magazine, and some of his friends, and they took surreptitiously what notes they could. These were subsequently put into shape for publication by another hand. Such reporting was a violation of the standing order of the house. passed in 1728, declaring the publication of any of its proceedings to be a breach of privilege, and on the attention of the house being called in 1738 to the reports in the *Gentleman's Magazine* it threatened to proceed with the utmost severity against the offenders. Thereupon Cave published his reports as "Debates in the Senate of Lilliput," and instead of giving the first and last letters of each speaker's name, employed such barbaric terms as "Wingul Pulnub" for William Pulteney. Dr. Johnson composed the speeches for the *Gentleman's Magazine* from 1740 to 1743, the names of the speakers being given in full. Though he said he took care not to let the "Whig dogs" get the best of it, he really dealt out argument and eloquence to both political parties.

In the latter half of the century the newspapers began to report parliamentary debates more fully, with the result that, in 1771 several printers, including those of the *Morning Chronicle* and the *London Evening Post*, were ordered into custody for publishing debates of the house of commons. A bitter struggle between the house and the public ensued. In 1772 the newspapers published the reports as usual, and their right to do so has never again been really questioned. Early in the 19th century, greater freedom of access to both houses was given to newspaper reporters. Special galleries for their accommodation mere provided in the legislative chambers of the new palace of Westminster erected in place of the old which was burned down in 1834. The press gallery of the house of lords was first used in 1847, and the press gallery of the house of commons in 1852. At this time the London newspapers had a virtual monopoly of parliamentary reporting, since only their representatives were admitted to the galleries.

The *Times* established a supremacy for the best parliamentary report, which has never been shaken. The other London papers, however, gave less and less attention to the debates while the leading provincial newspapers began to publish full reports of debates of local interest. They employed reporters in the service of the London journals but their reports mere printed a day late. Then telegraphic wires from London were placed at the disposal of provincial newspapers from six o'clock at night till three o'clock in the morning. The arrangement was first made by the *Scotsman* and by other newspapers in Scotland in the 1860s. When the telegraphs were taken over by the state in 1870 the facilities for reporting were increased in every direction. News agencies undertook to supply the provincial papers, but the reports which any agency

supplied were identical. In 1880 a select committee of the house of commons was appointed to consider whether the gallery should continue to be closed to all save the London papers and the news agencies. It reported in favour of the extension of the gallery and of the admission of provincial papers. The press gallery of the house of commons was accordingly enlarged and representatives of the leading provincial newspapers were admitted at the opening of the session of 1881. At this period the *Times* first established telephonic communication with the gallery. In 1951 that paper introduced a new tool of parliamentary reporting—the system of teletypesetting, by which a compositor in the palace of Westminster could set type by remote control of a linotype machine in the offices of the *Times*. This system had been used in the United States and by the *Scotsman* and the *Glasgow Herald* between London and their head offices.

What is commonly called "descriptive reporting" has in some cases nearly shouldered the reporting of speeches out of newspapers. The special correspondent or the war correspondent is a "descriptive reporter." The "interviewer" came into great prominence during the 188os and 189os. In 1900 in the English case of *Walter* v. *Lane* it was decided on the final appeal to the house of lords that the reporter of a speech, printed verbatim in a newspaper, was under the Copyright act of 1842 to be considered the "author." Absurd as it might seem to call the reporter the author of another man's speech, the decision gave effect to the fact that it is his labour and skill which bring into existence the "copy" to which alone can right of property attach. Strictly speaking, he is the author of the *report* of the speech; but for literary purposes the report *is* the speech. Any other persons present when the speech was made could equally have obtained copyright in *their* report of it; there may be more than one verbatim report. and therefore more than one "author." The effect of *Walter* v. *Lane* was not, it was considered, affected by subsequent legislation of the law of copyright.

Law reports have a special place in the English judicial system. When a new point of law is determined in a lawsuit, that case becomes in theory a precedent for future cases in which the same point arises. Whether a case in fact becomes a precedent depends mainly, however, on whether it is reported, and the reporting of cases has always been in private, or at least unofficial hands. Any law report made by a barrister may be cited in court—those, for instance, appearing in the *Times* are frequently so cited when no fuller report is available—but it is usual to cite reports specially prepared for the purpose. These should begin with a headnote stating succinctly the point determined, usually by reference to the facts found, followed by a full statement of the relevant facts, the arguments of counsel, and the judgment of the court on the law. Reports in this form date back to the time of Lord Mansfield, chief justice, in the late 18th century, and thereafter a strict doctrine of *stare decisis* evolved requiring the judges invariably to follow the decision of at least a higher court in future similar cases. In 1865 the Council of Law Reporting was set up, a non-profit-making body publishing the *Law Reports,* but a host of series of reports published commercially, mostly defunct by the mid-195os, competed with them, often printing more cases. Accordingly in 1953 the council instituted the *Weekly Law Reports,* at least as full as any private series, only select cases of which appear finally in the *Law Reports.* The *Law Reports* alone set out the arguments of counsel, which add considerable value to a report; for if a point was missed it may be raised again in a future case to show that the reasoning of the court was wrong—per *incuriam.* The odd fact remains that the great-majority of cases are never reported at all, and the selection of those so reported remains in unofficial hands. Comparison with other countries (such as the United States), where cases are generally reported, shows that the principle of *stare decisis* works better under the English system.

See also CENSORSHIP; CIVIL LIBERTIES; COPYRIGHT; NEWSPAPERS; SHORTHAND; TELEGRAPH. (R. P. Cx.)

UNITED STATES

The first known reporting of news for current publication in America consisted of an account of a Guatemalan earthquake printed in a Mexican newssheet. The first known such publication in what is now the United States was in a broadside published in Boston in 1689 and entitled "The Present State of the New-English Affairs"; the reporter was Increase Mather, u-ho told of what was being done in England in regard to the Andros revolution.

Because colonial papers were made up chiefly of articles taken from other newspapers issued in England and other colonial towns, essays, political documents, etc., direct reporting by newsmen connected with their respective papers was limited to brief pieces about the most important local happenings written by the editor or a friendly contributor. It was not until the rise of the "penny press" in the 183os, with its emphasis on local news, that reporting came into its own as the most essential part of newspaper work. In 1851, Horace Greeley, one of the greatest U.S. editorial writers of the time, testifying before a British house of commons committee, insisted that U.S. readers gave far more attention to news than editorials. William Rockhill Nelson. founder (188o) of the *Kansas City Star,* declared, "The reporter is the essential man on the newspaper; he is the big frog in the puddle."

Types of News Reporting.—Most important of all are the local reporters, because (1) they outnumber those of any other category, and (2) local news is always regarded as of primary importance. A local reporter sometimes does little or no writing. A "leg man" telephones his news to a "rewrite man," and may visit the office of his paper only occasionally. A "cub" reporter is a beginner and usually has a routine "beat," while a "star" reporter receives from his editor the most important special assignments.

The capital, or state house, correspondent reports news of the state government. In states containing large cities, handling such news for metropolitan papers is a big task, especially during sessions of the legislature.

Washington correspondents cover the news of the national government. Their task is complicated, exacting, responsible. They cover the capitol, the White House, the various departments and bureaus, etc. There has been increasing insistence on "digging out" news of situations instead of waiting for its development in events, or merely collecting "handouts." There were about 1,400 reporters, including photographers, covering Washington in the 195os, three-fifths serving daily newspapers, one-fifth radio and television and one-fifth periodicals.

Foreign correspondence is the goal of many ambitious reporters, but in peacetime United States papers and news agencies keep only about 300 full-time U.S. reporters abroad. When they work in war areas, these men and women become war correspondents, accredited by military, naval, or air commands. During World War II, the U.S. war department accredited 1,186 U.S. correspondents and news officials. and the navy department 460 more—a total of 1,646 newsmen for all media.

Distribution by Media.—In modem communication! reporting is by no means limited to the men and women who gather and write the news. Gathering is essential to the process, but the reporter may write, picture, or speak the news for newspapers, magazines, books, radio, television, or motion pictures.

Newsphotography has been a means of reporting ever since the American Civil War pictures of Mathew B. Brady, and movie news shorts have been used ever since the Spanish War motion pictures of J. C. Hemment. With the development of the inexpensive halftone engraving process in the last two decades of the 19th century, pictures as news made an increasingly important contribution to reporting.

Beginning with an amateur broadcast of election returns in 1916, radio gradually came to play a large and essential part in the news distribution system, and all large broadcasting stations include on their staffs local newsmen who make direct reports. The networks have their own reporters at Washington and abroad, and radio reporters have seats in the senate and house press galleries.

Reportorial Ethics.—Strides toward professional standing have been made by reporting, through (1) better training in schools of journalism and liberal arts colleges, and growing acceptance of specialized training for journalism by employing editors; (2) increasing group solidarity through organization and the recognition of such codes as the Canons of Journalism of the American

Society of Newspaper Editors and Walter Williams' "Journalist's Creed"; and (3) a better wage scale, largely through the efforts of the American Newspaper Guild, organized in 1933. (F. L. MT.)

REPOUSSÉ (Fr. "driven back"), the art of raising designs upon metal by hammering from the back, while the "ground" is left relatively untouched. The term is often loosely used, being applied indifferently to "embossing." Embossing is also called *repoussé* sur *coquille* and *estempage*, but the latter consists of embossing by mechanical means and is therefore not to be considered as an art process. Moreover, it reverses the method of repoussit, the work being done from the front, and by driving down the ground leaving the design in relief.

Repoussé—a term of relatively recent adoption, employed to differentiate the process from embossing—has been known from remote antiquity. Nothing has ever excelled, and little has ever approached. the perfection of the bronzes of Siris (4th century B.C., in the British Museum), of which the armour-plate—especially the shoulder-pieces—presents heroic figure-groups beaten up from behind with punches from the flat plate until the heads and other portions are wholly detached—that is to say, in high relief from the ground of which they form a part. Yet the metal, almost as thin as paper, is practically of constant thickness, and nowhere is there any sign of puncture.

The art was not only Greek and Graeco-Roman in its early practice; it was pursued also by the Assyrians. the Phoenicians, and other oriental peoples, as well as in Cyprus and elsewhere, and was carried forward, almost without a break, although with much depreciation of style and execution, into mediaeval times. In the 11th century the emperor Henry II. presented as a thank-offering to the Basle cathedral the altar-piece, in the Byzantine style, decorated with fine repoussé panels of gold (representing Jesus Christ nith two angels and two saints), which is now in the Cluny Museum in Paris. Up to this time, also, repoussé instead of casting in metal was practised for large work, and Limoges became a centre for the manufacture and exportation of sepulchral figures in repoussé bronze. These were affixed to wooden cores. By the time of Benvenuto Cellini the art was confined almost entirely to goldsmiths and silversmiths (who, except Cellini himself, rarely cast their work); and to them the sculptors and artists of to-day are still content to relegate it.

The elementary principle of the method, after the due preparation and annealing of the plate, was to trace on the back of it the design to be beaten up, and to place it face down ards upon a stiff yet not entirely unresisting ground (in the primitive stage of development this was wood), and then with hammers and punches to beat up the design into relief. According to Cellini, his master Caradosso da Milano would beat up his plate on a metal casting obtained from a pattern he had previously modelled in wax; but he is not sufficiently explicit to enable us to judge whether this casting was a hollow mould, which would result in true repoussé, or in the round, which is tantamount to *repoussé sur coquille*, or embossing.

Nowadays the plate is laid upon and affixed to a "pitchblock," a resinous ground docile to heat, usually composed of pitch mixed with pounded fire-brick, or, for coarser work such as brass, with white sand, with a little tallow and resin. This compound, while being sufficiently hard, is elastic, solid, adhesive and easy to apply and remove. Gold and silver are not only the densest and most workable but the most ductile metals, admitting of great expansion without cracking if properly annealed. The tools include hammers, punches (in numerous shapes for tracing, raising, grounding, chasing and texturing the surfaces), together with a special anvil called in French a *recingle* or *ressing*, in English "snarl." The *recingle*, or small anvil with projecting upturned point, was known in the 16th century. This point is introduced into the hollow of the vase or other vessel such as punch and hammer cannot freely enter, which it is desired to ornament with reliefs. A blow of a hammer on that part of the anvil where the prolongation first projects from it, produces, by the return spring, a corresponding blow at the point which the operator desires to apply within the vase. The same effect is produced by the modern "snarl" or "snarling iron"—a bar of steel, with an inch or two of the smaller end upturned and ending in a knob—held firmly in a tightly screwed-up vice, whereby the blow is similarly repeated or echoed by vibration. The repoussé work, when complete, is afterwards finished at the front and chased up. *See* also METALWORK, DECORATIVE; SILVERSMITHS' AND GOLDSMITHS' WORK.

(M. H. S.)

REPRESENTATION, a term with the broad general connotation of making present something or somebody that is not present; but more especially the term is used in a political meaning and pertains t@modern government as a method of solving the problem of how to enable a very large number of people to participate in the shaping of legislation and governmental policy.

Representation in the broadest sense has roots which link it with the world of beliefs called magic, a world in which mysterious connections were regularly assumed to prevail between distinct persons and beings. both natural and supernatural. Without going into the historical evolution of the various meanings of "represent," "representation" and "representative." it is worth noting that the modern governmental meaning was not attached to these expressions until the 16th century, when parliamentary development began. Sir Thomas Smith, in his *De Republica Anglorum* (1583), uses the expression freely in describing parliamentary institutions.

It must be admitted, however. that a magical element remained in spite of the continuous effort to rationalize the relationship spoken of as representation. Some writers, such as Jean Jacques Rousseau, simply denied that representation of the will of the people is possible While few would be willing to follow Rousseau, it is generally agreed that representation of the electorate in modern representative assemblies poses very real problems, because the views both of the representative and of those represented are likely to undergo change as the situation changes.

Theoretical Problems of Representation.— In large modern countries the people cannot, of course, assemble in the market place as they did in democratic Athens or Rome. If, therefore, the people are to participate in government, they must select and elect a small number from among themselves to represent them and act for them. Through the course of a long historical evolution, the methods for such elections have been rationalized. The extended 19th-century struggle for electoral reform in England was fought over this issue; rotten boroughs, patrons and other features of aristocratic nepotism were eliminated. In these reforms. Jeremy Bentham's "rational" principle of utility prevailed against Edmund Burke's earlier defense of traditional practices. Direct general elections have since that time been accepted as the most "rational" method for choosing representatives, whether they be legislative or executive. For executives are also representatives of the people. The view that this is not so is a survival of attitudes developed during the monarchical age, when progressive forces fought the crown as unrepresentative. It is important that executives be included among the people's representatives because of the paramount role the executive establishment plays in modern government. Public policy in most modern democratic governments is shaped as much by the executive as by the legislative. Since parties are usually led by the chief executive, their role in determining the pattern of representation strengthens the executive's representative position.

Somewhat different are the role and position of the courts The thorough legal knowledge required of a good judge has stood in the way of choosing judges by election. Wherever judicial bodies have been elective. much dissatisfaction has developed. In most jurisdictions, judges are ordinarily selected on the basis of technical competence—a relatively objective standard. Elections have not seemed a "rational" method. The supreme court of the United States would certainly seem to most people less representative if it were elected by the people. The reason for this is that all representation involves ideas; for only through an idea can the making present of one thing or person by another be conceived. Another problem would arise as the result of the divisions of the electorate; minority interests might be neglected

The deepest and most obscure aspect of representation is its ideological foundation. There has always been controversy be-

tween those who would have the representatives of the people act as delegates carrying out instructions and those who would have them be free agents acting in accordance with their best ability and understanding. The latter alternative was stated by Edmund Burke in his celebrated speech (1780) to the electors at Bristol:

Parliament is not a *congress* of ambassadors from different and hostile interests, which interests each must maintain, as an agent and advocate, against other agents and advocates; but parliament is a *deliberative* assembly of *one* nation, with *one* interest, that of the whole; where not local purposes, not local prejudices ought to guide, but the general good. . . .

Certainly, gentlemen, it ought to be the happiness and glory of a representative to live in the strictest union, the closest correspondence, and the most unreserved communication with his constituents Their wishes ought to have great weight with him; their opinion high respect; their business unremitted attention. . . . But his unbiased opinion, his mature judgment, his enlightened conscience, he ought not to sacrifice to you, to any man, or to any set of men living. These he does not derive from your pleasure; no, nor from the law and the constitution. They are a trust from Providence, for the abuse of which he is deeply answerable.

Burke's idealistic conception accords neither with the reality of popular politics nor yet with the democratic ideal that the will of the people should prevail. The issue as to whose will is to prevail and is therefore to be taken as the will of the whole cannot be sidestepped by asserting, as Burke does, that parliament represents *one* nation, with *one* interest. While this is true in the abstract, the issue at hand is who is to say what that general interest is at a given time. For the conflict of various interests and their possible relation to a more comprehensive public interest is the real issue. Abstractly considered, a special mandate cannot be admitted, since it would make the members of representative assemblies into mandatories for special interests. But there is a great difference between a special mandate and a broad indication as to the general line of policy to be pursued.

The reason that the elected representatives of a party can be said to represent their electorate is basically that these representatives and those whom they represent are bound together by a world of ideas and beliefs that they share. Consequently, it can be assumed that any conclusion the representatives come to with regard to a new issue is likely to be the same as the conclusion the electorate would have come to had it been able to consider the new facts. But one gets lost in metaphysics of a rather shady sort when one claims that the majority represents the minority in any concrete sense. It is the majority and the minority together who represent the people as a whole and their general interest. But what about the single chief executive? All attempts to lift a chief executive above parties have proved abortive. A disastrous example is provided by the institution of the presidency under the German republican (Weimar) constitution. Such insistence upon the nonpartisan character of the chief executive is a result of the persistence of ideas prevalent during the monarchical age. when the king or the crown was supposed to be the preordained representative of all.

Dual Nature of Representation. — Historically speaking. representative assemblies developed in most European countries in the course of the later middle ages as an important part of the medieval constitutional order. Though great variations existed. the three estates were usually composed of nobility, clergy and the merchants of the cities (the burgesses). In the English parliament the higher nobility was joined with the higher clergy in "the lords spiritual and temporal," while the lower squirearchy and the burgesses together constituted the commons. This latter, the English system of two estates, proved more viable than the commoner continental system of three. The representatives of the loner estate mere originally called by the crown in order to secure additional financial support over and above the feudal dues. *(See* FEUDALISM; PARLIAMENT.) Quite naturally, these representatives when gathered together proceeded to present complaints and petitions in an effort to strike a bargain. Such bargains were in favour of their own class. They represented their class as agents of the local powers and acted under instructions or mandates. But when, after the deal was struck, the king and the two houses of parliament acted together as "the king in parliament," they were taken to represent the whole realm. This historical background shows clearly that it is not justifiable in drawing the sharp distinction Burke had in mind between agents with definite instructions and representatives speaking for one nation. An elected body is both: a deliberative assembly from *one* nation with *one* interest. that of the whole, *and* a congress of ambassadors from different and hostile interests. This dualism in political representation cannot be escaped. Many political philosophers have tried to do it, but with unsatisfactory results. The fascists and Communists have. by their insistence upon a monistic view. been forced into seeking some kind of religious or inspirational sanction, deifying the state, the proletariat or the folk and their respective leaders. The dualism of representing both the whole and one or another of its parts lies deeply embedded in representative schemes.

Representation Defined. — In the light of the foregoing, it is possible to suggest a definition of political representation: Representation is the process through which the attitudes, preferences, viewpoints and desires of the entire citizenry or a part of them are, with-their expressed approval, shaped into governmental action on their behalf by a smaller number among them, with binding effect upon those represented.

Some features of this difficult definition require further comment. It is necessary to speak advisedly of attitudes, preferences, viewpoints and desires, rather than of will, influence or control, because the large citizen bodies of modern times do not possess a clearly defined will in most matters of public policy, because of lack of knowledge. It is necessary to use the general expression "governmental action." rather than legislation or policy. because all kinds of governmental activity are expressive of popular reactions. Perhaps the most important part of this definition is the phrase "with their expressed approval." Since such approval can be secured only periodically, it must be in a form covering a specified period of time. Finally, it is essential for genuinely representative action that it be accepted by those represented as theirs and hence binding upon them in all its consequences — a result which flows from their expressed approval. But while periodic elections are the commonest method for demonstrating expressed approval, there are exceptions, such as in constitutionally established courts, where the expressed approval may be found in a constitution adopted by common consent; or as in a special interest represented in so-called economic councils.

SOME HISTORICAL AND CONSTITUTIONAL ASPECTS OF REPRESENTATION

Representative systems of the rationalized type are a modern growth. They certainly were not found, as Montesquieu implied, in the forests of ancient Germany. It has been shown that political representation arose as part of the medieval constitutional order. Like so many medieval institutions, this political representation drew its inspiration from the church, whose vast body of the faithful was presumably represented by the great councils in which all Christian people were believed to be present.

Reasons for the Late Appearance of Representation. — But why did representation appear so late in the history of mankind? Essentially, the answer must be that it was not needed before modern times. The great empires of Asia had been animated by religious beliefs in which the individual human being counted for little and his personal preferences for less. In classical antiquity, with its city-states, the small number of citizens made personal participation possible. Aristotle deemed this participation so vital that he opposed altogether a political framework larger than the average city-state. Such personal participation became impossible whenever such a city-state expanded beyond the local unit. Attempts to solve the problem through federal organization foundered because of the lack of an ideological base upon which a representative scheme might have been evolved. The Romans undertook to embody the citizenry of each city of their Latin federation in the Roman citizenry by using various fictions, but the system broke down when republican Rome expanded and the Romans adopted the Asiatic technique of deifying an emperor. Still, the Roman constitution unquestionably contained elements of genuine representation. These elements were crippled, however,

by the ascendancy of the unrepresentative senate. By contrast, the spirit of corporate solidarity in the medieval towns, shires, monasteries and cathedrals was sufficiently developed to make the group willing to participate in the larger community through group representatives. Unless such solidarity provides a common base of ideas, true representation cannot take place.

Representation and Constitutional Government. — Except in small communities, constitutional government is impossible without a system of representation. Constitutional government is government in which the use of power is restrained by a constitution which defines the functions of various power-holders. Restraint necessarily calls for dividing governmental power. Undivided power is unrestrained power.

From a historical standpoint, the need for securing responsibility in government is the central objective in all the various schemes of representation. This is true even of completely supernatural schemes, such as that by which a king is supposed to represent God on earth. For this notion may be the most powerful restraint upon the ruler and provide an impulse for him and his officials to act justly and avoid abuse of power. Examples abound not only in the experience of Europe but in such systems as the sultanate of Turkey or the empire of China. But this scheme works only as long as the faith lasts. If the ruler becomes an unbeliever, the most arbitrary tyranny easily develops.

The division of power may take many different forms. Perhaps the two most important modern forms are the so-called separation of powers, and federalism. For both, representation is of vital importance. Distinct federal divisions of the electorate, created and maintained under a constitution, require the selection of distinct groups of representatives among whom the several functions of government may be divided. (See FEDERAL GOVERNMENT.) The same is true under any kind of separation of powers; it presupposes a variety of representatives for different constituencies. Looked at from this angle. these schemes for dividing "power" really amount to dividing the people in a number of different ways and then giving these several subdivisions a voice in shaping governmental action through different representatives nho are kept from abusing their power by holding each other in check. Such a plan could, of course. have no practical effect unless the community were actually divided into a number of groups, parties and classes.

Not only does constitutional government depend upon representation, but representation in turn depends upon constitutionalism. For unless the community is ready to agree upon and live by a basic charter in accordance with which power is wielded, plans for representation are liable to break down, as they did in post-World War, I Italy and Germany. The representative quality rests upon a belief in common ground as far as doing things is concerned, and while there is no need for agreement on fundamentals other than the constitutional mores themselves, the latter, which have sometimes been called constitutional morality, are indeed of paramount importance. Representation, it might be said, is a game in which the rules are prescribed by the constitution as approved by the people. *(See* CONSTITUTION AND CONSTITUTIONAL LAW.)

Representation and Legislation. — Ever since the 16th century. legislation has been considered the most important phase of governmental action. Legislation involves the making of rules binding upon the whole community. Such general rules, it was felt, should bear the closest possible relation to the community's general beliefs. The higher law which Sir Edward Coke and others expounded as the yardstick for evaluating parliamentary statutes mas believed immutable, a precious heritage of principles upon which all legislation should be based. At this point, the Protestant idea that one cannot force men in matters of belief, now generally accepted by all Christians as well as by many other faiths, reinforced the growing idea of the necessity of consent in matters of general legislation. A specific act of government may be justified in terms of a specific emergency, but no general rule can be considered valid unless assented to by those to whom it is to apply. Since the citizenry is too large, representation becomes essential. "No taxation without representation" is a vivid expression of this general view.

There is another aspect which suggests the use of representative assemblies as the natural agents for the purpose of making laws. A general rule presupposes that there is a series of events which have certain aspects in common. There must be a normal situation. If an event is recurrent, time elapses. Time is available, therefore, for deliberation to determine what is right and proper. Deliberative processes in turn are well suited to the relatively slow procedure of representative bodies. Nevertheless, the procedure of a well-organized representative assembly is so arranged as to result in action; namely, the adoption of a general rule. The enactment of such a general rule requires careful adjustment of conflicting viewpoints; really workable compromises need to be reached. Through argument and discussion the area of agreement is determined in the representative legislature. It symbolizes the consent which legislation presupposes, if it is to be compatible with the dignity of man's autonomy in matters of basic conviction and belief.

ELECTORAL SYSTEMS AND REPRESENTATION

In our discussion so far the electing of representatives has been spoken of as if an election were as simple a thing as throwing a stone. Actually, some of the most difficult problems of representation arise in connection with elections. Should elections be secret or public? Should limiting qualifications be required of those participating in the elections? How should the country be divided so as to make it possible for people to vote? These and related issues have all been sharply debated at one time or another, with a view to their bearing upon the central issue of making the results representative.

To the ancients, democracy meant that the whole citizenry met in the market place and decided all matters of common concern. To the modern world, democracy means that the whole citizenry regularly elects representatives. after having read about their platforms in the newspapers or listened to them in a meeting or over the radio or television. But there is a great difference between those elections in which the citizen is confronted by a clear-cut alternative between electing either A or B, and thereby supporting either party X or party Y, and elections in which he must choose among A, B. C, D, E, F and so forth and thus align himself with one of at least half a dozen parties, none of which has any chance of securing a majority.

The English and U.S. System. — The so-called two-party system has long been traditional in the United States and Great Britain. British parliamentary government rested for a long time upon a strictly traditional system of elections. It abounded with abuses of all kinds, such as rotten boroughs — unpopulated or depopulated areas which retained the right of representation in parliament. Through a series of reforms Britain eventually arrived, in 1884–85, at the single-member constituency, though the constituencies continued to lack uniformity of size and structure. Elections thereafter were decided in England by relative majority or plurality. This means that the candidate who secures the largest number of votes wins the seat. The balloting is secret, though before 1885 it was public, with much brawling and rioting. The British electoral system is thus clearly directed toward the goal of dividing each constituency, and thereby all of the United Kingdom. into two parts: the majority which is to govern and the minority which is to criticize. This situation may mean permanent minority status for a man who belongs to the wrong party in a particular constituency. As the English writer Walter Bagehot wrote in *The English Constitution* (1873), "I have myself had a vote for an agricultural county twenty years, and I am a Liberal; but two Tories have always been returned, and all my life will be returned." A Democrat in Vermont or a Republican in Alabama is in the same situation.

The main criticism brought against this system of single-member constituencies is that the number of representatives elected is usually not proportional to the ratio of votes cast. Such is virtually certain to be the case, because in many constituencies one of the parties may predominate, as Democrats do in the southern states of the United States or Tories do in many rural constitu-

encies in England. It may result in apathy among the voters, or in a shift to primary contests as the key political decision. It may even happen that a minority of votes secures a majority of representatives.

Gerrymandering ("Electoral Geometry").—If the desirability of a majority (plurality) system of elections be conceded, the issue of how to divide the electorate appropriately is of great importance. As long as the population shifts, periodic readjustments of the boundaries of electoral districts are necessary, if gross injustices such as rotten boroughs are to be avoided. In the United States and elsewhere this issue is a familiar one; there is a recurrent political fight over reapportionment. Even with skillful and competent handling, there are bound to be lags. Under adverse conditions, reapportionment becomes a football of party politics. Since in order to gain a seat all a party needs is a small majority of votes, it is very tempting for the party in power to redraw the political map, that is, the boundaries of districts, wards and other subdivisions, so as to distribute its voting power most effectively. The resulting shapes of electoral subdivisions are often fantastic and not even always contiguous. Because a salamanderlike sprawling district was first constructed under a governor of Massachusetts, Elbridge Gerry, in 1812, this practice is known as gerrymandering. It is easy to construct cases which illustrate how the same electorate may give a majority to opposing parties as a result of adroit electoral geometry. (See APPORTIONMENT, LEGISLATIVE.)

The Issue of Proportional Representation. — The nonproportionality of single-member constituencies electing representatives by pluralities as well as gerrymandering has given rise to a series of proposals for proportional representation which seek to remedy these defects. The idea first appeared in the French national convention in 1793, without practical results. It was further elaborated by a number of writers (see Bibliography) who invented several systems.

It is clear that proportional representation responded to a widely felt need. The underlying idea of all the various proposals was to secure a representative assembly reflecting with more or less mathematical exactness the various divisions in the electorate. Why should such divisions be reflected? "The voice of minorities should be heard," is the answer.

The most penetrating philosophical argument in support of the general idea of proportional representation was set forth by John Stuart Mill. He called it "one of the very greatest improvements yet made in the theory and practice of government. . . . In the first place, it secures a representation, in proportion to numbers, of every division of the electoral body: not two great parties alone . . . but every minority in the nation. . . . Secondly, no elector would be nominally represented by someone whom he had not chosen. Every member of the House would be the representative of an unanimous constituency." Mill stressed the strong tie, the complete identification, the weakening of localism, the higher intellectual qualification of the representatives and the avoidance of collective mediocrity. Finally. Mill saw it as a check on "the ascendancy of the numerical majority" by offering "a social support for individual resistance. . . . a rallying point for opinions and interests which the ascendant public opinion views with disfavour." In his enthusiasm, Mill called proportional representation "personal representation" which offers a refuge to the "instructed elite." No objections of real weight could be seen by Mill, though in his usual deliberate manner he examined a few which he found wanting. Yet it is obvious that his whole argument rested upon certain unexplained major premises. His is an extreme individualist argument which he reinforces by the undemocratic preoccupation with the enlightened few who might be lost in the shuffle of the ignorant mass.

But the key assumption is that there can be no representation of the nhole without a representation of each of the whole's parts. What actually is the primary function of a representative assembly? Is it to represent or is it to do something else? To put the question is to answer it. The primary function is to participate in governing. In order to be able to do that, a representative assembly needs a measure of cohesion. It cannot be, as we have seen, solely a congress of ambassadors from different and hostile interests. It must be able to reach decisions.

The elusive quality of Mill's approach is made evident by the opposing view of Walter Bagehot, another eminent writer on government and a 19th-century liberal like Mill, albeit more to the right. Bagehot, in rejecting proportional representation, put the following question: What will proportional representation do to the functioning of a parliament as we know it? Bagehot was a practical man, a banker, and his great achievement in this debate was to spell out what everyone knew in practice, namely, that the function of a parliament was twofold: (1) for the majority to support the cabinet in its conduct of the government; and (2) for the minority to criticize the actions of the government. This combination of action and criticism enables a parliament to represent the people as a whole.

Bagehot considered the basic difference between election by majority and proportional representation the fact that proportional representation makes the constituency voluntary-each voter individually is able to choose his own constituency. He votes as a voluntary member of a group which has no other tie. A constituency being the group or segment of voters that is entitled to send a member to parliament or congress, this is indeed the basic point, although the language of advocates of proportional representation often obscures it. To put Bagehot's point another way. all proportional schemes suggest saying to the electorate: If a certain number among you, say 10,000, can agree upon a candidate, that candidate shall be elected. The majority system, by contrast, is based upon this approach: A certain number among you shall constitute an electoral district, and the one for whom the largest number among you vote shall be considered elected. "Under the compulsory form of constituency the votes of the minorities are thrown away. . . . Again this plan gets rid of all our difficulties as to the size of constituencies. . . . Again the admirers of a great man could make a worthy constituency for him." But central party organizations would acquire an overweening influence. "The crisis of politics would be not the election of members, but the making of the constituency. . . . The result of this would be the return of party men mainly. . . . Upon this plan, in theory voluntary, you would get together a set of members bound hard and fast with party bands and fetters infinitely tighter than any niembers now. . . ." These are brief bits from a memorable passage in Bagehot's The English *Constitution* which anticipated with remarkable clairvoyance some of the troubles that arose when proportional-representation schemes were actually tried. His arguments do not, of course, exhaust the problem. They are focused upon the issues which arise when the cabinet governs with the support of the majority of a parliament. They fail to take into account the problems which appear when the divisions or cleavages among the electorate have gone so far that failure to represent them adequately would undermine the belief of the people in the justice of the constitution.

Theory and practice suggest that the truth lies somewhere between the lines of argument taken by Bagehot and Mill. There are situations, such as in multinational Switzerland, where proportional representation is probably to be preferred, but then parliamentary government should be discarded or at any rate considered very difficult of operation. There are others, such as in Great Britain, where the later evolution of parliamentary government, with its increasing emphasis on executive leadership, would seem to make a majority system advisable.

The Problem of Justice. — A broader philosophical issue which deserves special consideration is the justice of a representative system. Mill, in his plea for proportional representation, laid considerable stress upon this aspect. "There is a part," he wrote in Considerations on Representative Government, "whose fair and equal share of influence in the representation is withheld from them; contrary to all just government. . . . The injustice and violation of principle are not less flagrant because those who suffer by them are a minority. . . ." Mill considers this matter of justice to the minority so obvious that he proclaims representation in proportion to numbers the first principle of democracy. What kind of justice and democracy is this? Let it be assumed for the

moment that representation should be that of individuals and that it is unjust to a minority not to be "represented," or "represented adequately." If there were only one such minority, perhaps it would not be too bad, although the number of representatives who would criticize rather than help to decide would be increased. It would mean less action, rather than different action. If there were many such minorities, so that no group any longer had a majority, it might mean complete inaction for long periods. This situation arose toward the end of the Weimar republic and spelled its doom. It arose in France in the 1930s with disastrous effects, and again in the early 1950s. What then about justice for the majority? Is it not a question of competing claims? Why should the question of what is just to the minorities be given precedence over what is just to the majority? Admittedly, the majority wants some action. If such action is, through proportional representation, delayed or altogether prevented, what is the justice of that? Problems of justice are problems of adjustment between conflicting claims.

The election of representatives, therefore, always involves the paring down of some claims; justice can be achieved only through a careful balancing of these. Presumably the majority's claims are weightier than those of any minority. Representation is a broad thing: The majority participates through acting, the minority through discussion and criticism. Proportionalists fail to consider the possibility that there might not be any majority at all, in spite of the fact that the need for action, and hence the existence of a majority, may be paramount. A just government is above all a government which governs, No government which fails to do that can possibly be just.

Experience **with** Proportional Representation.— AS contrasted with the time when Mill and Bagehot wrote, there is today a substantial body of experience with the workings of proportional representation. But the conclusions to be drawn from this experience divide the experts. On the one hand the enthusiasts for the proportional scheme contend that it is the only truly democratic method that at the same time solves the problem of gerrymandering and other forms of corruption.

On the other hand, there are scholars who have been inclined to blame proportional representation for the collapse of the Weimar republic. as well as the general tendency toward the anarchy of multiple parties and boss rule. A detailed analysis of the 20th-century experience of Belgium, the Netherlands, the Scandinavian kingdoms, Switzerland and Ireland, as well as local experience in the United States and in the British Commonwealth, makes it difficult for the detached observer to agree with either of these views. Leaving aside the rigid list system used in the German republic, and generally condemned. it would seem that all these countries achieved substantial stability and a great deal of social progress under proportional representation, whether combined with parliamentary government or not.

The systems differ from each other in many interesting details. In Belgium lists were used, but the voter could indicate personal preference for individual candidates; in the Netherlands the same was true, but there was also a national pool; in Norway and Sweden there were likewise lists in use, but the voter himself determined how the candidates on the lists were ranked. In Denmark a complicated plan of combining single-member constituencies with proportional representation by way of a transferable vote was employed. Switzerland made use of a list system which gave the voter extreme freedom in making up his list and an almost mathematical representation of views in the community was achieved; yet the resulting complex party structure in the representative assembly permitted effective action, because the Swiss did not use a parliamentary system of government. Finally. Ireland adopted the single transferable vote system long advocated by the British Proportional Representation society. with virtually every county an electoral district. A critical evaluation of the different systems may be looked for in the special works suggested in the bibliography below. Suffice it to say that these countries found proportional representation compatible with their governmental tasks and settled down to a general acceptance of it. The same might be said of quite a few U.S. municipalities.

The conclusion regarding proportional representation is not simple. It all depends upon the group and class structure of the community, the constitution and pattern of the government at large, the extent to which foreign policy is vital and imposes its requirements of integration and consistency. The fact that Switzerland did well under proportional representation does not prove that the United States might do well also.

Yet proportional representation does provide an opportunity for political self-expression to minorities which are already crystallized as politically self-conscious groups. If the representative assembly is capable of integrating these conflicting groups, either by foregoing the task of "supporting" the government, as in Switzerland, or by remaining content to co-operate with a monarchical head, as in the Scandinavian countries and the Netherlands, proportional representation may work better than a majority system. In many U.S. cities the city manager has provided a neutral balance wheel which enables a city council proportionally elected to function effectively. *(See* also PROPORTIONAL REPRESENTATION.)

In the last analysis, the problem of representation under modern conditions should be seen functionally in relation to the task assigned to the representatives. Legislation is one function, executive direction and leadership another, judicial and administrative determination something else again. Any system of representation, electoral or other, which works will be acceptable to the people at large and considered just; any system which fails to do so will be rejected or will become a fatal flaw which may bring on the collapse of the entire governmental system. For technical as the problems of representation may seem, they relate to the very core of modern popular government: Unless the people can be made present in their thought, their opinions and their will, democratic government becomes impossible.

BIBLIOGRAPHY.—Besides the broad philosophical discussions and some continental legal studies, there are only rather partisan analyses. The broad treatments of comparative government contain general analyses. Here might be mentioned Carl J. Friedrich, *Constitutional Government and Democracy,* ch. xiv, xv and xx (1950), and Herman Finer, *Theory and Practice of Modern Government* (1932). Special treatments are to be found in G. H. Hallett and C. G. Hoag, *Proportional Representation— the Key to Democracy* (1937), and F. A. Hermens, *Europe Between Democracy and Anarchy* (1951). An important source is still the *Report of the Royal Commission Appointed to Enquire into Electoral Systems,* Cd. 5163, and its *Minutes of Evidence,* Cd. 5162 (1910); May McKisack, *Parliamentary Representation of the English Boroughs in the Middle Ages* (1932); James Hogan, *Election and Representation* (1945); *W.* Konopczynski. *Liberum Veto* (1918). For American parties, *see* V. O. Key, Jr., *Politics, Parties and Pressure Groups,* 4th ed. *(1958).* (C. J. FH.)

REPRESENTATIVE GOVERNMENT: *see* REPRESENTATION.

REPRISALS are measures of self-help in violation of normal international law to remedy past injuries or to stop continuing injuries in time either of peace or of war. They have been considered permissible only if in retaliation for an injury resulting from a violation of international law, if peaceful measures for obtaining redress have been exhausted without success and if the measures adopted are no more severe than the injuries complained of. (Naulilan Incident, Portugal and Germany. Arbitral Decision, July 31, 1928; H. W. Briggs, *The Law* of *Nations,* p. 951 [1952].)

Formerly a private person might be given "letters of marque and reprisal" by his government permitting him to seize ships of foreign flag at sea in order to gain compensation for a claim against a person of the nationality of the vessel's flag, in case the courts of that state had "denied justice." This practice was, however. ended by the Declaration of Paris (1856), which abolished privateering. Reprisals were, therefore, permitted only by the public forces of a state. *(See* PARIS, DECLARATION OF.)

Reprisals in time of war should be preceded by a public declaration calling upon the enemy to cease its illegal behaviour; should, so far as possible, be of a type not to injure innocent enemy or neutral persons; and should be stopped as soon as the enemy discontinues its illegal behaviour. The legitimacy of naval reprisals against the enemy, but injuring neutral commerce, was a matter of controversy between the United States and Great Britain before the War of 1812 and during the period of U.S. neutrality in World

War I. In spite of neutral protest, British prize courts sustained orders in council, injurious to neutral commerce. in their character of measures of reprisal. (*The Fox,* Edw. 311; *The Stigstad,* [1919] A.C. 279; *The* Leonora [1919] A.C. 974.)

Reprisals in time of peace have taken the form of territorial occupation, administration of customs, detention of vessels in port and "pacific blockade." The United States has contended that vessels of third states cannot be seized or otherwise interfered with for breach of "pacific blockade" although they can for breach of a "war blockade." In 1902 Germany, Great Britain and Italy changed their pacific blockade of Venezuelan ports to a war blockade in response to a protest based on this contention. In the 19th century pacific blockades in fact often extended to vessels of third states. and a League of Nations committee held that in accord with this practice economic sanctions against a covenant-breaking state might extend to vessels of nonmember states.

After the occupation of Corfu by Italy in 1923 as a measure of reprisal against Greece, a League of Nations committee of jurists implied that the obligation of members not to "resort to war" prohibited reprisals of warlike character. The more extensive obligations, of parties to the Kellogg-Briand Pact of 1929 and the Gnited Nations charter, to settle disputes only by peaceful means and to refrain from use of threat or force have been held to abolish peacetime reprisals in international law unless authorized by a competent international authority. Hostile acts in "individual or collective self-defence" against "armed attack" are, however, permitted by the charter (art. 51).

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(Q. W.)

REPRODUCTION, the process by which a living thing, whether plant or animal, gives rise to another of its kind, is commonly cited as one of the outstanding characteristics of living matter. In so far as biologists have ever been able to discover, all life comes from pre-existing life. No living thing has ever been found to arise directly from nonliving matter. The only possible exception may be the filterable viruses, so-called because, being particles too minute to be visible under the highest powers of the microscope, they have their size estimated by the smallness of the pores through which they will filter. Such viruses apparently possess most of the characteristics of living matter including that of reproduction. The reproduction may be, however, merely the capacity for duplication from the products of their own chemical activities, or for reorganization of the several ingredients of the nutritive matrix in which they are located. In other words, they may be operating merely as centres of crystallization, as it were, of the various constituents of the surrounding medium into an organization similar to their own. This power is seemingly possessed by various nonliving fermentlike substances. How such synthetic duplication differs from ordinary protoplasmic reproduction—if it does—is by no means clear, since we still know so little about the chemical basis of the latter.

By Division and Growth.— At some point in their life cycle living things give rise to other living things like themselves or which will become like them through a process of development. In one-celled animals and in the simpler many-celled types, reproduction commonly consists in a division of a parent form into two or sometimes into several descendants. True protoplasmic growth is increase of living substance, and inasmuch as reproduction is a continuation of such substance in the form of new individuals, it may be looked upon as a process of overgrowth.

For purposes of emphasis and discussion it is common practice to, state the two great aims or ends of all living organisms as: (1) preservation of the individual, and (2) perpetuation of the race, but since these are both based fundamentally on nutrition they do not stand wholly apart. Growth is the outcome of nutrition, and reproduction may be regarded as a form of discontinuous growth. Constructive metabolism proceeds to a certain limit, and then the organism divides, or part of it is detached and continues life activities as a separate individual. Or to state it another way, reproduction is a means by which metabolic activities established in a given individual are passed on to be continued in the form of new individuals.

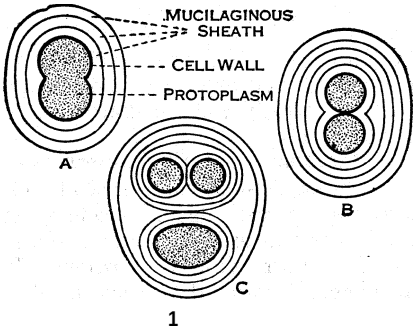
By Germ Cells.—In more complex creatures reproduction is manifested by the giving off of special cells termed germ cells, or gametes, which either alone, or more commonly after pairing, give rise to new individuals. Germ cells which pair (fig. 6) are usually differentiated into macrogametes and microgametes, and commonly, particularly in animals, come to be borne by different parents which are then designated as male and female.

The Multicellular Body.—In unicellular organisms the new individuals may continue to live apart as independent cells, but in the more complex plants and animals the division products remain associated, growing and functioning as components of a more highly specialized order (fig. 11). The advantage in this is evident, since each unit cell, although in a large measure retaining its identity, can, together with certain of its fellows, specialize in the perfection of some particular function, while depending on neighbouring groups of cells for the more effective carrying-out of other functions necessary to the organism as a whole. Just as in human society it is advantageous to have such specialists as carpenters, electricians, shoemakers, bakers, merchants, teachers, doctors and others, so in cell aggregates specialization in different directions, as for motion, digestion, sensation and the like, permits of the development of a more complex and efficient organism.

Although certain unicellular forms and certain nutritive cells, such as egg cells, may be visible to the unaided eye, cells for the most part are of microscopic dimensions. The clue to their small size, and possibly to the reproduction of organisms by division in the first place, lies apparently in the physical necessity of maintaining a certain ratio between surface and mass in a functioning body. It is a physical law that surface increases as the square, and mass as the cube. Or to put it more concretely, when a cell doubles in diameter the mass to be nourished increases eightfold but the surface through which nourishment is to be absorbed and wastes discharged increases only fourfold. It is evident, therefore, that with any considerable increase in size, the supply of foodstuffsand oxygen from without and the elimination of wastes from within must fall below the needs of the cell since the surface becomes insufficient to provide for the exchange. The cell solves this problem by dividing, thus reducing mass and increasing surface. This necessity of maintaining a certain balance between mass and surface, indeed, is probably back of the first protoplasmic reproduction. As already noted, it is essentially a matter of overgrowth and division, or, in other words, discontinuous growth.

The Rise of Sex.—Superimposed upon this original method of direct reproduction, however, we find, even in the firstlings of life, the foreshadowing of sex. Beginning with the simplest organisms, temporary or permanent pairing of two individuals may occur before initiation of reproduction. Out of this has grown sex, and as a result unquestionably much of the complexity and diversity of all higher organisms, whether plant or animal.

To understand the significance of reproduction and the intricacies imposed upon it through sex, it is well to begin with its initial expressions in the unicellular organisms, most of which are too small to be seen without the aid of a microscope. Probably the simplest living things are the blue-green algae. Examining the one-celled body of the most primitive of these, one sees a homogeneous granular-looking material which is really of jelly-like consistency. This is the essential living substance or protoplasm (*q.v.*). In these simple algae it is suffused by two pigments, a blue and a green, and is encased within a protecting and supportive wall—a lifeless product of the protoplasm itself termed cellulose. The green component, chlorophyll, is a pigment which is present in all green plants. Chlorophyll has the remarkable capacity of enabling plant protoplasm to utilize in the synthesis of food the energy supplied by sunlight. Out of the two simple raw materials, carbon dioxide (CO_2) and water (H_2O), which



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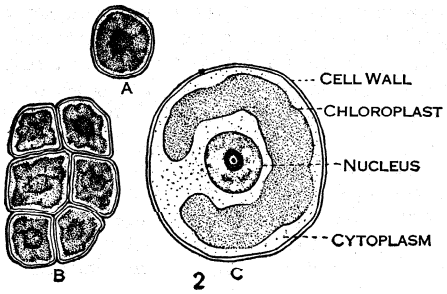

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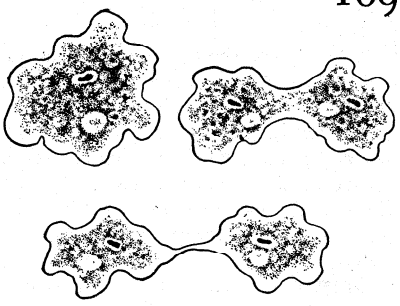

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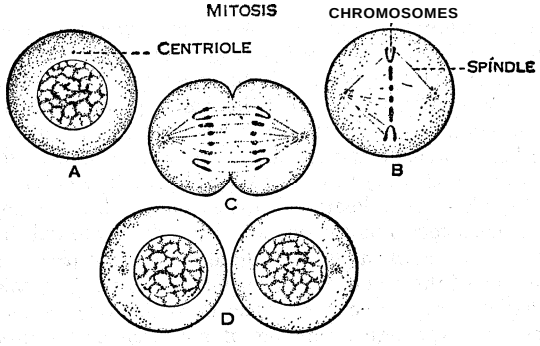

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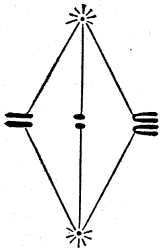

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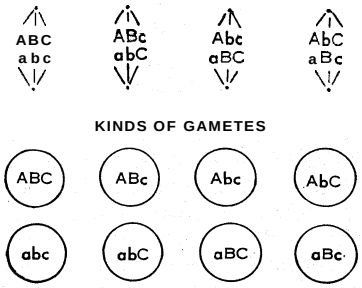

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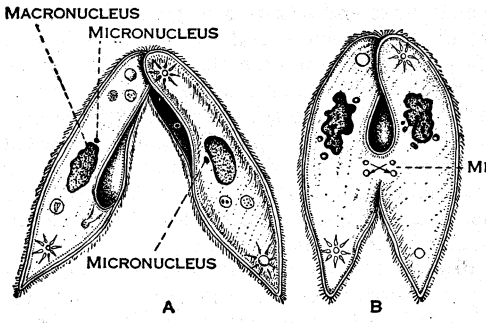

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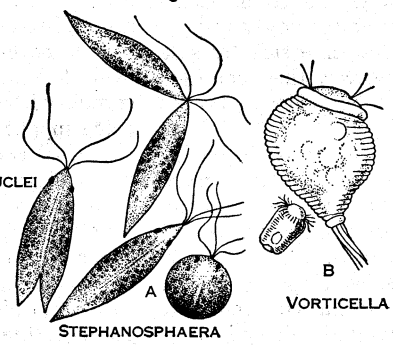

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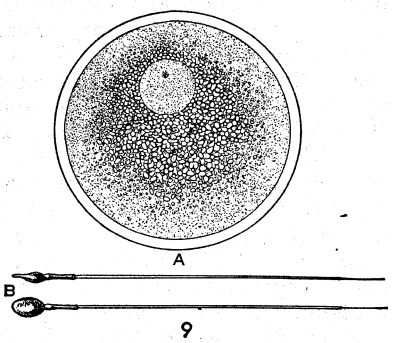

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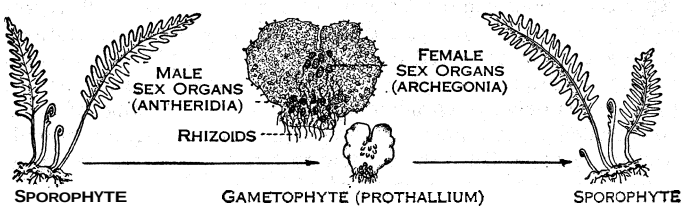

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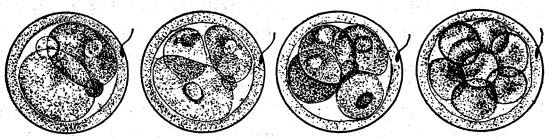

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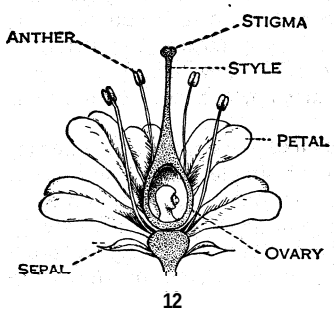

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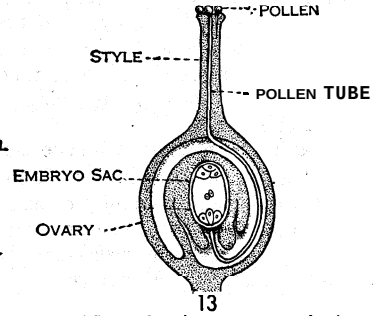

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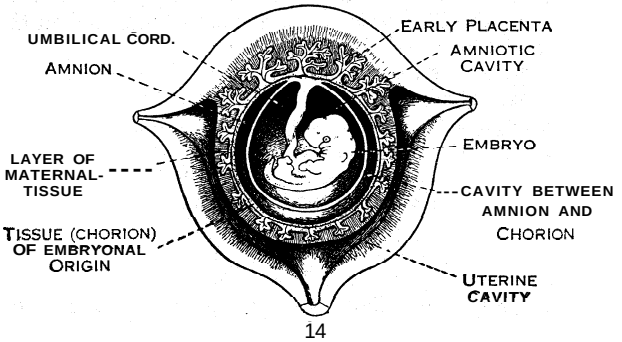

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Fig. 1. Division stages of a blue-green alga (*Gloeothece*). Fig. 2. A, single cell; B, colony of green alga (Pleurococcus); C, highly magnified *Pleurococcus* showing cell organs. Fig. 3. Amoeba reproducing by division. Fig. 4. Mitosis in a cell possessing six chromosomes (three pairs): A, chromatin diffusely distributed in nucleus (resting stage); B, equatorial plate stage with chromatin concentrated into six chromosomes ready for division (precocious division before alignment on spindle is not uncommon); C, divergence of divided chromosomes and beginning of cytoplasmic division; D, division completed. Fig. 5. Chromosomes arranged for reduction division. Fig. 6. Eight kinds of gametes may result from the reduction divisions of a germ cell possessing three pairs of chromosomes (ABC from one parent, abc from the other). Fig. 7. A, beginning of conjugation in Paramecium *caudatum*; B, diagram of two conjugating paramecia (the macronuclei disintegrate; after several micronuclear divisions, all micronuclei but two disappear in each individual; one of these then passes to the opposite individual and fuses with the residual micronucleus; the animals then separate and after several divisions each descendant resumes the original state with one micronucleus and one macronucleus). Fig. 8. A, fusion of two protozoa (*Stephanosphaera*) of equal size: B, fusion of two of unequal size (*Vorticella*) to form a new individual. Fig. 9. Human ovum and human spermatozoon (showing different aspects of latter). Fig. 10. Alternation of generations in the fern; left and right, sporophyte stages; centre, the gametophyte (prothallium). Fig. 11. Two-, three-, four- and eight-celled stages in the cleavage of the monkey ovum (drawn from photographs of the living cells by Lewis and Hartman). Fig. 12. Parts of the flower. Fig. 13. Enlarged ovary of flower showing path of fertilization and the greatly reduced gametophyte. Fig. 14. Schematic illustration of very young human embryo in the uterus

when alone are devoid of available energy and possess no food value, chlorophyll enables the plant to build the simple sugar glucose, rich in usable energy. Part of the food thus manufactured is combined with nitrogenous ingredients of the cell to make new protoplasm, which serves for replacement and growth; some is stored as starch, or otherwise, and serves as food for future use.

Such cells as those of the blue-green algae are exceptionally simple in that apparently all parts of the protoplasm engage equally in the life activities; there are no specialized regions (fig. 1). Most cells, whether of single- or many-celled plants or animals, are differentiated into at least two distinct regions termed the nucleus and the cytoplasm or cell body. There is no clearly defined nucleus in the blue-green algae. In the nucleated cell the nucleus is usually discernible within the cytoplasm as a denser, more or less spherical body, sharply delimited by its own membrane. The cytoplasm, depending upon the kind of cell involved, may also contain other formed bodies, notably in all green plants beyond the blue-green algae, one or more bodies known as chloroplasts (fig. 2), within which the chlorophyll is confined and thus no longer diffused throughout the entire cell.

When the cell of a simple blue-green alga reaches a certain size, it solves the surface-mass relation by simply pinching in two in the middle to form two smaller cells. These in turn, wholly independently of each other, grow and repeat the process; and thus growth and reproduction are carried on indefinitely. This is perhaps the simplest conceivable type of reproduction. Commonly in various species of the blue-green algae the newly formed cells—two, four or more—may remain for a time side by side within a mucilaginous sheath (fig. 1). However, they continue to be mutually independent and eventually the "colony" breaks up and each individual goes its separate way.

There is also a group known as the green algae, so distinguished because they possess only the green pigment. Like the blue-green algae they may exist as one-celled individuals or in colonial form. A far greater complexity of structure is evident, however, in that the protoplasm is differentiated into three distinct parts or organelles: a central denser body or nucleus, which seems in the main to control the activities of the rest of the cell and bear the essential materials of heredity; an irregularly shaped body, the chloroplast, within which the chlorophyll is confined and which is therefore endowed with the power to manufacture food, and the surrounding matrix in which they lie, the cytoplasm (fig. 2). The cytoplasm serves primarily to use the food manufactured by the chloroplast in the maintenance and growth of the cell and to regulate the interchange of materials through the cell wall.

Mitosis and the Genes.—Although the size and shape of the cell varies greatly among the different species of the green algae, each species retains this characteristic protoplasmic differentiation. To maintain the life activities and permit of growth, these cells like all others must divide from time to time in order to preserve the essential ratios of surface and mass. When the cell reaches a certain size-limit division occurs, but the operation is of more intricate nature than that seen in the blue-green algae. The process, termed mitosis, characterizing the cell divisions of all higher organisms, involves a series of changes that bring about a precise division of the nuclear contents. How accurate this is can be appreciated only after a careful study of the operation in progress. In mitosis special bodies known as chromosomes appear as the result of a rearrangement of the nuclear contents (fig. 4). These are of characteristic number and appearance in each particular kind of plant or animal. In man the number is 46. Ordinarily, when cell division occurs, each individual chromosome divides and thereby passes samples of all its contents on to the new cells. Painstaking studies by means of the highest powers of the microscope have revealed that each chromosome carries, chainlike, a series of still smaller units, the chromomeres, representatives of each of which are contributed to the new generation of cells. Evidence from various sources establishes that the fundamental units of heredity, the genes, reside in these individual particles or chromomeres, and that thus with their division and regrowth each newly formed cell gets a full contribution of the inheritance mechanism. All characteristics of living organisms are primarily because of the influence of these genes, although in their expression, of course, environmental influences also play an important part. All hereditary differences involve differences in the genes of the individuals concerned.

Maintaining Numerical Constancy of Chromosomes.—Careful study has revealed that, in organisms characterized by biparental origin, the chromosomes are really in pairs, coming in single sets from each parent. In the cells of human tissues, therefore, there are 23 pairs, one of each kind from each parent. In mature germ cells this dual number is reduced to a single set in the finished germ--ovum or spermatozoon—and thus the numerical constancy is maintained. The separation is of such a nature that each definitive germ cell, while receiving only half of the original number of chromosomes, gets one of each pair (fig. 5); that is, one of each kind. If, for example, the original number of chromosomes is six—that is, three pairs—and we designate those which come from the father as ABC and those from the mother as abc, then the line-up for reduction-division may be any of those indicated in fig. 6. The individual chromosomes do not divide as in ordinary mitosis of body cells, but corresponding chromosomes merely lie side by side (paternal by maternal) and separate when the cell divides. Thus, whether a given chromosome of the reduced set is of maternal or of paternal origin is merely a matter of chance. The only necessity is that each final germ cell (gamete), whether of maternal or paternal origin, have one of each kind of chromosome, since each carries special hereditary determiners and has its own particular role to play in development of the new individual. That this is true is evident from the fact that the ova of certain animals can be stimulated by chemical or mechanical means to develop without being supplied'with the second set of chromosomes, yet the new individual is complete in all its parts, though typically possessing only a single set of chromosomes in each of its various cells. If, however, one of each kind of chromosome is not represented, the developing form shows characteristic deficiencies, depending on which one of the single (haploid) set is missing.

Advantages of Biparental Inheritance.—The obvious advantage in biparental inheritance lies in the fact that young produced by the mingling of hereditary materials from two lines of ancestry will be, to some extent, unlike either parent. They will represent various combinations of ancestral traits and will, therefore, show considerable variety. Of the many new combinations some will be better fitted to survive than others under the prevailing conditions of existence. As many different paths of life present themselves, depending upon the survival value of their commingled ancestral traits, the combinations in certain individuals prove to be better fitted now to this, now to that niche in surrounding nature than do those of others. The weak, the ill-adapted are weeded out generation after generation; those most in harmony with their environment survive. Inasmuch as environment is never constant, and in the course of years may change profoundly, a perpetual premium is placed upon capacity for modification and adjustment. Thus, apparently, primarily through sexual reproduction, much of the bewildering variety of structure and pattern in living things which confronts us has been built up.

Variants in Reproductive Devices—As one scans either the plant or the animal kingdom from the simplest to the most complex types, many variants in sexual reproductive devices may be observed. But all serve one final end; namely, the bringing together of two germ cells—commonly termed microgamete and macrogamete or, in animals, spermatozoon and ovum. These enter into a permanent union which constitutes the initial cell from which, through a succession of cell divisions, the new organism will arise. It is important to remember that no matter how discrepant these pairing gametes may be in size, they each carry the same number of chromosomes and therefore contribute the same number of genes.

In the simplest plants or animals the cells which unite may be of similar size; but, as forms rise higher in the scale of life, discrepancy in size becomes apparent until in the most complex organisms it may be extreme. The human ovum, for instance.

although itself only about $\frac{1}{125}$ of an inch in diameter, has a volume about 35,000 times that of the sperm (fig. 9), yet each contributes 23 chromosomes to the zygote.

Advantages of Dimorphic Gametes.—Apparently it has been found advantageous in organisms of biparental origin to have one of the gametes conserve stores of food for consumption of the newly developing form. But, since such increased bulk diminishes activity, a compensatory reduction in size commonly accompanied by motility develops in the opposite or male gamete. Moreover, inasmuch as the burden of effecting union has fallen largely to the microgametes, they have come to be produced in prodigious numbers, thus ensuring that one will reach and fertilize the more inactive macrogamete. In witness of this one has only to recall the countless millions of pollen grains, each bearing a microgamete, produced by a flowering plant, or the equally great numbers of spermatozoa carried in a single milligram of semen.

The occurrence of sex throughout the whole range of life, from all but the simplest organisms to man, is self-evident expression of its importance. It so pervades the make-up of the higher animals and plants that the significance of much of their structure and behaviour is interpretable only in terms of it. The reciprocal sexual structures and activities between the two forms we designate as male and female, whether in plants or animals, have come to their present state of mutual adaptation through millions of years of selection, and either set of such differences would be wholly meaningless without the other. Not only have special structures arisen which are connected with the reproductive system, but innumerable secondary characters such as devices to ensure pollination in plants, or ornaments which serve for allurement or sex-identification in animals, have appeared. There was much less intricacy in the make-up of living organisms during the millions of years of their existence before the coming of sex, but from that time on increasing complexities appeared in many groups and in many directions so that diversity of form and structure multiplied rapidly. It seems improbable, indeed, that living things could have become so remarkably complex without the establishment of sex.

Although the fundamental factors involved in reproduction, whether asexual or sexual, are readily discernible, the secondary differences in structures, activities and mutually adaptive relations which appear in both the plant and the animal kingdom become bewildering in their diversity. While most of these are interpretable in terms of special environing conditions, the paths of procedure are often very circuitous and the processes understandable only in terms of the distant ancestry from which modern forms have been derived.

In Unicellular Organisms.—Among one-celled organisms, whether plant (Protophyta) or animal (Protozoa), some form of division—equal fission as in the amoeba (fig. 3), budding or spore formation—is the dominant procedure even though it may be alternated, especially in the higher types, with occasional pairing analogous to the sexual unions of multicellular forms (Metazoa). In some members of the most primitive of the main groups of Protozoa (Rhizopoda, forms which can acquire large surface by the flowing out of pseudopodia) sex is possibly in a way foreshadowed in some in the coalescence of amoebulae into plasmodia as in the slime molds (Mycetozoa) from time to time. And the multiple conjugation seen in some Heliozoa and other protozoa, as well as in certain algae, may be a still further advance of the same nature. Such multicellular formations, through confluence of a number of individual cells, however, seem early to have given place to the union of only two cells, as seen in all higher organisms, and therewith the development of the bisexual form of reproduction characterized by the appearance of male and female types. In such protozoa as the colonial flagellate *Stephanosphaera,* the total fusion (conjugation) of two indistinguishable units (isogamy) occurs (fig. 8a); in others, such as *Vorticella,* the conjugating units differ in size (anisogamy, fig. 8b). In many different kinds of protozoa (for example, the radiolarians), special reproductive units (gametes) arise by division of the ordinary vegetative units. Such gametes are commonly dimorphic, and they unite in pairs to form a zygote, which may either grow into the original form or subdivide into many smaller individuals.

In any discussion of the evolution of sexual reproduction the situation seen in paramecium, a member of the most complex class of protozoa, the Infusoria, is interesting and instructive. Paramecium (fig. 7) possesses a large oval nucleus (macronucleus) and, in a small depression in its side, a tiny, spherical micronucleus. The macronucleus seems to be wholly nutritive; the micronucleus, reproductive in function. Commonly the elongate animal reproduces by a simple transverse fission into two. After a number of such divisions—usually several hundred—the process is interrupted ordinarily by a temporary union of two individuals during which, after disintegration of the macronucleus and elaborate preparations of the micronucleus, micronuclear material is exchanged. The animals then separate and resume reproduction by division. Regrowth is rapid and, under favourable conditions, 4 divisions in 24 hr. may occur. Calculations show that a single paramecium could thus produce 268,000,000 offspring in one month.

Investigations have shown that although the individuals of a particular species of paramecium may look alike, nevertheless they are divided into mating types. Individuals of the one type, commonly the progeny of a single individual (clone), ordinarily will not unite with each other but will conjugate actively with members of other strains. In some species such as Paramecium bursaria, as many as eight distinct mating types have been identified, members of any one of which, though not conjugating together, would conjugate readily with members of any of the other seven types. Variants are known, however, in which members of one mating type will conjugate with only one or a few of the other mating types.

In nonconjugating strains of paramecium, however, a process of internal nuclear reorganization, known as endomixis, occurs from time to time which apparently effects a physiological readjustment similar to that following conjugation. This suggests that some form of occasional constitutional reorganization is necessary. Although usually secured through nuclear exchange, under unusual conditions it may thus by endomixis be otherwise accomplished.

The exhaustive studies of Prof. H. S. Jennings and his associates, made to determine in what respect conjugating and nonconjugating members of the same stock differ, are enlightening. One of the fundamental experiments was to divide a given strain into two parts and keep them under identical conditions, except that conjugation was permitted in one line and prevented in the other. The nonconjugating strains maintained about the same even rate of division, with no evidence of decline. In the conjugating strains, however, marked differences in division rate appeared in different families. Thus, hereditarily diverse families arose even though the conjugating strains were all derived from the same parental stock. Evidently great variety resulted from the new combinations of hereditary characters incident to the interchange of nuclear materials between the two conjugants. Some of the new strains thus secured were vigorous, others weak. Obviously, such combinations as possessed survival value under the conditions prevailing would result in the perpetuation of the fortunate strains. It is significant, furthermore, that unfavourable changes of the conditions under which these infusoria live usually induce conjugation.

Such facts among the protozoa bear out the inference already reached regarding the relation between sex and heredity in the higher animals, namely, that there is enormous insurance value in the constitutional diversity brought about by biparental inheritance—insurance that, in a changing environment, at least some of the variants will probably prove fit.

Rejuvenescence.—It is believed by some biologists that sexual reproduction not only results in a diversified progeny but that the fusion of the two germ cells, or the exchange of reproductive nuclei in protozoa, also commonly induces an actual rejuvenescence—a restoration of youth, as it were—to the protoplasm of the newly formed zygote. Professor G. N. Calkins has shown, for example, that in the protozoan *Uroleptus* mobilis actual rejuvenescence follows conjugation. In this species, after about

200 or more divisions, in the absence of conjugation, the division rate slows down and the individuals pass into a decline followed by structural degeneration and death. Conjugation, however, renews the waning activities of the protozoon and initiates a new cycle of active growth and division.

Asexual Reproduction in Multicellular Organisms — In the lower levels of many-celled animals and extensively throughout the plant kingdom, it is common for more or less of the parent body to separate off as a new individual which may or may not become wholly free. In some instances, as in the sea anemone, the entire body may split longitudinally into two. The fresh-water Hydra buds off new individuals when food is abundant. On the other hand, a starving hydra may reabsorb its own buds. Certain species of starfish multiply by separating off their arms (see REGENERATION). And various wormlike forms, especially among the flatworms and the nemertine worms, may divide into several pieces, each of which develops into a completely functioning individual. In certain cases the asexual multiplication leads to the formation of colonies in which the individuals remain attached, as in the zoophytes and corals, the polyzoa and the compound tunicates.

Among plants an endless variety of asexual reproduction is evident, ranging from the innumerable forms of bulbs or bulblike structures to the new individuals produced through the sending out of runners, as in the strawberry, which root at intervals.

Hermaphroditism. — Many common animals, such as hydras, flatworms, earthworms, leeches and snails may have both ovary and testis present in the same individual (hermaphroditism), though not uncommonly the ova and the spermatozoa mature at different times, so that in spite of their double sex there is cross-fertilization, In such forms as the earthworm, for example, when two individuals enter into sexual union, they pair in such a way that the sperm receptacles of each conjugant are stocked with spermatozoa from the other, and when the eggs are shed they are thus fertilized by spermatozoa from the other individual. In various of the internal parasites, such as the liver flukes and tapeworms, there is self-fertilization (autogamy).

Alternation of Generations. — Although the asexual mode of reproduction is common in all except the highest metazoa and in the great majority of the metaphyta, these all, for the most part, also exhibit sexual reproduction. The latter becomes of increasing importance in the ascending scale of structural complexity. The highest animals which show asexual reproduction in the adult stage are the Tunicata. Here, in the salps, a solitary, so-called nurse buds off a chain of sexual individuals which eventually separate. The alternation of a nonsexual polyp form with a sexual medusa form, seen in the Coelenterata, is one of the most commonly cited examples of alternation of generations (metagenesis). Hydroid colonies are formed in such small branching colonial animals as Obelia, for example, by growth and budding from an original free-swimming planula larva which has become attached. To the human eye such colonies look like minute branching plants attached to submerged objects in the shallow water along the seashore. At the end of each branch is a nutritive polyp. From time to time cylindrical individuals (gonangia) arise which come to bear small lateral medusa buds. These eventually mature and are set free as minute medusae or jellyfish. The free-swimming medusae produce ova and sperm and thus reproduce sexually. Each fertilized ovum grows into a polyp, which again by budding produces the original nonsexual colonial type.

A classical example of metagenesis also frequently pictured in textbooks is that of a much larger kind of jellyfish known as Aurelia. A free-swimming. embryo becomes attached and develops into a polyp which, through a system of transverse budding (asexual reproduction), eventually becomes subdivided into a stack or column of saucer-shaped young medusae (ephyrae). These become free and swim away as individual jellyfish that produce ova and sperm and thus reproduce sexually. From the fertilized ova the new generation of polyps is produced. Not all coelenterates, however, exhibit such alternations of polyp and medusa generations. Many medusae are known in the life cycle of which there is no polyp form and the entire great group of anemones and corals, though for the most part reproducing by division as well as by eggs, have no medusa stage.

In the early developmental stages of even the highest vertebrates, however, twins or even quadruplets may arise by division of a single egg or embryo. Identical twins in man, for example, are believed by some embryologists to arise in this way. And in such simpler mammals as the armadillo the quadruplets which constitute the usual litter are definitely known to have been derived from a single ovum. The same is true of the multiple embryos which spring from a common source (polyembryony) in such parasitic insect forms as Encyrtus. In such vertebrates as the amphibia it is a relatively simple laboratory experiment to separate the first two cleavage cells of the dividing ovum and demonstrate that each will then develop into a complete and normal larva instead of the half of one it would have been without the operation.

In plants alternation of sexual with asexual generations is conspicuous in mosses and ferns. In such plants one phase in the life history (sporophyte) has to do with the production of spores —special reproductive cells which develop without fertilization. The second phase (gametophyte) is characterized by the production of macrogametes and microgametes, corresponding to the ova and spermatozoa of animals. Such gametophytes, therefore, constitute the sexual generation. In ferns, for example, spores are discharged from spore cases located on the fronds. Such as land on moist soil or sometimes on the fern frond itself, develop into small sexual plants termed prothallia (gametophytes). These eventually develop the usual two types of sex cells, the macrospores and the microspores (fig. 10). When the egg cell of such a prothallus is fertilized by a sperm cell (antherozoid) it grows into the familiar fern plant (sporophyte). In flowerless plants, and in the primitive flowering plants known as cycads and gingkos, the male cell (antherozoid) is locomotor as in most animals.

In flowering plants such alternate occurrence in one life history of two or more distinctive forms is not so obvious as in ferns and mosses, but close inspection shows that the male and female gametophytes exist in much reduced form as minute structures dependent on the sporophyte. The pollen grain, for example, is not itself a male germ cell but is really a minute gametophyte or bearer of the functional sperm cell. Likewise, the functional egg cell is borne by a female gametophyte or embryo sac which is a part of the flower itself (fig. 13). Looked at from the standpoint of alternation of generations the plant body which bears the flowers is the sporophyte, while special parts of the flower represent the gametophytes. Usually, an eight-celled structure, one cell of which is the egg cell, constitutes the female gametophyte (macrogametophyte); and (2) an even more reduced structure consisting of two sperm nuclei and a pollen tube nucleus constitutes the male gametophyte (microgametophyte).

The microspores form within the anthers (fig. 12) and upon nuclear division become pollen grains. The dehiscence of the pollen sacs frees the pollen. Shortly before or after being shed, a tube nucleus and two sperm nuclei arise from an earlier nucleus. One sperm nucleus eventually unites with the egg to form the fertilized egg or zygote; the other unites with the so-called fusion nucleus (see centre of embryo sac, fig. 13) to form a triple-fusion nucleus made up of three haploid sets of chromosomes. The zygote germinates to form the young sporophyte. The triple-fusion nucleus, in some seeds, gives rise to a nutritive endosperm around the embryo.

Where alternation of asexual with sexual generation occurs in either the plant or the animal world, it is usually associated with some advantageous hastening of productivity in favourable seasons of the year or under other special environing conditions. In the competitions of living things the struggle is severe, and great numbers must be produced in order that a select few, adapted to the prevailing conditions, may survive and maintain the race. Commonly, the quickest and easiest way to get numbers is through asexual reduplication, leaving it to the slower and more intricate methods of sexual reproduction to establish from time to time that variability which is necessary as the basis for adap-

tive selection.

Dual Hosts.—Some of the most complicated life cycles are found under specially hazardous conditions of existence, where the chances against successful propagation are meagre. Numerous examples occur among the internal animal parasites. If parasites increased in too great numbers within a given host, not only would the host be destroyed but with it often the parasites themselves. This is avoided commonly by the utilization of two hosts, part of the life cycle being passed in one, part in the other. Thus, in such human parasites as malaria, for example, female mosquitoes from any of the several species of Anopheles are the sources of infection in man. Spindle-shaped cells (sporozoites), which invade the human red blood corpuscles, are injected from the saliva of the mosquito when she bites. These multiply by division within the red blood cells. Liberated through destruction of the corpuscles they enter new red cells, and the process is repeated until a large number of red blood corpuscles have thus been destroyed and the number of parasites enormously increased. Such reproduction in the blood cells of man (primary host) are asexual. Eventually male and female gametocytes are formed, but these undergo their final transformations and conjugation only if withdrawn from the blood of man into the stomach of the anopheles mosquito (secondary host). The resulting zygotes penetrate to the outer wall of the mosquito's stomach where, in saclike pockets, they undergo repeated nuclear divisions with the eventual formation of numerous spindle-shaped sporozoites. With the rupture of the surrounding sac, the sporozoites make their way through the body spaces to the salivary glands of the mosquito whence they are injected with the saliva into the human host.

Many similar examples of alternate hosts might be cited among both vertebrates and invertebrates, and the various devices hit upon for securing transmission from one host to another afford some of the most complex and perplexing chapters in the study of animal relations. In the common pork tapeworm (*Taenia solium*), for example, man, the primary host, becomes parasitized by eating underdone pork (secondary host) which contains the encysted larvae. When taken into the human alimentary canal, the small head, bearing suckers and a circlet of hooks, attaches to the intestinal wall and the worm begins to grow rapidly in length by the formation of segments. These increase in size from the anterior toward the posterior end, new segments arising in the narrow neck region. The whole chain is regarded by zoologists as a colony of individuals. Without mouth or alimentary canal of its own, the parasite is wholly dependent upon the digested food in the intestine of its host. The terminal segments, filled with embryos, are shed from time to time and pass from the body of the host. When the embryos are swallowed by a pig, they become freed as six-hooked larvae which bore their way out of the intestinal tract and encyst as so-called "bladder-worms" in the muscles or other structures of the pig. They attain their adult form only when such infected flesh is eaten and they are released into the human intestinal tract. The chances against the perpetuation of such forms are obviously great, yet there is an abundance of both pork and beef tapeworms.

The Life Span.—In unicellular organisms there seems to be no death from old age. When an alga or an amoeba reaches a certain size and nutritional state, it simply divides and what was one living individual now is two (fig. 3). If death occurs, it is because of some harmful condition in the environment such as lack of food, existence of enemies or the like. The protozoon we view through our microscope has no dead ancestors; it is the direct descendant of the original of its kind. With the establishment of a body as distinct from the germ, natural death enters the scene. The cells which jointly constitute what we might call the vegetative individual eventually perish; only the reproductive individuals known as germ cells maintain continuity between successive generations.

Although, if we may judge from what we see in nature, the penalty paid for a body is death. the higher realizations of living matter could not have been attained without that combination of diversity and unity made possible through the association of specialized cells which make up the bodies of the more complex organisms. Under these circumstances, from the standpoint of survival value of the species, it is desirable for the individuals of today to give place eventually to those of tomorro , because environing conditions are never constant for extensive periods. and it is only by giving the reproductive variants a chance that new fitnesses may be established and prolonged survival be made possible. Insurance of the welfare of the species is the all-important accomplishment.

What determines the life span of any one particular species is not always evident, but it may be safely said that in general organisms live only long enough to ensure their continuance as a race or stock (see LONGEVITY). Duration of life is, within generous limits, automatically adjusted to survival of the species Where the hazards of existence are numerous or outstanding, the rate of reproduction is high and the number of offspring produced is great; uhere the risks are fewer and the individual is better prepared to cope nith them, the rate is low (fig. 14) In generai there is an automatic adjustment between length of life of the individual and the chances of the young for survival. Any extraordinary increase in numbers, as may happen with unusual abundance of food, favourable weather conditions or removal of natural checks, is eventually offset by such factors as competition within the group itself for food, disease incident to propinquity and by the multiplication of enemies which feed upon its members. Either sudden increase or decrease in numbers is likely to prove disastrous. Slight fluctuations which do not upset the so-called "balance of nature" are more likely to prove safe.

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PHYSIOLOGY OF REPRODUCTION

It is common knowledge that the majority of animals and plants have more or less definite times at which they breed. though the ova (estimated at ***200.000*** in man) are possibly preformed at birth. These depend often upon seasonal or environmental conditions and it is well known that spring and summer are the times for reproductive activity among birds, insects and a host of other animals. Unusual warmth or cold may hasten or check the periodic development of sexual activity and the accompanying internal and external changes which take place in the body. The connection between breeding and food supply is also generally realized. Moreover. where climatic and nutritive conditions are approximately uniform throughout the year. periodicity in the breeding habits of animals is often obliterated. Thus. Semper states that sexual periodicity is absent among molluscs. insects and other land animals in the Philippine Islands. On the other hand, the regularity of the migratory movements, which directly relate to changes in the reproductive organs and the instincts for breeding, occurs to a great extent independently of temporary climatic conditions, though not wholly so. *(See* MIGRATION BIRD.) It is clear. however. that broadly speaking, the factors which control the periodic changes in the generative system in association with breeding are of two kinds, the external ones referred to above, and internal factors inherent in the animals themselves, and particularly in the essential reproductive organs Before attempting to describe these changes and the manner in which they occur it will he well, briefly, to describe the reproductive organs, referring more particularly to the higher animals.

The Generative System.—Among vertebrates the sexes are nearly always separate, although a few species are hermaphrodite The usual arrangement, however, is for each individual to have its own characteristic sexual organs, those of the other sex. if represented at all, failing to develop or undergoing early degenera tion. In the male or' all lower vertebrates (including birds) the

testes lie dorsally inside the body cavity and discharge their products, the spermatozoa, along with fluid secretions, into ducts communicating with the exterior by a passage (the cloaca) common to the urogenital and alimentary systems. In most mammals, on the other hand, the testes lie outside the main body cavity in a double sac (the scrotum) between the anus (or opening of the gut) and the penis. The testes are largely composed of tubules whose walls give rise to the spermatozoa and these latter are budded off into the interior as in other animals. Between the seminiferous tubules are interstitial cells. These give rise to chemical substances (hormones, *q.v.*) which pass internally into the blood. (See ENDOCRINOLOGY.) There is strong evidence that these internal secretions by their power of stimulation are responsible for the growth and development of the distinctively male characters and instincts. Thus, the presence of the testes is commonly regarded as the test for maleness.

In all mammals the spermatozoa pass out from the testis by a number of short ducts (the *efferent* ductules) into a coiled tube lying alongside it (the epididymis). This acts as a storehouse for the spermatozoa until they are ejaculated. Spermatozoa may remain alive within the epididymis and still be capable of fertilizing ova for 30 days (rabbit). The epididymis is a long coiled tube with muscular walls and the coils lie in juxtaposition so that the whole forms one discrete body closely applied to the testis. From each epididymis a duct (the *ductus* deferens) passes back through the inguinal canal (a passage connecting the scrotum with the body cavity). The two vasa deferentia open close together in the common channel with which the urinary bladder also communicates. This passage (the urethra) is continued within the erectile copulatory organ or penis, at the end of which it opens to the exterior. In addition to these organs there are several accessory glands communicating with the common urogenital passage. These are the seminal vesicles, the prostate gland and *Cowper's* glands, all of which contribute fluid substances to the semen in which the spermatozoa swim; the secretions are believed also to cleanse the urethra of urine prior to the ejaculation of semen. The above description applies more especially to man, but in the majority of the lower mammals the organs are similarly arranged.

The ovaries, the essential reproductive organs of the female, likewise serve a double function. They produce the ova and also elaborate internal secretions comparable to those of the testes; these secretions are responsible for initiating the development of the female characters, as well as being a necessary factor in the sexual and reproductive processes. In the lower vertebrates the ova are large because of the amount of food substances (yolk) contained in them (as with the egg of the fowl), but in mammals they are microscopic, each being about $\frac{1}{125}$ in. in diameter (this, however, is considerably bigger than a spermatozoon, which is about $\frac{1}{500}$ in. in length). The ova art? contained within little sacs (Graafian follicles). These begin by being very small, but as they approach maturity their cavities enlarge until they protrude from the surface of the ovary; eventually (unless, as often happens with many of them, they have degenerated) they discharge their ova to the exterior in ovulation.

The ovaries are attached, one on either side, to the dorsal wall of the abdominal cavity by the broad ligament. The tubes which convey the ova to the exterior are also suspended by this ligament, a double fold of tissue arising from the wall of the body cavity. In the lower vertebrates the oviducts are provided with glands secreting albumen or egg white which coats the ovum as it passes down the tube. The egg shell in those animals in which it is formed is also secreted by a gland; in birds this is at the posterior end of the oviduct just in front of where it opens into the common urogenital passage. At the anterior end each oviduct has a fimbriated trumpet-shaped aperture which expands at ovulation and receives the eggs as they pass into the body cavity. The interior of the expanded end is provided with cilia which direct the passage of the ova into and down the tubes. The oviducts are usually paired to correspond with the ovaries, but in birds only the left ovary and oviduct are present. In mammals and birds the ova are usually fertilized by the spermatozoa in the passage of the oviduct, but in the lower vertebrates (*e.g.*, most fish) this often occurs outside the body. In mammals, the oviducts (small, somewhat-coiled tubes) swell out posteriorly to form the *cornua* uteri, or womb. These may continue double throughout their entire length and open separately into the vagina (rabbit) or after continuing separate for a considerable distance may unite together to form the corpus uteri or body of the uterus (cow, sheep, mare, bitch, etc.) or they may extend for only a short distance before opening into the corpus uteri, which is a sac or bag (man). At the hind end the corpus uteri narrows down to form a neck (cervix) and this opens into the vagina by the os uteri. The uterus is the organ which contains the developing young during pregnancy. It has thick muscular walls on the outside and a mucous membrane with numerous glands lining the cavity inside. These secrete a fluid which helps to nourish the developing embryo during pregnancy and supplies a medium in which the spermatozoa swim after copulation. The vagina is the broad urogenital passage which extends backward through the pelvis and opens to the exterior at the vulva. The latter is constituted by all the female generative organs visible externally. The lateral boundaries are the labia, or lips. The clitoris is a small rod-like erectile structure and corresponds to the penis of the male but is solid.

The mammary glands, although not directly concerned with the reproductive processes, are dependent upon the ovaries for growth. They consist of milk-secreting tissue and are provided with ducts which convey the milk to the nipple, whence it can be drawn off.

The Reproductive Cycle.—At the approach of the breeding season in most animals the gonads (testes and ovaries) undergo marked growth. This is very pronounced in fishes and is hardly less marked in birds. Thus, in the sparrow in winter the testis is no larger than a grain of mustard seed but at the breeding season it reaches the size of a small cherry.

The male breeding season, when it occurs, is called the season of rut. The increase in the size of the testes which occurs prior to rut is accompanied by activity not only of the cells which give rise to the spermatozoa (the spermatogenetic tissue of the seminiferous tubules) but also of the interstitial cells. In some mammals the testes are not permanently retained in the scrotum but descend thither at the beginning of rut and are withdrawn into the abdomen again after the rutting season is over (*e.g.*, many rodents). In insectivores (*e.g.*, mole and hedgehog) the testes descend periodically into temporary receptacles. In the mole it is estimated that the testes increase in size 64 times, and the seminal vesicles, prostate and other accessory glands likewise show enormous growth. The time for sexual intercourse is continuous throughout rut, there being no short periods of quiescence within the breeding season as in the females of many species. Among domestic animals generally there is no special season of rut, the male being capable of service throughout the year, the semen evacuated normally containing an abundance of spermatozoa. In this respect these species differ from their wild ancestors, for in the undomesticated state the male usually experiences a rutting season at the same time as the breeding season in the female.

In the female mammal the times for sexual intercourse, instead of extending continuously over a season of considerable duration, as with the male, are restricted to periods of "heat" or oestrus. These may recur at rhythmical intervals within one breeding season (mare, cow, ewe, sow) or there may be only one oestrus to the season (bitch). The former condition has been described by Walter Heape as polyoestrous, the latter as monoestrous. The whole cycle of changes is known as the oestrous cycle. In the case of a typical monoestrous mammal, such as the dog, the oestrous cycle is divided as follows: anoestrum (period of rest); pro-oestrum (period of growth and preparation); oestrus (period of desire); pregnancy or (alternatively) pseudopregnancy.

During the anoestrum the reproductive system is, relatively speaking, quiescent. The Graafian follicles which contain the ova probably undergo slow growth and ripening, but they do not become conspicuous upon the ovarian surface until near the end of the anoestrum. The uterus is relatively anaemic and the

glands inactive. The mammary glands are also inactive unless lactation is in progress after recent pregnancy. The entire anoestrum in the bitch lasts about three months.

The pro-oestrum is marked by increased activity of the generative system generally. It is the time of coming on heat. The follicles come to protrude visibly from the surface of the ovaries. The uterus also undergoes growth, the blood vessels increase in size and number and the glands in the mucous membrane elaborate more secretion. At a slightly later stage a definite haemorrhage occurs in the uterus and blood is passed out to the exterior at the vulva. The mammary glands may also become slightly congested. The entire pro-oestrum lasts from one to two weeks and external bleeding may go on for ten days, but it is usually slight, consisting of no more than a sanguineo-mucous flow.

Oestrus or heat is the period at which (and, ordinarily, only at which) sexual intercourse takes place. It is marked internally by ovulation, that is, the rupture of the Graafian follicles and the discharge of the ova, which then become mature and ready for fertilization by spermatozoa. The wall of the uterus undergoes repair at this time but the glandular secretion is abundant and more liquid in character, to provide a suitable medium for the spermatozoa. In the bitch oestrus lasts about a week.

Oestrus is succeeded by either pregnancy or pseudopregnancy. Each of these periods in the bitch lasts about two months. At their termination the uterus and the generative organs pass back to a condition of rest, and so the oestrous cycle is repeated. The complete cycle takes about six months in the bitch, there being typically two cycles and two oestrous periods in the year but there is a good deal of individual and racial variation.

If pregnancy takes place as a result of fertilization of the ova, discharged during oestrus, these segment and become attached to the inside wall (mucous membrane) of the uterus, which grows around each of them. The structure formed in this way is highly vascular and serves as the organ of nourishment for the developing embryos to which the ova give rise. (See VERTEBRATE EMBRYOLOGY.) This organ is the placenta and is characteristic of nearly all mammals. The embryos are attached to the placenta of the mother by the outer of a number of membranes, and vascular processes (villi) grow out from this membrane (the *chorion*) into the hypertrophied uterine mucous membrane now forming the maternal placenta. Thus, a close connection is formed between the embryo and the mother and the placenta acts as an organ of respiration, supplying the developing young with oxygen brought thither in the maternal blood, and an organ of excretion, getting rid of carbon dioxide and the waste nitrogenous products, besides supplying the necessary nutriment, During pregnancy also the uterine muscles undergo a great hypertrophy, and are responsible for a great part of the increased weight which occurs in that organ. Thus, in the human subject, the virgin uterus weighs about 30 grams, whereas the same organ at the close of pregnancy, apart from the contained young, weighs 1,000 grams. It is through the rhythmical contraction of the uterine muscles that the young are expelled in parturition (the act of giving birth). The mammary glands undergo great development during pregnancy in preparation for the secretion of milk at its close.

If the ova discharged at ovulation are not fertilized during oestrus (as when coition does not occur) they die in the uterus and disintegrate. Nevertheless, in the bitch and many other mammals the uterus and mammary glands pass through growth-changes which, though not so pronounced, are similar in character to those during pregnancy. Thus, the mucous membrane becomes highly vascular and the glands greatly enlarge. The mammary glands also undergo marked development and toward the end of the period secrete milk. Even virgin bitches secrete milk freely about two months after the cessation of oestrus. At the end of this pseudopregnancy the generative system as a whole subsides into a condition of rest.

The ovarian changes (at any rate in the bitch) are also similar in both pregnancy and pseudopregnancy. The Graafian follicle, after parting with its ovum, becomes converted into the corpus luteum, or yellow body, so called because of a pigmented fat (lutein) formed inside it. The yellow body is formed by the rapid hypertrophy of the cells surrounding the cavity of the follicle; this is so great that the individual cells increase in size 16 or 20 times. This structure, which plays an important part during pregnancy, lasts throughout that period (and correspondingly during pseudopregnancy) and then undergoes degeneration.

In polyoestrous animals there is a succession of oestrous periods within a single breeding season, that is to say, that if coition does not take place at the first oestrus, or if for some other reason the ova discharged at ovulation are not fertilized, the animal, instead of experiencing a prolonged pseudopregnancy followed by an anoestrum (as with the bitch), undergoes a short period of apparent quiescence, called by Heape the dioestrum, and then comes on heat again. Thus, with the sheep, the ewe, if she fails to become pregnant at her first oestrus, comes back to the ram (as the shepherds say) after about 15 days, and if she again fails, may experience a third oestrus after another 15 days, and so on for a succession of cycles until the breeding season is over or the ewe succeeds in becoming in-lamb. This short (or dioestrous) cycle in the sheep is therefore 15 days. The number of dioestrous cycles which the animal is capable of experiencing depends partly on the breed and partly on the environment, whether favourable or otherwise. Among sheep of all breeds there is a complete gradation between the monoestrous condition of certain wild varieties and the extreme of polyoestrum exhibited by certain merinos, in which there may be no anoestrum (even in the nonoccurrence of pregnancy) but (in the absence of the ram) an unbroken succession of dioestrous cycles which last the whole year. Many wild animals (*e.g.*, rodents) are polyoestrous and the dioestrous cycle may last for only a few days.

In polyoestrous animals ovulation typically occurs during oestrus and is followed by the formation of the corpus luteum. The time of persistence of this structure varies according to whether or not pregnancy occurs. In the absence of pregnancy the corpus luteum persists for the duration of the dioestrum and then begins to degenerate as if to make way for the ripening of a fresh batch of follicles in the ovary and a new oestrous period. If, however, pregnancy takes place the corpus luteum continues in the ovary until parturition as in monoestrous animals. In reality, the dioestrum, instead of being a period of complete rest, is of the nature of a very abbreviated pseudopregnancy, and the uterus undergoes some growth changes in association with the presence of the corpus luteum in the ovary.

In man there is typically no anoestrum (except among the Eskimos in winter) and the menstrual cycles, each lasting about a month, correspond to the dioestrous cycles of the polyoestrous lower mammal. The actual menstrual phenomena probably represent the degenerative changes at the end of an abbreviated pseudopregnancy (or dioestrum) telescoped into the pro-oestrum of a new cycle. Ovulation takes place most commonly about the 14th day after the beginning of the menstrual flow but it may occur at other times, though rarely, in the week or ten days before the beginning of menstruation.

In some animals (rabbit, ferret) ovulation takes place only after coition. The actual process can be demonstrated in an anaesthetized rabbit whose ovaries have been exposed to view (J. Hammond). It is possible that in man also ovulation may sometimes require the additional stimulus set up by coition. In most domestic animals (bitch, sow, ewe, cow, mare) ovulation takes place spontaneously at or about the time of oestrus.

The Testis and Ovary as Organs of Internal Secretion.— It has been mentioned that the testis, besides producing the spermatozoa, is also an organ elaborating an internal secretion which is discharged into the blood. A similar statement may be made about the ovary. The evidence for these conclusions falls under three heads: (1) the effects of removing these organs (castration and spaying); (2) the effects of transplanting the testis or ovary into animals whose own gonads have previously been removed and (3) the result of injecting tissue extracts prepared from testes or ovaries.

The general effect of castration in all vertebrate animals is to prevent the development of the secondary characters of sex, that is, of those characters which, while correlated with the sex in

question, are not directly concerned with reproduction. This statement applies to ovariotomy or the extirpation of the ovaries in the female as well as to castration in the male. It is essential, however, that this operation should be performed early in life to have its full effect. It not only ensures permanent sterility (whenever it is done) but if performed on the young stops the development of superficial sexual characters as well as the accessory reproductive organs (prostate gland, etc.). Thus, in man, castration prevents the growth of hair on the face and various parts of the body and arrests the enlargement of the larynx and the consequent deepening of the voice normally characteristic of puberty in the male. In stags castration inhibits the growth of the antlers and in those breeds of sheep which are horned in the male and hornless in the female it prevents development of the horns; moreover, the horn growth is arrested at any stage of development at which castration is performed. With fowls, castration is followed by an arrest of the development of the erectile structures about the head (comb, wattles, etc.). Castration has been practised on the domestic animals from the earliest times, for it improves the quality of the flesh and favours fattening in meat-producing animals and is conducive to a greater tractability in working animals since the disturbing effects of sexual desire no longer occur.

If the testes are removed from the normal position and grafted to an abnormal one (or if the testes of another male are transplanted immediately after castration), the organs exert their usual influence on the secondary sexual characters and accessory sexual glands, although their normal nerve connections have been severed. Since, then, the influence of transplanted organs can not be through intermediation of the nervous system it would seem that it must operate through chemical substances passed into the blood and so into the general circulation. Thus, in experiments upon fowls the testes have been removed and broken up into pieces, which have attached themselves to different parts of the alimentary canal or the wall of the body cavity, and the birds have developed into typical cocks with comb, wattle, etc., male voice and sexual and combative instincts. Furthermore, the experiments of Eugen Steinach and others have shown that the grafting of testes into females whose ovaries had been removed may cause the development of secondary male characters and bring about a partial or complete reversal of sex. For the successful implantation of testis tissue, as with most other organs in higher vertebrates, the material to be transplanted must come from an animal of the same species; in salamanders and frogs sometimes grafts may become incorporated and persist in the host organism when the living transplant has come from a donor of different species. Mammalian testis grafts will secrete hormone when they are incorporated into any locality in the host organism, but the grafts will produce spermatozoa only when transplanted into the scrotum or in the anterior chamber of the eye. In these two localities the body temperature is sufficiently low to permit formation of completed spermatozoa. The scrotum functions as a heat regulator, effectively reducing the temperature below ordinary body temperatures. Testes of mammals that fail to descend into the scrotum, or are located as grafts in the abdomen, are unable to produce spermatozoa because of the higher temperature in this locality. Testes of birds, which have even higher body temperatures than do mammals, are more heat resistant; however, active division of the germinal cells of the testis apparently occurs almost exclusively at night during periods of sleep in which the body temperature falls by several degrees.

Ovariotomy leads to the suppression of the distinctly female characters. If done before puberty the uterus and mammary glands do not develop and the general bodily form tends toward a neutral condition not dissimilar to that of the castrated male. If performed after puberty ovariotomy is followed by cessation of the oestrous or menstrual cycles and the uterus undergoes atrophy in much the same way as occurs normally at the menopause (climacteric) or time of permanent cessation of reproductive activity (in women at from 45 to 50). If, however, the ovaries (or one of them) instead of being removed are grafted to an abnormal position such as the ventral wall of the body cavity or into a kidney the oestrous cycle is continued and the uterus remains normal. Since the ovary in such a position is without its normal nerve supply it is presumed that its influence on the organism is because of internal secretions passed into the circulation. The corpus luteum is also known to be an organ of internal secretion serving the special function of secreting into the blood substances essential for maintaining the raised nutrition of the uterus during pregnancy and for the development of the mammary glands, for if this structure be removed surgically pregnancy can not continue, the uterus lapses and the mammary glands fail to develop. The corpus luteum also plays some part in controlling the short or dioestrous cycle, for so long as it is present in its integrity heat can not occur; but if it is extirpated some days before a new oestrous period is normally due, the period occurs shortly after the operation of removal. Thus, Hammond, by squeezing out the corpus luteum of a cow, has induced oestrus after 9 days instead of the usual 19 to 21.

Internal Secretions and the Control of Reproductive Processes.—An understanding of the role exercised by internal secretions in the first establishment of a functional reproductive system at the age of puberty, and in the control of the rhythmical processes occurring during reproductive life, is largely a development of the 20th century. Internal secretions from the sex glands, while immediately responsible for the principal functional changes, are themselves regulated by the secretory activity of other endocrine glands, especially those from the pituitary gland.

Analyses of the oestrous cycles in the guinea pig, repeated approximately every 15th day, were made by C. R. Stockard and G. N. Papanicolaou in 1917, and five-day cycles in the rat were carefully described by J. A. Long and H. M. Evans in 1922. The inactive period of the cycle, or dioestrum, gradually changes to the pro-oestrum as renewed growth of follicles occurs in the ovary. The entire female reproductive tract—oviducts, uterus and vagina—become more vascular, increase in size and show active changes in their glands; the vaginal epithelium exhibits renewed cellular activity under the old epithelial wall, which is rather precipitously cast off into the cavity of the vagina. The period of oestrus, or acceptance of the male, in these small rodents is restricted to a few hours in comparison with several days for larger mammals; it occurs as follicular size approaches the maximum and as samples of the castoff vaginal cell wall show nucleated epithelial cells mixed with the old cornified cells of the vaginal epithelium. Ovulation occurs approximately 10 hr. after the first mating is permitted. The growth, or estrogenic, phase of the cycle is followed by the luteal or regressive phase and this involution period is indicated by the character of cells appearing in a smear taken from the vagina. The cornified cell stage of the smear is gradually superseded by one in which scattered leucocytes appear and the final quiescent stage of the dioestmm is characterized by a scanty smear composed of cells almost exclusively made up of leucocytes.

Thus, the state of the reproductive cycle can be diagnosed rapidly from the living female by means of examining a smear made from the open vagina. The known correlations between the character of the smear and the ovarial condition makes it possible to understand the condition of the ovary simply from microscopic observations of the vaginal smear. Since removal of the ovaries abolishes all cyclical phenomena as well as recurrent phases of activity on the part of the uterus and vagina, the vaginal smear technique provides a rapid test for the estrogenic hormones involved in these changes in the reproductive tract, and thereby has aided tremendously in efforts to identify the source and to follow the procedures of isolation of these hormones.

The fundamental activities of the sex glands (testes and ovaries) are not self-regulating phenomena, but were shown clearly to be dependent upon secretions from the anterior lobe of the pituitary gland by Philip E. Smith and Earl T. Engle in 1927. This sex-gland activity involves both the formation of mature germ cells and the hormone secretion by the respective sex gland. Removal of the pituitary gland (hypophysectomy) in the adult animal leads to immediate involution of the sex glands, with loss of capacity to mature sex cells and inability to secrete hormones. Conversely, the introduction under the skin of a normal animal

of finely ground fresh pituitary substance, or extracts made from fresh or dried pituitary tissue, rapidly stimulates excessive activity on the part of the gonads. Defective secretion of pituitary hormones introduces defective activity on the part of the testis or ovary.

Some notion of the delicacy of interaction between the gonads and pituitary body can be appreciated from a knowledge of the regularity in the short recurrent oestrous cycles, and such phenomena as menstruation in the human females, as well as from the regularity in the strictly annual breeding cycles. In many wild mammals the gonads are active for but a short span of the year. During the periods of low gonadal, or reproductive, activity the pituitary gland is far less potent in stimulating sex-gland activity when introduced into a test animal than it is at the approach of the breeding season. Also, since the sex glands of the sexually inactive seasonal breeding animal can be stimulated rapidly into intense activity it becomes evident that the problem oi the control of the seasonal sexual activity is essentially the problem of seasonal pituitary activity.

The external environment as well as internal conditions both play a role in these reproductive processes and in the secretory activity of the pituitary body. The relative lengths oi day and night have marked influences on the reproductive state of birds especially, as well as of some mammals, whereas other animals, particularly hibernating ones, appear to be less responsive to light changes. Jacques Benoit (1937) demonstrated clearly that the effect of added light was indirect in that it incited the pituitary gland of light-treated ducks to greatly increased secretory activity.

The secretion of substances (hormones) by the pituitary gland in the adult animal, that so markedly affect the reproductive system, is modified by factors other than light. The nutritive state of the animal is important. Simple inanition or starvation affects the secretory activity of the gland; lack of vitamin B_2 (lactoflavin or riboflavin) in the diet has a similar effect. The concentration of sex hormones in the circulation tends to inhibit secretion oi the substances acting upon the gonads, hence a reciprocal gonadal-hypophyseal interaction constitutes at least one contributory element to the intimate control of the reproductive cycles

The initiation of sexual activity, or the condition commonly known as puberty, depends upon the secretory activity of the pituitary gland. Prepuberal animals can be thrown into reproductive activity long before it normally occurs if pituitary secretions are merely introduced under the skin.

Other organs of internal secretion than the pituitary gland probably play a definite role in the control of breeding cycles. This appears to be true for the thyroid secretions in some animals and less definitely for other products of internal secretion.

Fertility **and** Sterility. — The number of spermatozoa discharged in a normal ejaculation of human semen is estimated at 226,000,000, whereas the number of ova ejected at one ovulation is usually only 1. For mammals generally the number of ova discharged is on an average only slightly more than the average number of young in a litter. It follows that the female rather than the male controls the size of the litter. (On the other hand, Sanders has shown for horses that a reduction in the number of spermatozoa may reduce the chances of the ovum being fertilized) The sheep discharges one or two (sometimes three and rarely more) ova at oestrus, but by flushing the ewes, that is supplying them with extra or stimulating food before and during breeding, the number may be increased and consequently a higher proportion of lambs obtained. This is an example of the influence of favourable nutrition upon fertility. Too high feeding (resulting in adiposity), however, promotes atrophy of the ova in the ovary and so is conducive to sterility. There is evidence also that sterility may be caused by the absence of certain essential accessory food substances or vitamins (*q.v.*) and that one such vitamin is present in green food (Herbert Evans). Degeneration of ova in the ovary may therefore be caused by faulty nutrition of various kinds, but some degeneration is normal

Sterility may result from coition at an inappropriate time, that is, at too long an interval before or after ovulation, for Hammond has shown in the rabbit that the ova are not capable of being fertilized for longer than four hours after their release from the ovary, and that the spermatozoa in the female passages do not retain their power of fertilization for more than two days (In the male passage, where they are quiescent, they retain this power for 30 days.) It is probable that in many other mammals the duration of viability of the spermatozoa and ova is not widely different. In animals such as the mare, which has a prolonged oestrus (a week or more), sterile unions may well be the result of this cause (Hammond).

Artificial insemination is sometimes successfully resorted to in cases where sterility has been because of an abnormal constriction of the *os uteri* or to the presence of an acid secretion in the vagina.

Fertility, like other characters, is capable of being transmitted from one generation to another Thus, rams which were twin lambs may hand on the tendency to produce twins to the next generation of ewes, and by breeding from rams which were twins the fertility of a flock may be increased.

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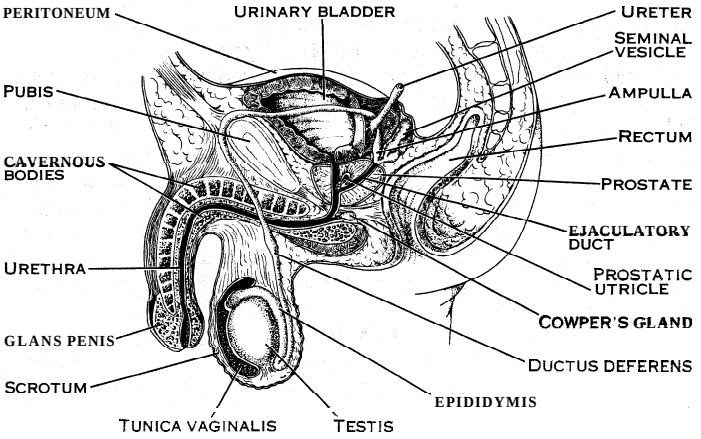
REPRODUCTIVE SYSTEM. The reproductive system comprises the organs. glands, secretions and other elements by means of which animals are able to reproduce themselves. Since in some parts of its course the reproductive system shares certain structures with the urinary system, the two are commonly referred to in medical practice as the genitourinary or urogenital system. (See URINARY SYSTEM.)

This article has to do with the anatomy and functions of the reproductive system in human beings, and is divided into sections on the male and female systems; there is a third section on embryology.

MALE REPRODUCTIVE SYSTEM

The external genitalia of the male consist of the penis, the erectile copulatory organ; and the scrotum, a loose pouch of skin just beneath the base of the penis (see fig. 1). Within the scrotum



FROM C D. TURNER, "GENERAL ENDOCRINOLOGY"; REPRODUCED BY PERMISSION OF W. B. SAUNDERS COMPANY

FIG. 1.—DIAGRAMMATIC SAGITTAL SECTION SHOWING THE RELATIONSHIP OF THE MALE REPRODUCTIVE ORGANS

are the gonads or testes, which produce the male germ cells, called spermatozoa. The spermatozoa accumulate in a convoluted tubular organ, the epididymis, which is closely applied to the surface of the testis. From the epididymis, the germ cells pass through a muscular duct, the ductus deferens, and into the urethral canal of the penis, through which they are discharged into the female reproductive tract. Opening into the male reproductive passages are accessory glands: the seminal vesicles, prostate gland and bulbo-urethral (Cowper's) glands. These contribute secretions that add to the bulk of the semen and create a fluid medium favourable for transport and sustenance of the spermatozoa.

EXTERNAL GENITALIA

Penis. — The penis is made up of three cylinders of erectile tissue covered by skin and subcutaneous tissue devoid of fat. Two of these cylinders, the corpora cavernosa, are side by side, while the third, the corpus spongiosum, is underneath. The posterior ends of the two corpora cavernosa diverge at the root of the penis, becoming more and more fibrous in structure, and are attached on each side to the inner border of the pubic arch. The corpus spongiosum ends posteriorly in a bulbous enlargement that is situated between the diverging columns of the corpora cavernosa. The head of the penis is formed by a large bell-shaped expansion of the corpus spongiosum, known as the glans. On its posterior surface are two concavities, which receive the rounded anterior ends of the corpora cavernosa. On the upper surface and sides of the penis the posterior rim of the glans projects as a well-marked ridge, the corona glandis, which is set off from the shaft by a constriction called the neck of the penis. The corpus spongiosum is traversed for its entire length by the urethra, a canal that begins

at the bladder, passes downward through the prostate and pierces the urogenital diaphragm to enter the bulb of the corpus spongiosum from above. Thence it runs forward through the shaft of the penis to terminate in the external meatus, a vertical slit at the end of the glans. The penile portion of the urethra serves for passage of both urine and seminal fluid and is therefore a portion of the reproductive system that is shared with the urinary system.

The skin of the penis is thin, distensible and loosely attached to underlying structures. Near the head it forms a fold, the foreskin or prepuce, that normally covers the greater part of the glans; when this is drawn back, two folds on the undersurface of the penis are seen to unite to form a median fold, the frenulum, which is attached to the glans just below the meatus. In the depression behind the corona, the skin is reflected from the inner aspect of the prepuce onto the glans where it forms a thin, closely adherent. transparent layer that is rich in sensory nerve endings. The prepuce is often removed in the practice of circumcision (*q.v.*).

The corpora cavernosa consist of a strong, fibroelastic, cylindrical sheath, from the inner surface of which incomplete walls of connective tissue extend into the interior. dividing the corpus into a labyrinthine system of spaces or compartments. These spaces in the erectile tissue are lined with endothelium and are interposed between the arteries and the deep veins of the penis. When the penis is flaccid, the spaces in the corpora cavernosa are largely collapsed, but upon psychical or mechanical stimulation, the blood vessels supplying the penis are dilated and the influx of blood into the erectile tissue is thereby enhanced. At the same time a layer of muscle investing the posterior part of the corpora cavernosa contracts and restricts the outflow. The impounding of blood within the vascular spaces of the corpora cavernosa causes them to elongate and to become distended and stiffened, resulting in erection of the penis. The internal structure of the corpus spongiosum and glans resembles that of the corpora cavernosa, but the connective tissue trabeculae are finer and the spaces they delimit are smaller. The engorgement of this finer-meshed erectile tissue causes the enlargement of the glans and the swelling of the wall of the urethra in erection.

Scrotum. — The scrotum is a pouch of skin that is divided into two compartments by a wall down the middle. Each compartment contains a testis, an epididymis and a portion of the spermatic cord. The left half of the scrotum reaches a somewhat lower level than the right half. The skin contains scattered coarse hairs and well-developed sebaceous and sweat glands. The deep layers of the scrotal skin contain smooth muscle fibres forming the dartos. Contraction of these fibres draws up the scrotum and produces a corrugated appearance of the skin.

During development of the fetus, the scrotum arises as a pair of outpouchings of the abdominal wall called the genital swellings. The testes develop in the abdominal cavity and later descend into the genital swellings. The vessels, nerves and ductus deferens that are drawn down with the testis constitute the spermatic cord. The passageway in the abdominal wall through which the testis and spermatic cords enter the scrotum is called the inguinal canal. It is at first widely open but eventually forms a flat-sided oblique passage in the abdominal wall about 3 cm. (1½ in.) in length. In the adult it remains a point of potential weakness in the body wall through which abdominal contents may be forced into the scrotum in the common pathological condition called inguinal hernia. In the descent of the male gonads the layers of the anterior abdominal wall are carried into the scrotum as coverings of the testes and spermatic cord. Thus the entrance to the inguinal canal, the abdominal inguinal ring, is formed by a funnel-shaped expansion of the transversalis fascia as it envelops the spermatic cord; the exit from the canal, the subcutaneous inguinal ring, is surrounded by the aponeurosis of the external oblique muscle.

In the scrotum, beneath the dartos, there is a thin layer of connective tissue, the external spermatic fascia, which is continuous at the subcutaneous inguinal ring with the aponeurosis of the external oblique muscle of the abdominal wall. The next deeper layer in the scrotum, the cremasteric fascia, contains bundles of muscle fibres derived from the abdominal internal oblique muscle. In fear, rage or exposure to cold, contraction of the cremasteric muscle tends to draw the testes upward toward the abdominal cavity. The next layer, the internal spermatic fascia, is relatively thin and is derived from the transversalis fascia of the abdomen. The innermost layer, the tunica vaginalis, is a double layer forming the serous investment of the testis; it is derived from the peritoneum lining the abdominal cavity. The outer, parietal layer is closely adherent to the internal spermatic fascia; the inner, visceral layer invests the testis and a portion of the epididymis. The scrotum has a lower temperature than the body cavity, and it is believed to have a heat-regulating function. Migration of the testes to a scrotal pouch occurs only in certain mammals, and for these species it has been shown that the germinal elements of the testis produce spermatozoa only at a temperature below that of the abdominal cavity.

Testes. — The testes or testicles are the essential male organs of reproduction. Each is oval, about 4–5 cm. (1½–2 in.) in length and 2.5–3 cm. (1 in.) in width. The testis has a dense fibrous capsule, the tunica albuginea, from which thin walls penetrate into the interior, dividing it into about 250 compartments or lobules. Within each lobule there are from one to three highly convoluted seminiferous tubules. These join straight tubules, tubuli recti, that open into a plexus of communicating tubes, the rete testis. The spermatozoa produced in the seminiferous tubules are carried via the tubuli recti to the rete testis, and from there they pass through 15 to 20 small ducts. the efferent ductules, into the epididymis.

Microscopically the seminiferous tubule has a small, irregular lumen surrounded by the germinal epithelium, which is enclosed by a basement membrane. The germinal epithelium is composed of the germ cells in different stages of maturation (called, according to their stage of development, spermatogonia, spermatocytes, spermatids and spermatozoa) and their supporting elements, the Sertoli cells. The mature spermatozoon is a highly specialized motile cell consisting of a head, a middle piece and a long tail or flagellum, which executes vigorous lashing movements that propel the cell forward. Spermatozoa are produced in astronomical numbers. It has been estimated that an average man discharges 400,000,000,000 sperm in his reproductive lifetime. A single ejaculate contains hundreds of millions, yet, if fertilization is achieved. only one of this enormous number enters the ovum. The condensed nucleus in the head of the fertilizing spermatozoon contains all the hereditary material contributed by the father. The endocrine function of the testes is believed to reside in the interstitial tissue, which is located between the seminiferous tubules. The cells of this tissue produce the male sex hormone responsible for maintenance of accessory reproductive organs and development of secondary sex characteristics such as deep voice, beard, muscular build, etc.

Epididymis.—The epididymis is a firm, elongated body closely adhering to the posterior surface of the testis. At the upper pole it is enlarged to form the head, and at the lower pole there is a lesser enlargement. the tail. The entire epididymis consists of an extremely tortuous tube that is 15 to 20 ft. long when extended. Because of its great length it can accommodate a large number of spermatozoa. The cells lining this convoluted tube are believed to produce a secretion that plays a role in the nutrition of the spermatozoa.

Internal Organs

Ductus Deferens. — The ductus deferens (or vas deferens) is the continuation of the tube of the epididymis. It extends from the tail of the epididymis to the posterior surface of the prostate, where it joins the duct of the seminal vesicle to form the ejaculatory duct (see fig. 1). The ductus deferens ascends from the epididymis to the subcutaneous inguinal ring, being joined in this part of its course by testicular arteries, veins, lymphatics and nerves to form the spermatic cord. These structures pass obliquely through the abdominal wall, via the inguinal canal. At the abdominal inguinal ring they separate, the ductus passing down the side of the pelvis and then turning inward along the back wall of the bladder to the prostate, where it meets its fellow of the opposite side.

The ductus deferens has a thick muscular wall with a uniform diameter of about three millimetres until it reaches the seminal vesicle; there it broadens out and forms the ampulla of the ductus deferens. the lumen of which has numerous outpocketings. Immediately before joining the excretory duct of the seminal vesicle, the ductus deferens again becomes round and slender.

Seminal Vesicles and Ejaculatory Ducts.—The seminal vesicles are two saclike appendages of the ductus deferens that are fixed to the rear surface of the bladder and lie lateral and parallel to the corresponding ductus deferens *(see* fig. 1). Each vesicle is composed of a thin-walled tubular structure, 10 to 12 cm. long, folded back and forth upon itself and enclosed in a fibromuscular capsule. Arising from the main tube are numerous pouches (sacculations or diverticulae). The excretory duct of the seminal vesicle on each side joins the ductus deferens to form an ejaculatory duct. The two ejaculatory ducts are narrow and thin walled and run side by side through the prostate gland to open into the urethra. The seminal vesicles were formerly regarded as seminal receptacles for the storage of semen, but according to the modern view their function is purely glandular and they do not store semen. The principal reserves of spermatozoa are contained within the epididymis, and those that are to be delivered in any one ejaculation accumulate in the ampulla of the ductus deferens just prior to ejaculation. Here, in the secretion of the ampulla, the spermatozoa first come into contact with fructose, the principal carbohydrate substrate for their metabolism: and it is probable that sperm motility is initiated at this time. The main source of fructose is in the secretion of the seminal vesicles which is discharged in the process of ejaculation into the prostatic urethra together with the secretion of the prostate and the spermatozoa contained in the ampulla. In man, the greater part of the volume of the ejaculate is derived from the secretion of the seminal vesicles.

Prostate.— The prostate is situated just below the bladder and is traversed by the urethra and the ejaculatory ducts. It is pyramidal in form. with the base upward in contact with the floor of the bladder. The vertical dimension is from 2.2 to 3 cm. (1 to $1\frac{3}{8}$ in.), the transverse diameter from 3.5 to 4 cm. ($1\frac{3}{8}$ to $1\frac{3}{4}$ in.) and the thickness from 2 to 2.j cm. ($\frac{4}{5}$ to 1 in.). The prostate is composed of glandular tissue enclosed in a dense fibrous capsule. Microscopically it consists of 30 to 50 branching tubuloalveolar glands embedded in a stroma rich in smooth muscle fibres, which aid in discharge of the prostatic fluid in ejaculation. The glands join 16 to 20 minute ducts that enter the prostatic urethra on either side of a longitudinal ridge in its rear wall, the colliculus seminalis. The secretion of the prostate is a thin, milky fluid that is weakly alkaline and has a characteristic odour. In old age the prostate commonly undergoes a generalized enlargement that may ultimately constrict the urethra and cause urinary obstruction.

Cowper's Glands.—Opening into the urethra where it passes into the bulb of the corpus spongiosum are the ducts of two small glands. the bulbo-urethral or Cowper's glands *(see* fig. 1). The glands themselves are about five millimetres in diameter and are situated on each side of the urethra within the urogenital diaphragm. They produce a mucoid secretion that probably functions as a lubricant.

FEMALE REPRODUCTIVE SYSTEM

Genital Anatomy

External.— The external genitalia in the female collectively comprise the vulva. The vulvar orifice is bounded laterally by the labia majora, two prominent rounded folds of skin that correspond to the scrotum of the male. They have a sparse covering of hair and meet in the mid-line so that they largely conceal the other external genital structures. Between the labia majora are a pair of pendulous skin folds, the labia minora, that enclose a shallow elliptical depression called the vestibule. Toward the front the labia minora are continuous with one another, forming the prepuce, a thin fold of skin that covers the sensitive clitoris. The clitoris is a rudimentary erectile organ. the counterpart of the penis of the male. Opening into the vestibule below it are the urethra, the urinary passage from the bladder; and the vagina, the flattened fibromuscular tube that receives the penis during copulation. In virgins, the entrance of the vagina is narrowed by a circular fold of mucous membrane called the hymen.

Internal.— The internal reproductive organs consist of the female gonads or ovaries. located within the body cavity, and a system of tubular organs that communicate with the exterior at the vaginal orifice. Egg cells or ova are produced in the ovaries and are released singly at monthly intervals. Closely associated with the ovaries are the open ends of the right and left oviducts (Fallopian tubes). At the time of ovulation either of these may receive the ovum. If coitus occurs. the ovum may be fertilized by one of the spermatozoa reaching the upper part of the oviduct. The developing ovum then passes down through the oviduct to the cavity of the uterus or womb, where it becomes implanted and is nourished until birth. The lower end of the uterus projects into the upper end of the vagina (see fig. 2).

The dilated neck of the uterus and the vagina constitute the birth canal, through which the infant emerges at the termination of pregnancy.

Ovary.—The mature ovary is a firm organ about the size of a large almond shell, with a scarred or wrinkled exterior. Its surface is covered by a layer of low cuboidal cells forming the

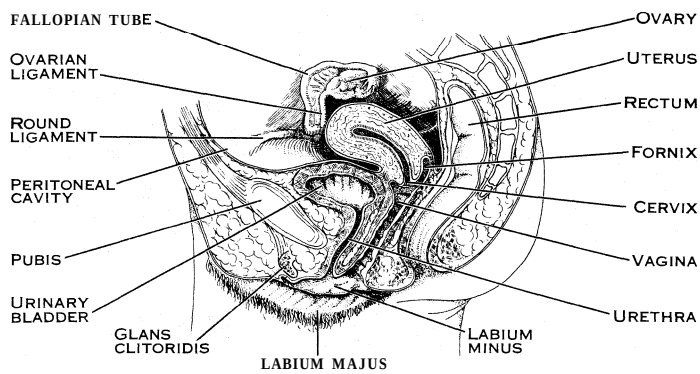


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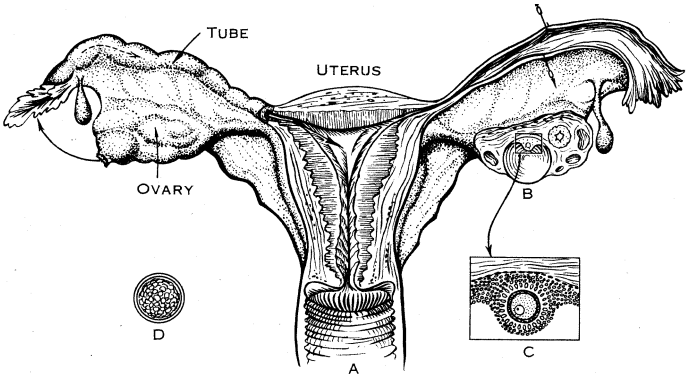
FIG. 2.— DIAGRAMMATIC SAGITTAL SECTION SHOWING THE ARRANGEMENT AND RELATIONSHIP OF THE FEMALE REPRODUCTIVE ORGANS

germinal epithelium. Near the surface are many minute egg cells that have remained dormant since birth. Each is surrounded by a layer of flattened follicle cells. An ovum and its covering layer of cells form a primordial follicle. In a young adult woman each ovary may contain as many as 200,000 of these, but the number decreases progressively throughout the reproductive period of life. From time to time, certain of the primordial follicles begin to grow. The ovum within slowly enlarges and the follicle cells multiply rapidly, giving rise to a thick cellular wall. Fluid accumulates between the follicle cells and a central cavity gradually develops. The vesicular structure formed in this manner is called a Graafian follicle. Within it the eccentrically placed ovum and the cells immediately surrounding it form a domelike projection from the wall into the fluid-filled cavity. Several hundred partially developed follicles of this kind may be present in an adult ovary. In each ovulatory cycle one of these continues to grow to large size and finally releases a ripe ovum. The great majority of the follicles seen in the ovary develop only to a certain stage and then degenerate. Although their ova are thus wasted, these follicles nevertheless serve a useful purpose before their degeneration in that their cells are active in the production of female sex hormone. Of the thousands of primordial follicles present in the ovaries at birth, fewer than 400 are likely to produce mature ova during a woman's reproductive life.

Oviducts.—The oviducts (Fallopian tubes) are sinuous tubes of involuntary muscle, 4–5 in. long, running laterally from the uterus to the ovaries. They are lined by an extensively folded mucous membrane. Near the ovary the open end of the oviduct is expanded into a thin-walled, funnel-shaped structure, the infundibulum. Its edges are prolonged into a number of slender, tapering

processes called fimbria, some of which are attached to the ovary. By contraction of its muscular wall, the oviduct can change its shape and position. It is particularly active at the time of ovulation, when it becomes reddened from dilatation of all its blood vessels and moves so as to bring its open fimbriated end into close apposition with the surface of the ovary, thus facilitating the passage of the ovum directly into the infundibulum. The lumen of the oviduct narrows and becomes very small where it passes through the thick. muscular, uterine wall. Ciliated cells lining the oviduct maintain a constant slow movement of fluid from the body cavity toward the uterus.

Uterus.—The uterus, when not pregnant, resembles a flattened pear in size and shape. with the stem end directed downward toward the vagina (see fig. 2). The body of the uterus, the corpus uteri, is usually bent forward so that it lies upon the urinary bladder and is thus at an angle to the cylindrical neck. the cervix uteri. The thick wall of the uterus is composed largely of involuntary muscle. The uterine cavity is flattened from front to back and is roughly triangular in form, with the upper angles extending out toward the openings of the oviducts. and the lower angle directed downward toward the cervix (see fig. 3). The lining of the corpus uteri, the endometrium. is a mucous membrane specially adapted for the reception and sustenance of the fertilized ovum. It is covered by a single layer of ciliated and secretory cells that is continuous with the lining of many simple tubular glands that extend from the surface of the endometrium down to the muscle of the uterine wall. The glands are embedded in a loose connective tissue richly supplied with blood vessels. The cervix of the uterus has a slender cavity narrowed by projecting folds of mucous membrane. Opening into it are numerous branching, mucus-secreting glands, At its lower end the cervical canal communicates with the vagina through a narrow slit, the external os (see fig. 3).



FROM CORNER, "OURSELVES UNBORN" (YALE UNIVERSITY PRESS)

FIG. 3.—(A) DIAGRAM OF HUMAN OVARIES, OVIDUCTS (FALLOPIAN TUBES) AND UTERUS. AS SEEN FROM THE REAR. THE RIGHT TUBE AND THE UTERUS ARE DRAWN AS IF OPENED BY REMOVAL OF THEIR REAR WALLS, TO SHOW THE CANAL OF THE TUBE AND THE CAVITY OF THE UTERUS. THE ARROWS AT THE LEFT INDICATE THE COURSE OF THE OVUM FROM OVARY THROUGH TUBE TO UTERUS; (B) A RIPE FOLLICLE IN THE OVARY. WITH EGG CELL (NOT TO SCALE) IN ITS WALL; (C) ENLARGED VIEW OF THE EGG HILLOCK OF THE FOLLICLE IN SECTION; (D) EGG CELL (OVUM) EXTERNAL ASPECT. MAGNIFIED ABOUT 30 DIAMETERS

Attachments.—The attachments of the ovaries! oviducts and uterus support them, while at the same time permitting their independent movement and allowing for enlargement of the uterus in pregnancy. The principal support for all three organs is provided by the two broad ligaments. Each of these consists of a double layer of peritoneum extending from the sides of the uterus to the lateral wall of the pelvis. The blood vessels, lymphatics and nerves reach the uterus by passing between the layers of the broad ligaments. Each ovary is suspended from the back of the broad ligament by a fold of peritoneum. the mesovarium. A small peritoneal fold also passes upward from the tubal end of the ovary to the pelvic wall. This is the infundibulopelvic ligament. Through it, blood vessels reach the ovary from above. The ovarian and uterine vessels communicate within the broad ligament. and blood can reach these organs via either route. The medial pole of the ovary is attached to the uterus by a stout band of connective tissue. the ovarian ligament. A fibrous cord, the round ligament. runs laterally from the uterus to the wall of the pelvis, from there anteriorly passing through the abdominal wall via the inguinal canal. to terminate in the skin and subcutaneous connective tissue of the labia majora. The round ligament in the female corresponds to the gubernaculum in the male, the fibrous band that attaches the lower pole of the testis to the skin of the scrotum. The cervix of the uterus is held back by the uterosacral ligaments, two folds of fascia and peritoneum that run from the back of the cervix around the rectum on either side to attach to the fascia over the anterior surface of the sacrum.

Reproductive Function in Woman

During childhood there are no signs of activity in the female genital organs, but at the beginning of adolescence (8 to 12 years) the ovaries are activated by the hormones of the pituitary gland (hypophysis) to begin the production of large follicles, which in turn secrete ovarian hormone. The latter is carried in the blood stream and stimulates development of all parts of the reproductive tract. In addition. the bony pelvis, breasts, hair and fat depots begin their progress toward maturity. There is a rhythmic alternation in the dominance of the hormones of the hypophysis and ovary.

Eventually the hormonal tides attain a height that results in bleeding from the endometrium and the first menstrual flow occurs (see MENSTRUATION).

Menstrual Cycles.—During the childbearing period of life the sequence of events in the cycle is usually as follows: at intervals of about a month. under stimulation from the hypophysis, one ovarian follicle outstrips its fellows in growth. In a few days it attains a diameter of about ½ in. and protrudes from the ovary like a clear blister. Usually only one follicle at a time enters upon this final growth period, but occasionally more may develop; if the ova produced are fertilized. multiple births may result. At ovulation the ripened egg cell loosens from the wall of the large follicle and soon the wall bulges, breaks and the viscid follicular fluid wells out, carrying the ovum along with it. At this time of the cycle. the level of ovarian hormone circulating in the blood stream reaches a peak, and the oviducts and uterus are stimulated to greater activity. It has been possible to peer into the body cavity through an endoscope at such a time and see the fimbriated end of the oviduct wrapped closely about the ovary while the organs move rhythmically. The close joining of the open end of the infundibulum to the ovary facilitates the entrance of the ovum into the oviduct. If spermatozoa are present, the egg may be fertilized almost as soon as it is liberated from the follicle. In any case it is swept into the oviduct by ciliary action and is slowly moved along by peristaltic contractions, reaching the uterus about the fourth day after ovulation.

In the interim, the uterine endometrium has grown thick through cell division and accumulation of interstitial fluid, and its glands have increased in length and complexity. This preliminary period of preparation of the uterus for reception of the ovum is called the follicular phase of the cycle becauseit is dominated by the hormone produced by the growing follicles. Ovulation is expected to occur on about the 14th day of a 28-day cycle, but it may occur as early as 7 days after the beginning of menstruation or may be delayed for 18 days or more. The period of the cycle subsequent to ovulation is called the luteal phase because it is dominated by the hormone produced by the corpus luteum, an organ of internal secretion that arises in the ovary from the wall of the ruptured follicle. Immediately after ovulation, while the egg is still in the oviduct. the thin wall of the collapsed follicle thickens rapidly and its cells undergo a marked.change in their appearance. A meshwork of thin-walled capillary vessels develops between them, and the entire structure is transformed into a conspicuous yellow body grossly visible in the ovary at the site formerly occupied by the follicle.

The hormone secreted by the cells of the corpus luteum produces further changes in the uterus that make it a most favourable site for implantation and nourishment of the embryo. Under its influence the contractions of the uterus are slowed down; the endo-

metrium thickens and its arteries lengthen and become more coiled; its glands grow more contorted and are distended with a secretion rich in nutrient substances. These changes take place whether the egg has been fertilized or not.

If conception does not occur, the corpus luteum remains active for only 10 to 14 days. With the decline in its hormone output, the blood flow to the uterus is reduced and the endometrium begins to shrink. Its superficial zone suffers particularly, for it is supplied by the coiled arteries. which, at this time, begin to constrict intermittently. The walls of the superficial vessels are damaged and ultimately break down, permitting blood to seep out into the surrounding tissue. The extravasated blood at first accumulates within the endometrium but finally drains into the cavity of the uterus. This marks the beginning of menstruation. The blood-soaked, degenerating tissue soon loosens and sloughs off, leaving a raw surface. The greater part of the thickness of the endometrium degenerates and is lost during menstruation, but the bases of the glands persist, and the multiplication and migration of their cells quickly restores the surface layer after menstruation is over.

A period of relative inactivity may ensue before another set of ovarian follicles enter upon their final growth and release the follicular hormone that stimulates anew the growth in thickness of the endometrium.

Menstrual cycles continue more or less regularly unless interrupted by pregnancy. They are accompanied by various general bodily changes. At the middle of the cycle a sudden slight fall, followed by a rise in the basal body temperature. may be detected. Rarely abdominal pain may be experienced at the time of ovulation. The relations between hypophysis and ovary may be affected by other hormones and by the nervous system as well. Changes in climate, living conditions, infections or psychic disturbances may consequently affect the reproductive cycle. When the responses of the ovaries begin to wane at the age of 45 to 50 years, the hormonal balance is upset and changes occur in the economy of the body as a whole. These give rise to the characteristic symptoms of the menopause (*q.v.*) or change of life.

(D. W. FT.)

EMBRYOLOGY

The development of the reproductive organs is closely interwoven with that of the urinary system (*q.v.*). It will here be convenient to take up the development at the stage in which the genital ridge is seen on each side of the attachment of the mesentery; external to this, and forming another slight ridge of its own, is the Wolffian duct. while, a little later, the Mullerian duct is formed and lies ventral to the Wolffian. Cntil the fifth or sixth week the development of the genital ridge is very much the same in the two sexes, and consists of cords of cells growing from the epithelium-covered surface into the mesenchyme, ahich forms the interior of the ridge. In these cords are some large germ cells which are distinguishable at a very early stage of development. It must, of course, be understood that the germinal epithelium covering the ridge. and the mesenchyme inside it, are both derived from the mesoderm or middle layer of the embryo. About the fifth week of human embryonic life the tunica albuginea appears in the male. from which septa grow to divide the testis into lobules, while the epithelial cords form the seminiferous tubes, though these do not gain a lumen until just before puberty. From the adjacent mesonephros. or perhaps coelomic epithelium, cords of cells grow into the attached part of the genital ridge, or testis, as it now is, and from these the rete testis is developed.

In the female the same growth of epithelial cords into the mesenchyme of the genital ridge takes place, but each one is distinguished by a bulging toward its middle. in which alone the large germ cells are found. Eventually this bulging part is broken up into a series of small portions, each of which contains one germ cell or ovum and gives rise to a Graafian follicle. Mesonephric cords appear as in the male; they do not enter the ovary, however, but form a transitory net ork (rete ovarii) in the mesovarium.

As each genital gland enlarges it remains attached to the rest of the intermediate cell mass by a constricted fold of the coelomic membrane, known as the mesorchium in the male and the mesovarium in the female. Lying dorsal to the genital ridge in the intermediate cell mass is the mesonephros, consisting of numerous tubules which open into the Wolffian duct. This at first is an important excretory organ, but during development becomes used for other purposes. In the male, as has been shown, it may form the rete testis, and certainly forms the vasa efferentia and globus major of the epididymis: in addition to these, some of its separate tubes probably account for the ductus aberrans and the organ of Giraldks (see fig. 4). In the female the tubules of the epoophoron represent the main part, while the paroophoron. like the organ of Giraldks in the male, is probably formed from some separate tubes (see fig. 4).

The Wolffian duct, which in the early embryo carries the excretion of the mesonephros to the cloaca, forms eventually the body and tail of the epididymis, the ductus deferens and ejaculatory

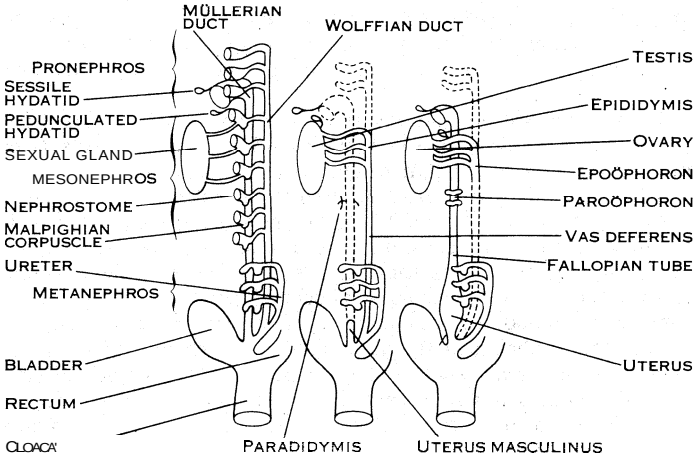


FIG. 4.— DIAGRAM OF THE FORMATION OF THE GENITO-URINARY APPARATUS (SUPPRESSED PARTS ARE DOTTED)

duct in the male, the seminal vesicle being developed as a pouch in its course. In the female this duct is largely done away with, but remains as the collecting tube of the epoophoron, and in some mammals as the duct of Gartner, which runs down the side of the vagina to open into the vestibule.

The Mullerian duct, as it approaches the cloaca, joins its fellow of the opposite side, so that there is only one opening into the ventral cloaca1 wall. In the male only the lower part of it remains as the uterus masculinus, but in the female the Fallopian tubes, uterus and probably the vagina are all formed from it (see fig 4). In both sexes a small hydatid or vesicle is liable to be formed at the beginning of both the Wolffian and Miillerian duct; in the male these are close together in front of the globus major of the epididymis and are known as the sessile and pedunculated hydatids of Morgagni. In the female there is a hydatid among the fimbriae of the Fallopian tube which of course is Miillerian and corresponds to the sessile hydatid in the male, while another is often found at the beginning of the collecting tube of the epoophoron and is probably formed by a blocked mesonephric tubule. This is the pedunculated hydatid of the male. The development of the vagina is peculiar. Instead of the two Miillerian ducts joining to form the lumen of its lower third, as they do in the case of the uterus and its upper two-thirds. they become obliterated, and their place is taken by two solid cords of cells, which later became canalized and the septum between them is obliterated.

The common chamber, or cloaca, into which the alimentary, urinary and reproductive tubes open in the fetus has the urinary bladder (the remains of the allantois) opening from its ventral wall (see PLACENTA ; URINARY SYSTEM).

During development the alimentary or anal part of the cloaca is separated from the urogenital. According to F. Wood Jones, the anal part is completely shut off from the urogenital and ends in a blind pouch which grows toward the surface and meets a new

ectodermal depression, the permanent anus, not being part of the original cloacal aperture but a new perforation. This description is in harmony with the malformations occurring in this region.

The external generative organs have at first the same appearance in the two sexes and consist of a swelling, the genital eminence, in the ventral wall of the cloaca. This in the male becomes the penis and in the female the clitoris. Throughout the generative system the male organs depart most from the undifferentiated type, and in the case of the genital eminence two folds grow together and enclose the urogenital passage, thus making the urethra perforate the penis, while in the female these two folds remain separate as the labia minora. Sometimes in the male the folds fail to unite completely and then there is an opening into the urethra on the undersurface of the penis—a condition known as hypospadias.

In the undifferentiated condition the integument surrounding the genital opening is raised into a horseshoelike swelling with its convexity over the pubic symphysis and its concavity toward the anus; the lateral parts of this remain separate in the female and form the labia majora, but in the male they unite to form the scrotum. The median part forms the mons Veneris or mons Jovis.

It has been shown that the testis is formed in the loin region of the embryo close to the kidney, and it is only in the later months of fetal life that it changes this position for that of the scrotum. In the lower part of the genital ridge a fibromuscular cord is formed which stretches from the lower part of the testis to the bottom of the scrotum; it is known as the gubernaculum testis, and by its means the testis is directed into the scrotum. Before the testis descends, a pouch of peritoneum called the processus vaginalis passes down in front of the gubernaculum through the opening in the abdominal wall, which afterward becomes the inguinal canal, into the scrotum, and behind this the testis descends, carrying with it the mesonephros and mesonephric duct. These, as has already been pointed out, form the epididymis and ductus deferens. At the sixth month the testis lies opposite the abdominal ring, and at the eighth reaches the bottom of the scrotum and invaginates the processus vaginalis from behind. Soon after birth the communication between that part of the processus vaginalis which now surrounds the testis and the general cavity of the peritoneum disappears, and the part which remains forms the tunica vaginalis. Sometimes the testis fails to pass beyond the inguinal canal, and the term "cryptorchism" is used for such cases.

In the female the ovary undergoes a descent like that of the testis, but it is less marked since the gubernaculum becomes attached to the Müllerian duct where that duct joins its fellow to form the uterus. Thus, the ovary does not descend lower than the level of the top of the uterus, and the part of the gubernaculum running between it and the uterus remains as the ligament of the ovary, while the part running from the uterus to the labium is the round ligament.

In rare cases the ovary may be drawn into the labium just as the testis is drawn into the scrotum.

For diseases and disorders of the reproductive system, see GYNAECOLOGY; and UROLOGY. Information related to the reproductive system may also be found in ENDOCRINOLOGY; CHILDBIRTH; HORMONES; MENSTRUATION; MENOPAUSE; OBSTETRICS; PLACENTA; etc. (F. G. P.)

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REPTILES (Reptilia) is the name given to a class of vertebrates which hold a position in the animal kingdom intermediate between the amphibians and the birds, and the mammals. The group arose, perhaps in Lower Carboniferous times, from the Labyrinthodont Amphibia, and was already varied at the end of the Carboniferous. During Permian times the class branched out into many orders, one of which included the ancestors of the Mammalia, whilst from another the birds, crocodiles, Sphenodon, and perhaps the lizards and snakes arose. The tortoises are the descendants of another early group. In a recent survey by Nopcsa, it is pointed out that, of the 125 families into which he divides the reptiles, only 18 are represented by living forms, whilst of the 19 orders only four are extant. The modern forms fall into the orders Crocodilia, including the crocodiles and alligators; the Squamata, the lizards and snakes, the Rhynchocephalia, represented only by the Tuatera lizard of New Zealand, and the Chelonia, the tortoises and turtles. (For information on the natural history of these forms see CROCODILIAN; LIZARD; SNAKES; TURTLE.)

These living forms are characterized as follows:

(1.) The animal breathes air by lungs.

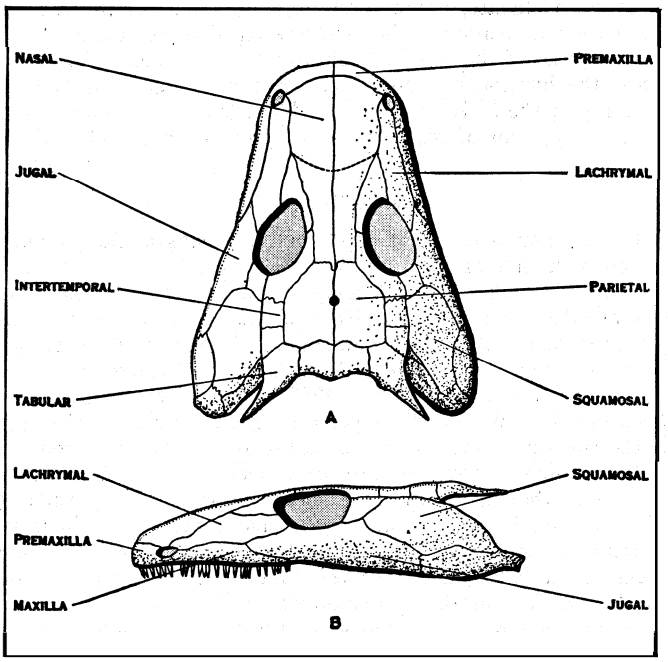
(2.) The body temperature is variable.

(3.) The skin is covered with horny scales formed by the epidermis.

(4.) Fertilization is internal, and an egg, consisting of a yolk surrounded by albumen and contained in a shell, is usually laid and hatched by the heat of the sun or of decaying vegetation. In some cases reptiles are viviparous.

(5.) In the brain the cerebral hemispheres are comparatively small. Their roof tends to become thinned and may be almost membranous. There is a well-developed hypopallium which becomes assimilated to the corpus striatum, losing the original stratification of the neurones. The mid-brain is relatively large and its roof forms a pair of large optic lobes.

(6.) The olfactory organ has its surface increased by a simple turbinal or concha, and there is a well-developed Jacobson's organ.



FROM PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY

FIG. 1.—SKULL OF THE **EMBOLOMEROUS** AMPHIBIAN PALAEOGYRINUS; (A) FROM ABOVE, (B) FROM THE LEFT SIDE

The posterior nares may be immediately below the external nostrils or may be carried back to the hinder end of the head.

The eyes are usually present, but may be hidden in burrowing forms. The retina normally contains both rods and cones, but may consist exclusively of either type. There is a pecten in the form of a folded sheet projecting into the vitreous humour.

The internal ear shows a more marked separation of *sacculus* and *utriculus* than obtains in Amphibia, a lagena always occurs and is associated with a perilymphatic duct, in some cases so as to form a rudimentary cochlea. The tympanic cavity lies high up and the tympanic membrane is either superficial or lies at the end of a short external auditory meatus. The membrane is con-

nected to that closing the *fenestra ovalis* by a straight rod, whose inner end, the columella, is bony, whilst the outer half, the extra-columella, is often four-rayed, a short dorsal process being connected to the end of the paroccipital process and a ventral process often continued into the hyoid.

(7.) There is a well-developed tongue capable of free movement. The mid-gut has the usual structure; there is a cloaca and an urinary bladder of allantoic origin. The lungs are more elaborate than those of Amphibia and less than those of mammals.

(8.) The heart is three- or four-chambered, there being two auricles and a ventricle more or less completely divided into two. There is no bulbus; three arteries arise from the ventricle; of these one is the right systemic, another the pulmonary, whilst the third is the left systemic and both carotids. The posterior cardinals have both almost disappeared as such, the post-caval vein returning most of the blood from the posterior part of the animal to the heart. There is a coronary circulation.

(9.) The functional kidney in the adult is a metanephros discharging by a ureter into the cloaca. The ovary is often single and the egg always large. The oviduct is provided with glands which secrete albumen and a shell. A copulatory organ is usually present in the male, but is variable in structure.

(10.) The pre-sacral part of the vertebral column is usually less clearly divided into regions than in mammals and birds. There are two sacral vertebrae and a longer or shorter series of caudals. The atlas consists of a pair of neural arches, a single inter centrum and a centrum which forms an odontoid, though it may not be fused to the axis. There is sometimes a pro-atlas. The vertebra of the rest of the column always consists of a neural arch and a centrum with inter-centra forming chevron bones in the tail. Small inter-centra may be present throughout the column. Ribs are usually present on all vertebrae except the posterior caudals; they may be single or double headed. A true sternum is usually present, connected to some of the dorsal ribs by sternal ribs.

The neural cranium is generally incompletely ossified, a good deal of the lateral walls anteriorly being membranous. It is often movably connected to the dermal bones of the skull roof and palate. There is a single occipital condyle, mainly basi-occipital but with contributions from the ex-occipital. A supra-occipital is present and articulates with the parietals. The inner ear lies within the opisthotic, usually fused with the ex-occipital, the pro-otic and the supra-occipital. An ossification in front of the pro-otic, in the side wall of the cranium, is absent in only two orders. There is an ossified basi-sphenoid, but the unossified pre-sphenoid is usually underlain by a para-sphenoid.

The dermal bones of the skull form a roof, which may be very incomplete or, indeed, absent, over the masticatory muscles, whilst the orbit is surrounded by a ring of bones which are continuous with the maxillae and nasals which enclose the anterior end of the head. In the palate the pterygoids are always large bones articulating with the basi-sphenoid and extending back to the quadrate. Pre-vomers and palatines are always present and ectopterygoids usually so. In many forms an epipterygoid is ossified. The lower jaw is complex, it articulates with the quadrate by an articular bone of endochondral origin, and at least five membrane bones contribute to its structure.

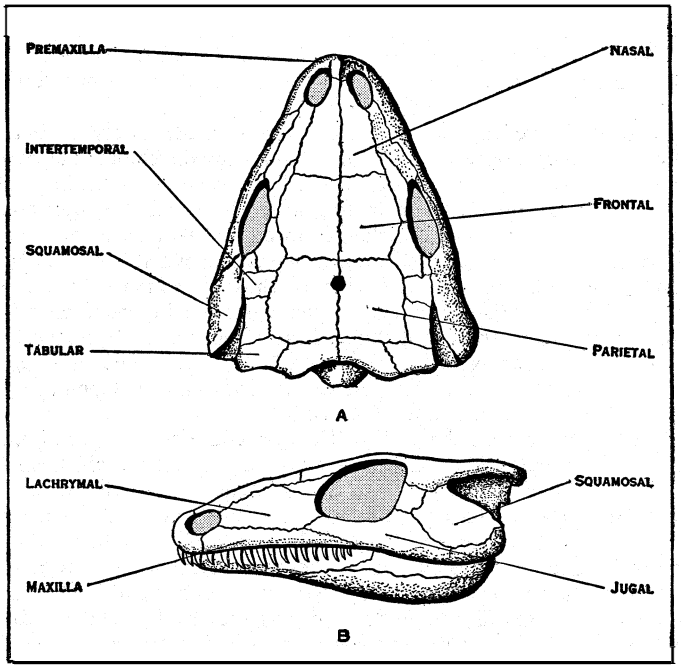
Fore and hind limbs are usually present, but either or both may be absent. The shoulder girdle consists of a pair of scapulae and "coracoids," both contributing to the glenoid cavity. There are generally clavicles and an inter-clavicle. The hand and foot are primitively pentadactyl, the fourth digit being the longest.

(11.) Segmentation of the egg is incomplete (meroblastic). No primitive streak is formed and a rudimentary archenteron with both roof and floor may be established. There is an amnion and an allantois, membranes developed for the protection, nutrition and respiration of the embryo.

Amphibian Ancestry.—The Amphibia, which were the ancestors of the reptiles, spent the greater part of their life in water, probably crawling on to land only to pass from one pool to another. They laid small eggs, which were fertilized after they had passed out from the body of the mother. These eggs developed into an aquatic larva which breathed by means of gills; subsequently, when this larva had reached a relatively large size, the gills were absorbed and the animal became dependent on the air for the main bulk of its oxygen. An aquatic animal may have, and in the case of the Amphibia did have, a soft skin which can only remain healthy if it be kept moist. Living Amphibia secure this condition by pouring out mucus and water from glands in their skin, which is therefore slimy. An animal which adopts this method has great difficulty in roaming far from water, the possibility of dying from desiccation being always present. Thus one of the first changes necessary to make an effectively terrestrial animal from an amphibian is to alter the character of its skin in such a way that it becomes water-tight, and has a dry outer surface. Such a change in a vertebrate is most readily achieved by thickening the epidermis and laying down keratin in its outer layers; continuation of this process leads to the formation of the horny scales of reptiles, which are made by localized patches of skin exceptionally active in the production of keratin. As such a skin does not require to be kept moist, glands are very poorly developed in the skin of reptiles.

During the transition from water to air the sense organs necessarily undergo great modifications. The olfactory organ, which had become adapted to the relatively large amounts of odorous substances which could come to it in solution in water, had to be made capable of recognizing the much smaller amounts brought to it as vapour through the air. In the intervening stage of the Amphibia the nose becomes double, one part of it, Jacobson's organ, functioning in water, the rest in air. When the reptiles became completely terrestrial, Jacobson's organ took on the new function of smelling the material lying in the mouth, and the rest of the organ became the normal organ of smell.

The eye, adapted for focussing objects under water, has to be so changed in its proportions as to see its surroundings through air.



FROM PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY

FIG. 2.—SKULL OF THE COTYLOSAUR SEYMOURIA; (A) FROM ABOVE. (B) LEFT SIDE

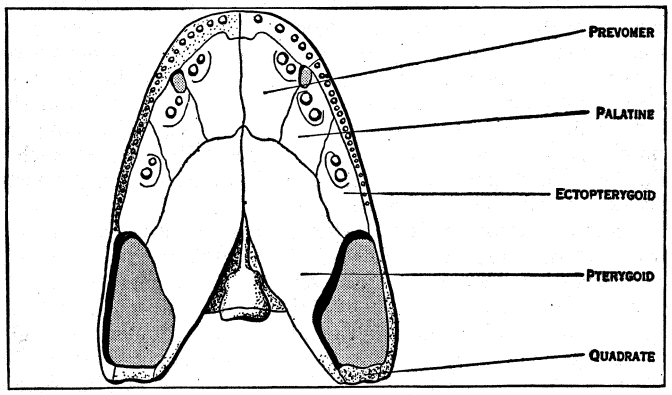
That part of the ear whose function is to determine the position of the animal with respect to gravity and to recognize changes in position. can remain unaltered, but the lagena, which, with its associated structures, the columella, middle ear and tympanic membrane, is concerned with hearing in the ordinary sense, necessarily undergoes changes on account of the very different specific gravity of the mediums, water or air, through which sound waves come to it.

Aquatic Amphibia have, in common with fish, a special sense,

whose organ is the lateral line, which is concerned with the recognition of movements in water; with the transition to land this sense is entirely lost.

Any animal living in water is so nearly floating that the proportion of its weight which has to be supported by the limbs is extremely small. As soon as it comes out of water practically the whole of its weight falls on the legs. Thus the skeleton and musculature necessarily become more powerful.

The most serious changes, however, are those in the mode of reproduction. An amphibian which lays its eggs in the water can fertilize them there, but a terrestrial animal can only lay an egg



FROM PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY

FIG. 3.— PALATE OF THE EMBOLOMEROUS AMPHIBIAN, BAPHETES

if it be included in a shell which will protect it from mechanical injury and, a matter of more importance, from drying up. Such a shell cannot be perforated by a spermatozoan, so that fertilization must take place within the body of the mother before the shell is formed. The uro-genital organs of both sexes have to be so modified as to allow this to take place, and the oviduct of the female must be provided with the glands that are necessary for the formation of the shell.

The amphibian egg may be comparatively small; it only needs to contain a food supply sufficient to maintain the developing embryo to a stage when it hatches as a small larva capable of feeding on the abundant food present in the water in which the egg was laid. The animal, which hatches from an egg laid on land, must make its appearance at a stage in development when it can maintain itself under conditions similar to those in which its parents live. The time taken in reaching such a stage of development is considerable, and the egg included in its shell has no opportunity of obtaining food or water from outside. Thus, when laid, the egg must contain everything necessary for the development of the embryo up to the time of hatching.

The reptile ovum, the yolk of the egg, contains the great bulk of the food materials, whilst the albumen, the white which surrounds it, is mainly a water store. The egg-shell is porous and transmits gases. The character of the development of the large egg is necessarily modified by its bulk, much of the yolk remaining undivided into cells until it is absorbed and converted into part of the animal's own tissues. Special embryonic membranes, the amnion and allantois, are produced during the development for the protection of the embryo and for its nutrition and respiration, the allantois serving also as a reservoir for the nitrogenous waste products produced by its metabolism.

The great majority of these changes, including all those which are of the greatest importance, cannot be determined from fossil material, and we are driven back for the discrimination between fossil reptiles and fossil amphibians to the use of technical points mainly of little functional importance to the animal. The break between the Amphibia and Reptilia was regarded by Huxley and other early workers as the most important in the vertebrate phylum; such contrasted terms as Ichthyopsida and Sauropsida, Anamniota and Amniota emphasize its importance. None the less we now know an animal, *Seymouria*, from the lowest Permian of Texas, which is regarded by one group of students as an amphibian and by another as a reptile. As the osteology of this animal is very completely known, the doubt which exists as to its systematic position illustrates vividly the completeness with which the gap between these two divisions has been bridged.

Seymouria is a small animal about 2 ft. in length, with a comparatively small head, no visible neck, a somewhat stumpy body, and a short tail. The limbs were very muscular, but short. The hands and feet were placed far away from the middle line, and the stride was exceedingly small. Each limb has five digits.

The skull of *Seymouria* consists of two parts, which could have easily been separated from one another. These are the brain case, made of bones which have replaced the cartilage which existed in the-embryonic skull, and a superficial coating covering the whole outer surface of the head (except for the nostrils, orbits and pineal foramen), and the roof of the mouth, made of bones which have developed in the lower layers of the skin. The pattern formed by these dermal bones is identical with that which is found in the more primitive Labyrinthodont Amphibia, and is important, because from it the structure of the corresponding parts of the skulls of all other reptiles can be derived, by a process of reduction. The palate of *Seymouria* is, in essence, identical with that of an Embolomerous Labyrinthodont. The brain case, however, differs somewhat from those of the Amphibia. For example, the single occipital condyle is convex instead of being concave, and there is a large fenestra ovalis leading into the ear which does not exist in the Embolomeri. There are also variations in other details of the structure of the otic region. In the lower jaw, *Seymouria* is identical with an amphibian, but the vertebral column is very different.

In the amphibian the first vertebra articulates with the condyle by a disc-shaped inter-centrum followed by a disc-shaped centrum, of the same character as those which succeed it. In *Seymouria* the rounded condyle articulates below with a concavity on an inter-centrum which represents only the lower half of that of the amphibian, and with facets carried on the lower ends of the two halves of the neural arch. The centrum of the atlas is a curious trefoil-shaped bone which fits in between the three elements which articulate with the condyle; this arrangement is completely reptilian. The structure of a vertebra from the middle of the back of *Seymouria* is quite peculiar. There is a small cylindrical centrum separated from the next by an intercentrum having the shape of half a disc. The neural arch is enormously heavy, it articulates with the centrum alone and the pre- and post-zygopotheses are produced laterally as masses of bone which overhang the much smaller centrum. The articulating faces are quite flat and placed horizontally, so that the back, although free to move from side to side, must have been extremely stiff dorso-ventrally.

Vertebrae of this type are known in no amphibian, but in a less exaggerated form occur in many of the more primitive reptiles. It is reasonable to believe that they were evolved as a clumsy method of giving that stiffness to the back which is necessary to an animal which, living in air, has to support the whole of its weight. The ribs of *Seymouria* do not differ essentially from those of some Labyrinthodonts. The limb girdles and limbs are of the amphibian pattern except in one or two details, e g, the occurrence of an ent-epi-condylar foramen piercing the humerus, and the number of the phalanges, which is two, three, four, five, three, the characteristic reptilian number.

Thus it is possible to be in doubt whether an extinct animal whose skeleton is completely known is an amphibian or a reptile, the break between the two being completely bridged so far as the skeleton is concerned. From a skeleton similar to that of *Seymouria* it is possible to derive those of all later reptiles, and in this way, by sorting out separate evolutionary lines to establish a classification which may express not only differences of structure existing between the animals contained in it, but something of their phylogenetic relationships.

Evolutionary Development.— The reptiles, as a whole, with a few doubtful exceptions, divide into two great branches, the mammal-like reptiles and the rest. The differences between the members of these two groups are to be found mainly in the structure of the brain case and the back of the skull. In all the

mammal-like reptiles the inner ear lies in the lower part of the side wall of the brain case, the brain extending far above it, while in all other reptiles the ear extends throughout the whole of the side wall of the cranium and is not exceeded in height by the brain. In *Seymouria* the tympanic membrane is stretched across a notch on the outer surface at the back of the skull; in the mammal-like reptiles this notch is destroyed, so that the occipital surface of the skull is flat and the tympanic membrane, if it exists at all, lies ventrally in the neighbourhood of the hinder end of the lower jaw, to one of whose elements it is attached. In the remaining reptiles the tympanic or otic notch is preserved, bounded above by a special process of the squamosal or tabular bone, and by the free distal extremity of the paroccipital. The tympanic membrane, when present, lies high up on the side of the head, far removed from the lower jaw. In the mammal-like reptiles the stapes is attached directly to the quadrate bone, while in the others it is continued by an extra columella which is inserted into the tympanic membrane.

It is customary to recognize a primitive group of reptiles, the Cotylosauria, which includes the most primitive members of each division of the reptiles. The animals included in it agree with *Seymouria* in that the dermal bones of the outer surface of the skull form a continuous sheet, perforated only by the nostrils, orbits and pineal foramen. This group is restricted to Permian and Triassic time, and its members thus possess very primitive limbs and limb-girdles. They are usually devoid of a neck, the shoulder-girdle lying immediately behind the head. The back is short and the vertebrae of which it is composed have very massive neural arches which articulate with one another by horizontal surfaces. The centra are perforated and transmit a continuous notochord. There is usually a series of intercentra throughout the column. The shoulder girdle has three bony elements, the scapula, procoracoid and coracoid in each side of the cartilage girdle; all of them contribute to the glenoid cavity. Cleithra are often present, and clavicles and large inter-clavicles are universal. The fore leg is short and massive, the humerus projecting out at right angles to the animal's body and lying in a plane parallel to the ground. It can only be moved backwards and forwards, and is incapable of rotation. The elbow joint is flexible, so that the fore arm has much freedom of movement. The hand has five fingers, the number of the phalanges being 2, 3, 4, 5, 3, in the digits from 1 to 5. The pelvis consists of an ilium, pubis and ischium on each side, these bones meeting one another in continuous sutures, so that the whole structure is "plate-like." The hind limb projects out laterally and the knee is relatively inflexible; it could be stretched out straight, but, in many cases, could not be closed even to a right angle. The foot has five toes with a digital formula 2, 3, 4, 5, 4.

This super-order can be divided into three sub-groups, as follows:—(A.) *Seymouria morpha,* primitive forms represented by three genera, *Solenodonsaurus,* from the Upper Carboniferous of Czechoslovakia; *Seymouria,* from the basal Permian of Texas, and *Kotlassia,* from the Upper Permian of Russia, which may not properly belong to the group.

These animals possess skulls which very greatly resemble those of the Embolomerous Amphibia. (*See* AMPHIBIA.) These skulls have a narrow otic notch differing from that of all other reptiles; the neural cranium is peculiar in that the powerful paroccipital processes which arise from the sides of the brain case extend outwards and upwards to support the tabular bones. The basioccipital, together with the exoccipitals, form a rounded condyle. There are well marked basisphenoidal tubera and the basipterygoid processes of the basisphenoid are short, and in *Seymouria* support the pterygoid, not directly, but through the intervention of the epipterygoid. The parasphenoid is short and narrow. The palate is almost completely roofed with bone, there being small palatal nostrils and sub-temporal fossae in addition to a very conspicuous inter-pterygoid vacuity. The palatine bears a large tusk, the marginal teeth in the upper jaw form a uniform unbroken series and exhibit an indefinite replacement. The lower jaw is built up from nine bones, dentary. splenial, post splenial, angular, sur-angular on the outer surface, the series of three coronoids between the prearticular and dentary, and an articular bone which, unlike that of all contemporary Amphibia, is not a mere part of the sur-angular. With this exception, the jaw is identical with that of a Labyrinthodont.

The vertebral column is massive, there is no distinction of neck, trunk, and lumbar region, all the vertebrae from the atlas back to the sacrum bearing two-headed ribs; there is one sacral vertebra. In the shoulder girdle a coracoid is absent, the lower part of the primary structure being ossified entirely as a pre-coracoid. The glenoid cavity has the characteristic screw-shaped form of the early Tetrapod. The humerus is an extraordinary bone, nearly as wide as it is long, while the fore arm is short. The hand is short and broad, the five fingers ending in small claws.

The pelvis is plate-like, the pubes and ischia being exceptionally large elements; the femur, short, broad and unusually massive, exactly resembles that of contemporary Amphibia. The fibula is widened distally, and the tarsus is remarkable among reptiles in possessing three bones in its proximal row, the intermedium being still separate from the tibiale. The foot is five toed, with the normal formula.

The mammal-like members of the Cotylosauria belong to the group (B.) Captorhinomorpha. This group includes a considerable number of reptiles, all of Lower Permian age, which vary a good deal in their general structure. The most typical are Captorhinus and its descendant, Labidosaurus. These animals are comparatively small, with no neck, rather long bodies and not excessively long tails. They had a straddling gait, the ventral surface touching the ground and the feet being placed well away from the side of the body. The head is pointed, the face in front of the eyes narrow, while the temporal region is wide. The skull is completely roofed and there is no trace of an otic notch, the head having a square cut appearance posteriorly. The brain case seems to be high, and is loosely connected with the rest of the skull by the summit of the supraoccipital and the ends of the paroccipital process. The stapes is very massive and extends from the fenestra ovalis, which is placed below the level of the brain, to the quadrate to which it is attached.

The lower jaw differs from that of *Seymouria* by a lateral compression of its hinder half, and by the reduction of the coronoids to one.

The vertebral column is characterized by the massiveness of the neural arches and the obsolescence of the neural spines. The centra are small and perforated, the intercentra much reduced. All the ribs are single-headed. The remainder of the skeleton does not differ materially from that of *Seymouria,* which has been described above.

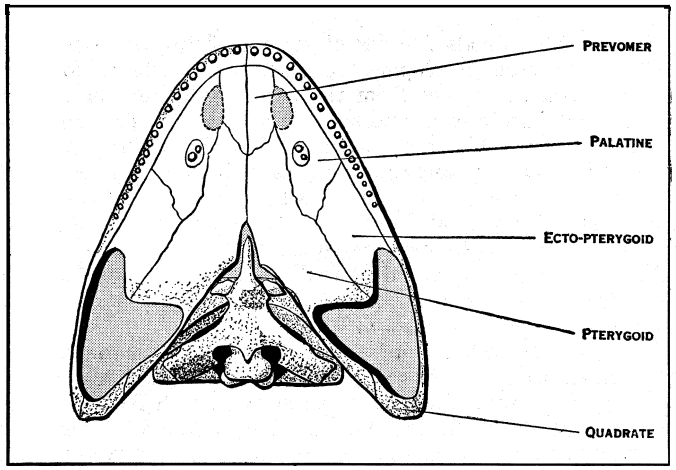
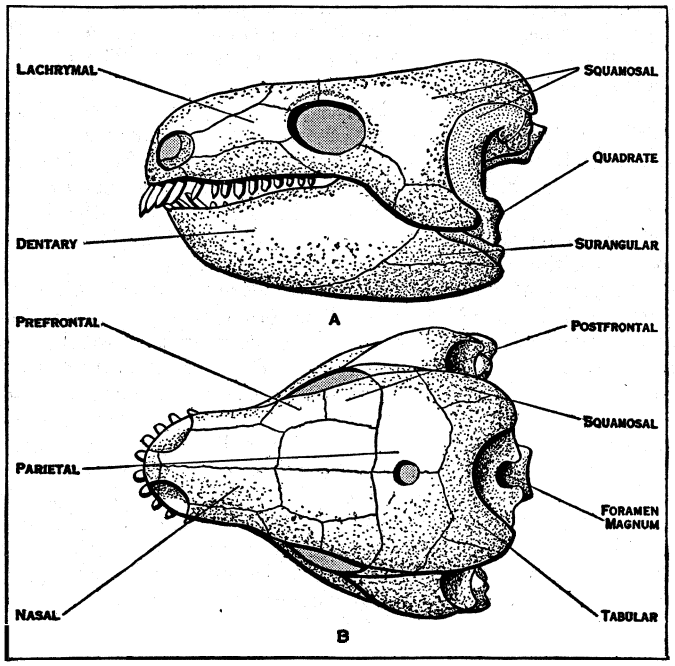


FIG. 4.—SKULL OF THE COTYLOSAUR SEYMOURIA (AFTER WATSON)

The earliest and most primitive members of the group of mammal-like reptiles belong to the order Pelycosauria. The most primitive members of this group, such as Varanosaurus and Mycterosaurus are small, rather slender animals, with elongated pointed heads. They had no visible neck, the shoulder girdle being placed behind the skull. The body was long and the

tail even longer. Their skulls differ from those of the Captorhinomorpha most obviously in that the dermal roof is no longer complete, but is perforated by a large lateral vacuity which is bounded by the jugal, postorbital and squamosal bones. This opening serves to give room for the thickening of the masticatory muscles, which necessarily occurs when they are shortened so as to close the mouth.

Another important difference is that the supraoccipital bone becomes so widened that, with the overlying interparietal and tabular, it forms a plate on the hinder surface of the skull, which reduces the post-temporal fossae to very small proportions.



FROM WILLISTON, "OSTEOLOGY OF REPTILES", (HARVARD UNIVERSITY PRESS)

FIG. 5.---SKULL OF THE CALYLOSAUR, DIADECTES; (A) LEFT SIDE WITH LOWER JAW, (B) FROM ABOVE

The only important changes in the post cranial skeleton are that the neural arches become light and narrow, the neural spines high, and the articulation faces of the zygapophyses are obliquely placed.

From such animals a series of short evolutionary lines arose, which led to the development of some extraordinary forms in which the neural spines from the head to the root of the tail become immensely elongated, and, in some cases, provided with lateral processes like the yard-arm of a ship. These animals, Dimetrodon and Naosaurus, must have been of grotesque appearance, one with a huge head with great piercing teeth, the other with a very small head with crushing dentition, each with a crest, as high as its own length from head to the root of the tail. Animals so specialized naturally had only a short range in time, they only occur in Lower Permian rocks, but the latter ranged from Czechoslovakia to Texas.

More conservative members of the group gave rise to a number of reptilian orders whose remains have been found in the Middle and Upper Permian rocks of Europe and South Africa, and in the Trias of South Africa, Asia and North America. The most important of these orders, the Theriodontia, included the ancestors of the mammals, and its members exhibit a series of stages which seem to bridge the structural gap between a Pelycosaur and a mammal very completely.

Some of these changes are illustrated by a comparison of the skulls of *Scymnognathus* and *Cynognathus*.

The skull of *Scymnognathus*, a Gorgonopsid, differs from that of a primitive Pelycosaur in that in it the whole head is flattened, the temporal vacuity, instead of facing laterally, is directed upward and is greatly increased in size; this change implies that the muscles which close the mouth had changed, an originally rather simple mass splitting up into pterygoidal, temporal and masseter muscles. In order to give room for this powerful development the side of the roof of the skull, formed by the jugal postorbital and squamosal, is bowed out, with the result that the quadrate and quadrato-jugal, being fixed in position by their articulation with the lower jaw, become detached from the side of the head and remain inserted in a depression on the front face of the squamosal, within the temporal vacuity. At the same time they are somewhat reduced in size.

The enlarged masticatory muscles require a more extensive area of attachment on the lower jaw, to provide which the upper and hinder end of the dentary becomes free and grows upward. At the same time, the hinder half of the jaw, composed of the surangular, angular, articular and prearticular bones, become converted into a thin sheet by a lateral compression, and the lower border of the angular is notched, a special lamina of the bone being reflected over the outer surface of its posterior part. To this reflected lamina the lower edge of the tympanic membrane seems to have been attached.

The palate, though it still has the posterior nares placed far forward, is advanced because it is very much vaulted, owing to the downgrowth of the maxillae on each side of it. Posteriorly, the pterygoids, with a parasphenoid held between them, form a narrow girder which connects the basisphenoid with the anterior part of the palate.

The stapes still articulates with the quadrate. The brain case is incompletely ossified in front of the point of exit of the fifth cranial nerve. The branches of that nerve pass on each side of the rod-like epipterygoid, and the cerebral hemispheres are enclosed in a single ossification homologous with the sphenethenoid of a frog.

Cynognathus has advanced beyond *Scymnognathus* in that the face has become deeper and more rounded, and the nostrils larger. The temporal vacuity has enlarged so that it is bounded above by the parietal, and this bone is drawn up into a deep sagittal crest which allows of longer temporal muscles. The quadrate and quadrato-jugal have become greatly reduced in size, but retain their position and function.

The coronoid process of the dentary has increased enormously, and now overlaps the rest of the lower jaw so greatly that it has nearly, but not quite, acquired an independent articulation on the squamosal.

The hinder part of the lower jaw, though still retaining all its constituent bones, has become so small that it seems inadequate to resist the very great stresses to which it might be subjected during feeding. The reflected lamina of the angular is still present in the form of a slender downturned process.

The palate has changed greatly, the original roof of the median area is still present in part, but it is concealed from view by a secondary palate exactly like that of a mammal, which is formed by ingrowths from the maxillae and palatines. By this change the posterior nares are driven so far backward that they open behnd the cheek teeth, and the animal became capable of breathing whilst the mouth was full of food undergoing mastication. The ectopterygoid is greatly reduced, and the posterior part of the pterygoid, the quadrate ramus, has vanished altogether, its place being taken by a process which grows backward from the root of the epipterygoid.

The side walls of the brain case have become bony by a widening of the upper end of the epipterygoid, now recognizable as the homologue of the mammalian alisphenoid. This arrangement involves the inclusion in the cranial cavity of a space, the cavum epiptericum, which in most other reptiles lies outside the cranium. By a continuation of changes in the same direction as those which converted a Gorgonopsid such as *Scymnognathus* into the Cynodent *Cynognathus*, a primitive mammalian structure is easily reached.

The face changes little, a disappearance of the internarial processes throws the bony nostrils into one, the prefrontal and postorbital disappear, and the orbit becomes confluent with the temporal fossa.

Further growth of the dentary leads to the development of a new temporo-mandibular joint between that bone and the squa-

mosal, and the quadrate and hinder part of the jaw, freed from any function in connection with the jaw, become available as auditory ossicles. The stapes persists, little changed, the quadrate, further reduced in size, becomes the incus. The articular is the malleus, and the prearticular its processus folianus. The angular, to which the tympanic membrane has been attached for a very long period, becomes the tympanic, and the surangular disappears.

This account of the origin of the mammalian auditory ossicles is confirmed by the mode in which those bones develop in every mammal; indeed, all marsupials are still born in a stage in which the lower jaw still moves on the old reptilian joint between the incus and malleus, and the musculus tensor tympani still functions as a jaw muscle.

The palate of *Cynognathus* requires very few modifications to become typically mammalian. The already minute ectopterygoid vanishes, the great flanges of the pterygoids, which exist to ensure the accurate closure of the mouth, become unnecessary when the new temporo-mandibular joint is established, and vanish, and the posterior ramus of the alisphenoid becomes the tympanic process.

The skull of *Scymnognathus* is connected to the complex atlas by a single condyle composed of the basi and exoccipitals, that of *Cynognathus* has a mammal-like pair of exoccipital condyles.

More serious modifications have to be made in the ear region and brain case. The opisthotic and pro-otic of *Cynognathus* house only part of the inner ear, the summit of that organ lying in the supraoccipital. In mammals, the whole lies in a single bone, the periotic. The mammalian periotic is a much smaller bone than the pro- and opisthotics of a cynodont, and, unlike them, it is comparatively unimportant as a buttress for the squamosal. None the less, it is not impossible to homologize the different regions of the two sets of structures.

The post-cranial skeleton of Cynodonts shows a similar resemblance to that of mammals, some of the more important features of the evolution being discussed in the section *Locomotion* of this article. Thus we know in considerable detail the evolutionary stages which lie between the structure of an embolomerous amphibian and that of a mammal. Unfortunately, we can trace no such ancestry for the birds. We are certain that they sprang from a group of reptiles very remote from the mammal stock, but we are still faced by a considerable gap.

Classification.—The classification of reptiles is necessarily based on skeletal characters, and is still in a state of flux. The existing divergences of view are not very important; they relate to the phylogenetic position of a few orders, and do not seriously affect the main outline.

Class **Reptilia.**—Tetrapodous vertebrates, which breathe air throughout their life. The body temperature is variable. The heart possesses a sinus venosus. two auricles and a ventricle incompletely or completely divided into two; there is no conus arteriosus. Both svstemic arches persist. The red blood corpuscles are nucleated, oval and biconvex. The kidney is a metanephros, and there is an allantoic bladder, in most forms. There is a cloaca, which in living reptiles is divided into a series of regions. The skin is either naked or covered with scales, never with feathers or hair. It includes very few glands, always placed in special situations, and not generally distributed. The skeleton is ossified. The skull comprises a cranium, of cartilage bones, and an extensive series of bones, which, dermal in origin, sink in and become membrane bones in the later forms. The occipital condyle is single or double. The lower jaw articulates with a quadrate bone and is built up of a number of bones. There is a rod-like columella auris. The vertebrae consist mainly of centra and neural arches, intercentra, when present, being small. Ribs occur on all precaudal vertebrae, those in the thoracic region joining to form a sternum in the mid-ventral line.

The pectoral girdle, when fully developed, includes at least a scapula and precoracoid, clavicles and an interclavicle. The pelvic girdle, except in one or two cases, articulates with two or more sacral ribs. The limbs are primitively pentadactyle and the phalangeal formula 2, 3, 4, 5, 3 or 4.

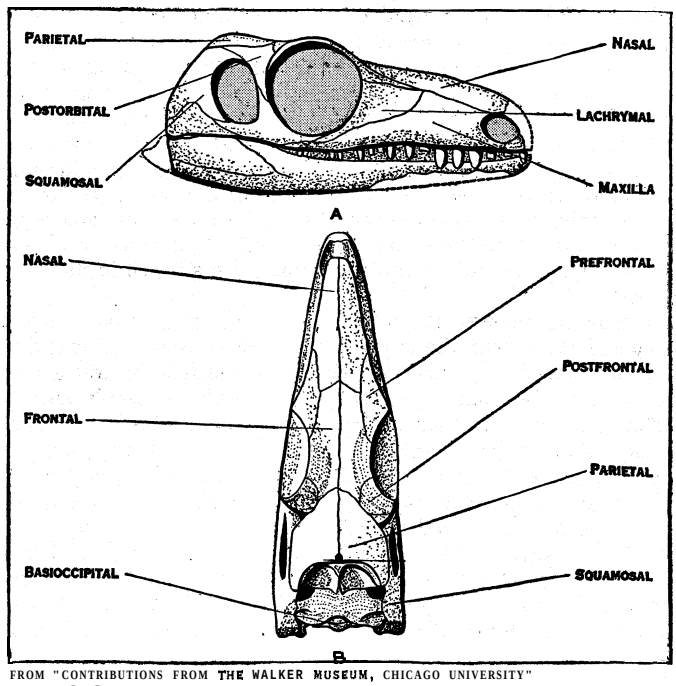
Fertilization is internal, the eggs are large and yolk laden, usually laid, when they are surrounded by a coat of albumen and a shell which is often calcified. Cleavage is meroblastic, a primitive streak is not formed, the embryo is surrounded by an amnion and an allantois is developed.

Super-order. Cotylosauria. Archaic reptiles in which the temporal region of the skull is completely covered by a continuous roof of dermal bones. Stapes either articulating with the quadrate or ending in a tympanic notch. Lower jaw usually with more than one coronoid. Presacral vertebrae (except in Pantylus) with very heavy neural arches with horizontal zygapophysial articular faces. Ribs one or two headed. No ossified sternum. Abdominal ribs sometimes present as fine bony rods. Shoulder girdle with scapula and precoracoid at least, a coracoid usually present in addition. Cleithra usually, clavicles and an interclavicle always present. Humerus with (usually) a screw-shaped head, short and with widely expanded extremities. Pelvis, plate-like, the suture between the pubis and ischium extending from the acetabulum to the middle line.

Order 1. Seymouriamorpha. Cotylosaurs in which the skull greatly resembles in all external features that of the Embolomerous Labyrinthodonts, the dermal bones are sculptured and the otic notch extends far forward below the tabular and supratemporal, so that the quadrate slopes backward. Stapes ending in the otic notch. Fenestra ovalis low down on the cranium, below the level of the base of the brain. Intercentra present and very large, ribs one or two headed. Only one sacral vertebra. Shoulder girdle without coracoid or cleithrum, limbs primitive.

Upper Carboniferous to Upper Permian. Families, *Seymouriidae, Kotlassiidae.*

Order 2. Captorhinomorpha. Cotylosaurs in which the otic notch has been obliterated by a movement backward of the upper end of the quadrate. Dermosupraoccipitals and tabulars, when present, restricted to the occipital surface. Stapes articulating



FROM "CONTRIBUTIONS FROM THE WALKER MUSEUM, CHICAGO UNIVERSITY"

FIG. 6.—SKULL OF PELYIOSAUR MYCTEROSAURUS; (A) RIGHT SIDE WITH LOWER JAW, (B) SKULL FROM ABOVE

distally with the quadrate. Brain case behind the incisura prooticum short and high, fenestra ovalis ventrally situated. Intercentra usually present. One or two sacral vertebrae. Shoulder girdle with both precoracoid and coracoid. Cleithrum present or absent. Limbs' primitive, though sometimes slender.

Lower Permian. Families *Captorhinidae, Pantylidae, Limnoscelidae.*

Order 3. Diadectomorpha. Cotylosaurs in which the otic notch is enlarged by a movement forward of the lower end of the quadrate, dermosupra occipitals and tabulars when present on the

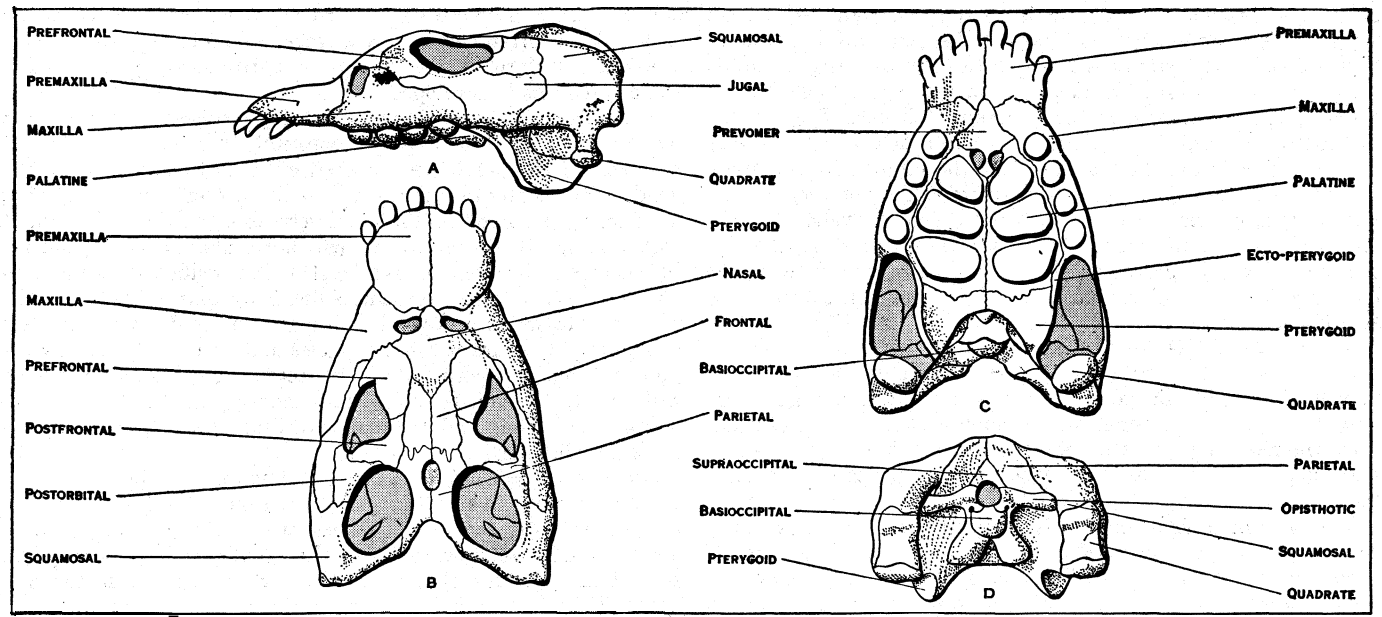


FIG. 7.— SKULL OF PLACODUS: (A) LEFT SIDE. (B) FROM ABOVE, (C) FROM BELOW, (D) OCCIPUT (AFTER BROLI)

upper surface of the skull, the latter overhanging the otic notch. Stapes terminating freely in the otic notch. Brain case long, fenestra ovalis placed at about the middle of its height. Intercentra usually present. Two to four sacral vertebrae. Shoulder girdle with a scapula alone or with three cartilage bones. Cleithrum usually present. Humerus always with expanded ends but often of advanced structure. Ilium sometimes backwardly directed.

Lower Permian to Middle Trias. Families: *Diadectidae, Pariasauridae, Procolophonidae*

Super-order Theromorpha (or *Anomodontia*). Mammal-like reptiles. Reptiles in which the temporal region of the skull is perforated by a single vacuity, bounded primitively by the postorbital and squamosal, but enlarging so that the parietal and jugal also enter its borders. Cranium short and high behind the incisura prooticum, fenestra ovalis below the level of the base of the brain. Stapes articulating with the quadrate. The lower jaw, and especially its hinder end, laterally compressed, the angular in all except, perhaps, the most primitive forms, with a notch in its lower border.

A pro-atlas present, the neural arch of the atlas usually a pair of bones, which, with the intercentrum, rest on the anterior end of a trefoil-shaped odontoid. Vertebrae with slender neural arches with oblique articular faces, centra notochordal or deeply amphicoelous. Intercentra usually present, at any rate in the cervical region, ribs always two-headed anteriorly, usually single-headed posteriorly. An ossified sternum sometimes present, abdominal ribs present as slender rods in primitive forms. Pectoral girdle with scapula, precoracoid and coracoid in all forms (except one, Varanops), clavicle with expanded lower end, and interclavicle a wide flat sheet. Cleithra usually present, but small. Pelvis very variable, plate-like in primitive forms, with an obturator foramen in later types. Ilium, directed forwards, vertically, or backward. Two to seven sacral vertebrae. Limbs exhibiting all stages of advance from primitive cotylosaur-like organs to a pro-mammalian condition. Digital formula primitively 2, 3, 4, 5, 3 or 4 reduced to 2, 3, 3, 3, 3 in later forms.

Order 1. Pelycosauria. Primitive Theromorpha in which the pterygoids articulate with the basipterygoid processes of the basisphenoid by a movable joint. The quadrate is relatively large and the quadrato-jugal forms part of the lateral surface of the skull. The shoulder girdle has a screw-shaped glenoid cavity shared by the scapula, coracoid and precoracoid, and the limbs are primitive. The pelvis is plate-like.

Upper Carboniferous and Lower Permian. Families: *Poliosauridae, Ophiacodontidae, Sphenacodontidae, Edaphosauridae, Caseidae, Bolosauridae, Palaeohatteriidae.*

Order 2. Deinocephalia. Theromorpha in which the pterygoids are attached to the basisphenoid by an immovable joint. The basioccipital and basisphenoid are produced downward below the occipital condyle as a thick sheet of bone. The quadrate is unreduced and the quadrato-jugal is on the lateral surface. The shoulder girdle in early forms has the glenoid cavity borne only to a very slight extent on the precoracoid, but it is screw-shaped; in later forms this structure disappears and the glenoid cavity is restricted to the scapula and toracoid. The limbs are of modernized type. The pelvis is plate-like, the ilium being attached to four sacral ribs.

Middle Permian. Families: *Tapinocephalidae, Titanosuchidae.*

Order 3. Dromosauria. Small Theromorpha in which the facial region of the skull is very short, the temporal fossa is bounded above by the postorbital and squamosal and the zygomatic arch is reduced to a narrow rod so that the quadrate and quadrato-jugal project below it. Shoulder girdle with the glenoid cavity on the scapula and coracoid, precoracoid large. No cleithra Pelvis plate-like. Limbs very long and slender, digital formula 2, 3, 3, 3, 3.

Upper Permian. One family only.

Order 4. Dicynodontia (or *Anomodontia).* Theromorpha in which the preorbital part of the skull is very short, whilst the temporal vacuity is greatly enlarged. The latter is bounded above by the postorbital and squamosal. The quadrate and quadrato-jugal are reduced, and rest in a recess in the front face of the lower end of the T-shaped squamosal, which is widely expanded laterally so as to form a sheet in the plane of the occipital surface. The pterygoids are rigidly fixed to the basisphenoid, and are not produced into transverse flanges. The premaxillae are fused and toothless, the maxillae may have a large canine or a series of small cheek teeth, or both, or be toothless. A horny beak like that of a tortoise was always present. The articular of the lower jaw always has the unique feature of a convex articular surface. Intercentra are absent except in the atlas and axis. The tail is short. The glenoid cavity is entirely, or almost entirely, restricted to the scapula and to the coracoid. There is an acromium on the scapula which also shows the beginnings of a mammal-like scapular spine.

There is an obturator foramen in the pelvis. The limbs are short and powerful, the track wide, and the digital formula 2, 3, 3, 3, 3.

Upper Permian to Middle Trias. Division into families not yet carried out.

Order 5. Theriodontia. Theromorpha in which there is a differentiation of the dentition into incisors, canine and cheek teeth. The face is usually long, the temporal fossa, short in primitive forms,

elongated in the more advanced types, the parietal entering into its border.

Quadrate and quadrato-jugal, fused, much reduced and carried in a recess on the front face of the squamosal.

Pterygoids forming great transverse flanges, behind which they suddenly contract to form a narrow girder extending back to the basisphenoid. Palate at first with the large posterior nares placed anteriorly, becoming vaulted, the air passage being finally cut off from that for the food by a secondary palate. The dentary, always extending above the surangular, in a free coronoid process. Limbs and their girdles variable.

Sub-order 1. Gorgonopsia. Primitive Theriodonts, with the postorbital and squamosal meeting above the temporal fossa. Single occipital condyle: No sub-orbital vacuities. No secondary palate. Scapula without acromion, plate-like pelvis, digital formula (of hand) 2, 3, 4, 5, 3.

Upper Permian.

Sub-order 2. Cynodontia. Advanced Theriodonts, with the parietai entering the temporal fossa. No sub-orbital vacuities. A secondary palate. Pair of exoccipital condyles. Scapula with acromion. Pelvis with an obturator foramen. Limbs modernized, digital formula 2, 3, 3, 3, 3.

Top of the Permian and Lower Trias.

Sub-order 3. Therocephalia. Primitive Theriodonts with large temporal vacuities into whose border the parietal always enters. Large sub-orbital vacuities. No secondary palate or vaulting of the mid line of the anterior part of the palate. Single occipital condyle.

Upper Permian.

Sub-order 4. Bauriamorpha. Advanced Theriodonts, with the parietal forming part of the temporal fossa. Large sub-orbital vacuities, a secondary palate. Single occipital condyle.

Lower to Upper Trias.

Order 6. Thalattosauria. A group of marine reptiles, still incompletely known, but perhaps allied to the Pelycosauria. If so interpreted they may be defined by the following characters:—Skull with a very elongated face formed by the maxillae and premaxillae, nostrils dorsal and immediately in front of the large orbit, nasais small. The large temporal fossa is entirely lateral and is bounded above by the postorbital and squamosal. Quadrate large. A supratemporal present. Parietals short and wide. Vertebrae with biconcave centra which are short cylinders, ribs single-headed. Scapula and coracoid incompletely ossified. Humerus with expanded ends and a twisted shaft. Radius and ulna short flattened bones.

Upper Trias.

Super-order Archosauria (Diaptosauria). Reptiles in which the temporal region of the skull is perforated by two vacuities, the upper of these, the supratemporal fossa is bounded by the parietal, supratemporal, squamosal and postorbital the lower, the infratemporal fossa lies between the postorbital squamosal, quadrato-jugal and jugal bones.

The brain, at any rate in the later forms, is completely enclosed by bone, a pair of latero-sphenoids surrounding the cerebral hemispheres and stretching back to have a suture with the pro-otic. The epipterygoid forms no part of the wall of the cranial cavity. The fenestra ovalis lies half way up the wall of the brain case. There is always a distinct neck, often of eight vertebrae.

The pectoral girdle contains a scapula and precoracoid on each side, the true coracoid never appearing. Cleithra are never present. The sternum usually ossifies from a pair of centres. The limbs are never of the primitive Cotylosaurin character, and are often very highly modified. The digital formula is 2, 3, 4, 5, 4 or 3.

Order 1. Thecodontia. Primitive Archosauria in which a supratemporal, tabular and interparietal may be present in the skull. A preorbital vacuity may be present or absent. The ribs may have one or two heads and a sternum if ossified is paired.

Clavicles and an interclavicle are always present, the pelvis is plate-like, and there are only two sacral vertebrae.

Upper Permian to Upper Trias. Families: *Eosuchidae, Phytosauridae, Pseudosuchidae, Erythrosuchidae, Erpetosuchidae* and others not yet defined.

This order is, in a sense, artificial, it includes the ancestors, for the greater part unknown, of the remainder of the orders of Archosauria, and in addition contains a number of animals which belong to short-lived unsuccessful side branches.

Order 2. Crocodilia. Archosaurs usually of medium or large size, and adapted more or less completely to an aquatic habit. The skull is characterized most clearly by the fact that the quadrate is very large, and lies at a very low angle with the horizontal. The wedge-shaped otic cavity so formed is closed behind by a downgrowth of the squamosal, which, with the overlapping "exoccipital" reaches the quadrate. The tympanic membrane lies some distance below the outer surface, and the external auditory meatus can be closed by a muscular flap. The elongated face is chiefly formed by the maxillae, the external nostrils, usually confluent in the bony skull lying quite anteriorly. There is always a secondary palate, the choanae lying posteriorly between the palatics or pterygoids. The vertebrae are amphiplatean or procoelous, the ribs double-headed throughout the presacral part of the column, the dorsal ribs articulating entirely with the neural arch. The coracoid is elongated, clavicles are absent; and the sternum is unossified. The ilium is a small bone supported by two sacral ribs, and the pubis is excluded from the acetabulum.

The hand is five-fingered, the foot has the fifth toe reduced to a stump of its metatarsal.

Lower Jurassic (Upper Trias) to Recent. Families: *Teleosauridae, Metriorhynchidae, Dyrosauridae, Goniopholidae, Libycosuchidae, Pholidosauridae, Stomatosuchidae, Gavialidae, Crocodilidae.*

It is not improbable that the Crocodilia sprang from the family *Erpetosuchidae* of the order Thecodontia.

Order 3. Saurischia (Deinosauria parts) Archosauria, with a well-developed preorbital vacuity. The neck is sharply marked off from the trunk. The presacral ribs are two-headed, and the dorsal ribs articulate only with the neural arch. Clavicle and interclavicle are lacking, the coracoid is short. There are three or more sacral vertebrae. The pubis and ischia form diverging rods, primitively the pelvis is plate-like, but the bones separate from one another in later forms. The acetabulum is perforate. The fore limb is shorter than the hind, and the femur moves in a plane parallel to the animal's length. The body is thus held well above the ground, and the animal is often bipedal.

Sub-order Theropoda. Carnivorous Saurischia, in which the dentition consists of a single series of the codont, laterally compressed teeth in the premaxillae and maxillae. The cervical vertebrae may be opisthocoelus. The fore limb is often very much smaller than the hind, and the animals are usually bipedal. The hand tends to be reduced to the first three fingers, which are provided with powerful claws, and the foot becomes functionally tridactyl and symmetrical about the third toe.

Middle Trias to Upper Cretaceous.

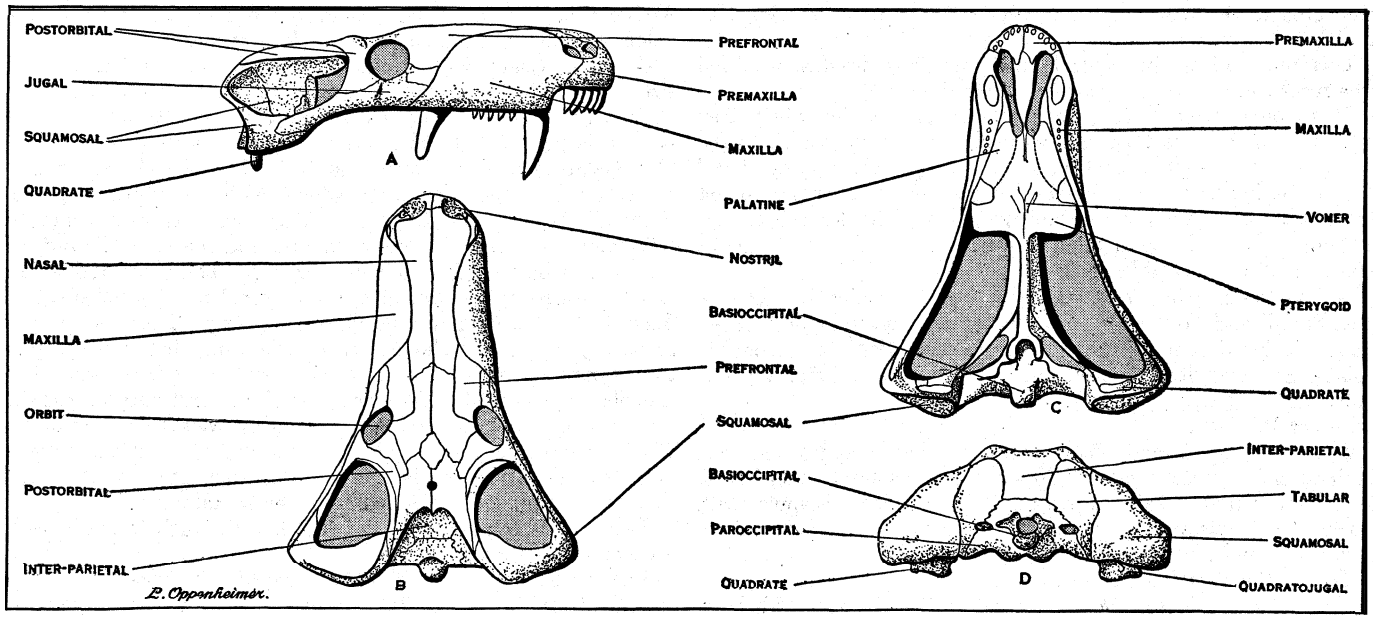
Families: *Hallopidae, Podokosauridae, Coeluridae, Compsognathidae, Ornithomimidae, Plateosauridae, Zanclodontidae, Anchisauridae, Megalosauridae, Spinosauridae.*

Sub-order Sauropoda. Herbivorous Saurischia, usually of gigantic size. The skull is extremely small, and the dentition feeble. The cervical and many or all the dorsal vertebrae opisthocoelic, Accessory articulating faces are developed in the neural arch of the dorsal vertebrae. The dorsal centra are excavated laterally, so that they may be reduced to mere shells of bones.

The animals are quadripedal, and walk on the ends of the metapodials, both feet are five toed, but some of the digits have a reduced number of phalanges and most lack claws.

Middle Jurassic to Upper Cretaceous. Families: *Cetrosauridae, Allantosauridae, Camarosauridae, Diplodocidae, Titanosuchidae.*

Order 4. Ornithischia (Deinosauria pars). Archosauria of herbivorous diet. The preorbital fossa is usually small or absent, the nostrils very large. The quadrate, unless secondarily fixed, is movable, a spherical head on its upper extremity resting in a cup in the squamosal. Premaxillae usually toothless, and covered with a horny beak, which opposes a similar structure carried by a special predentary bone in the lower jaw. Posterior end of the dentary raised into an upstanding coronoid process. The pubis bifid, a prepubic process stretching forward along the belly, and a posterior part passing downward and backward parallel to the



BY COURTESY OF THE ZOOLOGICAL SOCIETY OF LONDON

FIG. 8.—SKULL OF THE GORGONOPSID REPTILE, SCYMNOGNATHUS
A. Right side, B. from above, C. from below, D. occiput

ischium. Ilium elongated anteroposteriorly. Acetabulam perforate. Fore leg shorter than the hind, the animal being often bipedal. Hand usually pentadactyl, foot often tridactyl.

Rhaetic to Upper Cretaceous.

Super-family Ornithopodidae. Families: *Hypsilophodontidae, Camptosauridae, Ignanodontidae, Trachodontidae. Super-family Stegosauridae.* Families: *Scelidosauridae, Stegosauridae, Acanthopholidae, Polocanthidae. Super-family Ceratopsidae,* with one family.

Order 5, *Pterosauria.* Archosauria fully adapted for flight. The vertebrae and many long bones are hollow and, where occupied by air sacs, arising no doubt, like those of birds, by extension of the bronchi. Skull elongated, triangular in plan, and peculiar in that the quadrato-jugal excludes the jugal from the border of the infra temporal fossa. Teeth may extend throughout the jaws, be restricted to their anterior ends, or be absent altogether.

Cervical vertebrae large, procoelous, and very freely movable, head carried nearly at right angles to the neck. Dorsal vertebrae small, sometimes largely fused, sacrum of four to 10 vertebrae, tail either very short or greatly elongated and quite stiff.

Scapula and coracoids elongated slender rods, the latter articulating with a large shield-shaped sternum. Clavicular arch absent. Ilium long, pubis and ischium fused with it and with each other, not meeting in a median symphysis. Prepubic bones present. Fore limb supporting a wing, which is formed by a fold of skin arising from the side of the body and stretched between the upper arm, fore arm and greatly extended fourth finger, and the hind leg. Fingers one to three, present and clawed.

Sub-order Rhamphorhynchoidae. Pterosaurs, with a long tail, wing metacarpal short, fifth toe well developed.

Upper Trias? Lower Lias to Upper Jurassic.

Sub-order Pterodactyloidae. Pterosaurs, with a short tail, wing metacarpal long, and fifth toe reduced or absent.

Upper Jurassic to Upper Cretaceous. Families: *Pterodactylidae, Ornithocheiridae.*

The birds, class Aves, are certainly descendants of Archosaurian reptiles; had the group become extinct in Cretaceous time it would be regarded as an order equivalent to those listed above.

The remaining reptilian orders cannot usefully be grouped into super-orders.

Order Rhynchocephalia. Reptiles in which the temporal region is perforated by two fossae; the supratemporal fossa seems to differ from that of Archosauria in that the post frontal enters into its margin, whilst the infratemporal fossa differs by the exclusion of the quadratojugal.

The preorbital part of the skull is short, and there is no preorbital opening. The fenestra ovalis is placed high in the skull. The dentary bears a single series of acrodont teeth which bite into a groove between the similar teeth on the maxilla and palatine, so that with use they acquire a wedge-shaped section. The vertebrae have amphicoelous centra, and all the ribs are single-headed. An unossified sternum is present. The shoulder girdle includes scapulae, precoracoids, clavicles and an interclavicle.

The pelvis has an ilium attached to two sacral vertebrae and directed downward in front. The pubis and ischia are plate-like in primitive forms, but diverge widely in later times. The limbs are pentadactyl, and the fifth metatarsal has a hook-shaped upper extremity.

One group of Rhynchocephalia, the *Champsosauridae,* became highly adapted to an aquatic life in estuaries.

Middle Trias to Recent. Families: *Rhynchosauridae, Saurano-dontidae, Sphenodontidae, Champsosauridae.*

Order Squamata. (The following account does not include the characters of the reptile Pleurosaurus, which is, perhaps, a member of the order.)

Reptiles in which the dermal roof of the temporal region is so far reduced that only a single temporal arcade, or none at all, remains. The quadrate is thereby freed so that it can move, its rounded head articulating with one or two bones which are connected with the parietal. If two bones be present the inner is firmly applied to the front face of the posterior wing of the parietal, and rests against and may even be firmly fixed by suture to the front face of the end of the paroccipital process. This bone is either the supratemporal or squamosal, or, very improbably, tabular. The outer bone is fixed to the lateral surface of the inner, often overlapping it on to the parietal; it stretches forward as the hinder part of the temporal arcade, and meets the postorbital and sometimes the jugal. This bone is either the squamosal or quadrato-jugal. In the palate the pterygoid no longer reaches the prevomers, and the whole is often very lightly constructed.

The vertebrae are usually procoelous, but may be amphicoelous; there are two sacrals or none. Ribs are single-headed throughout. The shoulder girdle, if present and fully developed, consists of scapulae and precoracoids, often enlarged and notched or fenestrated, clavicles, an interclavicle and a sternum. The pelvis has a forwardly and downwardly directed ilium, the pubes and ischia are divergent rods. The limbs are pentadactyl primitively, but may be reduced or absent.

Sub-order Lacertilia (Lizards). Squamata in which a temporal arcade is usually present, and in which the two rami of the lower

jaw are connected suturally at the symphysis. An epipterygoid is present in the normal position and the anterior part of the brain case is very little ossified. The pterygoid articulates with the basipterygoid process of the basisphenoid.

Upper Jurassic to Recent.

Division Ascalabota.

Section Gekkota.

Families: *Ardeosauridae, Gekkonidae, Uroplatidae.*

Section Iguania. Families: *Iguanidae,* and *Agamidae.*

Section Rhiptoglossa. Family *Chamaeleontidae.*

Division Antarchoglossa. Section Scincomorpha. Families: *Xantusiidae, Scincidae, Anclytropiidae, Flyliniidae, Dibamidae, Gerrhosauridae, Lacertidae, Tejidae, Amphisbaenidae.* Section Anguimorpha. Families: *Euposauridae, Varaniidae, Dolichosauridae. Aigialosauridae, Mosasauridae, Pygopodidae, Glyptosauridae, Helodermatidae, Anguidae, Xenosauridae, Anniellidae, Zonuridae.*

Sub-order Ophidia (Snakes). Squamata in which the temporal arcade has completely vanished, and the quadrate is very freely movable. The pterygoids have lost all connection with the basisphenoid, and the palate has become mobile, connected to the cranium only by ligaments and by its connection with the maxillae and quadrate. Much of the palate and the maxillae may vanish in burrowing forms. The brain case is completely ossified, the epipterygoid being absorbed into it. The two halves of the lower jaw are loosely connected by an extensible ligament.

The vertebral column is extraordinarily long, in one case containing 565 vertebrae. Each vertebra has a procoelous centrum and a heavy neural arch, on which additional articulating faces, the zygosphenes, and zygantra, are developed. The single-headed ribs are long and are very freely movable antero-posteriorly; by such movements they cause the transversely widened ventral scales to catch the ground, and force the animal along.' There is never any trace of a fore limb or its girdle. All three elements of the pelvic girdle may be present in one family, the Glauconidae, but in most this limb is entirely absent. Upper Cretaceous to Recent.

Families: *Typhlopidae, Glauconiidae, Ilysiidae, Uropeltidae, Boidae* (boa constrictors), *Xenopeltidae, Colubridae.* As the last family contains nine-tenths of all known snakes it is subdivided into the series Aglypha (harmless snakes), Opisthoglypha (poisonous but little dangerous to man) and Proteroglypha (typical poisonous snakes).

Sub-order Pleurosauria. A small group of extinct reptiles including only one or two genera, which may be related to the Squamata; if so, these are not, as usually held, derived from the Archosauria. Aquatic reptiles with a very long body and lizard-like limbs partially adapted for swimming. Limb girdles of Lacertilian type. Skull elongated and depressed, quadrate short and immovable. There is a single temporal fossa, bounded below by a broad arcade composed of the squamosal, postorbital and jugal. There is no supratemporal, and the outer surface of the quadrate is covered by a quadrato-jugal. Upper Jurassic. One family.

Order Sauropterygia (Plesiosauria). Reptiles which show a progressive adaptation to a marine life.

Skull with a single temporal vacuity surrounded by the parietal, squamosal, postorbital and post-frontal, and therefore apparently homologous with the upper temporal vacuity of Rhynchocephalia, and not with the single fossa of Theromorpha and Squamata. The single temporal arcade is formed almost entirely by the squamosal and postorbital, the jugal being a small bone wedged in between the postorbital and the hinder end of the maxilla. A quadrato-jugal is absent. The fenestra ovalis lies high in the side wall of the brain case. The palate is primitive, the posterior nares being anterior, and the pterygoids reaching the prevomers.

Except in Placodonts, the neck is long, often exceedingly so (76 vertebrae in Elasmosaurus), the back is long and the tail short; there are usually three sacral vertebrae, but may be more. The cervical ribs, though double-headed in early forms, articulate only with the centra, the single-headed dorsal ribs being supported entirely by the long transverse process of the neural arch.

The pentadactyl limbs are large, and are more or less completely converted into paddles by a flattening and shortening of the radius and ulna and tibia and fibula, and an increase in the number of phalanges. The shoulder girdle consists of scapulae and coracoids, which meet one another in median suture. Clavicles are'probably always present, an interclavicle usually so. The ilium is small, the pubis and ischium, though separated by an obturator foramen, are expanded into flat sheets of bone. A strong plastron of abdominal ribs is always present.

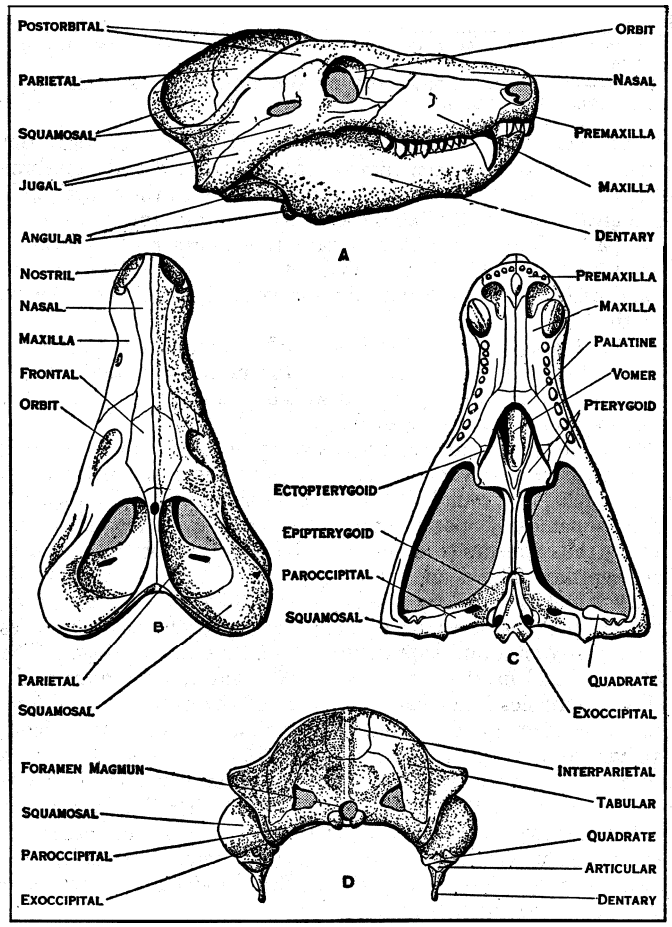
Sub-order 1. Trachelosauria. A single, small reptile, with a long neck consisting of 20 vertebrae whose centra support two-headed ribs. Dorsal ribs single-headed and articulating with the long transverse processes of the dorsal neural arches.

Ilium and femur like those of a land reptile.

Lower Trias.

Sub-order 2. Nothosauria. Sauropterygia in which the limbs are still incompletely converted into paddles, the elbow and knee joints still being flexible. Phalangean formula 2, 3, 4, 5, 3 or 4.

In the skull the opisthotic is enlarged distally, and articulates with the squamosal quadrate and pterygoid, so as to close the middle ear cavity behind. Clavicular arch powerful; coracoids



FROM ANNALS & MAGAZINE OF NATURAL HISTORY (TAYLOR AND FRANCIS)

FIG. 9. — SKULL OF THE CYNODONT. CYNOGNATHUS

A. From the right side, with lower jaw, B. from above, C. from below. D. occiput

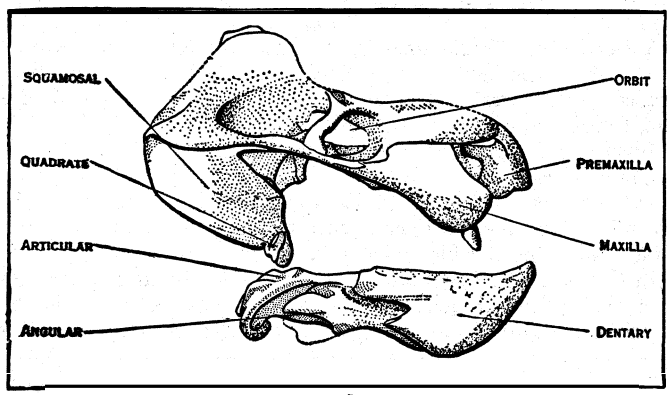
meeting in a short symphysis, which lies behind a line joining the glenoid cavities. Ilium articulating with both pubis and ischium.

Middle Trias, perhaps just appearing in the Lower Trias. Families not discriminated.

Sub-order 3. Plesiosauria. Sauropterygia in which the limbs are completely converted into paddles, with no freedom of movement at any joint; the number of phalanges in the five fingers and toes is increased, reaching 6, 13, 15, 13, 9 or more. The distal end of the opisthotic is slender, resting on the binder surface of

the squamosal. Clavicular arch, when present, reduced to flat sheets of bone, supported by the greatly enlarged acromia of the scapulae. Coracoids with a symphysis which extends forward between the glenoid cavities. Ilium articulating only with the ischium. Rhaetic to Upper Cretaceous. Families not yet discriminated.

Sub-order 4. Placodontia. Sauropterygia in which the skull has become modified to support great crushing teeth in the maxil-



FROM "PROCEEDINGS" BY COURTESY OF THE ZOOLOGICAL SOCIETY OF LONDON AND DR. PEARSON

FIG 10.—SKULL AND LOWER JAW OF THE DICYNODONT REPTILE KANNEMEYERIA. RIGHT SIDE

lae and palatines. Neck with eight vertebrae, the cervical ribs articulating with both centrum and neural arch; dorsal vertebrae with concave nrticulations, ribs attached solely to the neural arch. Limb girdles essentially like those of Nothosauria, fore limb somewhat paddle-like, but with the primitive number of phalanges, Femur like that of a land animal. A well-developed armour of dermal ossifications both dorsally and ventrally. Middle Trias to Rhaetic.

Order Ichthyosauria. Reptiles which are fully adapted for a marine life. The head is elongated, the neck short and the tail very long and powerful, provided with a terminal fin, which is the most important swimming organ.

The limbs are paddles, they are never large, and the hind limbs may become very small. The skull has a single temporal fossa which is surrounded by the parietal, supratemporal (often called squamosal) postfrontal, and sometimes frontal. This opening thus appears to differ in its boundaries from all found in other reptiles. The deep, but usually very short temporal arcade is very largely formed by a bone, often called the supratemporal, which is, perhaps, the true squamosal; it contains also processes of the postfrontal and supratemporal, and a quadrato-jugal. The postorbital and jugal are narrow bones round the enormous orbit.

The nostril lies immediately in front of the orbit, and the long rostrum is built up from the premaxillae and nasals. The biconcave vertebral centra are extremely short, and the neural arches feeble. The ribs are two-headed at least anteriorly, and articulate solely with the centra. There is no sacrum. The hinder part of the tail is downturned very slightly in Triassic forms, nearly at right angles in those from the Upper Jurassic, in order that it may support the lower lobe of a vertical caudal fin whose upper lobe has an unossified skeleton.

The shoulder girdle consists of scapulae and coracoids which meet in a powerful median symphysis between the glenoid cavities, and a rigid clavicular arch. The pelvis has a narrow ilium and pubis and ischia, separated by an obturator foramen, but expanded into great sheets in Triassic forms. In both fore and hind limbs the proximal bone is very short and widened distally, the remainder of the limb, in the later forms, being reduced to an interlocking mass of polygonal bones. The number of fingers is often increased to seven or more, and the phalanges increase to a very great number.

Middle Trias to Upper Cretaceous. Families: *Mixosauridae, Ichthyosauridae.*

Order Chelonia. Reptiles in which the trunk is enclosed in a shell built up from a series of dermal bones; with which the neural arches and ribs become continuous. The limb girdles are unique, in that they lie entirely within the ribs. Skull without any temporal vacuity, but the continuous sheet of bone which, in the primitive forms, overlies the temporal muscles may be emarginated either from the back or from below, or from both, so that in extreme cases the squamosal may be left without connection with any other bones of the skull roof. The powerful vertically-placed quadrate is then only supported by its abutment. in the pro-otic opisthotic and pterygoid.

Postfrontals and lachrimals are always, nasals usually absent, and the external nares are confluent. Except in Triassochelys, the jaws are toothless, and they always support a horny beak. There is often a small secondary palate, not homologous with that of mammals or crocodiles, formed by extensions of the palatines and prevomers. The eight cervical vertebrae are so formed that the neck is flexible, bending into a vertical loop in Cryptodeira, and into a horizontal S in Pleurodeira.

The dorsal vertebrae are ten in number, the first being free, or nearly so, from the shell, whilst the rest are fixed immovably by their attachment to the neural plates of the carapace; the two sacral vertebrae are similarly attached. The posterior dorsal vertebrae are pecuhar, in that each of their neural arches rests on two centra.

The shoulder girdle consists of a scapula, whose acromian process is produced into a long rod lying horizontally, and approaching its fellow in all forms except Triassochelys, and a coracoid which form a curious pedunculate glenoid camty. Cleithra are Present only in Triassochelys. Clavicles and an interclavicle are entirely detached from the shoulder girdle and form part of the plastron.

The ilium usually articulates, not with the sacral ribs, but with the carapace; the pubis and ischium are lacertilian-like. The limbs are much modified, in order to reach the girdles which lie within the shell, and to allow of their withdrawal in the more primitive forms. The fifth metatarsal is hook shaped. Both feet are pentadactyl, the phalangeal formula never exceeding 2, 3, 3, 3, 3, and being sometimes reduced to 2, 2, 2, 2, 0.

The shell, in its fullest development, consists of a dorsal carapace, built up from a median row of nuchal, preneural, eight neural and two suprapygal bones, and lateral rows, each of eight costals, articulating with the neurals, a variable development of supra marginals may occur secondarily; in their absence the costals articulate with a continuous chain of marginals which connect carapace and plastron.

The plastron consists of three plates anteriorly, the epiplastra which are clavicles, and an entoplastron, the interclavicle; a pair of hyoplastra, two pairs of mesoplastra, one pair of hypoplastra and one of xiphiplastra. The neural bones are co-ossified with the neural spines of the dorsal vertebrae, the costals with the ribs of the second to ninth dorsals.

Sub-order Amphichelydia. Chelonia with no power of completely withdrawing the head within the shell, mesoplastra present, pelvic girdle not fused with the plastron. Families not yet discriminated. Middle Tnas to Eocene.

Sub-order Pteurodezra. Chelonia which withdraw the head sideways. Mesoplastra usually present, pelvic girdle fused with the carapace, and usually with the plastron. Families: *Pelomedusidae, Chelyidae, Miolanidae, Plesiochelyidae.* Jurassic to Recent.

Sub-order Cryptodira. Chelonia which withdraw the head vertically. Mesoplastra absent, pelvic girdle never fused with the plastron. Families: *Thalassemydidae, Chelydridae, Testudinidae, Cinosteriidae, Platysternidae, Chelonidae, Protostegidw, Dermochelyidae, Dermatemydidae, Trionychiidae.* Jurassic to Recent.

There is a considerable number of small Palaeozoic reptiles which do not fall into any of the 19 orders defined above. Of these the more important are: Eosaurus from the Coal Measures of the United States, which may be Cotylosaurian; Eunotosaurus from the Upper Permian of South Africa, which may be an ancestor of the Chelonia; Broomia from the Upper Permian of South Africa, which may be an ancestral lizard; and Araeos-

celis, from the Lower Permian of Texas, which has also been regarded as a lizard ancestor.

Limbs and Locomotion. — The Lower Permian reptiles of all groups possess limbs which either belong to a definite characteristic type or are clearly simple derivatives of it.

In all of them a distinct neck is absent, the body is of circular section, although variable in length, and the tail is usually of considerable size.

The fore limbs were attached to the body immediately behind the head, the upper arm lies parallel to the ground, and was capable of being moved backward and forward only. The elbows were thus pointed directly outward. The forearm lay nearly parallel to the principal plane of the animal, and made a very small angle with the ground. The wrist was large in comparison with the forearm, and the hand possessed five somewhat spreading digits. The hind leg was attached to the body at a considerably higher level than the fore leg. The thigh projected freely from the body, almost at right angles, and the lower leg made a wide angle with it, indeed the stiff knee could not, in many cases, be bent to a right angle. The ankle joint was flexible, and the five toes greatly resemble the fingers of the same animal.

As the large head makes the load carried by the fore legs rather larger than that on the hind, the hand is generally larger than the foot.

These animals, like the lizards and salamanders of to-day, threw their backbones into lateral waves as they walked. Their procedure was as follows: — When the animal is standing with its right fore leg advanced to the greatest possible extent, and the right hand on the ground, the head is turned to the left, and the left hand lies near to it but is ready to be lifted. The trunk is thrown over to the right side and the base of the tail to the left. This body flexure implies that the right hind leg is turned somewhat backward and the left hind leg is directed forward. The left hand is then lifted from the ground by movement at the elbow, and carried forward not only by a movement of the upper arm on the shoulder girdle and a straightening of the elbow, but also by a bending of the backbone so that the head becomes directed to the right. This movement of the back involves a corresponding twist of the pelvis, which brings the left hind leg to its backward position, and makes it necessary to lift the right foot from the ground. The right hind leg is then swung forward by motion, mainly at the hip joint, and the foot placed down as far ahead as possible. During these movements the animal, as a whole, has travelled forward and the right hand is ready to be raised. Its movements agree exactly with those of the left, and it is followed in turn by the left hind foot.

Thus the animal progresses with a waddling gait, the head and body being constantly thrown from side to side of the line along which the animal is moving. The feet are moved one at a time, so that the animal is never standing on less than three of them, and are placed wide apart. This mode of walking must have been extremely slow and clumsy; measurements suggest that a reptile about a yard in length, without the tail, must have made a track 1 j in. in width, with a stride of some 6 or 8 inches.

Fossil materials enable us to trace the steps whereby the later reptiles gradually improved their modes of walking, until on one line, they became like the more primitive mammals, walking with their bodies raised high above the ground, the feet brought in towards the middle line and the stride long, whilst along a second course they became bipedal, striding along on their hind legs, with their heads raised high in the air.

The nature of the skeleton and musculature which is associated with the primitive type of locomotion is as follows: — The shoulder girdle consists of the pair of primary elements, each of which is in the most primitive forms, *Seymouria* and *Varanopus*, ossified as two bones, the dorsal scapula and ventral precoracoid. The glenoid cavity has a characteristic shape in that its articular surface is a rather narrow screw-shaped strip of a cylinder whose axis is nearly vertical. The glenoid cavity is shared nearly equally by the two bones. The two halves of the primary shoulder girdle do not touch one another in the mid line ventrally; but are held in position with respect to one another by the powerful clavicular arch. This consists of pairs of cleithras and clavicles and an interclavicle. Each cleithrum is firmly attached to the front edge, and sometimes to the upper end of the scapula. The clavicle is firmly attached to the front face of the lower end of the cleithrum and has no contact with the scapula; its lower end is turned inward so as to underlie the thorax, and is usually widened, its lower end underlying the lateral margin of the interclavicle. The interclavicle is usually a thin flat bone, with a widely expanded anterior end, and a narrower shaft projecting posteriorly under the sternum, which is unossified.

The whole girdle was held in position by muscles, the serrati passing from the ribs to the inner surface of the scapula and by others, sternomastoids and cleidomastoids passing from the head to the clavicular arch. Posteriorly, the coracoid is attached to the ventral surface of the abdomen.

The humerus of these reptiles has its extremities very much widened and placed nearly at right angles to one another. The articular surface of the head is screw-shaped, and fits the glenoid cavity so accurately that the bone cannot be rotated, and is restricted to a to-and-fro motion along a definite track. The widened proximal end allows the muscles which pass from the humerus to the ventral part of the animal, the pectoral and coraco-brachials, to have a mechanically favourable insertion. The widened lower end of the humerus similarly secures a favourable insertion for the flexor muscles which pass from it to the palmar surface of the hand and forearm, and take the whole weight of the anterior part of the body.

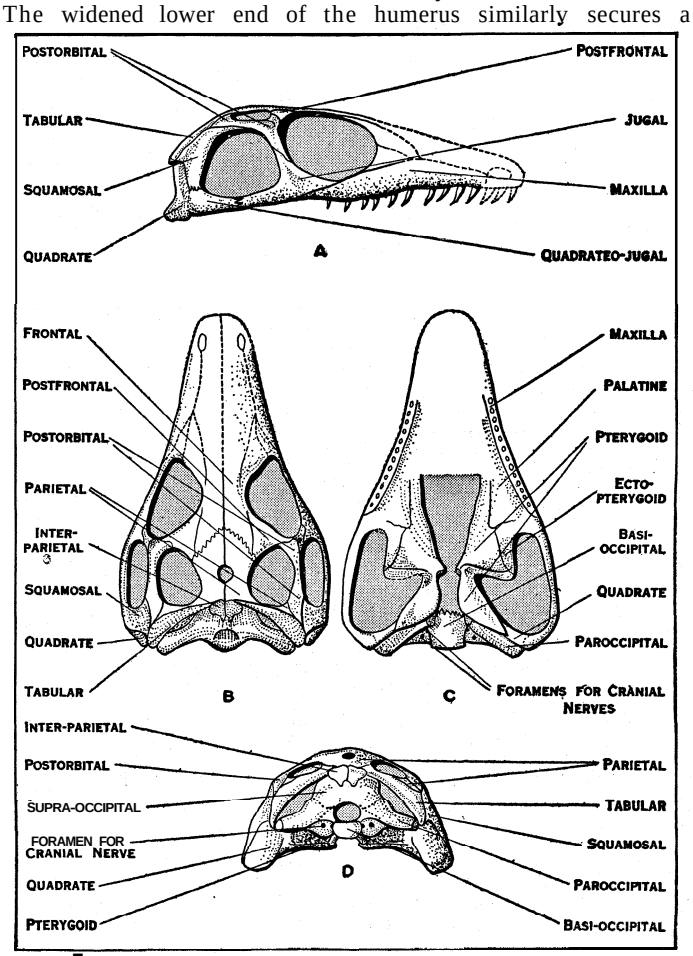
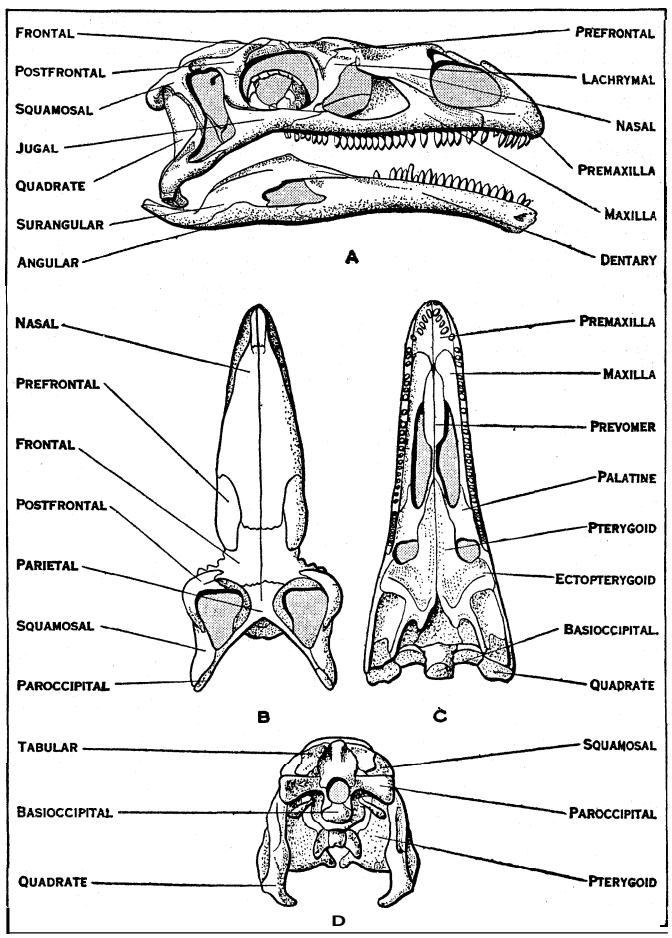


FIG. 11. — SKULL OF THE PRIMITIVE THECODONT, YOUNGURA
A. Right side, B. from above, C. from below, D. occiput

The lower end of the humerus bears a hemispherical boss on its front face, with which the head of the radius articulates, and a cylindroid articulation on its end which fits into the sigmoid notch of the ulna. The distal ends of the radius and ulna are widely separated; they articulate with the four bones: radiale, intermedium, ulnare and pisiform, of the proximal row of the carpus. The middle row of the wrist usually consists of only two

bones, the centralia, one of which forms part of the inner border, whilst the other separates the intermedium from the distal row. This consists of five bones, of which the fourth, which articulates with the ulnare, is the largest. The metacarpals articulate directly with the corresponding carpals and the number of phalanges is 2, 3, 4, 5, 3 respectively. This ensures that the ends of the fingers lie in a straight line at right angles to the animal, when the hand is placed on the ground.

The pelvis is attached to the vertebral column by the sacral ribs, which vary in number in Lower Permian reptiles from one



FROM POMPECKJ AND HUENE, "GEOLOGISCHE UND PALAEONTOLOGISCHE ABHANDLUNGEN" (GUSTAV FISCHER)

FIG. 12.— SKULL OF THE DINOSAUR. PLATIOSAURUS
A. Right side with lower jaw, B. from above, C. from below, D. occiput

to four. It consists of three pairs of bones, the ilia, pubes and ischia. These meet in a triradiate suture, so that each supports about one-third of the acetabulum, with which the head of the femur articulates. The pubis and ischium of the same side are firmly united by a continuous suture and the two halves of the pelvis articulate continuously. so that the whole structure is usually described as plate-like. The femur is a straight bone, with the articular face of its head placed on the end of the shaft. The condyles at the distal end are only slightly curved, well separated and placed at such an angle as to suggest that the knee could neither be extended into a straight line nor flexed beyond a right angle.

The tibia is a bone with an expanded upper end, and is always shorter than the fibula, which is unusually massed. At their lower ends the two bones are widely separated. The tarsus, in one case (Seymouria) has a proximal row of three bones, the tibiale intermedium and fibulae, corresponding with those of the carpus, but in nearly all other reptiles and their descendants, the mammals and birds, the intermedium is no longer found as an independent bone, even during development, and has fused with the tibiale to form an astragalus. As a result of this fusion the tibia articulates only with the astragalus, whilst the fibula impinges on both astragalus and fibulare or calcaneum. The calcaneum is always in direct contact with the fourth and fifth (if present) distal tarsal, whilst the astragalus is separated from the first three distal tarsals by a row of two or more, usually one, centrale, the mammalian navicular. There are primitively five digits, the fourth being the longest. The phalangeal formula is 2, 3, 4, 5, 4.

The great majority of the changes which take place in the structures of these limbs during the evolution of the reptiles can be explained by a consideration of the mechanics of the structures under modified conditions of locomotion.

In the line of the mammal-like reptiles, and also in some of the other forms, the first change which takes place in the shoulder girdle is the addition of a bone, the coracoid, to the two existing in the primary shoulder girdle. These animals then acquire a pectoral girdle which resembles the pelvis in that the facet for articulating the proximal bone of the limb is carried almost equally on three bones. The glenoid cavity at first retains its screw shape, the humerus being restricted in its motion to an excursion along an arc lying nearly parallel to the ground. Gradually, as an integral part of the whole process whereby these animals acquired a more rapid and less clumsy gait, the plane of this glenoid cavity becomes twisted round, so that the humerus moves freely in a dorso-ventral direction and the elbow is no longer directed outward, but is drawn in toward the side of the body, nearly to the stage in which it exists in the more primitive mammals. This change results in the restriction of the glenoid cavity to the scapula and coracoid alone, the precoracoid no longer contributing to it.

Concurrently with this change, the humerus took up a more vertical position, so that the muscles connecting it with the coracoid could become smaller, in part because the forces they had to exert were actually reduced and, in part, because their insertion became more favourable. Thus the coracoid and precoracoid suffer steady reduction compared with the scapula. Finally, in order to secure a larger surface for its attachment, one muscle, which serves to support the animal's weight and to drive the humerus downwards, migrates on to the inner surface of the scapula, the tendon by which it is attached to the humerus passing over a notch in the front border of the scapula below the point at which the clavicle is attached to that bone. In this way a definite acromium becomes established, and the upper part of the anterior border of the scapula becomes recognizable as the homologue of the spine of a mammalian scapula.

The most important change in the clavicular arch is the gradual reduction and final complete disappearance of the cleithrum. The other bones sink in from their original position in the skin. so that they become surrounded by muscles on all sides, but otherwise they suffer comparatively little change during the evolution of the mammals.

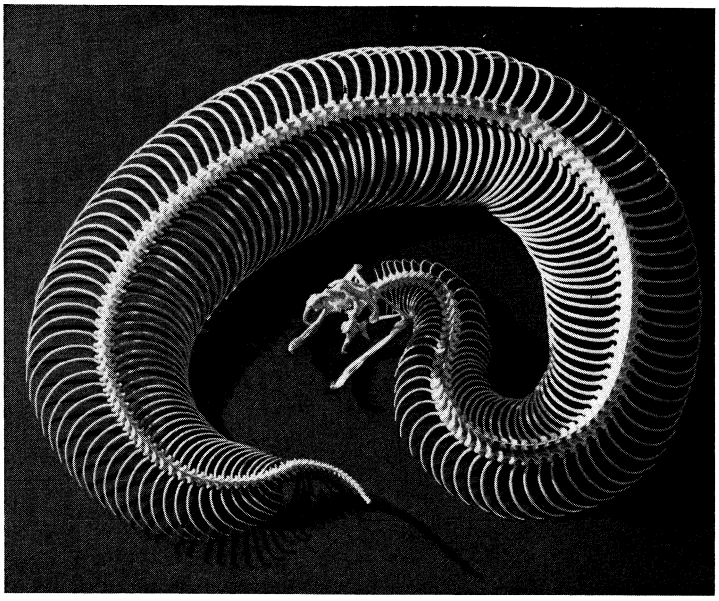
The great changes in the position of the fore limb during the development of the mammal-like reptiles necessitate corresponding modifications of the structure of the humerus and other limb bones. Of these, the most striking is the gradual narrowing of the two ends of the humerus and their rotation until they become nearly parallel.

In the hand, the number of phalanges in the third and fourth fingers is reduced to three, so that the formula becomes that characteristic of mammals, 2, 3, 3, 3, 3. It is evident that this change is associated with a new pose in which the third finger, which becomes the longest, lies parallel to the mid line of the animal and the others are symmetrically placed on each side of it.

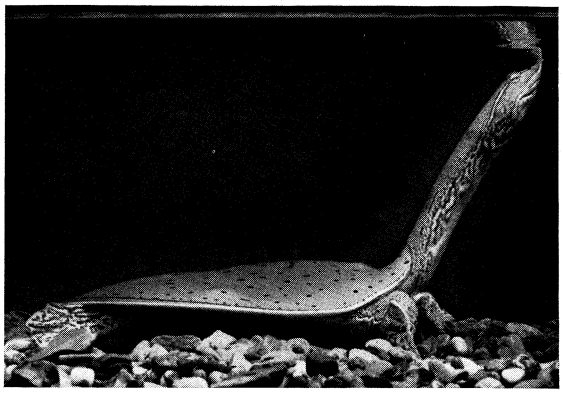
In the pelvis, the most important changes are a widening of the upper part of the ilium associated with an increase in the number of vertebrae in the sacrum, and the development of an obturator foramen, a gap lying in the suture between the pubis and ischium.

The femur so changes its shape that it can lie with the knee directed as much forward as outward, and the lower leg become capable of much freer movement. At the same time the astragalus and calcaneum shorten so that the tibia and fibula rest partly on their upper surface, thus forming an ankle joint which is on

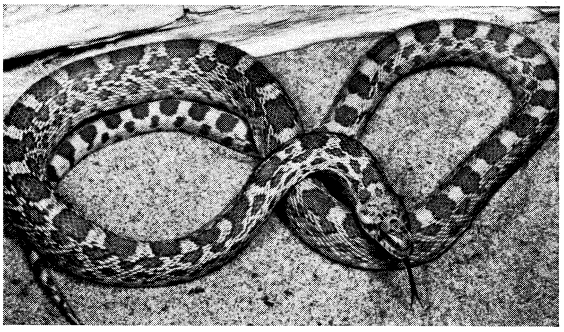
REPTILE



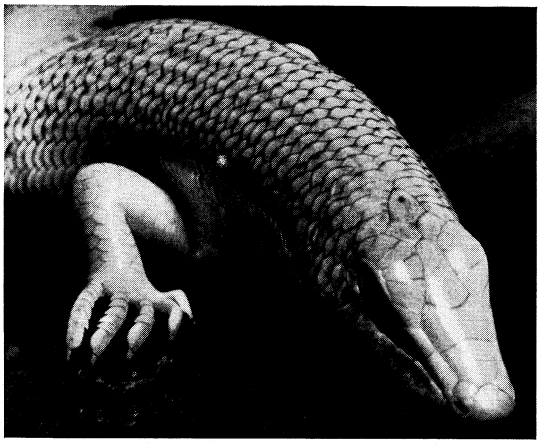
Skeleton of a gaboon viper (*Bitis* gabonica), showing arrangement of vertebrae and ribs. The sharp fangs of tnis snake — which is poisonous — may be seen in the upper jaw



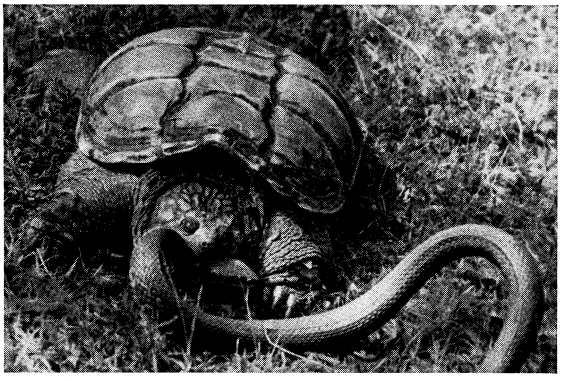
Spiny softshell turtle (*Trionyx* species) with its neck stretched out to bring its nostrils above the water. All reptiles are air breathing and have lungs



Bull snake (*Pituophis catenifer* subspecies) with its forked tongue extended. The flicking of the tongue is a response to odour or vibration. When retracted, the tongue touches Jacobson's organ, a chemical receptor in the roof of the mouth

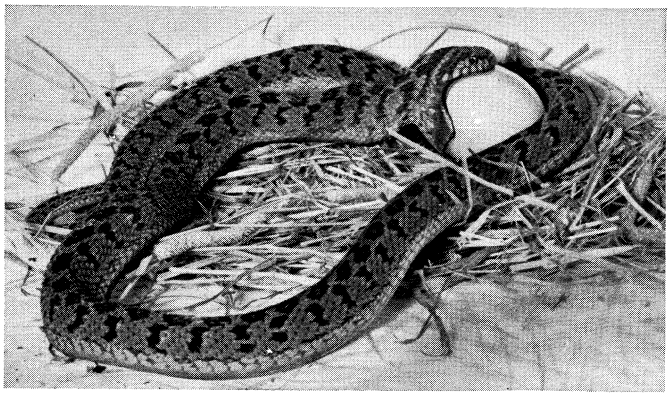


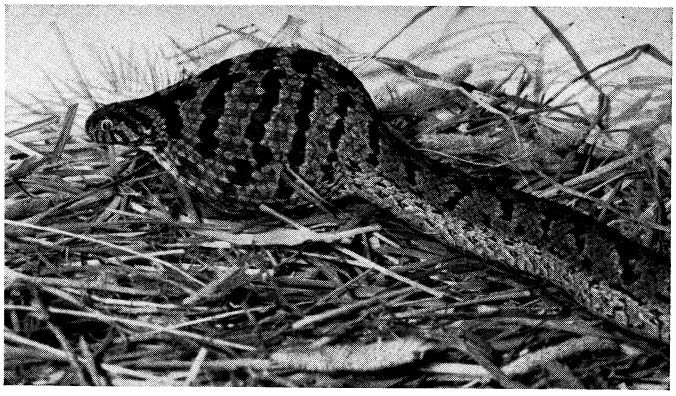
Close-up of the head of a sand skink (*Scincus philbyi*), showing the scaly epidermis characteristic of reptiles. The scales are composed of keratin, a hornlike tissue, which prevents drying of the skin, thus making it possible for reptiles to adapt themselves to nonaauatic life



Snapping turtle (*Chelydra serpentina*) eating a water snake (*Natrix* species). The great majority of reptiles are carnivorous, feeding on a variety of animal life

Two photos showing the egg-eating snake of Africa (*Dasypeltis* scaber) enjoying its favourite meal. The joints and hinging of the lower jaw in snakes make it possible for them to swallow objects much larger than themselves



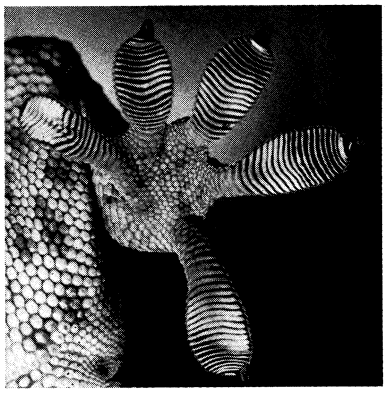


BODY STRUCTURE AND DIET OF REPTILES

BY COURTESY OF (TOP LEFT) AMERICAN MUSEUM OF NATURAL HISTORY, (CENTRE LEFT) ARABIAN AMERICAN OIL COMPANY, (BOTTOM, 2) NEW YORK ZOOLOGICAL SOCIETY; PHOTOGRAPHS, (TOP RIGHT) JOHN h. GERARD FROM NATIONAL AUDUBON SOCIETY, (SECOND RIGHT) JOHN H. GERARD, (THIRD RIGHT) LYNWOOD M. CHACE FROM NATIONAL AUDUBON SOCIETY

REPTILE

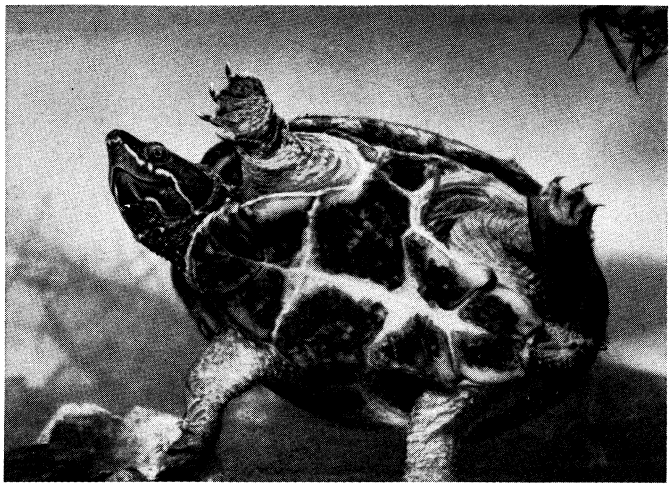
Small limbless reptiles, such as this wormlike lizard of the family Amphisbaenidae, move by pushing backward against a rock, twig or irregularity in the ground surface. Larger snakes move by stretching and contracting



Detail of the underside of a foot of a tokay (Gekko *gecko*), showing the pattern of plates or scales under the toes. Innumerable minute hooks attached to the plates enable the gecko to climb easily on smooth surfaces, even glass

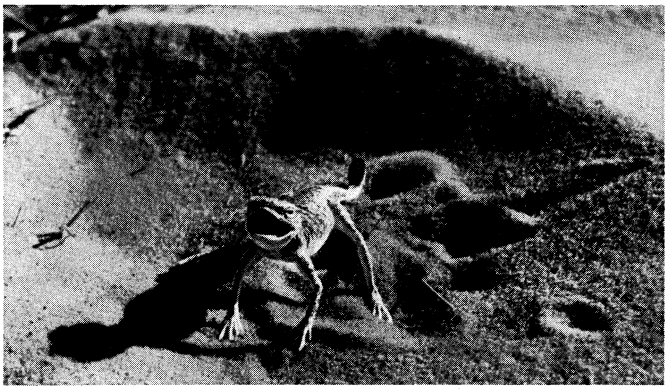
MEANS OF LOCOMOTION IN REPTILES

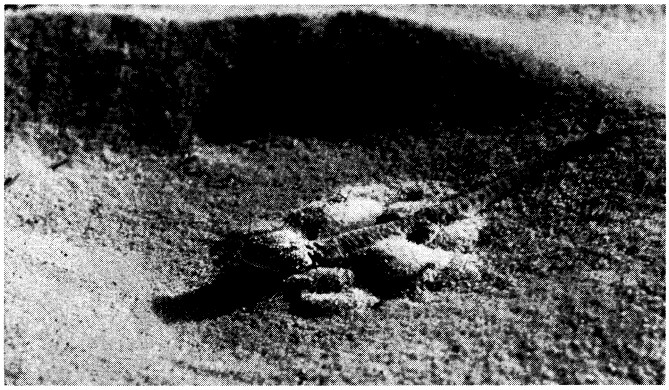
Restoration of an extinct Iguanodon, a Cretaceous dinosaur that walked on its hind legs, its body mass balanced by a long, thick tail. Some present-day lizards are also capable of bipedal locomotion, but only for short runs



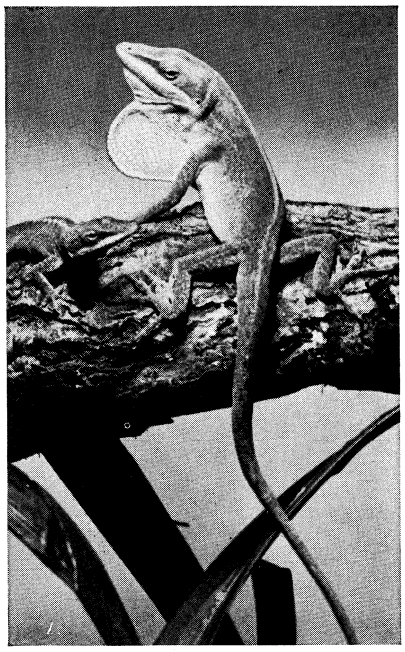
Underside of a turtle (Sternotherus species), an underwater view showing the fleshy webbing between the toes, creating a paddlelike foot that the turtle uses in swimming

Series of three photographs showing the Arabian toad-headed agamid (*Phrynocephalus nejdensis*) burying itself in the sand, a maneuver it can accomplish auickly when frightened, by burrowing and vibrating its body

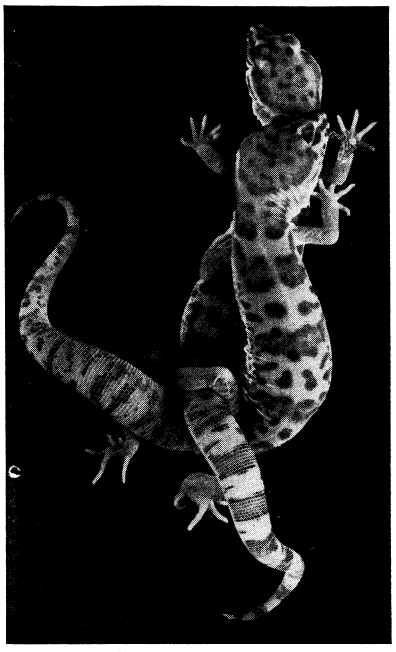




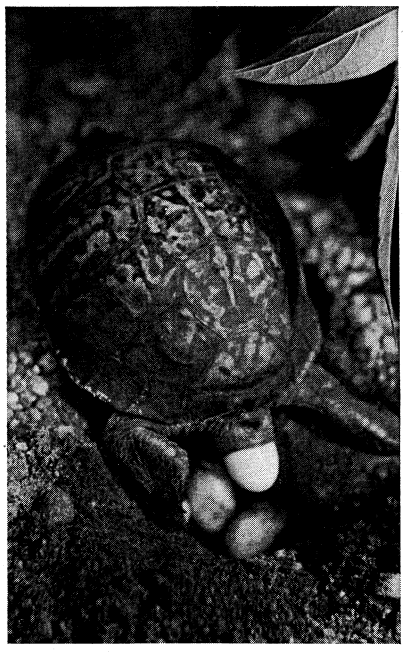
BY COURTESY OF (BOTTOM RIGHT, 3) STANDARD OIL CO (N.J.), (BOTTOM LEFT) AMERICAN MUSEUM OF NATURAL HISTORY; PHOTOGRAPHS (TOP LEFT) R MERTENS, (TOP RIGHT) HUGH SPENCER, (CENTRE LEFT) D. DWIGHT DAVIS



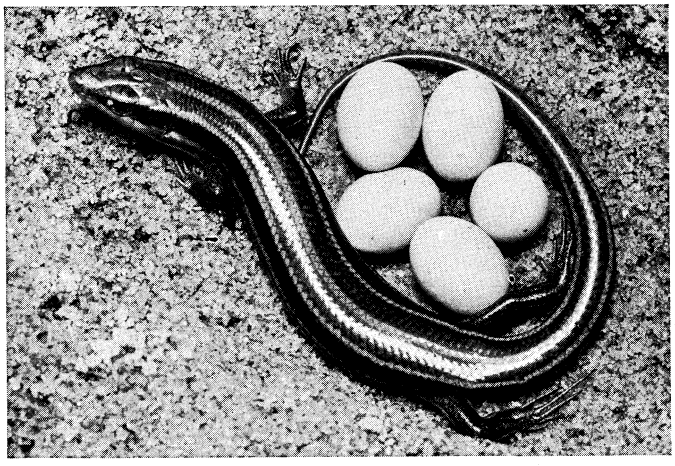
Male green anole (*Anolis carolinensis*) with throat dewlap extended to entice female to mate. Some form of display or unusual movement is typical of reptilian courtship



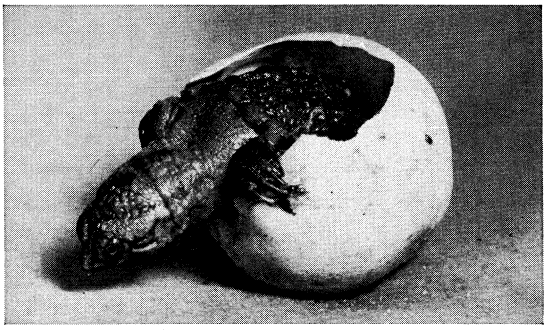
Banded geckos (Coleonyx variegatus) mating. Internal fertilization is a major distinguishing characteristic between reptiles and amphibia



Box turtle (*Terrapene* species) laying eggs. Turtles and some crocodilians dig nests for the eggs, covering the nest and leaving it after laying is completed

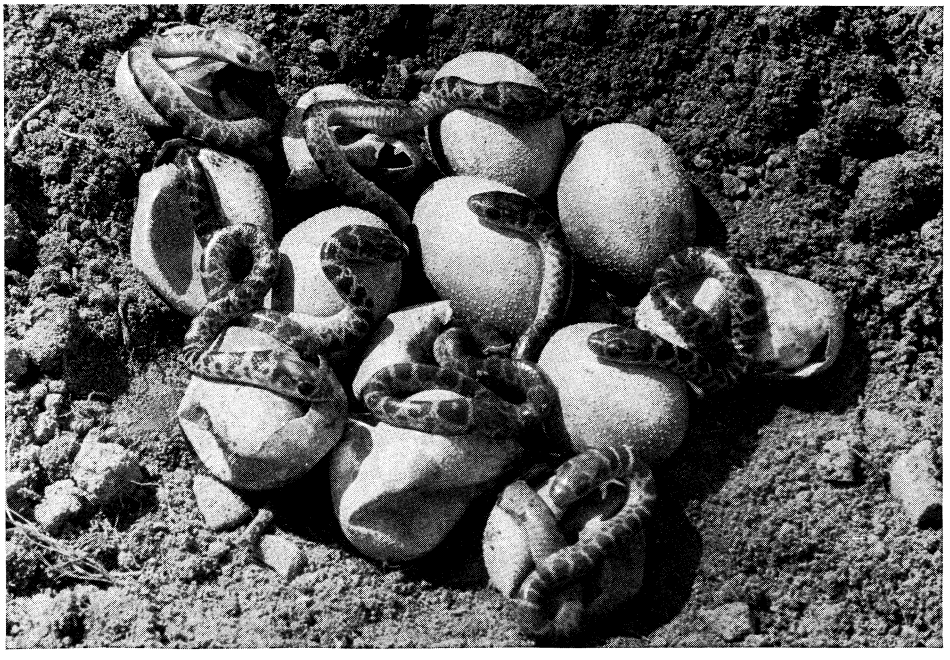


Five-lined skink (*Eumeces fasciatus*) with tail coiled around clutch of eggs. Parental care is rare among reptiles



Snapping turtle (Chelydra *serpentina*) hatching. Reptiles do not undergo metamorphosis; when they are born they are capable of all adult functions except reproduction

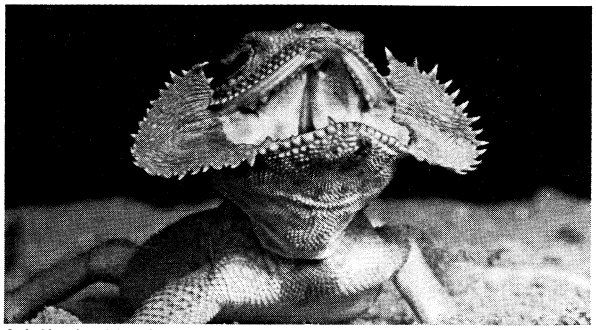
COURTSHIP, MATING AND BIRTHS OF REPTILES



A clutch of black racer (*Coluber* constrictor subspecies) eggs hatching. Reptile clutches of eggs or broods of young vary in size from 1 to about 200, with a gestation period (for American and European species) from 2 to 3½ months

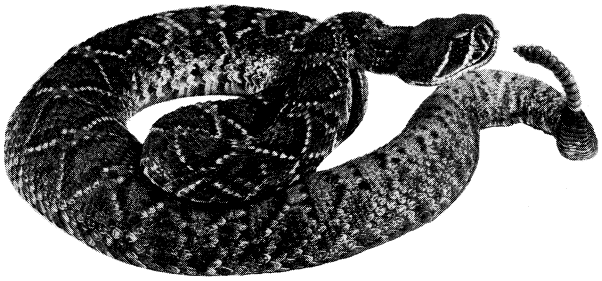
PHOTOGRAPHS, (TOP LEFT, TOP CENTRE) BERNARD GREENBERG, (TOP RIGHT, BOTTOM RIGHT LYNWOOD M. CHACE FROM NATIONAL AUDUBON SOCIETY. (CENTRE RIGHT) PAL H. HARRISON FROM NATIONAL AUDUBON SOCIETY. (CENTRE LEFT) JACK DERMID FROM NATIONAL AUDUBON SOCIETY

REPTILE

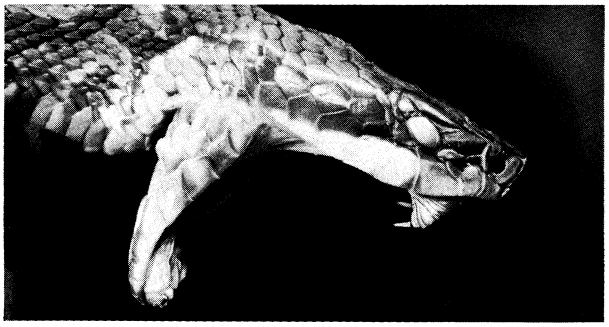


Asiatic toad-headed agamid (*Phrynocephalus mystaceus*) in defense posture. The large, brightly-coloured flaps are attached to the corners of the mouth. When extended, as shown, the mouth appears much larger and wider and is thus more formidable to enemies

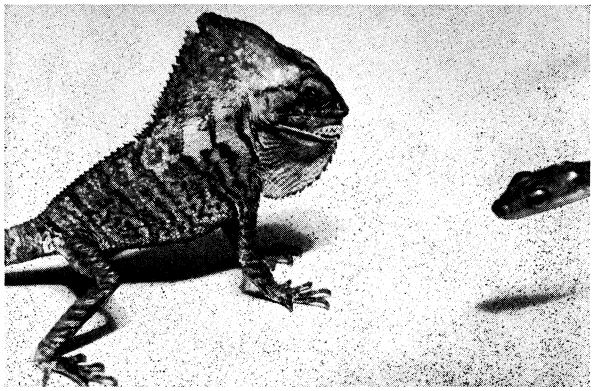
Australian lace monitor (*Varanus varius*), a large lizard (six feet long) with a heavy tail which can be an effective weapon when swung vigorously. The monitors also have strong jaws and large teeth



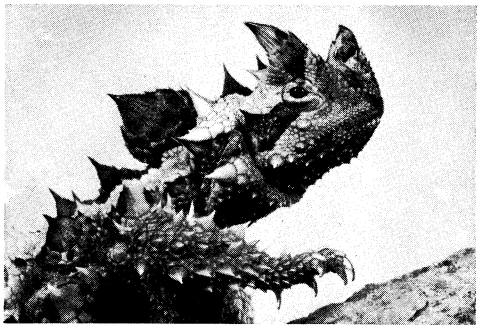
Diamondback rattlesnake (*Crotalus* species) showing the rattle which is used as a warning or threatening device. Other snakes employ noise, for example, hissing and spitting sounds, as a defense



Detail of the mouth and fangs of a water moccasin, or cottonmouth (*Agkistrodon* [*Ancistrodon*] *piscivorus*), a poisonous snake that injects its venom into its victims through a duct in the fangs



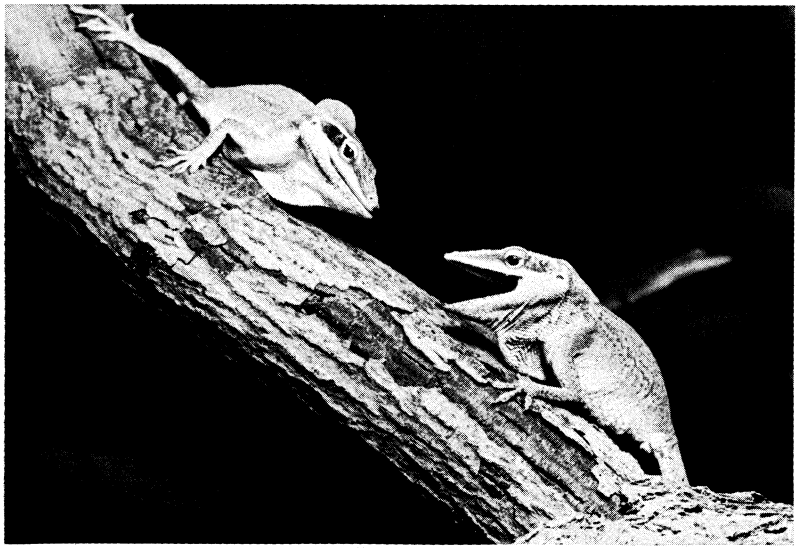
Reaction of a helmeted iguanid (*Corythophanes cristatus*) to a snake. The dewlap is extended and the body tensed to jump. This lizard will run on its hind legs when frightened



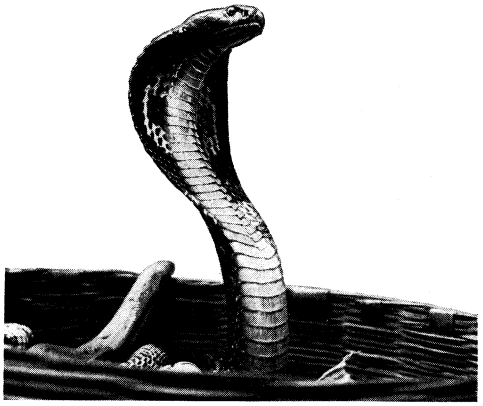
Head of an Australian thorny devil, or moloch (*Moloch horridus*), an example of passive defense through body form. Despite its appearance, the moloch is inoffensive

DEFENSE AND REACTION TO DANGER

Two male green anoles (*Anolis carolinensis*) preparing to fight. The one on the left is in a defensive position with the crest raised, dewlap extended, the dark spot behind the eye displayed and body widened and flattened



An Indian cobra (*Naja naja*) with its hood extended. Spreading or inflation of all or part of the body in defense is common among many types of reptiles



BY COURTESY OF (TOP RIGHT) AUSTRALIAN NEWS AND INFORMATION BUREAU, (SECOND LEFT) U S. FISH & WILDLIFE SERVICE PHOTOGRAPHS (TOP LEFT) R MERTENS (SECOND RIGHT) HUGH SPENCER, (THIRD LEFT) D. DWIGHT DAVIS, (THIRD RIGHT) JOHN WARHAM, (BOTTOM LEFT, BERNARD GREENBERG (BOTTOM RIGHT) YLLA—RAPHO GUILLUMETTE

the way to a mammalian structure and the phalangeal formula of the foot becomes reduced to 2, 3, 3, 3, 3.

The non-mammal-like reptiles exhibit so many different types of adaptation that a full analysis of the structures of their limbs is impossible; indeed, it has not yet been systematically attempted. Some of the main types of life are here discussed with reference to a particular case.

Nondescript. — The majority of lizards and Rhynchocephalia exhibit a simple modification of the mode of locomotion found in the most primitive reptiles. In them the body and tail are thrown into lateral waves, which pass steadily backward so that each point along the back swings from side to side across the animal's track as the creature moves forward. The hands and feet are widely separated, the body only just raised off the ground, and only one foot is moved at a time. In detail there is much variety; both fore and hind feet may be much everted, so that the first digits point forward and the toes increase in length from one to four, so that when in the natural position their claws end on a straight line at right angles to the body. In some cases, however, the fingers are directed forward and the hand is nearly symmetrical about the third finger, and even the foot is less asymmetrical than in the more primitive forms. Nevertheless, these animals always retain the original phalangeal formula.

These animals have a primary shoulder girdle consisting of a scapula and precoracoid, the glenoid cavity has lost all trace of the screw shape of primitive reptiles and permits considerable freedom of motion. In the larger and more advanced lizards the anterior part of the scapula and coracoid is much enlarged, and these bones are perforated by fenestrae.

The clavicles have an expanded, and sometimes fenestrated, lower end, and the interclavicle is usually cross-shaped. There is a large sternum, which is usually calcified although not ossified, with whose antero-lateral borders the precoracoids articulate.

The pelvis of these reptiles is of very characteristic pattern, the ilia are narrow rods with an expanded lower end which contributes to the acetabulum. It slopes downward and forward and is firmly held by its articulation with the two sacral ribs. The pubis and ischium are separated by a large obturator foramen which, in many cases in the bony skeleton, is confluent with that of the opposite side. The hind limb presents few features of interest, but it may be noted that a patella is sometimes present, and that most of the motion at the ankle-joint takes place between the two rows of tarsals and not, as in mammal-like reptiles, between the tarsus and lower leg.

One universal and unexplained feature of the hind foot of these reptiles is that the fifth distal tarsal is absent, and that the upper end of the fifth metatarsal has moved up into contact with the calcaneum, and has become much widened so that the whole bone is hook-shaped. As a result, the fifth toe tends to be widely separated from the other four.

This feature occurs in Rhynchocephalia, Thecodontia, Crocodilia, Dinosauria, Squamata, and Chelonia, and has been held to imply a close relationship between these orders.

Cursorial Progression. — The only group of non-mammal-like reptiles which became highly adapted for rapid progress on hard land was the Dinosauria. They arose from Thecodonts whose general body proportions and gait generally resembled those of certain lizards. These animals possessed slender scapulae and small precoracoids, clavicles and interclavicle were present, and there was, in some cases, a sternum with a single pair of ossifications. The fore limb was slender, the hand small and with five fingers. The pelvis had an ilium which was antero-posteriorly extended, but so low that the acetabulum lay on the level of the vertebrae. The pubis and ischium were plate-like, but much elongated and directed largely downward. The hind legs were much longer and more massive than the fore, a condition made possible to a quadripedal animal by the presence of a long tail, which acted as a counterpoise to the body. Although it is certain that these animals had a straddling gait, it is probable that the feet were placed unusually near to the middle line and the feet were not so asymmetrical as those of most lizards.

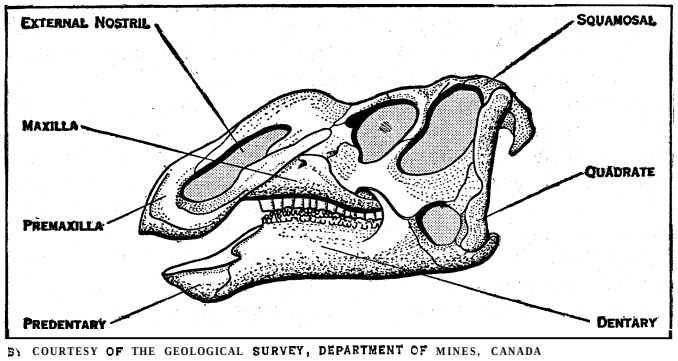
From such reptiles the Saurischia, the carnivorous dinosaurs arose by an increase in the length of the hind legs, and concurrent reduction of the arms. They became predominantly bipedal, a habit which necessitates the raising of the body so far above the ground that the whole animal balances about the pelvis. This pose can only be attained if the thighs are turned in until they lie parallel to the body of the animal, and the feet are placed on the line which marks the middle of the track. Such an arrangement ensures that the body need no longer be thrown from side to side, as it is in all more primitive reptiles.

A further result is that, as the powerful muscles which are used for propelling the animal forward no longer press the heads of the femora into the acetabula, this depression no longer needs a floor and becomes perforated. At the same time, in order to lengthen the muscles attached to them and thus enable the leg to swing through a larger arc, the pubis and ischium, both elongated, stretch downwards and away from one another, meeting only at the acetabulum. The reduction in size of the forelimb, which occurs because it is no longer required to carry the weight of the body, results in a reduction and final loss of the clavicular arch, and in a reduction in size of the precoracoid. Subsequently, certain carnivorous dinosaurs increased greatly in size and became quadripedal again, retaining in many parts of their skeleton features which arose during the bipedal stage in their ancestry.

The long limbs which are necessary for a bipedal cursorial life, involve elongated feet. These are secured by lifting the heel entirely off the ground, so that the animal walks on the ends of the metatarsals, the toes stretching out along the ground as they do in birds. As the foot is placed directly under the body it tends to become symmetrical about the middle third toe, and rapidly becomes either functionally or actually tridactyl. The hand, which serves as a grappling hook for catching the prey, is reduced to three fingers, all provided with claws, that on the thumb becoming very large indeed in the latest forms.

The other group of dinosaurs, the Ornithischia, pursue a somewhat similar course of modifications; they also become bipedal, some of them secondarily returning to a quadripedal life. But in them the extension of the pubis and ischium into long downwardly directed rods, which is necessary to afford suitable muscle attachments, takes place in such a way that the pubis acquires two branches, one directed downward and forward, the other directed backward so that it lies parallel to the ischium. The early stages of this arrangement are not known, but it persists throughout the whole group.

Flight.--One group of lizards, the genus Draco, has the habit of living in trees and of passing from tree to tree by making great



BY COURTESY OF THE GEOLOGICAL SURVEY, DEPARTMENT OF MINES, CANADA

FIG. 13.—SKULL AND LOWER JAW OF THE ORNITHOPODOUS DINOSAUR KRITOSAURUS

leaps, whose length is extended by the presence of a parachute, made by flaps of skin which project from the sides of the body and are supported by the much elongated ribs. Such gliding is scarcely flight in any true sense, it cannot be maintained by any action of the animal whilst in the air, and its extent is limited by the speed acquired at the original jump and by the height of the point of departure. A similar gliding habit, carried out without any elaborate mechanism by a mere concavity of the ventral surface, is exhibited by certain arboreal snakes from Borneo. The only reptiles which have acquired true flight were

the extinct Pterodactyls.

There are two series of the animals, in one of which the tail is extremely short and probably functionless, whilst in the other the tail is a very long stiff rod bearing a horizontal fin at its hinder end. The presence of this fin renders the maintenance of the body on an even keel much easier than it can have been in the tailless forms. The wing of every pterodactyl consists of a fold

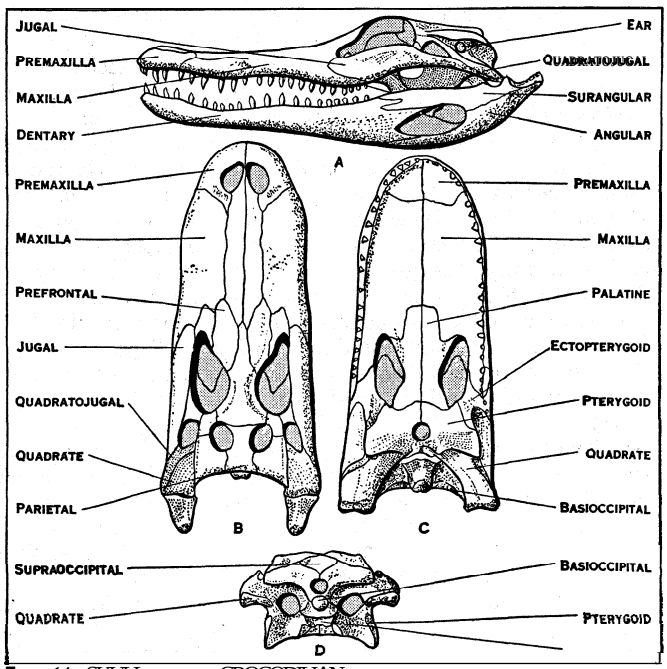


FIG. 14.—SKULL OF A CROCODILIAN, THE ALLIGATOR; (A) LEFT SIDE. WITH LOWER JAW. (B) FROM ABOVE, (C) FROM BELOW, (D) OCCIPUT (AFTER ANDREWS)

of skin which is supported by the greatly extended fourth finger and by the hind leg; it may or may not have connected the hind legs together, either directly or by passing on to the base of the tail. The structure of the fore limbs, which enabled these animals to perform automatically the many carefully-adjusted movements which are necessary for flight, is so strictly determined by mechanical considerations that it is practically uniform in all known species of the group.

In all of them, the scapula is an elongated narrow rod of bone which may articulate with the neural spine of the dorsal vertebrae. Its lower end forms the upper half of the glenoid cavity and is fused with the coracoid. This bone is elongated and straight, its distal end rests in a groove in the front of the large sternum, so that it is enabled to take directly the stresses resulting from the powerful wing muscles. The humerus is short, and the radius and ulna lie parallel to one another. The carpus consists of three bones, with the distal of which the wing metacarpal is articulated, so that it can revolve on its axis. The main joint at which the wing was folded lay between the metacarpal and first phalanx. The movements at the elbow and wrist are inseparably connected, and serve to alter the camber and angle of attack of the wing, thus enabling the animal to fly at varying speeds. It is interesting to note that a successful aeroplane, with an unusual range of flying speed, has been designed on lines suggested by the tailless pterodactyls.

Swimming.— Two extreme modes of swimming are open to a tetrapod. It may convert its limbs into paddles by whose actions it rows itself through the water, or it may use its tail as a propeller, either flattening it and causing waves to pass along its length or producing a fin at the extreme tip, which can be used like a screw propeller. Both types are found in reptiles.

The Chelonia include amongst the fresh water tortoises a number of animals which swim well with limbs which, except for the webbing of the toes, are much like those of a land animal. But in the marine turtles and in the fresh water Carettochelys from New Guinea, the limbs are transformed into paddles, mere bags of skin surrounding the whole of the elongated digits.

The Plesiosaurs carried this principle to its limit; in them each limb is a rigid oar, flattened and widened distally, circular in section where attached to the body. It was feathered when brought forward, then turned so that its broad plane was vertical for the swimming stroke.

The crocodiles, the semi-marine lizard Amblyrhynchus, and the sea snakes are the living exponents of the second mode of swimming. In them the powerful tail is laterally flattened, and is swung from side to side so that a series of waves passes along its length. The limbs are used for steering and for maintaining stability in the water. The only groups of reptiles which have formed a caudal fin are the Ichthyosaurs and the marine crocodiles of the family Metriorhynchidae. In each case the end of the vertebral column is suddenly turned down so that it passes into the lower lobe of a forked fin whose upper lobe is supported only by non-ossified structures. These animals show a reduction of the limbs, the pelvic limb of Ichthyosaurs and the pectoral limb of the crocodiles being reduced to a tiny paddle.

Limblessness.—Many lizards belonging to unrelated families, but chiefly of burrowing or sand living habits, exhibit a reduction of limbs associated with an elongation of the body. The process takes place gradually, all stages being known in one or other form between normally developed limbs and their complete absence. In snakes the reduction is always complete in the case of the fore limbs, whilst the hind limbs may be represented by a claw-like spur on each side of the vent. In some cases all three bones of the pelvis and the femur may be present. Normally, all trace of limbs, except for a rudimentary nerve plexus, is lost.

Skin.—The fact that the reptiles were originally distinguished from the amphibians by their more completely terrestrial habits, implies that in them the skin had become capable of withstanding desiccation, and the serious wear to which it became exposed.

The skin of amphibians is maintained in good condition by a coat of mucus, poured out from glands which lie all over it; that of reptiles is dry and covered by a watertight layer of horn, very well adapted for resisting abrasion. The horny layer, though continuous, is not of the same thickness throughout, but is divided into specially thickened areas, the scales which are connected by flexible regions. The scales may be flat, fitting together like a mosaic or separated widely, or they may be prolonged backwards so that they overlap and are overlapped by others, like slates on a roof. The scales often have a definite arrangement, which is used in the classification of Squamata.

The skin, as in other Amniotes, consists of a compound squamous epithelium which rests on a conum built of connective tissues. The actual scale consists of the keratinized outer layers of the epidermis, its thickness is increased by additions to its inner surface, and it grows in area either all round or at one end. The area of the scale is always raised by a special papilla of the corium, which may project so far that the scale overlaps that behind it. The scale is colourless, its transparency allowing the pigment in the cutis to show through.

The outer layer of the keratinized epithelium is worn away in crocodiles and Chelonia, but in the Rhynchocephalia and Squamata it comes away either in flakes or, in some lizards and snakes, in one piece. Such cast skins exhibit perfectly the continuity of the horny skin, which in them even covers the eyes. This process of shedding the skin is facilitated in some or all of these reptiles by a special mechanism which allows the head to be distended with blood. The papilla of the corium which fills the centre of each scale may, in crocodiles, some lizards and many fossil reptiles, be ossified as a bony scute.

The carapace and plastron of the Chelonia consist essentially of such scutes. Each ossifies in the corium, the bone finally occupying nearly the whole thickness of that layer, leaving only a thin sheet of connective tissue to support the peritoneum, and a similar sheet containing pigment cells below the epidermis in which the horny shields are developed. The originally dermal ossifications of the carapace extend so far down into the body of the animal that, in the end, they completely surround the middle parts of the ribs, which first calcify and are then ossified by ex-

tension of membrane bone from the scute.

Most of the glands found in the skin of reptiles are scent glands, which give to these animals their characteristic odour of musk, which has, no doubt, a sexual significance. All these glands are sac-shaped, multicellular structures opening by a pore on the surface, and their secretion is set free by disruption of cells.

The musk glands have the following distribution: — In crocodiles there is a pair which open by longitudinal slits on the inner sides of the lower jaws, and another pair lie within the lips of the cloaca; these are present in both sexes. Crocodiles possess also a row of small sac-like glands without external openings along each side of the back.

In Chelonia there is a pair of inguinal glands opening near the hypoplastra, and sometimes an anterior pair similarly related to the hyoplastra. Sphenodon has a pair of cloacal glands. Lizards have cloacal glands and, in addition, in certain forms there are the so-called femoral pores, which extend along the lower and hinder surface of the thigh to pass on to the belly in front of the cloaca. They are present in both sexes, but best developed in males. Each pore opens in the middle of a scale and leads into a canal which ends in a pocket with many shallow diverticula. The cells of the walls of these become detached, filling up the lumen of the gland and duct, and forming a rod which may project beyond the surface of the skin. It is possible that these structures are of assistance in copulation.

Muscular System. — No useful account of the muscles of reptiles can be given here, the functional effects of those used in locomotion are described in the section Locomotion.

Body Cavity. — The body cavity of reptiles is always more or less completely divided into sacs. A completely closed pericardium is always present. In lizards, a post-hepatic septum built up by special folds of the mesentery and suspensory ligament of the liver, may reach the ventral surface and bring about an almost complete division of the peritoneal cavity into two. In snakes, similar folds enclose the two lobes of the liver and the stomach in separate sacs. In Chelonia, the lungs lie above a fold of peritoneum which reaches the liver, excluding them from the general cavity. In crocodiles, there are two pleural cavities and a combinatidn of other folds connected with the liver forms a complete transverse partition separating the pericardium, lungs and liver from the rest of the peritoneal cavity. This sheet is muscular, and probably functions in respiration like the non-homologous mammalian diaphragm.

Digestive System: Teeth. — The teeth of reptiles may be found on the pre-maxillae, maxillae, on all the bones of the palate, and on the dentary and coronoid bones of the lower jaw. Individual teeth are generally simple cones with a conical pulp which produces dentine and an enamel cap. They may be set in sockets (thecodont) or fused to their supporting bone (acrodont or pleurodont). In the majority of reptiles they are shed periodically, and replaced as often as necessary. In reptiles, the marginal teeth of both jaws appear to belong to two series, whose members alternate with one another, and in primitive forms were functional alternately.

Thus, in these animals two teeth are usually separated by an empty emplacement in which a new tooth will arise, the original pair being shed together when it has grown to its full size. When the original teeth have been shed a new dental papilla passes outward from the lingual side to the empty socket and there produces a new tooth. In crocodiles this process has already happened before the tooth is shed, so that these new tooth crowns may often be found in the pulp cavity of the original tooth. Sphenodon, and some other recent reptiles with acrodont teeth, exhibit no replacement after maturity has been reached. The mammal-like reptiles in their various orders show all stages in the reduction of tooth change from the primitive unlimited replacement of all teeth to a mammalian condition in Cynodonts, where the incisors, canines and pre-molars are replaced once during the animal's life, and the molars, when once formed, are never shed.

The dentition of reptiles is usually homodont, that is, uniform or regularly varying from front to back of the jaw, but the Theriodont dentition is heterodont and mammal-like. The tooth crown may be elaborated into a crushing mechanism, in Placodonts, some Ichthyosaurs, and very effectively in the Trachodont dinosaurs, where several successive series of teeth are in use at one time, forming a splendid triturating surface, in Cotylosaurs, Theromorpha, and even, though imperfectly, in some lizards. The peculiarly specialized fangs of poisonous snakes are described in the article on these animals.

Tongue. — A tongue is present in all reptiles. In crocodiles and Chelonia, it is a short, broad, fleshy structure attached to the floor of the mouth over a large area. In crocodiles, a fold on the hinder margin of the tongue engages with a similar structure of the palate, so as completely to separate the air passage from that for food. In lizards the tongue may be flat, broad and not protrusible; it may be narrow, cylindrical and capable of being extended out of the mouth, or its cylindrical anterior half may telescope into the posterior portion, so that the whole can be projected far in front of the snout. This last type reaches its climax in the chameleon (*q.v.*).

Buccal Glands. — The only salivary gland of universal occurrence in reptiles is a sub-lingual. Upper and lower labial glands occur only in lizards and snakes, where they are arranged in rows between the lips and the teeth. The poison glands of the lizard Heloderma, and of the snakes, are special developments of such upper labial glands. They are described in the article SNAKE.

Gut. — In Chelonia, Sphenodon, lizards and snakes, the oesophagus passes gradually into the stomach, which is, in them, usually spindle-shaped, with its openings widely removed from one another. In crocodiles, the stomach is placed more transversely, the opening of the oesophagus and the pylorus being approximated. This stomach is an oval sac whose proximal portion is very muscular, recalling, in its arrangement, the gizzard of a bird; indeed, it customarily contains pebbles used for triturating food. The pyloric end of the stomach is distinct. The stomach always contains gastric glands.

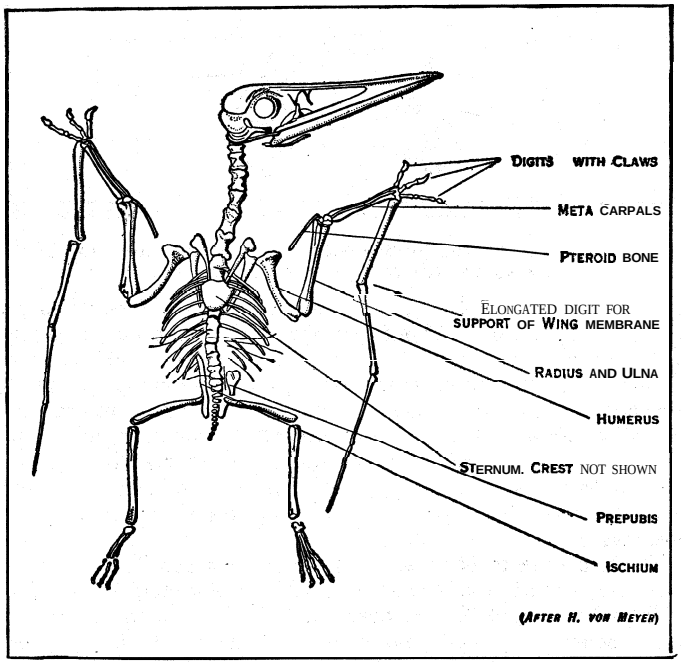


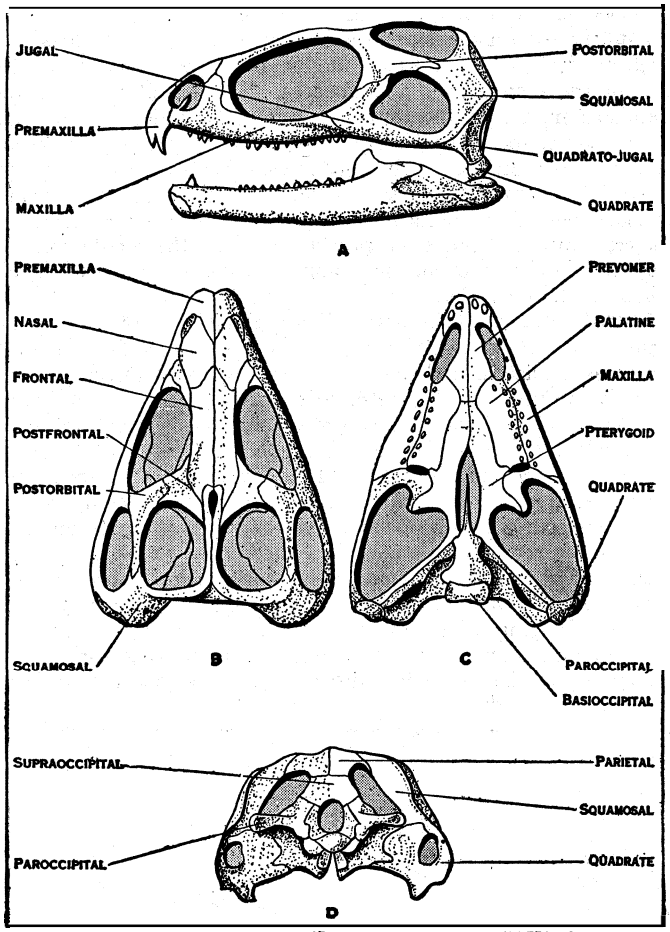
FIG. 15—PTERODACTYLUS SPECTABILIS FROM THE LITHOGRAPHIC STONE

A pyloric valve usually exists, and the duodenum is not usually sharply marked off from the rest of the small intestine; only in crocodiles does it form a loop round the pancreas as it does in birds and mammals. The walls of the mid gut are usually thrown into folds or ridges, but seem to contain few or no glands. There is usually or always an ilio-colic valve separating the mid from the hind gut; immediately beyond this the latter gives rise to a caecum in some lizards and snakes. The rectum ends in a cloaca which is usually of elaborate structure.

Cloaca. — The cloacal opening ieads into a proctodeum, a cham-

ber whose walls give origin to the copulatory organ or organs in the male, and their representative in the female duct to the pair of anal glands; the peritoneal canals when present open into it.

Copulatory organs are absent in Sphenodon, in Squamata they are a pair of papillae capable of being protruded through the lateral ends of the transverse cloacal slit, and of being retracted; being turned inside out by the contraction of special muscles



FROM WILLISTON, "WATER REPTILES OF THE PAST AND PRESENT" (UNIVERSITY OF CHICAGO PRESS)

FIG. 16.—SKULL OF THE RHYNCHOCEPHALIAN. SPHENODON: (A) LEFT SIDE, (B) FROM ABOVE, (C) FROM BELOW. (D) OCCIPUT

derived from the tail musculature. Each has a groove on its lateral surface which extends on the wall of the cloaca nearly to the opening of the vas deferens. In crocodiles and Chelonia, a median unpaired penis arises from the ventral wall of the proctodeum; it can be erected through the activities of corpora cavernosa, and is then extruded through the anterior end of the longitudinal cloacal slit. The dorsal or posterior surface of the penis is furrowed by a deep groove, which is probably converted into a canal during erection The groove leads backward to the openings of the seminal ducts.

The proctodeum is separated by a ridge which is, in effect, a sphincter, from the urodaeum, into which the ureters, vasa deferentia, oviducts and bladder open. A bladder is found in Sphenodon, Chelonia and most lizards; it is absent in all other reptiles. The urodaeum is partially subdivided in many reptiles; in snakes a dorsal recess receives the ureters and gonoducts, in crocodiles they open into the dorsal side of the urodaeum, whilst in Chelonia they discharge directly into the neck of the bladder. In Sphenodon, lizards and snakes, the oviducts open rather dorsally, in crocodiles and Chelonia ventrally, the vasa deferentia having a similar opening in all forms.

The urodaeum is, in some aquatic Chelonia, produced into a pair of their walled sacs on the dorsal side, which are constantly filled and emptied of water, thus serving as accessory respiratory organs, In all reptiles except crocodiles and Chelonia there is an additional cloacal chamber, the coprodeum, which serves for the storage of faeces.

Urogenital System.—The kidney of an adult reptile is always a metanephros, discharging by a single ureter. The kidney may be elongated and its surface furrowed, or it may be a small compact organ. The urine of Chelonia and Crocodilia is fluid, that which is voided by snakes and lizards contains crystals of insoluble urates, an arrangement which prevents waste of water in these animals, which often live in very arid surroundings.

The ovaries are always paired, and large owing to the size of the yolky eggs. Interstitial tissue is small in amount. The oviducts have independent funnel-shaped ostia, and are usually provided with glandular walls which secrete the albumen and shell. In some viviparous forms they can combine with the faetal membranes to form a placenta. The elongated testes are connected with an epididymis of mesonephric origin.

Respiratory System.—All reptiles breathe by lungs. These are always produced by the elaboration of a median ventral outgrowth of the pharynx. The glottis lies immediately behind the tongue and is sometimes protected by a rudimentary upstanding epiglottis. There is a larynx, supported by arytenoid and cricoid cartilages, there being no thyroid cartilages; muscles passing from the laryngeal cartilages to the "hyoid" enable the glottis to be opened and closed. There are often vocal chords, which give to Sphenodon, crocodiles, some tortoises and lizards a voice, usually a grunt or squeak. The trachea is often long and its cavity is kept open by cartilaginous rings. The bronchi may be very short in Sphenodon or very long in tortoises. The lung is very variable in its structure; it may be almost as primitive as in Amphibia or become comparable to that of a bird.

In Sphenodon and snakes the cavity of the lung is single, but the walls are divided up into a series of cells by upstanding ridges or septa. In some lizards certain of these septa elongate so that the original single sac begins to be cut up into lobes, each with cellular walls. In crocodiles, this process has gone on so far that the lung is definitely divided into a number of chambers each of which receives a number of wide side canals, the parabronchi, in whose walls lie the alveoli. In Chelonia this process has gone so much further that the whole lung is spongy, the alveoli, through whose walls the whole of the respiratory exchange takes place, being connected with an irregularly branched series of bronchial tubes.

Not only is the actual structure of the lung altered in this way, but reptiles show an advance over the Amphibia in an increased size of the lung resulting from the development of a special anterior projection, the prebronchial part, which, very small in Sphenodon, becomes much more extensive in more advanced reptiles. In chameleons, long, hollow non-respiratory process of the lungs pass backward among the viscera; they are important as morphological forerunners of the air sacs of birds and Pterodactyls. In elongated legless reptiles one of the lungs is usually reduced, and may be absent.

The mode of respiration in Reptilia is not well known. In all except the Chelonia, movements of the ribs may be expected to draw air into the lungs, whilst the muscular post-hepatic diaphragm of crocodiles is, no doubt, used as is the comparable structure in mammals. In Chelonia, and probably also in other reptiles, air is actively forced down into the lungs by movements of the floor of the buccal cavity brought about by the hyoid and its musculature. In Chelonia, the protrusion and withdrawal from the shell of the neck and legs gives a pumping action which, by creating a virtual vacuum, draws air into the lungs.

Vascular System.—The heart of reptiles lies in the thoracic region, usually between the lungs. There is a sinus venosus, at least in most, which opens by a valve guarded slit into the right auricle. Right and left auricles are completely separated, and open independently into the ventricle or ventricles. The lower edge of the interauricular septum is expanded laterally into, usually, very large right and left membranous valves, which direct the arterial blood to the left, the venous to the right side of the ventricular cavity. The ventricle is incompletely, or, in Crocodilia, completely divided by an upstanding ridge into right and left

halves. Except for a possible relic in Sphenodon, there is no trace of a conus arteriosus nor of a truncus. Three arteries arise independently from the ventricle, and are then twisted round one another like a rope, so that they cross one another. That vessel whose origin is most to the right is the left systemic arch, the next is the pulmonary arch, and the third is the right systemico-carotid, from which arise both carotids. As a result of this arrangement, in Chelonia the pulmonary arch arises from a partially separated cavum pulmonale, and the two systemics from a cavum venosum, which has to be traversed during systole by the blood from the left auricle, which is originally discharged into the cavum arteriosum on the left side of the ventricle. In crocodiles, the right systemico-carotid alone leaves the left ventricle, whilst both pulmonary arch and left systemic come off from the venous right ventricle: but in them the left and right systemics are connected by a special opening, the foramen of Panizzi at the point where they cross. Although it has been shown by the electrocardiograph that the nature of the contraction of the heart in tortoises is much as in mammals, very little is known of its general physiology.

Arterial System.—The pulmonary arch soon divides into two branches, one to each lung; in Sphenodon and some lizards it gives off a paired laryngotracheal artery which is a relic of a

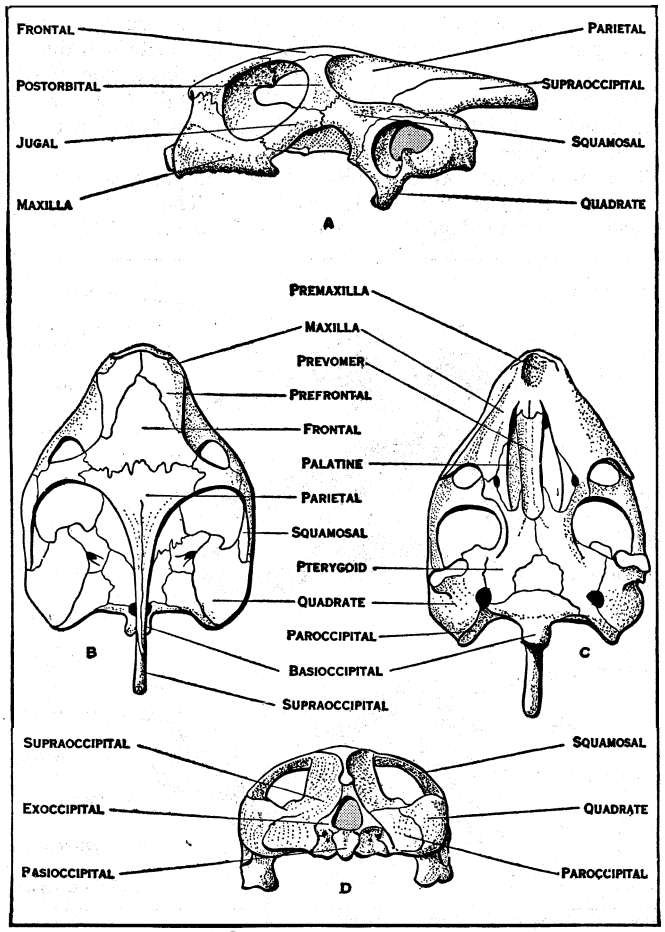


FIG. 17.—SKULL OF A TORTOISE, TESTUDO
A. Left side, B. from above, C. from below, D. occiput

Urodela structure. The systemic arches unite to form the dorsal aorta; from one or both of them arise coronary arteries to the heart. From the right come off both subclavians, and the left usually gives off a coelic branch. The carotids may arise independently from the right systemico-carotid, or may be formed by the branching of a single primary carotid. In snakes the right carotid is usually much reduced or absent.

Venous System.—The venous system is exceedingly complicated, differing in details in the four orders but with a common ground plan. The pulmonary veins pass straight from the lungs into the left auricle.

The venous blood is returned to the heart by the pair of precaval, and single postcaval veins which open into the sinus venosus. The branches of the precavals come from the head and fore limb, the subclavian often receiving an azygous vein from the anterior part of the body wall which represents part of the embryonic posterior cardinal. Nearly the whole of the blood which

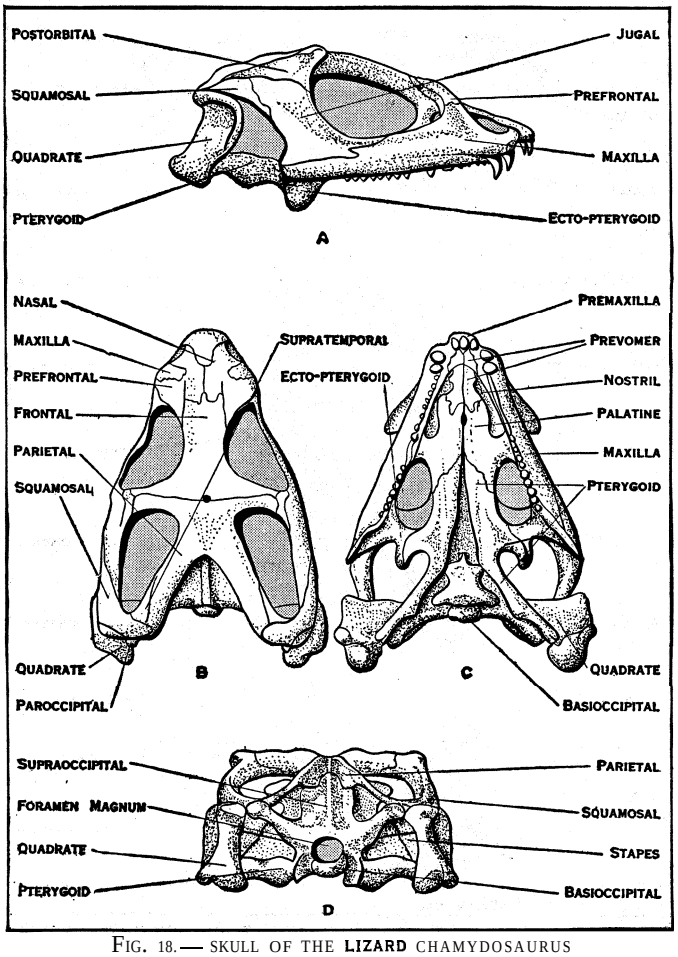


FIG. 18.—SKULL OF THE LIZARD CHAMYDOSAURUS
A. Right side, B. from above, C. from below, D. occiput

enters the heart through the postcaval has previously passed through one of the portal systems.

The renal portal system drains the tail, and part of the hind limbs, the afferent renals arising from the bifurcated anterior end of the caudal vein and the iliacs. The efferent renals open into the postcaval, whose hinder end is formed by them. The supra renal portal system consists of a series of afferent veins which come from the body wall; the efferents discharge with the gonadial veins into the postcaval.

The hepatic portal system includes the series of veins from the gut, which form the true hepatic portal vein and also the median anterior abdominal vein, which is originally formed by a fusion in the middle line of pelvic veins, themselves built up from the iliacs and a series of vessels from the hinder part of the body wall of the abdomen. The anterior abdominal passes along in a mesenteric sheet in the ventral part of the body cavity to enter the liver and there receive the hepatic portal or a branch from it. Finally, the whole of the blood in the liver passes by the hepatic veins into the posterior cardinal.

Lymphatic System.—Definite lymphatic canals are well developed in reptiles; those of the head unite into thoracic ducts which open into the innominate veins. There is a pair of posterior lymph hearts discharging into the iliacs.

Blood.—The red blood corpuscles are oval, biconvex and nucleated; they are larger than those of birds and mammals, smaller than those of Amphibia.

"Ductless Glands."—A spleen is constantly present in reptiles, placed near the stomach or within the loop of the duodenum behind the pancreas. The reptilian thyroid is a median structure placed somewhere on the ventral surface of the trachea.

There are two pairs of thymuses in Sphenodon and lizards, derived from the second and third pharyngeal pouches in the latter. In snakes there are usually two pairs derived from the

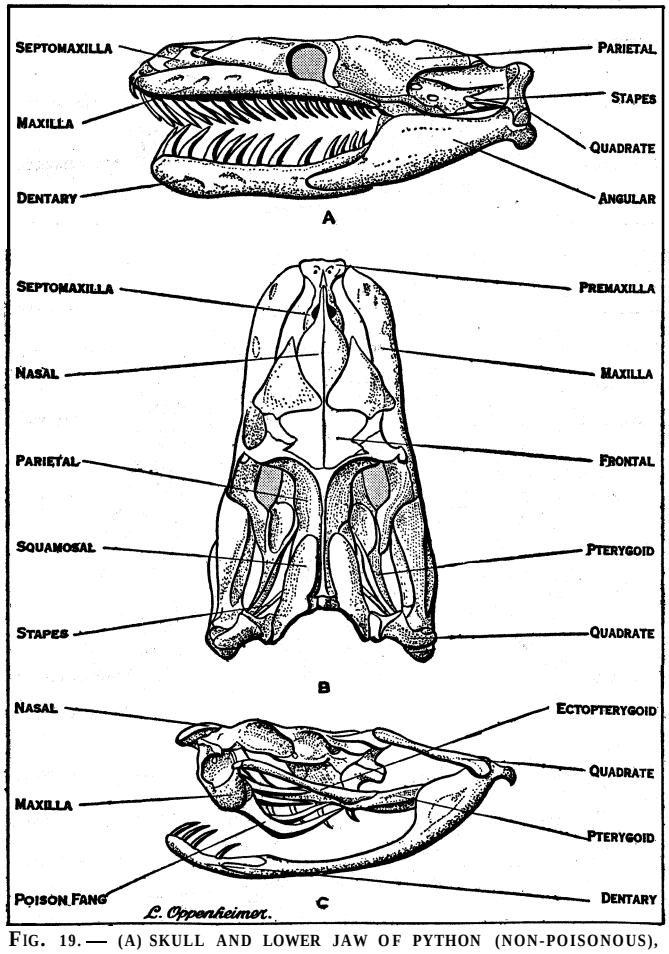


FIG. 19.— (A) SKULL AND LOWER JAW OF PYTHON (NON-POISONOUS), (B) SAME FROM ABOVE. (C) LEFT SIDE OF SKULL AND LOWER JAW OF RATTLESNAKE (POISONOUS)

dorsal extremities of the fourth and fifth pouches. A variable series of epithelial bodies, either dorsal or ventral, is present, and there is an ultimobranchial body of the left side, at any rate, in lizards.

Nervous System: Sense Organs.—Skin. Tactile corpuscles are found in the cutis of all reptiles. In crocodiles a group of them lies at the bottom of a pit, filled with non-conified cells near the anterior border of each of the large ventral scales. In Chelonia they lie in the thin layer of connective tissue between the epidermal scutes and the bony shell. In certain Agamids some of the scales of the dorsal surface bear long rod-like projections and are surrounded by nerve endings so that they may function as specialized tactile organs as do some mammalian hairs.

Taste.—It is clear that some sense of taste exists, the taste buds being probably on the tongue.

Smell.—The sense of smell is well developed in all recent reptiles. although it was much reduced or absent in the later Pterodactyls.

The external nostril, often provided with a valve, leads into a short vestibule, which opens out into the true olfactory chamber, whose wall is lined with the sensory epithelium which contain the olfactory cells. The area of the surface of this epithelium is increased by the presence of a ridge, the concha, which stretches into the cavity from the outer side. In crocodiles there is an additional concha, and there are reasons for believing that in Cynodonts, ethmo- and naso-turbinals were developed as in mammals. The nasal cavity finally opens to the palate by the internal nostril, which may be carried far back by the formation of a secondary palate.

Jacobsen's organ is, in Chelonia, a mere diverticulum of the ventral part of the nasal cavity. In Squamata it becomes an independent chamber, separated from the nasal cavity by the septomaxillary bone; it then has a special opening to the palate and may be very highly developed, receiving a large proportion of the olfactory nerve fibres. Its function is clearly to smell food after it has been taken into the mouth.

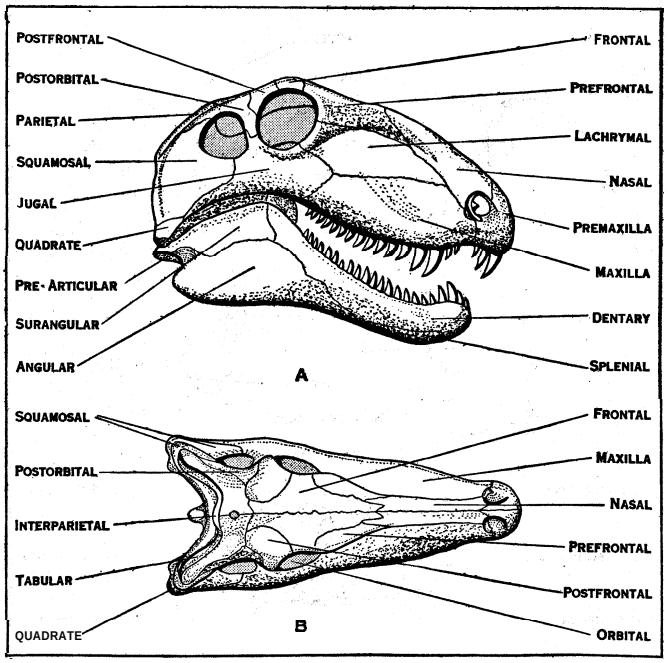
Jacobsen's organ soon vanishes in crocodiles. A special nasal gland is developed in the concha of reptiles, and the naso-lachrimal duct opens on the lateral wall of the nasal cavity.

Eye.—The eyes of reptiles are normally provided with movable upper and lower eyelids, and a nictitating membrane which is usually transparent and can be drawn across the cornea. The nictitating membrane may vanish in some lizards; in snakes it is permanently drawn across the eye, fuses with the remnant of the upper eyelid, and has a cornified scale on its outer surface, which is shed with the rest at ecdysis.

In some desert lizards the lower eyelid has a transparent window in the middle and is fused with the upper. In chameleons there is no nictitating membrane, and the upper and lower eyelids fuse, leaving only a small hole the size of the pupil. There are Harderian, conjunctival and lachrimal glands, whose secretion is discharged into the nose and palate by the naso-lachrimal duct.

The sclerotic coat of the eye ball often contains a ring of supporting ossicles, the cornea is convex. The crystalline lens is supported in a capsule by ciliary muscles, and accommodation can be carried out over a wide range.

The iris is usually brightly-coloured, and the pupil can contract either to a circular or a slit-like condition. The pupilary reflex to light is usually difficult to evoke. The retina is built up of



FROM "CONTRIBUTIONS FROM THE WALKER MUSEUM, CHICAGO UNIVERSITY"

FIG. PO.— SKULL OF THE PELYIOSAUR, SPHENACODON; (A) RIGHT SIDE. WITH LOWER JAW, (B) FROM ABOVE

small elements, both rods and cones being present in some forms, rods or cones alone in others. The retina, like that of birds, often contains pigmented oil granules, yellow, red, green, and, in Chelonia, blue and violet. Nutrition of the contents of the eye ball is secured, in many reptiles, by the presence of a pecten, a pigmented vascular projection, at first conical and when more highly developed fanshaped which arises from the fundus. A pecten is absent in Sphenodon and rudimentary in Chelonia. In snakes its place is taken functionally by a vascularization of the choroid. In chameleon there is a macula and fossa like that of

birds or primates. The eyes of reptiles are always laterally directed, but can be moved through a small arc of about 20°. They possess the normal series of six eye muscles and a retractor bulbi in addition. Reptiles appear to possess a colour sense, but accurate observations are lacking.

Pineal Eye.—In Sphenodon and lizards the epiphysis of the brain lies in a foramen between the parietal bones, and is covered by a transparent scale. It ends in a vesicle whose outer wall is lens-shaped, whilst the lower surface is a pigmented retina. It appears to exhibit no perception of light. The immense size of the pineal foramen in some fossil reptiles suggests that the pineal eye was functional in them.

Ear.—All reptiles have an inner and middle ear, an outer ear being present in crocodiles and the extinct Cynodonts. The inner ear is more advanced than that of Amphibia in that the utriculus is connected to the swollen sacculus by a duct from which the endolymphatic duct rises. There is a lagena which, in crocodiles, becomes much elongated and provided with a rudimentary organ of Corti seated on a basilar membrane.

The endolymphatic duct ends blindly, usually within the skull, but in Geckos is extended into a sac under the skin of the neck. There is a special perilymphatic duct which forms a closed tube definitely associated with the lagena. In crocodiles this begins to form definite scalae comparable to those of the mammalian cochlea.

The cavity of the middle ear is formed by an upgrowth from the first visceral pouch; in Sphenodon and lizards the cavity communicates with the pharynx by a wide opening, in Chelonia by a narrow Eustachian tube. In crocodiles the Eustachian tubes of the two ears meet and form a duct running in a special canal between the basisphenoid and basioccipital to open in the middle line just behind the choanae; lateral branches from the duct pass in canals between the basisphenoid and the pterygoids up into the supraoccipital and cranial roof, there enlarging into air spaces which again communicate with the tympanic cavities. Finally, a tube rising from each cavity leads air down into the quadrate and lower jaw. The history of this elaborate arrangement can be made out from fossil materials. In snakes, the tympanic cavity is totally obliterated. The outer wall of the tympanic cavity is the tympanic membrane, which, in crocodiles and most lizards, is a thin sheet sunk below the surface of the head at the lower end of an external auditory meatus. In Sphenodon and Chelonia it lies flush with the surface, and its outer surface is indistinguishable from that of the neck. In snakes and chameleons it is absent.

The tympanic membrane is connected with the fenestra ovalis by a rod, whose inner end is an ossified columella or stapes, whilst the unossified outer end is the extra columella. This is small and simple in Chelonia, absent in snakes, where the end of the stapes articulates with the quadrate, and in Amphisbaenans. In lizards, the extra columella has a dorsal process attached to the end of the paroccipital process, and often detached, a ventral process applied to the quadrate, and a plate for insertion in the tympanic membrane. The whole structure is of hyoidean origin, and the hyoid articulates with the end of the paroccipital process. In Sphenodon it fuses with the end of the extra columella, and in crocodiles it arises from its shaft to pass down the air canal to the lower jaw and become continuous with Meckel's cartilage.

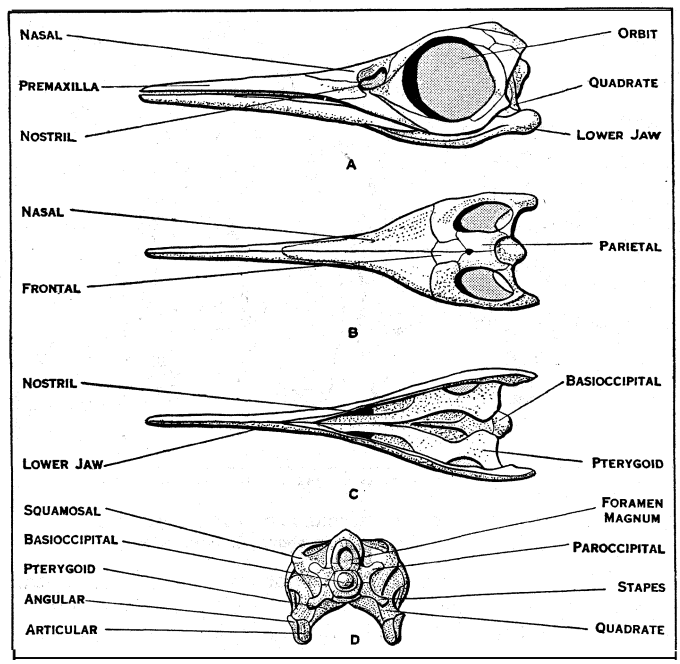
Most or all reptiles are capable of hearing, but we know nothing of their ability to discriminate musical notes.

Peripheral Nervous System.—The spinal nerves of reptiles agree in all important characters with those of other Tetrapods, the only interesting peculiarity being the presence in snakes of rudimentary pectoral and pelvic plexuses, relics of the limbs of their ancestors.

The sympathetic system presents an advance over that of most Amphibia in that many of the ganglia in the thoracic region are fused into a single large ganglion, and that the cervical sympathetic is separated into deep and superficial portions, each running continuously from the ganglion of the vagus to the thorax, the details varying in different orders. This arrangement is derived from that of Urodeles and leads directly to birds.

The cranial nerves of reptiles differ from those of living Amphibia in the absence of all trace of the lateral line system, except the auditory nerve, in the presence of a spinal accessory nerve XI. and in the fact that the hypoglossal nerve XII. passes out through the exoccipital bone.

Brain.—The reptilian brain is larger proportionately than that of an amphibian of the same size. The cerebral hemispheres



BY COURTESY OF THE CARNEGIE MUSEUM

FIG. PI.—SKULL AND LOWER JAW OF THE ICHTHYOSAUR OPHTHALMOSAURUS; (A) LEFT SIDE, (B) FROM ABOVE. (C) FROM BELOW

are pointed and usually pass gradually into the olfactory lobes. Their hinder ends are free and often project posteriorly so as to conceal the diencephalon.

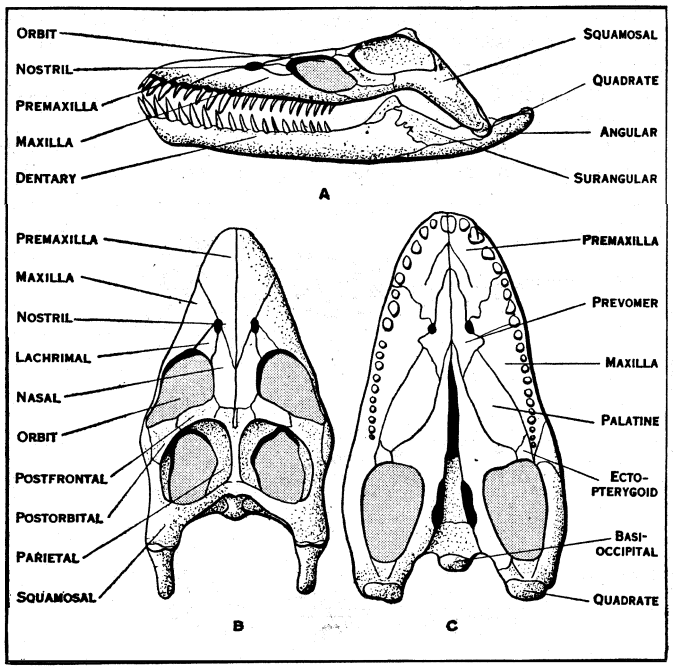
In Sphenodon and in Chelonia the whole of the upper surface of the hemisphere, from the hippocampus on the inner surface to the lateral face, is covered by a pallium, devoted to the sense of smell. This layer of cells then turns inward from the surface, and lies on the top of the corpus striatum, forming a hypopallium. In lizards, and especially in crocodiles, the dorsal surface of the hemisphere becomes less and less nervous until, in birds, it is a mere membrane playing no part in the functioning of the brain. In these reptiles the hypopallium becomes broken up by a penetration of nerve fibres, loses its pallial appearance and becomes assimilated to the corpus striatum. Thus, presumably in these animals, and certainly in birds, behaviour is controlled and memory exercised by a part of the brain quite different from that which fulfils these functions in mammals. In some reptiles, at any rate, the first trace of the neopallium, which is the important and developing part of the brain in mammals, is represented by a small cortical area in which alone other senses than smell gain a direct representation.

The mid brain of reptiles has its roof thickened and raised into a pair of optic lobes, which not only receive the endings of the optic nerves from the retina but are the motor area, stimulation of which brings about movements of the body.

The cerebellum of reptiles is always larger and better developed than that of Amphibia, though in living forms it is not externally divided into regions, as is that of a bird or mammal.

The brain of the extinct pterodactyls is interesting because, in the reduction of the olfactory lobe, the large size of the cerebellum and the lateral position of the optic lobes, it exactly resembles that of a bird, is indeed more like that of recent birds than is the brain of Archaeopteryx, which is the most primitive member of that class.

Reproduction.—Fertilization of the reptilian egg always takes place internally, in contrast to the condition in many Amphibia.



FROM THE CATALOGUE OF MARINE REPTILES OF THE OXFORD CLAY. BY COURTESY OF THE BRITISH MUSEUM

FIG. 22.—SKULL OF THE PLESIOSAUR. MURAENOSAURUS
A. From the left side, B. from above, C. from below

The egg is always large and provided with so large a store of food materials in the form of yolk that the growing embryo, without any additional materials, can hatch in a form capable of fending for itself, and is usually a miniature copy of its parents.

This ovum is surrounded by a semi-fluid layer of albumen, and enclosed in a membranous shell which may be calcified as is that of a bird. Usually the egg is laid before development has gone far, but in some cases it is retained within the oviduct until the foetus is ready to he born. These animals, including many lizards and snakes, are thus viviparous. In their case the egg shell is thin, and food materials may pass through it; indeed, in some cases it is practically absent, and the little lizard secures nourishment from its mother through a special placenta.

Cleavage is meroblastic, resulting only in the formation of a primitive plate of cells. Gastrulation involves an actual invagination, resulting in the formation of an archenteron which has both floor and roof. The process is, indeed, similar in principle to that in the Gymnophionan Amphibia. No primitive streak is formed behind the blastopore in Chelonia, Sphenodon, lizards or snakes.

The later development much resembles that of birds or monotremes. A headfold is formed, followed by tail and lateral folds, which gradually raise the embryo from the yolk and extraembryonic structures. An amnion arises from the extraembryonic somatopleure, as in birds, and an allantois is formed later by a ventral outpushing of the hind gut.

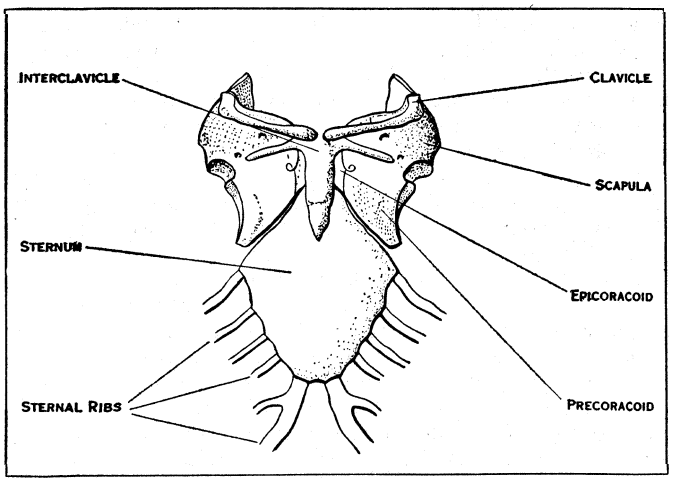


FIG. 23.—SHOULDER GIRDLE OF A LIZARD AMBLYRHYNCHUS FROM BELOW. SHOWING THE RELATIONS OF THE CLAVICLES, INTERCLAVICLE PRECORACOID AND STERNUM TO ONE ANOTHER

It serves not only as a reservoir for the excretory products of the embryo, but also as a respiratory organ. The embryo breaks its way out of the shell by the aid either of an egg-tooth, placed mesially on its nose or of a caruncula on its head. (*See* also VERTEBRATE EMBRYOLOGY.)

Mode of Life.—No general statements can be made about the habits of reptiles. Counting extinct forms, they have occupied all the habitats which are today filled with mammals, except that they are excluded from polar regions by the impossibility of hatching their eggs there, and in extreme cases of achieving a sufficiently high rate of metabolism. The temperature of the body of reptiles, like that of Amphihia, and unlike that of the birds and mammals, is determined by that of their surroundings, rising when the animal is in a warm place, and sometimes becoming very high in bright sunlight, and falling at night, perhaps to freezing point. The animal's muscular activity always keeps it a very few degrees above the air temperature.

Distribution.—Apart from the limitation imposed by temperature, no general statements can be made about reptilian geographical distribution; any useful account would occupy much space, and involve a discussion of the interrelationships of the families of lizards and snakes, a disputed field.

The oldest reptile bone is an isolated femur from the Lower Carboniferous of Scotland Eosauravus, from the Upper Carboniferous of Ohio, is probably a reptile, and Solenodonsaurus, from the top of the Upper Carboniferous of Czechoslovakia is certainly one. The evolution of the reptiles was rapid, nearly all orders being fully established by the end of Triassic times. Several important orders became extinct at the end of the Trias, but the reptiles were the dominant group of vertebrates to the end of the Mesozoic, when, within a short period though not simultaneously, many orders became extinct, leaving only the four which still survive.

Economic Importance.—Reptiles are of slight importance to man. Poisonous snakes are responsible for many deaths of man and domesticated animals in all tropical and some temperate regions. The marine turtle, *Chelone midas,* found in tropical ocean waters, provides the best of all soups; several fresh-water forms are often eaten, the most familiar of these being the terrapins, of the genus ***Chrysemys.*** The eggs of various species are also eaten. The skins of crocodilians, and of certain of the larger lizards and snakes, are tanned and used as leather. This consists only of the cutis, the horny epidermis being removed. This leather is extraordinarily tough, and the presence of the papillae which underlie the scales gives it an attractive surface The pigment, or at any rate such of it as is melanine, may remain in the leather and give it characteristic patterns Use of reptilian leathers for women's shoes and handbags led to the destruction of many of these animals Some alligators are bred for the purpose.

See also CROCODILIAN; DINOSAURIA; LIZARD; SNAKES; ICHTHYOSAURIA; PLESIOSAURUS; PTERODACTYL; TURTLE; etc, and the general articles EMBRYOLOGY; PHYSIOLOGY; ZOOGEOGRAPHY; etc.

(D. M. S. W.)

REPTON, a township in Derbyshire, Eng., about 8 mi. S.W. of Derby by road. Pop. (1951) 1,59j. Its famous boys' school was founded in 1557 by Sir John Port; the modern buildings incorporate considerable portions (restored) of an Augustinian priory established in 1172. There was a monastery in the 7th century, the first bishop of Mercia being established there. The parish church of St. Wystan has pre-Conquest work in the chancel, and beneath is a remarkable Saxon crypt. part of the wall of which may have been included in the original monastery chapel

REPUBLIC, a term denoting (1) a state not ruled by a monarch or emperor, generally a public interest and not a private or hereditary property; (2) a state where power is not directly in the hands of or subject to complete control by the people, in contrast with a democracy (*q.v.*); **(3)** more loosely, any regime where government depends actually or nominally on popular will. The latter meaning is implied more generally in the adjective, "republican," than it is in the noun.

"Republic" derives from the Latin words res *publica,* public affair or thing. That concept was in turn loosely equivalent to the classical Greek ta ***koinonia,*** common things or property, a term originally applied in the early city-state to the city's treasure, the public funds, and then by analogy coming to symbolize and denote the common interests. From these root origins derive in turn the concepts of commonwealth. which was the official title of Great Britain under Oliver Cromwell's rule, the first republic in the English-speaking world, and common weal or common welfare, at that same time a widely held designation of the proper end or purpose of government.

The term republic has generally been applied by historians first to the government of ancient Rome after the expulsion of the Etruscan kings, the Tarquins, and prior to the establishment of the empire by Augustus. During that period, indeed, political

institutions, constitutional arrangements and the locus of effective political power varied widely, though the regime might be generally described as one of aristocratic, or patrician, ascendancy moderated by popular. or plebeian, influence and assent. But the dual concepts which subsequently characterized the republican idea, absence of monarchy and a collective public interest and business, were present.

Some historians have also applied the term to the ancient Greek city-state. There, however, governments were normally classified by the numbers exercising power, such as monarchy, aristocracy and democracy. and their perversions. tyranny, oligarchy and ochlocracy (or, frequently, again democracy), where rule was arbitrary rather than directed by the principle of the good of the city. Nevertheless, one root idea of a republic. that of common interest and participation, was present in the contrast between Greek city-state and barbarian empires, with their irresponsible rulers and submissive mass of subjects.

In any event, republic, when applied to ancient governments, has implied some popular and collective power and the absence of hereditary or autocratic rule, as contrasted with government by kings or emperors.

The modern usage of "republic" derives from these dual ideas, absence of monarchy, and some degree of avowed concern for the common welfare of the state and for public control or participation. During the later middle ages there were established some brief-lived local republics, consequent on revolt. But it was in certain city-states of Italy during the Renaissance, of which the most celebrated are Venice and Florence (during a limited period after the expulsion and before the return of the Medici) that the republic re-emerged as a meaningful designation and form of government. Here again absence of monarchy, of an established lordly ruling family or of a self-imposed absolute ruler was the first test. In such republics a share in control of government was often confined to noble or wealthy privileged families. while the form of government tended to be by a small group, co-opted or elected on a narrow franchise, though sometimes with a titular head of state, such as the doge in Venice. On occasion, too, as a result of popular pressure or revolt, government might for a while come to rest on a broader base, and to include representatives of at least the lesser burghers and the artisans.

But republics which combined the ideas of absence of monarchy, a realm of public affairs and popular consent or participation first emerged, generally as temporary phenomena, in the 17th and 18th centuries. Cromwell's commonwealth, though it developed into rule by one man not unlike the more moderate modern dictatorships, had its genesis in antimonarchical doctrines and forces, expressed in the Great Rebellion against Charles I. During that conflict, too, the concept of the interest of the community at large in government became firmly associated with the republican idea. The Dutch republic, though it was headed by a stadholder. initially the equivalent of a modern strong president, combined opposition to monarchy (and to Catholicism) with a concept of independence not unlike the later idea of national self-determination, with implications of a common collective interest and a certain degree of public participation and control. Similar considerations also played a part in the early evolution of the Swiss republic. which after many vicissitudes became the modern federal republic of Switzerland. Here, however, the independent city-states of the Reformation, republican even when theocratic and in some cases free still earlier, provided a foundation.

The antimonarchical idea constituted a major element in both the American and the French Revolutions. The former created a lasting republic. the United States of America, while the second created a temporary republic in France but firmly established the republican idea and spread it throughout most of western Europe. In both revolutions the twin ideas of consent of the governed and the rights of man played a major part. A little later the separation of the Spanish-American colonies from Spain produced numerous republics which rested on similar ideas. During the 19th century, however. the moral significance of the republican idea declined in Europe, where monarchies continued and republics remained the exception. Constitutional government spread in the monarchies, and by the early 20th century the term "republic" no longer connoted the substance and content of political institutions and practice. "Democracy" tended to supplant "republic" in describing governments free from arbitrary and imposed authority. Democracy was widespread in Great Britain (also the British Commonwealth) and the Scandinavian countries—all monarchies. In Latin America, on the other hand, nominal republics were often dictatorships on behalf of oligarchies.

In these and other instances, the term "republic" had been stripped of its earlier appeal as the alternative to divine-right monarchy and autocracy.

After World War I, the emergence of dictatorships, which might function formally within a monarchical state (Fascism in Italy), might reject the idea of a republic without restoring monarchy (Francisco Franco's Spain), though restoring the title of empire (Hitler's third *Reich*), or might continue nominally as republics, rendered the classification of regimes into monarchies or republics practically meaningless. After World War II, moreover, the term had still less relevance. The United States of America, Franco's anti-Communist dictatorship in Spain and Joseph Stalin's Communist dictatorship in the U.S.S.R. were all nominally republics. In essence, the basic classification of governments was into constitutional governments and dictatorships, a division which corresponded in ethos to the former opposition of republic and monarchy. The term republic no longer had a manifest connection with struggles over liberty, authority and sovereignty.

The adjective "republican," however, was still sometimes used with connotations equivalent to its ancient meaning in political ethics.

In the United States the term "republic" has special connotations and is frequently used with supposed historical justification to contrast with democracy and as a ground for denial that the U.S. is technically a democracy. The bases for this contrast are (1) the ancient and purist use of the term "democracy" to denote small-scale direct democracy; (2) the classical fear, which continued at least to the end of the 18th century, of such democracy as unstable and fickle; (3) the Ciceronian interpretation, which widely influenced the U.S. founding fathers, of the Roman republic as a mixed and balanced government; and (4) the revival by Montesquieu in the 18th century of the idea of democracy as direct and small scale, and his insistence that democracy mas impossible in a larger state, which could be at best a representative republic. These ideas were studied and combined by a number of the founding fathers, and especially by James Madison. who used the term "republic" (1) as a technical designation for representative government as opposed to direct democracy and (2) to insist on the necessity for a system of checks and balances against the dangers of straight majoritarian decision in a legislature elected by majority on a single principle of representation. The insistence that republic is not synonymous with democracy either as direct democracy or as absolute majoritarian democracy, but rather is synonymous with constitutional democracy. is correct in the specific U.S. context, though that usage is a narrowing of the wider use of the term to denote any nonmonarchical regime. The guarantee to the states of the union of a republican form of government (in a nation whose given title deliberately excluded the designation republic) seemingly refers primarily to the more generic usage and it does not imply specific forms or checks.

See also GOVERNMENT; DEMOCRACY.

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REPUBLICAN PARTY (U.S.), was organized in 1854. Various small group meetings, the earliest in Ripon, Wis., mere held in a half dozen states. A mass meeting at Jackson. Mich., attended by former Whigs, Democrats and Free Soilers on July 6, 1854, adopted for themselves the name Republican. This was an appealing title not only for those who recalled Jeffersonian "republicanism," but for those who placed the national interest above all sectional interests and were opposed to states' rights. The

issue presented by slavery in Kansas had called this party into existence. It was from the beginning strongly nationalistic. The pronouncement that slavery was a moral, social and political evil was coupled with denunciation of the Kansas-Nebraska legislation and the Fugitive Slave law.

An informal gathering, national in scope, meeting in Pittsburgh, Pa., on Feb. 22, 1856, planned the first national convention, which assembled in Philadelphia, Pa., on June 17. Its platform denied to congress the right to recognize slavery in a territory, and held that congress had the right to abolish slavery in the territories and ought to do so. This view. no longer that of extremists, was representative of widespread sentiment in the north. John C. Frémont, widely known for his western exploration, who in 1849 had been elected to the senate from the state of California, was the nominee for the presidency. He won 114 electoral votes, but was defeated in a three-cornered contest against Millard Fillmore, candidate of the American ("Know-Nothing") and Whig parties, and the cautious and conservative Democrat, James Buchanan, who was elected.

Ensuing events rapidly consolidated and intensified the anti-slavery movement, and on May 16. 1860, a Republican national convention assembled in Chicago, Ill. This organization came to power in 1861 with Abraham Lincoln as president. In a four-party contest the Republican victory was that of a minority. Yet the new Republican party had rapidly displaced the Whig party in the north as the opponent of the Democratic party.

Lincoln's primary policy was the preservation of the union at any cost. The outbreak of rebellion in southern states and the secession of 11 states played havoc with existing party lines. For four years the armed conflict came to no positive conclusion. In the autumn of 1864 the president faced the necessity of going to the people at the stated election time, and did so with slight hope of a vote of endorsement. His supporters confessed their weakness. In calls for a convention and in the convention, they termed themselves the Union party. This party, with Lincoln as its nominee and a war Democrat, Andrew Johnson: as vice-presidential nominee, did defeat the Democrats who had in their national convention that year declared the war a failure. The war was continued to a successful conclusion, but the assassination of Lincoln, who died on April 15, 1865, brought a complete realignment of political forces.

Within a year of the end of hostilities, the Republican party had reappeared and was functioning as an organization bent upon retaining control of the government and taking a form that was to prove the most powerful yet seen in the history of parties in the United States. Throughout the following 30 years, the Republicans and the Democrats — who by the autumn of 1866 appeared as the one agency of strong opposition — fought for control of the national government, the Republicans usually winning.

The fight for improvement in the civil service, for genuine tariff revision, for a democratic land policy, for protection of the Indians — persisted within the parties. Within the Republican party, insistent insurgents and faultfinding groups protested in vain at the rigidity of party control. Two groups left the party, the Liberal Republicans in 1872, and the Progressives in 1912. Yet on each occasion many leaders and millions of voters remained.

In the years of chaotic reconstruction, the Republicans ruled harshly in the south and attempted to confer their political power upon the unprepared Negro. In these years the Republican party organization was revealed as of selfish design and cowardly practice, ruled by a small and usually self-perpetuating group of politicians who made party regularity a fetish. Their list of nominees for the presidency included Generals Ulysses S. Grant, Rutherford B. Hayes, James A. Garfield and Benjamin Harrison. and Maj. William McKinley. To the support of these tickets rallied voters from the villages and country districts of the old east and of the new west, mostly men of small means attached to the traditions of their pioneering forefathers. The Republican appeal was frankly to businessmen as the 19th century ended.

The tariff was included in the Republican platform as an issue in the campaign of 1896, but as this battle approached much greater prominence was given the question of the free and unlimited coinage of silver. William McKinley of Ohio was nominated by the Republicans on a gold standard platform and won the election.

Republicans in congress had in 1896 favoured recognition of the independence of the Cubans, who were in revolt against the government of Spain. In the Republican party platform that year was expressed the hope that not only would the Cubans win in their struggle for liberty, but that the government of the United States would actively use its influence to restore peace and give independence to the island. In his inaugural speech in March 1897, McKinley indicated his unwillingness to take steps that might appear to call for a war of conquest. But in April 1898, the president, responding to a strong popular demand, recommended the intervention of the United States. The congress then declared the war that for many months had seemed to members of both parties desirable and inevitable. The war nevertheless exposed issues in world relations that led to a sharp division between the two parties. A treaty of annexation of the Hawaiian Islands had been negotiated by Pres. Benjamin Harrison in 1893 and withdrawn by Pres. Grover Cleveland. The Republicans. who came to favour such annexation, argued military and commercial necessity. Despite strong Democratic opposition, in the summer of 1898 by joint resolution of congress the republic of Hawaii was annexed to the United States with territorial status,

The nation entered upon the congressional campaign of 1898 before the end of the war with Spain. The Republicans gained 8 seats in the senate, although the Democrats gained in the house by 29. The administration now called for the cession of the Philippines to the United States, and Spain was forced to yield.

A new era in Republican party domination was dawning. Theodore Roosevelt, who in 1898 had been elected governor of New York. was supported for the vice-presidency in the campaign of 1900 by Republican party boss T. C. Platt, who was anxious to get him out of New York politics. Roosevelt had a large and enthusiastic support among the delegates from western states, and was nominated against the wishes of both McKinley and Marcus Alonzo Hanna, who, however, bowed to the will of the convention. The problem of the party managers was one of first magnitude when, in the autumn of 1901, the assassination of President McKinley brought to the presidency the independent and imaginative Roosevelt. As the Republican party at this time was not possessed of a definite party program, as it had been in 1897, there was both opportunity and need for a leader who could reshape its appeal and its purpose. This President Roosevelt proceeded to do.

The business of the Republican organization had been primarily the task of running the government. Longer lease of power than usual had strengthened this tendency. The rising tide of social democracy made it certain, however, that no agency for the expression of the public will could long escape revaluation in the light of the demands of the common people for a larger share in self-government. In considering the course of action that should be his at this juncture, President Roosevelt chose to direct his attention to the trusts that had become powerful enough to disregard the government. The president's attack was directed not upon large business, as such, but upon powers that believed themselves superior to the government. The popularity of Roosevelt's position on the trusts and his aggressive action in the coal strike of 1902 brought to his support thousands who had for many years been interested in governmental control of corporations.

Roosevelt's acquisition of the widespread popular support that won him re-election in 1904 was made possible by the failure of the Democratic party to justify the expectations aroused in 1896. The party had seemed at that time to promise emancipation from the oppressions of organized wealth and a great minority of the voters had twice supported William Jennings Bryan for these reasons. When Roosevelt professed to desire these ends, many Democrats came to his support.

The overwhelming endorsement of Roosevelt in 1904 gave to his second administration a more personal character than had prevailed in the preceding three years. That Roosevelt subsequently brought about the nomination of William Howard Taft, who was elected in 1908, led to a widespread but erroneous belief that the Republican party organization was responsive to the Roosevelt

leadership. The overthrow of the Republican majority in the house of representatives in the congressional elections of 1910 ended the complete control of the national government which that party had held for 14 years. This election revealed the strength of insurgency in the west. A group of western Republicans henceforth opposed the national party upon all important measures.

In Feb. 1912. Roosevelt announced that if the Republican nomination were offered him by the national convention, he would accept. He was attempting to obtain what he had appeared to have in 1908, but which he had never won in open contest, either in 1901 or in 1904, that is, control of the party machinery. He was now prepared, on a platform advocating more direct government, to make the party organization responsive to the demands of the voters of the party. Presidential primaries in 12 states revealed that the majority of the voters participating were favourable to his candidacy. However, before the national convention assembled, it was known that there would be sufficient votes to nominate Taft. A third of the delegates, nevertheless refused to participate, foreshadowing defeat of the ticket. A mass meeting of citizens from 40 states met in Chicago in Aug. 1912 and organized what they termed the Progressive party (see PROGRESSIVE PARTY, THE). The platform called for a change in political machinery and for an aggressive program of social legislation. Roosevelt was nominated for the presidency and Gov. Hiram W. Johnson of California, was named for the vice-presidency. The contest that followed—with Taft the Republican nominee—assured election of the Democratic candidate, Woodrow Wilson.

Not until 1920 were the Republicans successful in placing another nominee in the presidency. Sen. Warren G. Harding of Ohio succeeded President Wilson for a period of 29 months. When Harding died suddenly, he was succeeded by Calvin Coolidge. By this time, the Republican party had become more than ever a coalition of sectional leaders and of divergent economic interests. The outstanding national figures were insurgents, riot regulars. Most conspicuous and powerful was Sen. Robert M. LaFollette of Wisconsin, who led an insurgent group out of the party in 1924. Coolidge was re-elected in the three-party contest on a wave of prosperity, which continued until after the election of Republican Herbert Hoover in 1928. Hoover represented, to a large following of independents and liberals, a new conception of government in the interests of the people in a new scientific age. As an engineer by profession, Hoover had established himself as a great humanitarian in the administration of relief abroad and later in the direction of the United States Food administration under President Wilson. World-wide depression that overtook the United States economy when it had not yet recovered from the business panic of 1929, and defections within the Republican party in congress led to Hoover's defeat in 1932, when Franklin D. Roosevelt became president. His repeated re-election, the succession of Harry S. Truman upon the death of Roosevelt on April 12, 1945, and the re-election of Truman—kept the Republicans in a minority position for 20 years.

In 1952, with the nomination of an outstanding military figure of World War II, Dwight D. Eisenhower, the Republicans again swept into power under the dominance of a group of liberals, as opposed to the conservatives led by Sen. Robert A. Taft. In both domestic and foreign affairs pursuing a moderate course, Eisenhower attracted much non-Republican support.

The Republicans meeting in mid-August of 1956, enthusiastically renominated President Eisenhower and accepted again, as his running mate, Richard M. Nixon of California. The president waged an aggressive campaign, and was drawn by the attacks of the opposing party to a spirited defense of foreign policy including the continuation of hydrogen bomb tests and maintenance of the draft for military service. President Eisenhower polled 35,582,236 votes to 26,028,887 for Adlai E. Stevenson, the Democratic nominee. The Republicans failed to win control of either the house or senate, however, and in 1958 the Democratic party increased its majorities in both houses.

In 1960 the Republicans nominated Nixon for president and Henry Cabot Lodge, U.S. ambassador to the United Nations, for vice-president. Both candidates vigorously defended the Republican administration's record and emphasized U.S. diplomatic gains and domestic advances. Foreign policy debate with Democrats, especially over points concerning action to meet Communist influence or military threat, led to strong charges and countercharges in campaign speeches and in Nixon's joint television appearances with Sen. John F. Kennedy, the Democratic candidate. At the polls on Nov. 8, despite the closest popular vote in the 20th century, Nixon and Lodge failed to carry most of the more heavily populated states with their large electoral vote and were defeated.

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REPUBLICAN RIVER, a river of the central United States, rises in eastern Colorado in Kit Carson and Lincoln counties, flows east in southern Nebraska, bends southeast at Superior, Neb., and flows into the Kansas river at Junction City in northeastern Kansas, 445 mi. from its source. The entire course of the river is over flat, level land with light rainfall. The stream is dry much of the year, especially in the upper part. During the spring and early summer months and during flood periods runoff is heavy. A control dam at Trenton, Neb., completed in May 1953, has a total storage capacity of 254,000 ac.ft. Water is used for irrigation in the Frenchman-Cambridge irrigation project. Cattle, wheat and corn are the main products from the Republican drainage. McCook, Franklin and Red Cloud, Neb., and Belleville, Concordia and Clay Center, Kan., are important towns on the river.

(M. J. L.)

REQUEST, LETTERS OF. The legal terms "letters rogatory," or "of request" (commission rogatoire), express a request made by one judge for the assistance of another in serving a citation, taking the deposition of a witness, executing a judgment or the doing of any other judicial act. The only trace of such a practice to be found in England or the United States, independent of statutory enactment, is in the admiralty doctrine that the sentence of a foreign court of admiralty may be executed on letters of request from the foreign judge or on a libel by a party for its execution. The British and United States courts issue commissions to private persons, generally, however, to consular officers, but sometimes to foreign judges in their private capacities, for the purpose of taking the depositions of witnesses. Many countries object to this process and require letters of request, which have to be forwarded through diplomatic channels. In ecclesiastical law, letters of request are issued for the purpose of sending causes from one court to another. Letters of request are also issued for other purposes: to examine witnesses who are out of the jurisdiction; to enforce a monition; etc.

REQUESTS, COURT OF, originally a committee of the king's council in England. Petitions of poor persons were heard by the justices in eyre and on the fall of the eyre were referred by the council to the chancery. By an Order in Council of 1390 these petitions were transferred to a committee of the council and the lord privy seal became its president. At first the court followed the king, but about 1516 Wolsey assigned to it a permanent seat in Whitehall, when it became known as the court of Whitehall or the court of poor men's causes. Lastly, it obtained its official title of the court of requests. The judges were at first those privy councilors who happened to be present, together with judges and masters as assessors. Eventually four privy councilors, or masters of requests, were appointed at fixed salaries.

REREDOS, an ornamental screen of stone or wood built up or forming a facing to the wall behind an altar in a church. Reredoses are frequently decorated with representations of the Passion, niches containing statues of saints and the like. In small churches the reredos is usually replaced by a hanging behind the altar, known as a dorsal. (See also ALTAR.) The use of the word reredos for, the iron or brick back of an open fireplace is obsolescent.

RESACA DE LA PALMA, a battle between Mexico and the United States, fought near Brownsville, Tex., May 9, 1846. U.S. troops under Brig. Gen. Zachary Taylor, ready to renew the conflict after the indecisive battle of Palo Alto (May 8), pursued a column under the Mexican Gen. Mariano Arista, who had entered

a dense growth that continued interruptedly to the Rio Grande, 7 mi. to the south. About halfway through the thickets, Arista disposed his command behind an old river channel which crossed the road at right angles. The bed (Resaca de Guerrero) was full of ponds and mud, impassable in many places. The U.S. troops. about 1,700, came upon the Mexican guns planted in the road and hacked their may toward their enemy. There was little direction or plan to the encounter, but one of Arista's flanks was accidentally turned and his force was routed. (W. A. G.)

RESCHEN SCHEIDECK, Alpine pass leading from the lower Engadine to the upper valley of the Adige. Near the summit (4,947 ft.) is the hamlet of Reschen, while below is the former hospice of St. Valentin auf der Haid, mentioned as early as 1140. Starting from Landeck, the motor road runs up the Inn valley to Pfunds, where it mounts above the gorge of Finstermiinz to the village of Nauders (27¼ mi.) joining the road from the Swiss Engadine (53½ mi. from St. Moritz). There it mounts gently to the pass and then descends, with the Adige, to Mals (15½ mi.), where the pass is sometimes wrongly named Llalserheide. The road now descends the upper Adige valley, or Vintschgau. past Meran (37¼ mi.) to Botzen (20 mi. from Meran) where the Brenner route is joined.

RESEARCH, INDUSTRIAL. The use of tools and machines to wring a living out of nature and to gain a measure of comfort and security reaches back to the earliest times, but until the late 18th century the tools were simple and progress was slow.

The Beginnings of Organized Scientific Research.—A century and a half earlier Francis Bacon had turned men's minds from mediaeval theorizing to observation, experiment and measurement, and scientific research (as the term is understood today) began to establish itself as a new force enabling man to understand the nature of things and turn this knowledge, if he chose, to his material advantage. The pioneers of the Industrial Revolution did not wait for research to grow up, so that before long experiment began to overhaul empiricism and in due course the application of knowledge obtained from scientific research became a powerful factor in creating. step by step, our modern standard of living.

Relation Between Industrial and Fundamental Research.—It is usual to speak of the research which has been directly associated with producing these results as industrial research, but although the term is well justified and generally understood, there is in fact no hard and fast dividing line between the various categories of research. It is truer to say that scientific research is a spectrum shading from fundamental research at one end to technical advance at the other. But just as the difference between one part of the spectrum and another can be recognized, so can the difference between fundamental research, pursued without concern or regard for material advantage, and industrial research which is undertaken for the economic, social and other advantages to be obtained from it. Nevertheless, it is fundamental research that produces the great discoveries and ultimately revolutions. Michael Faraday's researches on electromagnetic induction opened up the road to modern power stations; and after J. J. Thomson had coaxed the secret of the electron out of matter, Ernest Rutherford could begin to pick the lock of the atomic nucleus. J. A. Fleming's discovery of the thermionic valve arose from sheer scientific curiosity about the blackening of the carbon filament lamp, but it led to the creation of new industries — radio, radar and television — based on electronics.

But if fundamental research is the goose that lays the golden eggs, the goose is quite incapable of hatching them out. This is the business of the industrial scientist and technologist who. between them, make it possible for the industrial machines to deliver their products in an ever-increasing stream of abundance. Industrial research is not, however, concerned only with exploiting fundamental discovery. It bases itself squarely on the accumulated store of natural knowledge, attends to the need of the particular industry-it serves and through its work in the laboratory and workshop brings new manufacture a stage nearer. This may be simply an improvement of an existing process, but it may be an entirely new one and the product may be new also.

Industrial research has extended its scope to include the systematic study of industrial operations, the handling of materials and the layout of plant. And since it is concerned broadly with the economic efficiency of industry. it works to raise the level of productivity through the better use of resources, human and material. Technological advance is apt to conflict with habits of work and current conceptions of management, and the industrial scientist finds himself involved increasingly in the deep and largely uncharted sea of human relations.

INDUSTRIAL RESEARCH IN GREAT BRITAIN, EUROPE AND THE COMMONWEALTH

Research in Industry.—By far the greater part of industrial research in Great Britain is undertaken by industry in its own laboratories. Accurate figures are not available but in a survey made by the Federation of British Industries in 1950–51 (see **Bibliography**) a questionnaire was sent to 1,400 firms and the 361 replies indicated that 301 firms spent £23,779,000 on research and development as compared with the following figures of earlier surveys. Thus, in 1930, £1,736,000 was spent on research and development; in 1935, £2,696 000; in 1938, £5,442 000; and in 1945–46, £21,815,000. In the 1945–46 survey it was concluded that the total amount spent by all firms could be estimated as of the order of £30,000,000. The figure in 1955 was certainly not less than 650,000,000.

There are no corresponding figures available for the European countries, but as in Great Britain, large industrial research staffs are maintained by the leading manufacturing firms and particularly those in the newer industries which have sprung from research or have been, from the beginning, dependent on the laboratory; e g., oil, chemical, electrical and synthetic fibres. The main emphasis is on applied research and development, but it is recognized that a certain proportion of fundamental research should be undertaken, both for its own sake and to attract and retain scientific staff of good quality. This is not only important in itself but exercises a beneficent influence throughout the company, extending to the development and production departments. Development is many times more costly than the research itself, but any comparison of costs must take into account the fact that all research does not end in development. Many research projects do not turn out as expected and in any event costs and the market have the final say in the choice of which projects should be developed.

There is no way of evaluating the results of research in terms of accountancy. Most good industrial research laboratories can point to some outstanding achievements over a period of years and claim rightly that if they had done nothing else they would have paid for themselves handsomely. But although this may inspire confidence it does not enable a board of a company to determine how much of its profits it should devote to research. Research expenditure in industry is frequently expressed as a proportion of annual turnover, and the proportions, as would be expected, vary greatly from industry to industry (3% is not uncommon in firms in the newer science-based industries). There is, however, no logical justification for comparing or estimating research expenditure on this basis; experience and judgment are the only guides and boards of companies who are alive to the needs of the times endeavour to maintain a level of research which will enable them to remain competitive in world markets

The Role of the Government in Industrial Research.— The government has a smaller but nevertheless distinctive place in industrial research because of its special and general responsibilities. In Great Britain, government departments are concerned. directly or indirectly. with maintaining health and safety; adequate housing; methods of growing, storing and distributing food; transport by road rail and air; the maintenance of communications; the provision of electricity and gas; the development of atomic energy; and the provision of fuel and its economical use to meet the requirements of the nation. The government has general responsibilities also for the maintenance of physical and engineering standards and for promoting a high level of industrial productivity.

The realization at the beginning of the 20th century of the loss caused by the profusion of standards used by engineers and the advantages to be gained by a system based on accurate measure-

ment and a careful investigation of the properties of materials led in 1901 to the setting up of the British Engineering Standards committee. In this work the National Physical laboratory, which was founded at about the same time, co-operated and continues to co-operate very fully. The scope of the committee's activities gradually widened, and in 1931 the British Standards institution came into being as the approved body for the preparation and promulgation of national standards.

George V, then prince of Wales, showed a keen perception of the needs of his time when he opened the National Physical laboratory in 1902 with these words: "The object of the scheme is, I understand. to bring scientific knowledge to bear practically upon our everyday industrial and commercial life, to break down the barrier between theory and practice, to effect a union between science and commerce. . . ." The aims of industrial research could not be more tersely expressed.

These aims were furthered in 1915 by the creation of a committee of the privy council, with the lord president of the council presiding, "to direct, subject to such conditions as the Treasury may from time to time prescribe, the application of any sums provided by Parliament for the organization and development of scientific and industrial research." Simultaneously, an advisory council was established to consider and report on proposals for instituting specific researches; for establishing or developing special institutions for the scientific study of problems affecting particular industries or trades; and for the establishment and award of research studentships and fellowships. To serve these bodies the department of scientific and industrial research was established in Dec. 1916 as a separate department of state with its own parliamentary vote, or grant. The new department assumed responsibility, jointly with the Royal society, for the National Physical laboratory, and later the geological survey of Great Britain became part of it. Separate establishments were formed to cover other main fields of applied research. In addition, a scheme was planned for co-operative research associations to be set up by various industries with financial assistance from the government; and a system of grants to young graduates to enable them to undergo training in research was instituted.

In 1955 the department of scientific and industrial research controlled 14 research establishments and financed in partnership with industry 42 co-operative research associations. Its grants to universities for special researches and its maintenance allowances to students for postgraduate training in research amounted to more than £700,000 annually. The gross expenditure of the department in 1953–54 was slightly less than £6,000,000.

The principle on which the department of scientific and industrial research is based has been followed in varying degrees and by various means both in European countries and the commonwealth. National research councils have been set up in some countries which not only act as policy-making co-ordinating bodies but in some cases undertake programs of research on their own account. A detailed analysis of the different types of organization was made by the United Nations Educational, Scientific and Cultural organization in 1952. (See *Bibliography.)*

National programs of industrial research undertaken under direct government control may vary according to local conditions but the general pattern conforms to what may be called the prototype organization, the U.K. department of scientific and industrial research. The principal national organizations are listed in the table; fuller details will be found in two surveys by O.E.E.C. and the British Commonwealth Scientific conference (see *Bibliography).* In some countries the government controls research directly, through these organizations; in others the organization does not itself undertake research, but sponsors it by means of grants.

In Great Britain and several other commonwealth countries steps were taken after World War II to develop research results of potential value arising in government laboratories or elsewhere as the national interest required. In Great Britain the National Research Development corporation was set up under the Development of Inventions act, 1948, as a national corporation with funds available for investing in any development work required "in the public interest." Its functions were slightly modified in 1954.

Chief Organizations for Industrial Research in Europe and the Commonwealth

Country	Organization and date of foundation*
Australia†	Commonwealth Scientific and Industrial Research Organization 1949 (1926)
Belgium‡	L'Institut pour L'Encouragement de la RCcherche Scientifique dans l'Industrie et l'Agriculture (*I.R.S.I.A.*), 1944
Canada†	National Research Council, 1916
Denmark‡	Der Teknisk-Videnskabelige Forskningstaad, 1946
France†	Centre National de la Récherche Scientifique (C.N.R.S.), 1939 (1901)
German Fed. Rep.‡	Deutsche Forschungsgemeinschaft, 1949 (1920)
Great Britain†	Department of Scientific and Industrial Research, 1916
India†	Council of Scientific and Industrial Research, 1942
Italy†	Consiglio Nazionale delle Ricerche (C.N.R.), 1923
Netherlands†	Nederlandse Centrale Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek (T.N.O.), 1932
New Zealand†	Department of Scientific and Industrial Research, 1926
Norway†	Norges Teknisk-Naturvitenskapelige Forskningsrad (N.T.N.F.), 1946
Pakistan†	Council of Scientific and Industrial Research, 1953
South Africa†	Council for Scientific and Industrial Research, 1945
Spaint.	Consejo Superior de Investigaciones Cientificas, 1939
Sweden‡	Statens tekniska Forskningsrad, 1942
Switzerland‡	Fonds National Suisse de la Récherche Scientifique, 1952

*Date of foundation of earlier organization from which the present one developed is given in brackets. †Undertakes research directly. ‡Sponsors research by grants.

A further aspect of development is illustrated by projects undertaken jointly, to spread the cost of the work, by several European countries under the auspices of the Organization for European Economic Cooperation. International co-operation in research increased greatly during and after World War II.

Co-operative Research Associations. — In this field Great Britain was again a pioneer, as the department of scientific and industrial research from the time of its establishment in 1916 encouraged and supported research in individual industries through the setting up of co-operative research associations, financed partly by the industry concerned and partly by the government. The initial intention was that ultimately the associations should depend solely on industrial sources, but this principle was abandoned in 1945 when it was announced that government grants would form a permanent part of the normal income. The grants are reassessed at five-year intervals and the general tendency is to increase progressively the proportion of industrial income to government grant as the research association becomes established. On the industrial side, members' subscriptions are assessed by the association generally in relation to the size of each firm. After the passing of the Industrial Organization and Development act in 1947, some of the research associations derived their industrial income from a statutory levy, while other industries introduced a voluntary levy for the same purpose. Contributions from nationalized industries are regarded as industrial contributions. The nationalized industries largely assumed their predecessors' responsibilities and commitments to the research associations.

The co-operative research association type of organization has proved particularly suited to Great Britain. It has been successfully adopted in certain industries in several of the other Commonwealth countries, notably New Zealand, South Africa and India.

Co-operative research groups also exist in Belgium, Denmark, France, the German Federal Republic, the Netherlands, Norway and Sweden and other European countries. Methods of financing vary according to the country, but in most cases industrial income is supplemented by government grants. Details are given in the O.E.E.C. survey mentioned previously. Norway and Sweden have introduced a novel feature in that they provide in addition a central establishment where equipment and services are placed at the disposal of various industrial research groups for definite programs, generally for limited periods of a few years. Each group has its own staff and finances its own work. There is no rent, but a service charge is made covering 50% of the cost, the rest being met by state grants.

Independent Industrial Research Organizations. — In contrast with the growth of co-operative research organizations in Great Britain and Europe, centralized research services for industry in the United States have developed on different lines, the emphasis after 1945 being on the provision of facilities for confidential sponsored work. The rapid growth of nonprofit sponsored research

institutes in the United States, of which Mellon, Battelle and Armour were the first to be established, was not reflected to any considerable extent elsewhere, but some of the U.S. institutes began to open branches in Europe. Thus the Battelle Memorial institute established in 1952 a European counterpart known as Battelle International with branches in Switzerland and Germany.

In Great Britain after 1945, two sponsored research organizations, the Fulmer Research institute and the Sondes Place Research institute, were opened and were well established by 1955, but neither was operating on the scale of the larger American institutes.

Education for Research.—An adequate supply of scientists and technologists is one of the first requirements of any industrial community. Germany was one of the first countries to realize this and toward the end of the 19th century established a series of technical high schools which played an important part in its industrial development. Other European countries later established similar institutions, while in the United States colleges such as the Massachusetts Institute of Technology, Cambridge, filled a similar role.

In Great Britain there are many educational institutions which provide training in technologies as well as academic and commercial courses. Most of them have strong regional associations, and often specialize in education for practice in local industries. Some, however, are truly national institutions, and a few work in close association with universities. Most of the universities themselves cater for some branches of technology, but on the whole they give greater emphasis to training in basic science. After World War II increased attention was given by the ministry of education, the University Grants committee, the Advisory Council on Scientific Policy, the Federation of British Industries and others to the urgent necessity for increasing the supply of science teachers in the schools and of the scientists and technologists needed by industry where there is a considerable leeway to make up. The importance of higher technological education was repeatedly stressed and the need to extend facilities for the teaching and study of the applied sciences and technologies was accepted by the government. Policy became not to create completely new technological institutes of university status, but rather to expand and develop certain existing institutions of which the first would be the Imperial College of Science and Technology, London, where due emphasis would be placed on the development of postgraduate work. Other major expansions were planned at Manchester, Glasgow, Leeds and Birmingham.

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GROWTH OF U.S. INDUSTRIAL RESEARCH

The object of industrial research is the discovery and invention of useful processes and products. Hence this discussion of industrial research should be read collaterally with the article INVENTIONS AND DISCOVERIES.

It is impossible to make an important scientific discovery or to invent a process or machine without engaging in experimentation. Even a discovery made by accident must usually be developed by experimentation before it can be adopted. The prehistoric savage who first made pottery or thought of fashioning a basket or learned how to use heat in a hundred different ways engaged in the kind of experimentation that is still the mark of the empirical investigator and inventor but nevertheless deserves to be classed as research. In this broad sense industrial research is as old as man.

Industrial research in the modern sense is organized, planned, skilfully directed, continuous and as self-perpetuating as industry itself. It has been a powerful factor in the astounding industrial growth of the United States since 1900. It gained momentum with the disappearance of the last frontiers and the depletion of natural resources once supposed to be inexhaustible. It accounts in part for the transformation of the United States from an agricultural into an industrial nation.

There is no question that the flowering of scientific discovery in the latter half of the 19th century had much to do with the rise of organized industrial research. Such successful inventions as the telegraph, the telephone, the electric incandescent lamp, the generation and distribution of electric energy had sprung from the discoveries of such men as Michael Faraday (1791–1867) and had been reduced to something approaching commercial practice by imaginative, dogged empiricists of the Edison type. Industry had little more to do than make the most of these discoveries and inventions. Its next obvious step was to make the discoveries themselves, and this it cautiously proceeded to do.

Industrial research was individualistic in Europe until about the middle of the 19th century and in the United States until about 1900. The individual investigators were independent inventors of the Morse-Bell-McCormick-Edison type or occasional chemists and mechanics in the employ of the few manufacturing companies that could not dispense with expert technical guidance. There is no industry in which a chemist cannot be advantageously employed, yet industry showed no great interest in chemistry. University chemists were long distrusted largely for the reason that they knew little about the industrial processes that they were to improve. It was not until 1902 that E. I. du Pont de Nemours instituted organized chemical research—the first in its field to do so. Because of this distrust of the chemist the United States lagged behind Europe in organized industrial chemistry. Not until 1889 did the U.S. petroleum industry employ its first professional chemist, William Burton, who devised a cracking process once important in oil refining.

Before the beginning of the 20th century it was still possible for a gifted mechanic to acquire the knowledge and skills that he needed to evolve important inventions in widely different fields. With the advance of science and technology the "universal genius" found himself unable to cope with problems that could be solved only by highly trained mathematicians, physicists, chemists and scientists drawn from a dozen different disciplines. Yet it is from a kind of "universal genius," the individualistic Thomas A. Edison (1847–1931), that American industry learned how industrial research could create inventions on which whole new enterprises could be built. His private laboratory with its machine shop, its facilities for making instruments and models and its large reference library was something new in the annals of professional, individualistic invention. The 70-odd men who were employed in this laboratory in the 19th century were not formally organized, yet they constituted an organization because they all worked under Edison's direction on different portions of a common problem. Edison therefore deserves the credit of having set an example. Despite his frank dislike of "theorists" and university professors and his reliance on the try-and-try-again method, which might compel him to suffer a thousand failures before he achieved success, he employed good physical chemists and mathematical physicists, among them Arthur E. Kennelly (1861–1939), who was an independent discoverer with Oliver Heaviside (1850–1925) of the ionosphere, a layer in the sky that reflects radio waves over oceans and continents to their destination.

The great industrial laboratories of today all have their theorists. The General Electric company sprang in 1892 out of Edison's work and the enterprises that he founded or with which he was associated. The company's laboratory was the first in American industry to cultivate fundamental research.

The growth of industrial research has been uneven. The older the industry the more backward is it likely to be scientifically and technologically and the newer, the more active. Such new industries as electrical communications, telephony, radio, petroleum refining and television have sedulously fostered research almost from their beginnings, and such old industries as coal mining have been laggard. Mass-production industries (again automobiles, petroleum, electrical communications, electrical machinery) spend the

most money on research and employ the greatest number of scientists, engineers and laboratory technicians. Research policies are determined partly by the spirit of an industrial organization, partly by the character of the industry and the pressure of competition.

Edison's example and success do not alone explain the rise of industrial research in the United States. A high-tariff policy was also a factor; for high tariffs assured large profits, so that there was no great incentive to improve industrial products and processes through research. The merits of a new invention or discovery had to be almost glaringly obvious before a businessman would buy it. Neither he nor his banker could turn to specialists who could appraise the potentialities of an innovation. Hence the individualistic inventor was of necessity a gambler. who usually spent his own money in carrying out his ideas and took the risk of recouping himself with what profits he could make. Organized and planned industrial research has not taken all the risk out of discovery and invention but it has reduced it, so that millions are poured into experimentation with the strong probability that the harvest will be reaped in 20 or 30 years. The problems to be studied and the ends sought are usually determined by managerial policy. Directors of research are frequently responsible executives and sit on boards of directors. Indeed so intimate is the relation of the laboratory to manufacturing and selling that investors of large sums are as much concerned with research policies of the companies in which they may take a financial interest as they are in balance sheets. Research is probably the most powerful factor in the growth of an industrial enterprise, and the possibility of growth always receives the shrewd investor's attention.

The growth of the trust also had much to do with the rise of industrial research in the United States. Federal courts had interpreted the patent laws with the utmost liberality so as to carry out the constitution's purpose of encouraging invention. These interpretations made it possible for a patentee to do what he pleased in fixing prices, limiting markets geographically, granting licences, stipulating what materials should be used by the licensee in carrying out the patented process or making the patented product. The federal courts have for years been curtailing the monopolistic privileges granted to patentees. Cnder the patent law, as it was generously interpreted, it was possible to do legally for 17 years (the life of a patent) what was illegal under the antitrust law. Hence the great corporations turned to the patent monopoly. Patents imply invention and discovery and hence research. This is one reason why after 1900 more and more industrial laboratories were established.

Another reason, perhaps the most important, was the influence of the state on industry in such emergencies as war. The continental blockade prompted Napoleon to encourage French production of materials that could no longer be imported. The effect of military pressure on industry was always apparent. In the United States, the National·Academy of Sciences was chartered in 1863 "to investigate, examine. experiment and report upon any subject of science or art desired by any department of Government." In World War I Pres. Woodrow Wilson implemented this purpose by establishing the National Research council (see *Co-operating Agencies* below), a body that has played a conspicuous part in the development of the United States as a military power, though its activities are by no means restricted to military matters. In World War II the amalgamation of government and industry was virtually complete. Every university, every research laboratory was under contract to the government to conduct research of both military and industrial importance. In total war it is impossible always to separate military from industrial purpose. The far-flung research activities of the federal government were largely under the direction and control of the Office of Scientific Research and Development. The invention of the atomic bomb by scores of organized physicists and chemists called for the creation of the industrial communities of Oak Ridge, Tenn., and Hanford, Wash., and the laboratories of Los Alamos, N.M. So huge was this undertaking that it had to be separately administered. In addition the army and navy maintained their own research establishments. In other words, science was completely mobilized, no matter where it was pursued or by which organization. This mobilization did not disintegrate with the end of World War II. The so-called "cold war" waged by the U S.S.R. in its successful aggressions and the fear of western democratic nations that they would have to fight for their freedoms and their manner of life made it necessary to preserve the system of government-controlled industrial and other research that had evolved in World Wars I and II.

Industrial research has long been a major industry in itself. By the 1950s more than $2,500,000,000 was being spent annually by American industrial laboratories, according to a survey made by the Research Development board of 2,000 companies which together spent about 85% of the funds available for research. These 2,000 companies employed about 100,000 engineers who were engaged in what may be truly called research. Two out of every three of the 100,000 were on the payrolls of companies with 5,000 or more employees.

The larger the company the more self-sufficient is it likely to be. In other words it makes in its own shops about everything that the research laboratory may need. with the exception of special instruments. The smaller the company the more likely it is to contract with outside organizations for the building of experimental machinery and apparatus. The research laboratories of these smaller companies specify clearly yet broadly what is wanted but leave the preparation of working drawings and the production of prototype equipment to the contractor. The number of workers required to support a research scientist or engineer was 1.5 on the average in the mid-1950s, but as low as 0.9 for companies with less than 500 employees and as high as 1.6 for companies with 5,000 or more employees.

The expansion of industrial research and development in the United States after World War I and again after World War II was without precedent. It is difficult to separate industrial research from applied research as a whole, in which term must be included research carried on for military, agricultural, medical and other purely utilitarian purposes, so that government cannot always be separated from industrial participation. In 1951, for example, the federal government paid for nearly half of the cost of industrial research and development. The total cost of research undertaken by industry, including $1,400,000,000 paid by the government, was $2,500,000,000 in 1952. The government's share of expenditures ranged from 85% in aircraft production to as little as 3% in petroleum refining.

Statistics show that fundamental or basic research, on which industry must depend for its own improvement, was still neglected in the 1950s; that military necessity had forced the federal government to direct the course of industrial research into certain channels; and that research paid for by industry was highly concentrated in a few industries and in the large corporations. Industrial research, whether carried on with government or with private support, is still enormously concerned with practical results and very little with fundamental science. Despite its remarkable technical progress the United States was utterly dependent on European discoveries in basic science in meeting the industrial demands of peace and war. When it was found that the European stock of knowledge had been virtually exhausted and that it could not be rapidly replenished because of the destruction wrought in World War II and the loss of many scientists, the United States at last created the National Science foundation and charged it, among other things, with the task of cultivating fundamental science. It is the only agency that can appraise the effect of all the specialized programs of the federal government and aid the president and congress in appraising the government's scientific policies.

There is no question that military necessity did much to stimulate organized industrial research in every advanced country. One powerful stimulus came from World War I in which new and importunate demands were made on American industry. So it happened that the number of industrial laboratories in the United States increased from about 300 to more than 2,200 between 1920 and 1940.

Individualistic and organized industrial research both call for the application of fundamental scientific knowledge or "theory" to the production of goods. The purpose of fundamental or theoreti-

cal research in any branch of science is to add to the sum total of human knowledge regardless of practical results or profits. In the early days of organized industrial research it was not considered the function of the laboratory to engage in fundamental or theoretical research. Most industrial organizations' research laboratories continue to adhere to this principle and insist on practical results and profits. A few of the very large corporations engage on a fairly large scale in what may be properly called fundamental or theoretical research. Thus the Eastman Kodak company devotes much attention to the theoretical problems of photochemistry, the Bell Telephone lahoratories study sound and speech, the General Electric company the chemical transformations that occur in exhausted lamp bulbs and vacuum tubes and the generation of light by means that have no immediate commercial chance of success. Technological progress is hardly possible unless theories are developed and new principles and laws discovered in the university, industrial. government or other laboratory. If a process breaks down in the effort to improve it, if a product is faulty for no apparent reason it is fair to assume that the basic theory applied must be discarded or corrected to reach the industrial goal in view. Thpugh it is concerned primarily with practical results, industrial research is too often belittled as a mere exploitation of the conclusions reached by idealistic theoretical scientists who are not concerned with profits. The distinction between fundamental and applied or industrial research is not sharp. At best it is merely a convenience too often overstressed. For example. before it mas possible to arrive at an experimental plane that could travel faster than sound (that is, at a speed higher than about 730 m.p.h. at sea level) an immense amount of fundamental research in aerodynamics had to be conducted: yet always a practical result was kept in view. Science is science whether it is pursued in the factory or the university laboratory. In fact, fundamental and applied science are interdependent. Advance in one affects the other. The interdependence is manifest in the increasingly important part played by universities in solving the scientific and technological problems of industry.

The results of practical research carried on by universities for industry or for the federal government have been impressive and have changed the pattern of technical education. That change is not approved by scholars who cling to tradition. University professors often patent their inventions and discoveries and assign the patents to their universities. The royalties collected are an aid in meeting educational obligations. The argument that these activities distract attention from fundamental research is hardly supported by the available evidence. In some of the schools the royalties are turned back into research or used to expand the technical teaching program. Nevertheless, educators are alarmed at a trend which reduced the funds available in colleges and universities by nearly $4,000,000 in 1951–52, whereas in the same period the funds available for applied research useful to industry increased by $50,000,000.

Most of the money given to the universities for applied research comes from the department of defense or its close affiliates. In fact the department is the principal support of applied scientific research in the United States.

More important is the virtual conscription of university professors of science and technology to carry on military or industrially useful research for the government on a contract basis. The amount of federal money thus expended runs into the millions, as the figures presented earlier. indicate. The chief objection to this method of subsidizing the universities. in the opinion of some observers, is a whittling away of academic freedom or, mole specifically. of the right of the university scientist to publish what he has discovered. The exigencies of military secrecy prevent publication. There is no doubt that science, particularly nuclear physics, has been held back by this contractual system. Not only must most of the advances made be kept secret but the professor who engages in research for the government is thoroughly examined to make certain that he is not what is called a "security risk." This invasion of academic freedom aroused resentment in many quarters and engendered fears for the future of university education.

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Industrial Research by Companies.—One of the largest research establishments in the United States is the Bell Telephone Laboratories, Inc., which employs numerous physicists, chemists and engineers ior original investigation and development of new iorms and improvement of existing forms of apparatus and equipment ior electrical communication. In the laboratories oi E. I. du Pont de Nemours and' company, Wilmington, Del., chemists and engineers have studied problems of the heavy chemical, paint, lacquer, solvent, plastics, textile, dye, rubber and explosive industries. Other great laboratories were established by the Aluminum Company of America at New Kensington, Pa.; Dow Chemical company, Midland, Mich.; Eastman Kodak company, Rochester, N.Y.; General Electric company, Schenectady, N.T., Lynn and Pittsfield, Mass., and Cleveland, O.; General Motors corporation, Detroit, Mich.; Gulf Research and Development company, Harmarville, Pa.; Hercules Powder company, Wilmington, Del.; Monsanto Chemical company, St. Louis, Mo.; Radio Corporation of America Manuiacturing company, Harrison and Camden, N.J.; Standard Oil Development company, Linden, N.J.; and Westinghouse Electric corporation, East Pittsburgh, Pa., and Bloomfield, N.J.

Numerous conipanies have taken advantage of the industrial fellowship system of Mellon Institute of Industrial Research in Pittsburgh, Pa., as a means of solving problems in manufacturing practice. In 1954, for example, 80 fellowships were sustained by as many different companies, largely chemical manufacturers, and other iellowships were supported by trade associations.

A large number oi companies in the field of chemical industry make research grants to educational institutions, chief among them being E. I. du Pont de Nemours and company. Other firms making many grants to universities include E. R. Squibb and Sons; Merck and company; Standard Oil Company of California; Upjohn company; and Standard Brands, Inc.

Many college laboratories are used not only for purposes of instruction but also to a great extent for industrial research work and for commercial testing.

A considerable number of companies, mostly small concerns that have no laboratories of their own or larger companies that encounter few problems or are engaging in research for the first time, are regular or occasional clients of consulting laboratories. There are several hundred commercial laboratories in the country. and some of them are strongly staffed and excellently equipped for scientific investigation, particularly in specific industries. For example, a firm of consultants which has a main laboratory and also branches in other cities employs a large staff of scientists and their assistants for varied research. Most oi these commercial organizations do testing as well as research work.

Trade Association Research.—The U.S. department oi commerce has expressed the opinion that "among constructive activities of trade associations none is more fitting nor more profitable than scientific research." The study of production and distribution problems to evolve more efficient and more economical methods has in fact become a leading association activity. We shall describe here associative industrial or technological research, and not commercial or economic investigations which, while entirely different in nature, are oiten related to the former.

Five different procedures have been applied with success in conducting associative industrial research: (1) a number of associations co-operate with government departments and bureaus in accordance with the research associate plan; (2) other associations sustain scientific investigations in Mellon Institute of Industrial Research at Pittsburgh, Pa., in Battelle Memorial institute, Columbus, O., or in other research foundations; (3) some associations support fellowships or scholarships in educational institutions: (4) still others carry on research in commercial establishments, such as the laboratories of proiessional consultants; (5) a number of associations have founded their own lahoratories.

Federal Government Research.—For many years the scientific and technical research facilities of various government departments have been available, by legislative enactment! to duly qualified workers (Supp. Rev. Stat., 2, 71–2, 1532; Stat. L., 27, 1010; Bureau of Standards *Circular No. 296*). This plan has been developed especially. in the national bureau of standards, where various research associates are employed by associations or specific groups. Each associate is subject to the bureau's regulations and has most of the rights and privileges

of the members of the bureau staff. The investigational results are immediately accessible to the industry concerned and are published by the bureau. Specialists on the bureau's staff may be consulted by the association and its rescarch worker, and the latter is also permitted to use the scientific equipment, special laboratories and shops of the institution.

In general this flexible. closely co-operative plan was successfully applied. There are in fact nor a few notable instances of economic savings to technology from research in the bureau. It has been reported (Department of Commerce, "Trade Association Activities," *Domestic Commerce* Series *No. 20,* 1927) that great savings have come to industry and the public from the bureau's brakelining research, from its tire investigations and from its motor fuel studies. Research in the bureau eventuated in the iounding of a dextrose industry in the U.S. The following are among the outstanding investigations: constitution of petroleum, colour standardization, dental materials, silver, nonferrous alloys. soldered plumbing fittings, aviation lighting, railroatl signal glasses and portland cement.

Many agencies of the federal government do research and development. The agricultural research service and the Forest Products laboratory of the department of agriculture and the bureau of mines of the department of the interior have advanced technology by researches on behalf of various industries. The bureau of mines conducts various investigations in mining, metallurgy, health and safety, and on the economics oi the production, preparation and utilization of minerals. The laboratory of the National Advisory Committee for Aeronautics has maintained for years a central research plant serving the industries concerned and government alike. Certain researches of the public health service oi the department of health, education and welfare—investigations of dusty trades, sewage disposal, water purification, illumination of buildings and motor fuels—have also benefited industry.

The research and development work of the Atomic Energy commission is especially wide and important. Action toward national security accounted for 85% of the total government research and development budget in the mid-1950s. About 87% of this activity was in the realm of physical sciences. The National Science foundation, which conducted a wide survey of current industrial research, iosters much pure science investigation that promised to be basically useful to technology. Operations research with its multilateral scientific approach is supplementing physical science investigation in attacking comprehensive problems of industrial management.

Industrial Fellowship *System.*—Some of the research of Mellon institute is sustained by associations of manufacturers, according to the institution's industrial fellowship system. These association fellowships pertain to air pollution control, industrial hygiene, refractories and other fields. embracing water pollution abatement. The multiple fellowship of the Industrial Hygiene Foundation of America represented a collective. effort by 350 companies in behalf of employee health. Fundamental research in industrial health is nurtured and member companies are provided with practical plant applications to prevent industrial illness. The water pollution fellowship aimed to make both basic investigations and practical studies of any subjects promising to improve the water economy of the U.S. The American Refractories institute's multiple fellomship, established in 1917, was continued without interruption thereafter. Its incumbents enriched both refractories technology and metallurgy by their studies of the evaluation of refractories for specific purposes and by the improvements effected in manufacturing and testing methods.

An association fellowship of this type enables direct research service to a numher of industrial concerns instead of to an individual company. Its activities also give rise to stable relations of co-operation among the members of the association by the exchange of technical experience and research results. An association fellowship usually acts as a clearing house of information for the sustaining organization and gives technical assistance and scientific advice to the members. One of the prominent advantages of association research is that it enables a small manufacturer, who cannot afford to have a research laboratory of his own, to profit from the investigational work in the same way as a larger manuiacturer. Association rescarch reduces the cost factor to a minimum and thus promotes the welfare of manufacturers in the field concerned, without respect to size. Moreover, problems may be studied that require more time and expense than should be borne by a single manufacturer or company in view of the wider application of the results. The correlation of research effort, such as is done in the fellowships supported by associations, prevents unnecessary duplication in scientific inquiries.

Association Fellowships in Educational Institutions. — This class of research became important in many industrial fields. It serves to train technical specialists as well a; to aid in solving production problems. The Illinois Institute of Technology. Chicago, Purdue university, \Vest Lafayette, Ind., Ohio State university, Columbus, Columbia university, New York city. Iowa State college, Ames, and the universities of Illinois (Urbana), Michigan (Ann Arbor), Wisconsin (Madison), Minnesota (Minneapolis), Chicago, Cincinnati (O.) and Pittsburgh (Pa.) led in encouraging industrial research by associations and also by individual companies. Various trade associations sustained such investigational work, the American Petroleum institute being a leader in making educational grants.

Association-Owned Laboratories. — Industrial. research is not conducted in any set type of laboratory nor in accordance with any fixed plan. The nature of the problems, the financial support available and the uses to which the research findings are to be put determine the method. If problems are extensive and association members are so appreciative of the value oi research that they will contribute to the building and maintenance of a laboratory, it is often advisable for an association to do its own research.

Co-operating Agencies.—The National Research council serves as a general clearinghouse of information on research work undertaken throughout the country. Its division oi engineering and industrial research endeavours to co-ordinate the scientific resources of the nation as regards engineering and secures the co-operation of engineering agencies in which investigational facilities are available. It works in co-operation with the Engineering foundation and various national engineering and technical societies. Associations or companies undertaking research may ascertain irom the council what work has been done or is in progress along similar lines, thus avoiding duplication of effort.

The American Standards association, the American Society for Testing Materials and the American Engineering council are some of the organizations whose effectiveness depends in many cases on the collaboration that they receive from trade associations as well as individual concerns that carry on research.

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RESEDACEAE, the mignonette family of dicotyledonous annual and perennial herbs and shrubs. There are six genera and about 70 species.

Reseda odorata is the fragrant mignonette (*q.v.*), a popular garden annual; R. *luteola* is dyer's rocket or weld (*q.v.*).

RESENDE, ANDRE DE (*c.* 1499–1573), the iather of archaeology in Portugal, became a Dominican friar but, about 1540, entered the ranks of the secular clergy and was made a canon of Bvora. He traveled in Spain, France and Belgium and corresponded with Erasmus and other leading humanists. He was also intimate with King John III of Portugal.

Resende died in Bvora, Sept. 9, 1573

Resende's main Portuguese works are *Histdria da antiguidade da cidade de Evora* (1553) and *Vzda do Infante D. Duarte* (1789). His chief Latin work is De *antiquitatibus Lusitaniae* (1593).

See Francisco Leitão Ferreira, *Notícias* da Vida de *André* de Resende, ed. by A. Braamcamp Freire (1916).

RESENDE, GARCIA DE (1470–1536), Portuguese poet and editor, was born at Évora, and began to serve John II as a page at the age of ten, becoming his private secretary in 1491. He was present at his death at Alvor on Oct. 25, 1495. He continued to enjoy the same favour with King Manoel, whom he accompanied to Castile in 1498 and from whom he obtained a knighthood of the Order of Christ. In 1514 Resende went to Rome with Tristão da Cunha, as secretary and treasurer of the famous embassy sent by the king to offer the tribute of the east at the feet of Pope Leo X.

In 1516 he was given the rank of a nobleman of the royal household and became *escrivão de fazenda* to Prince John, afterward King John III, irom whom he received further pensions in 1525. Resende built a chapel in the monastery of Espinheiro near Bvora, the pantheon of the Alemtejo nobility, where he was buried.

Resende collected the best court verse of the time in the *Cancionezro Geral,* probably begun in 1483 though not printed until 1j16.

The *Cancioneiro* is redeemed from complete insipidity by Resende, and his verses on the death of D. Ignez de Castro inspired the great episode in the *Lusíadas* of Luiz Vaz de Camões (*q.v.*). Resende is the compiler of a gossiping chronicle of his

patron John II., which, though plagiarized from the chronicle by Ruy de Pina, has a value of its own. Resende's Miscellanea, a rhymed commentary on the most notable events of his time, which is annexed to his Chronicle, is a document full of historical interest, and as a poem not without merit.

His *Cancioneiro* appeared in **1516,** and was reprinted by Kausler at Stuttgart (3 vols., 1846–52). A new edition was published by the Hispanic Society of America in 1904. The editions of his *Chronicle* are those of 1545, 1554, 1596, **1607, 1622,** 1752 and **1798.** For a critical study of his work, *see* Antonio de Castilho, *Excerptos, seguidos de uma noticia sobre sua vida e obras, um juizo critico, apreciação de bellezas e defeitos e estudo da lingua* (Paris, **1865).** Also Anselmo Braamcamp, *As sepulturas do Espinheiro* (1901) *passim,* especially pp. 67–80, where the salient dates in Resende's life are set out from documents recently discovered; and Dr. Sousa Viterbo, *Diccionario dos Architectos . . . Portuguezes,* ii. 361–74.

RESERVE: see ARMY and the sections *Defence* of FRANCE, GERMANY, UNITED STATES and other countries.

RESERVES: see BANKING AND CREDIT.

RESERVES, NATURAL: see NATURAL RESOURCES.

RESERVOIRS. These may be divided into two classes, "impounding reservoirs" and "service reservoirs," the latter being concerned with the distribution of water (see WATER SUPPLY).

Impounding Reservoirs.--Owing to the fact that the flow of streams and rivers varies greatly throughout the year, it is necessary to provide works to store water if any substantial use is to be made of the annual discharge. Such works are known as impounding reservoirs, their function being to store water when the stream flow is ample for the purpose of augmenting the natural flow in dry weather.

The urgency for the construction of such reservoirs must have become apparent in very early times in countries where the climatic conditions were such that the streams ran dry for a portion of the year, and records exist of one being made in Ceylon as early as 504 B.C. Anciently reservoirs were formed by an embankment across the valley through which a stream flowed, and were sometimes of vast extent, the Padavil-Colan Tank in Ceylon, for instance, having an embankment 11 mi. long and, in parts, 70 ft. high.

Storage — Having selected a catchment area capable of yielding sufficient water, the capacity of the reservoir has next to be determined. This will depend upon the incidence and intensity of the rainfall and the loss by evaporation and absorption, conditions which vary within wide limits. In countries subject to long periods of drought, the necessary capacity will be greater than in those enjoying a temperate climate, and in India, for instance, where the rain falls only during monsoon periods, two years' storage of the daily quantity may be necessary.

Few records exist of the flow of streams in the British Isles taken over a sufficiently lengthy period to be of service, and recourse has generally to be made to the annual rainfall records, from which the annual discharge of the stream is deduced. Long period rainfall gaugings show that the rainfall of the driest year is about two-thirds, the mean fall of the two driest years about three-quarters, and the rainfall of the three driest consecutive years about four-fifths, of the average annual rainfall. Notwithstanding the wide variation of climatic conditions, these proportions hold fairly well over a large portion of the land surface of the globe (see "The Variations of Rainfall," by A. R. Binnie, Proc. *Inst.* C.E., vol. 109).

As storage increases in relation to the average flow of a stream, the maintainable yield increases in a decreasing ratio until a maximum is reached where there would be little advantage in further increase, and in the British Isles the economic limit is generally taken as that capacity which would be sufficient to equalize the flow of the three driest consecutive years.

The average annual rainfall of the three driest consecutive years, being approximately four-fifths of the average annual rainfall; and the average annual loss by evaporation and absorption being about 14 inches; the average annual discharge of the stream during the three driest consecutive years would be that due to 4 average rainfall—14 inches running off the catchment area, which may be denoted by f. The formula known, from its author, as the Hawksley Formula gives the number of days storage which should be provided to maintain this flow= $\frac{1000}{\sqrt{f}}$

In many cases it is not necessary to provide so large a storage, as some quantity may be required which is less than the average flow of the stream during the three driest consecutive years.

Fig. 1 gives the relation between the maintainable yield and the capacity to be provided for catchment areas in the British

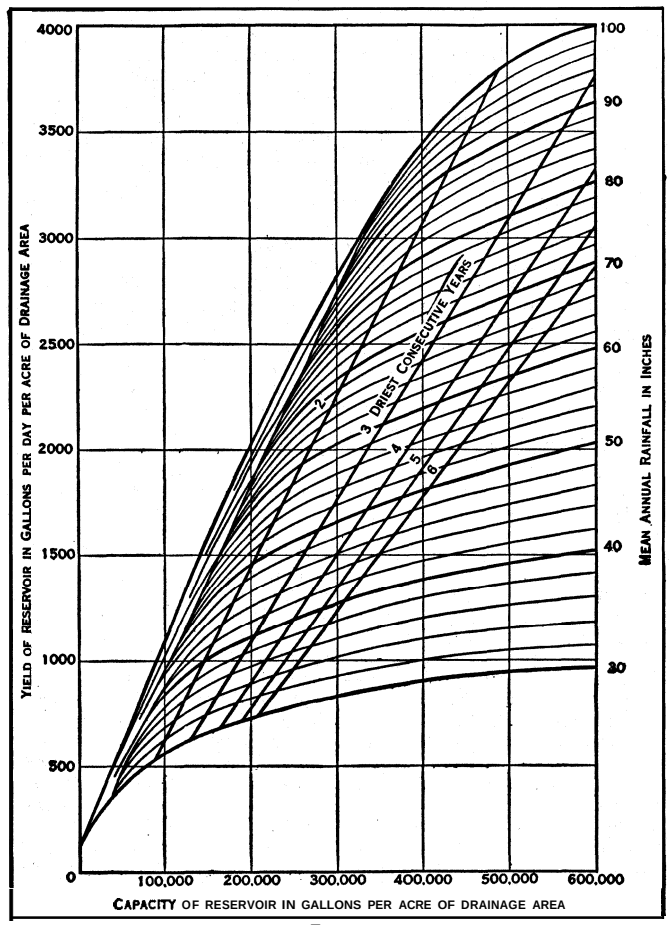


FIG. 1

Isles having a mean annual rainfall varying from 100 to 30 in., and is due to the investigations of Dr. G. F. Deacon. The capacity of the reservoir in gal. per ac. of catchment area is shown on the base line, and the yield of the reservoir in gal. per ac. per diem is given by the length of the vertical line between that capacity and the curve of average rainfall, the yield in gal. per ac. per diem being read from the vertical scale at the left-hand side. The storage required for any particular average rainfall to balance the average stream discharge during different series of consecutive dry years, is given by the diagonal lines which intersect the curve of rainfall on the diagram.

The diagram gives the capacity above the lowest draw-off level of the reservoir, and as it is undesirable to abstract muddy water for supply, this level should be well above the bottom of the reservoir. The loss by evaporation from a water surface is greater than the loss on the catchment area, and in the British Isles the depth of the reservoir should be about 6 in. more than would be required to give the gross storage, whereas in tropical countries the allowance may be as much as 6 ft.

TYPES OF DAMS

Dams may be divided into two classes, masonry or embankments; and the selection of the particular type will depend upon the nature of the materials on which they will rest, and which are available for construction.

Where good sound rock exists at no great depth from the surface, a masonry dam is to be preferred, but where the rock can

only be reached at a considerable depth, the cost is prohibitive.

Masonry Dams.—Masonry dams should be arched in plan concave to the water face where the length of the dam is not too great, as such a form adds to the stability, and the pressure of the water tends to clote temperature or contraction cracks at right angles to the axis of the dam. It is desirable to slope the foundations towards the water face, especially where the depth below the surface is moderate, as this reduces the tendency to slide on the foundations and the possibility of overturning due to the uplifting pressure of water penetrating between the masonry and the rock. The design should avoid the development of tension in the masonry, tending to rupture the dam on a horizontal plane; and the maximum pressure at any point in the masonry should be limited to 10–15 tons per sq.ft., depending on the materials used for construction and the nature of the underlying rock. Prof. Rankine pointed out the importance of avoiding tension, and evolved the theory on which most modern dams have been designed, viz.: that the resultant pressure due to the weight of the masonry and the water thrust must fall within the inner third of the dam if tension is to be avoided. Any fissure developing at the water face due to tension tends to increase owing to the water pressure, and may ultimately lead to the failure of the dam (see Prof. Unwin, *Proc. Inst.* C.E., vol. 126, and E. P. Hill, vol. 129).

The masonry of a dam is not isotropic as horizontal planes of weakness, where new work is superimposed upon that which has set, are difficult to avoid. It is advisable therefore to step the masonry at the water face so as to avoid the construction of a horizontal joint between old and new work.

The arched form of dam is economical when the radius of curvature is comparatively small, as the sectional area can be decreased by designing the dam as a horizontal arch transmitting the water thrust to its abutments. For reasons of economy modifications of the simple type of masonry dam have been introduced; these dams are of ferro-concrete construction, the pressure of the water being transmitted to buttresses by means of steel reinforced slabs or arches.

Earth Embankments.— The profile of the embankment requires careful study of the materials of which it will be composed, and slips have frequently occurred, leading to the complete or partial failure of banks, due to lack of local study and the adoption of a design which was unstable. Light sandy soils will stand at a high angle of repose, but clays or plastic materials require flatter slopes, the inclination decreasing as the base of the embank-

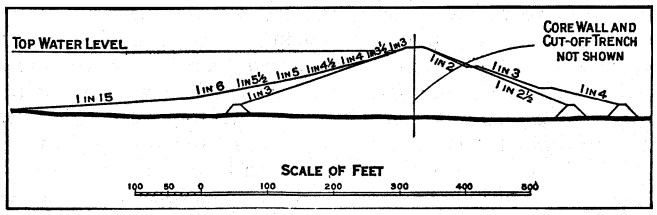


FIG. 2

ment is approached. On fig. 2 the inner line profile would apply to good banking material, and the outer line to clay or plastic material.

Care must be exercised to prevent the saturation of the outer slope of the bank, and when possible it should be composed of freely draining material. When such materials are not available, the outer portion should rest on a layer of stone terminating in a stone toe, vertical drains of dry stone being carried up through the bank at intervals.

Cut-off Trench.—In order to prevent percolation below the bottom of the embankment, a trench is first excavated across the valley bottom, carried down—if possible—to an impermeable substratum and continued into the hillsides, so as to cut off any percolation below top water level. This is filled with impermeable material, preferably concrete, so as to form a barrier to percolation below the bank; and an impermeable core wall is brought up in continuity with this barrier to prevent percolation through the bank.

Core *Walls.*—Puddle is the material generally used in, the British Isles to form the core wall, and reinforced concrete in America. Puddle is not an absolutely impermeable material, and the thickness of a puddle core wall must be much greater than that of a concrete core wall. The use of concrete core walls has been limited in the British Isles owing to the apprehension that such walls would crack under pressure due to unequal settlement of the embankment. That such fears are unfounded is proved by the numerous successful examples of such construction in America.

The very greatest care must be exercised in the construction of a puddle core wall to prevent the occurrence of any layer through which water could pass owing to the erosion which may take place, causing the formation of a cavity and the failure of the bank; whereas no erosion of the concrete would take place, and a crack would soon be sealed by earth carried in suspension by the water.

Tunnel Outlets.—It is necessary to divert the stream during construction, and for this purpose it is advisable to construct a tunnel round one end of the bank through which the stream may flow, and through which the supply pipe can ultimately be laid from the Valve Tower. A cheaper form of construction is to build a culvert under the bank, but many cases of whole or partial failure of such culverts have occurred due to the varying earth pressure. (*See* C. J. Wood, "Tunnel Outlets," *Proc. Inst.* C.E., vol. 59.)

Flood Works.—When a reservoir formed by a masonry dam overflows, water passes harmlessly over the top of the masonry into the stream below. It is obvious, however, that water cannot be allowed to overflow an earth embankment, as the material would rapidly erode, leading to the failure of the bank. It is therefore necessary to allow for the escape of flood water in such a way that the water level can never rise to a height that would endanger the bank.

The usual flood escape is provided by a weir of such a length and placed at such a level below the top of the bank as will ensure that the water in the reservoir can never rise above it, the weir discharging into a masonry channel placed in the hillside at one end of the bank. Another and more economical escape consists of a vertical shaft communicating below with the tunnel through which the stream was diverted during construction and terminating above in a bell-mouthed opening, the periphery of which forms the overflow weir.

Flood Intensity.— The maximum intensity of the flood discharge over the weir will depend on the extent of the catchment area, the maximum intensity of rainfall during a period bearing relationship to that area, and many other factors, such as the inclination of the valley, the steepness of the slopes, the permeability of the surface, and the presence of lakes or obstructions which would delay the discharge. It is impossible to determine the exact effect of many of these factors, and therefore recourse must be made to actual records of the maximum discharge from catchments of different areas.

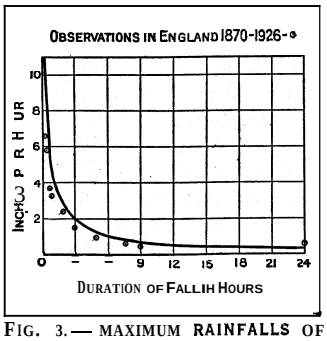


FIG. 3.— MAXIMUM RAINFALLS OF RARE INTENSITY

The main factor in determining the maximum intensity of a flood must obviously be the amount of rain which fell in a given period, a condition which varies so widely in different parts of the globe, that records of flood discharge in one country would not be applicable to another.

The curve on fig. 3 shows the relationship between rainfall and period, and is derived from the formula determined by Prof. Talbot as applicable to the Eastern United States for maximum rainfalls during different periods. The small circles show actual observations made in the British Isles, from which it appears that Talbot's curve fits British conditions fairly well. This fact is of importance as indicating that records of floods in the Eastern

States assist in arriving at the maximum intensity of discharge from different catchment areas in the British Isles. The larger the catchment, the smaller the flood discharge per unit of area. Most reservoirs are placed at comparatively high altitudes, where the catchment area is small, in order to impound water free from pollution and to furnish water to the district of supply by gravity. Failures of such reservoirs, due to insufficient provision for the discharge of flood water, are not infrequent and demand serious consideration. The formula $Q = 750/\sqrt[3]{M}$, where Q denotes maximum flood intensity in cu ft. per sec. per sq mi and M the drainage area in sq mi. agrees fairly well with records of maximum flood intensity in Great Britain. *See* also WATER SUPPLY AND PURIFICATION; DAM; WATERSHED. (W. J. E. B)

RESHAT NURI GUNTEKIN (1892–1956), Turkish novelist, short-story writer and playwright, first achieved fame with his *Chalikushu* (1922), the most popular Turkish novel of the day. Born in Istanbul, he was educated in Izmir and Istanbul and. after teaching in various schools, traveled widely in Anatolia as an inspector of education. He was elected to parliament (1939) and later became Turkish delegate to UNESCO. In *Chalikushu* (Eng. trans.. *The Autobiography* of *a Turkish Girl,* 1949) he combined a realistic description of the Anatolian scene with romance. Other novels and short stories in the same vein included *Aksham Guneshi* (1926; Eng. trans., *Afternoon Sun,* 1951). *Yeshil Gece* (1929), a penetrating study of the reactionary elements in Turkey. initiated the second phase of Guntekin's career. the writing of a series of novels dealing with the social problems brought about by radical changes in Turkish life. His style is easy and straightforward, though sometimes almost too sentimental He died in London. Dec. 6, 1956. (F. I.)

RESHT (RASHT), a former *ostan* (province) now Gilan, and its capital in Iran. The city is located on the left bank of the Siah Rud which is a branch of the Safid Rud and flows into the *murdab* or lagoon of Pahlavi (Enzeli). Population (1956) 109.493; *ostan* population 1,664,210 (1956). During the Bolshevik invasion in 1920 about 8,000 refugees left the town, but later returned; and a large part of the bazaar was burned. The town is situated in low malarious ground and was originally buried in jungle, but the Russians during their occupation of the place in 1723–24, cleared most of the jungle and it is now surrounded by rice fields. Resht is a centre of the rice trade and of the activities of the silk industry of Gilan. Resht suffered a good deal during World War I from the Russian army and, afterward in 1918, when the Dunsterville force had to fight its way to Pahlavi, strongly opposed by Kuchak Khan.

RESIDENCE, in general, a place of abode. In law, it usually means continuance in a place. *See* DOMICILE AND RESIDENCE.

RESIDENTIAL ARCHITECTURE. This article deals with the evolution of structures for human habitation. particularly single-family units, from earliest times to the present, in all parts of the world. (A discussion of the factors involved in the design and construction of contemporary dwellings will be found in HOUSE DESIGN. For discussions of multifamily structures, *see* APARTMENT HOUSE and HOTEL; for discussions of the social context of residential architecture, *see* HOUSING; CITY PLANNING; and ZONING. *See* also ARCHITECTURE.) The dwelling is the oldest branch of building, dating from man's first crude solutions for his most pressing problems: protection from the elements, wild beasts and human enemies. The architecture of shelters has developed extensively since the late 19th century.

Separate d ellings developed in three principal types: in hot climates the rooms usually were open or they surrounded an open-air courtyard; in colder regions the rooms generally were placed together in a compact block to facilitate heating. The third type was informal: the rooms were strung in rows at will. Bricks appeared with the beginning of civilization in Mesopotamia. Wood was the staple residential building material; brick and stone were employed in more luxurious houses. Two distinct methods of construction developed: one used the solid load-bearing wall, originally of rock or adobe, and later of masonry or reinforced concrete; the other method employed a framework of wood or, later, metal, with a covering of reeds, bark, wooden boards or, eventually, various composite materials. After the middle of the 19th century more glass and metal were introduced into the structure and, in an uneven progress, mechanical and electrical labour-saving devices were added to the ordinary house. Technical improvement in housing (*e.g.,* safety, comfort, sanitation) was complicated, however, by social pressures and by various intellectual and artistic trends.

Public buildings and palaces, monuments on which a higher art of building design was concentrated, were emulated in private dwellings. Residential design followed the main stream of public architecture through historic periods and styles, but was always a little more inclined to place convenience before effect. In western society, from the time of the Renaissance, the house came to be thought of as a vehicle of self-expression, and attracted the attention of architects. During the 20th century, residential architecture often led other forms of design.

The evidence of housing in prehistoric and preclassical eras is scant, and to some extent historians' accounts are in conflict. Nevertheless the houses of each important era may be visualized from archaeological fragments and knowledge of the materials that were available to the builders.

Primitive. — Masonry construction may have begun when the cave dweller sought to elaborate his cave by partially closing the mouth with a wall of piled rocks, or by adding external baffle walls, as in prepueblo dwellings on river banks in parts of the U.S. southwest. Frame construction may have begun when sticks were planted in a circle, their tops bound together and the conical frame covered with thatch or leaves. Either of the two structural systems mere used by prehistoric builders, according to the availability of materials. Defense was an important consideration to early village settlers. Little round cabins of stone, clay or wood were gathered within wooden palisades, rectangular huts were raised on piles above the water of lakes or sheltered bays. Roofs were pitched high on wooden frames, and thatched. Walls of thick wooden slabs were smeared over with clay to fill the crevices.

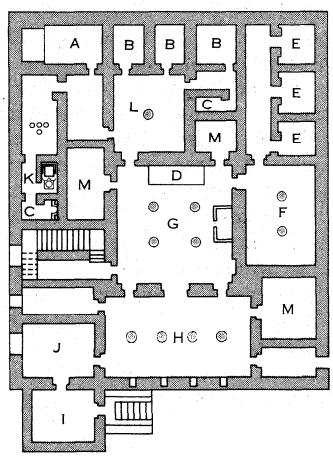
In the typical African compound each hut was made of a low circular wall of closely spaced and plastered sticks, roofed by a tall, conically framed cap of grass thatch. Huts were linked by fences. In the long houses of Borneo, which were elevated beside a river, series of one-family rooms were strung in long lines behind common verandas. The yurt of the wild nomadic Mongolian tribes was a circular house up to 20 ft. in diameter, made of felt fastened over a diagonally framed wall, its curved rafters rising to a wide smoke hole above the central fire. An exceptional example of primitive masonry and indigenous design is the Eskimo's igloo, a temporary winter home of compacted snow cut into beveled blocks and built into a dome. American natives produced several other ingenious house types. The wigwam of the Penobscot Indians of the north was a primitive cone, about ten feet wide and ten feet high, but the construction was slightly advanced. Bark paneling was held between t o separate frames of wooden poles lashed together at the ends. The construction of the tipi of the nomadic Indians on the semiarid plains was similar, but decorated hides or canvas (in the 20th century) formed a paneling more flexible than bark, and made the whole structure more easily portable.

The long house of the Iroquois tribes in the northeast was a windowless, rectangular building occupied by several families, each with an open alcove of its own. It was made, as the wigwam, of big bark panels held in a double framing. The pueblo of the U.S. southwest was a multistory agglomeration of family cells in adobe or stone. The ends of the closely spaced logs that supported the adobe slab roofs projected through the walls. Each floor receded from the one below, forming irregular roof terraces, from which ladders led up and down to other cells. (*See* also INDIAN, NORTH AMERICAN.)

Between the 17th and 19th centuries European colonists often revived the crudest types of mud and stick construction. Primitive dwellings are still being built in many parts of the world. In north Australia nomadic aborigines sleep in caves or behind low bark breakwinds erected for the night. Neolithic types of lake villages are still occupied in Cambodia and New Guinea. Various

rude forms of wood hut and mud cabin persist in Africa and parts of Asia. (See DWELLINGS, PRIMITIVE.)

Egyptian. — The great advances of Egyptian civilization did not extend to the poorer family house. It was still no more than a sleeping room and a storehouse, a low single cell open on one side. It was made of mud brick or of reeds plastered with mud and was roofed with palm leaves. However, the government did provide protection, eliminating the necessity of stockades, and the equable weather encouraged an outdoor life. Wealthier citizens built rooms behind or on either side of the central cell. The flat roof was strengthened with poles or with barrel vaults of brick and was used for eating and sleeping. Houses of leading citizens were either the block or the courtyard type. detached and sizable. A courtyard house was about 40 to 50 ft. square within a high surrounding fence. Rooms might occupy two sides of the square; the remainder was a semiroofed garden court serving as the main living area. In populous areas houses were pressed together on opposite sides of narrow streets. Often an outside staircase led to the flat roof. To the Egyptian the real home was the tomb (*q.v.*); it was the eternal habitation and the house was merely a temporary shelter. Nonetheless, the homes of the rulers were comfortable. An aristocrat's country house had a number of rooms grouped around a private courtyard. The house was set within a luxuriant formal garden enclosed by stables, storerooms and linking walls. Palaces were big, and the Pharaoh's central apartments were colourfully decorated and lavishly furnished for comfort and elegance. (*See* EGYPTIAN ARCHITECTURE.)



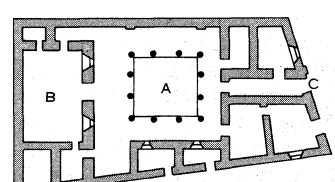
FROM T HAMLIN "ARCHITECTURE THROUGH THE AGES" REPRODUCED BY PERMISSION OF G. P. PUTNAM S SONS, N.Y.

FIG. 1.—PLAN OF AN EGYPTIAN HOUSE AT TEL EL AMARNA

(A) Master bedroom, (B) bedroom, (C) closet, (D) dais or couch, (E) guest auarters. (F) west hall. (G) great hall, (H) north hall, (I) porch, (J) vestibule, (K) bath, (L) women's quarters. (M) storeroom

Western Asiatic. — The pattern of housing changed little in the Mesopotamian and Aegean cultures. The poor-man's house was generally a single-cell hovel. The middle classes had multiroom blocks of various sizes. The upper classes enjoyed elaborate buildings, reasonably comfortable and sanitary, with courts, gardens, loggias and colonnades developed into spatial compositions. Architecture was called upon to provide a rich visual background for the indulgent life. In Babylonia, although a somen-hat more even distribution of wealth improved the standard of housing, the techniques of building did not advance beyond those of the Egyptians. For about 2000 years these techniques remained fairly constant. The poor man's cell was of mud brick, laid in the form of a tall pointed dome. Plain-faced stucco houses lined the winding, crowded, muddy city streets.

The middle-class house was built of sun-baked bricks; it was a compact block with a flat roof, which, when shaded by a light awning, was the principal living space. A rich merchant's house typically consisted of two stories, with thick brick walls, a central court ringed by dark, narrow rectangular rooms, and a veranda with bright awnings in front. Most of the rooms were storerooms, but some were used for refuge when both roof and court became too hot. Then the walls were watered and their fine white plaster surfaces were cooled by evaporation. (*See* PRE-HELLENIC ARCHITECTURE.)



MARQUAND, "GREEK ARCHITECTURE," (MACMILLAN)

FIG. 2.—PLAN OF GREEK HOUSE, DELOS

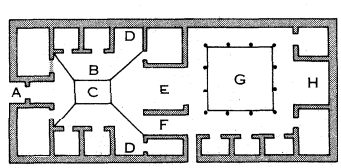
(A) Court, (B) chief room or thalamus, (C) main entrance

Greek.—In the golden age of classic Greece the houses of ordinary peasants were still crude cabins. A colder climate than that experienced by previous civilizations necessitated some heating. Through the brief cold winter, farm beasts shared single unpartitioned brick rooms with their owners. Smoke from a central hearth on the earth floor rose to a hole in the reed roof. Although the refinement of the monumental architecture was unsurpassed, the houses of even the illustrious Greeks were modest. Temples, theatres and public meeting places were the centres of living for men. Wives were restricted. and generally segregated in rooms behind or above the men's quarters. Family life hardly existed. The thalamus, or inner chamber, was the official centre of house life. For the middle classes, three- or four-story rental tenements crowded the tortuous, earthy streets of the cities.

After the Macedonian conquest, the houses of the wealthy began to reflect some of the architectural qualities of the public monuments. The remains of a big house of Hellenistic date at Palatitza in Macedonia indicate multiple courts, long wings and ranges of rooms linked by colonnades. House exteriors became almost as formal as those of temples, and interiors were splendid with murals, statues, pottery and textiles. (See GREEK ARCHITECTURE.)

Roman. — The Roman house of every size and degree of wealth was centred around the atrium (*q.v.*). The atrium derived from the single cell of the primitive hut, with its smoke hole in the centre. As the room enlarged, so did the smoke hole, and columns were erected to support its edge. By the time of the empire the atrium had become a semiopen court ventilating and lighting surrounding rooms. The richer houses developed a peristyle, or court with a garden, at the back; a second story was added and the atrium was made resplendent with ornament and statues. The appearance of the reception rooms always took precedence over comfort in the family areas.

The middle-class house had a smaller atrium, sometimes roofed over, with kitchen and dining room behind and bedrooms above. The farmhouse combined barns, oil and wine Dresses, storerooms and the dwelling in bne building around a courtyard. Poorer free men in Rome and its more crowded colonies lived in bare rooms in tall, dark insulae, or apartment blocks, some seven stories high. Augustus limited their height, in one of the world's first building regulations, to 70 ft. There are indications that they too were planned to surround a court in which the staircase rose past balconies giving access to the upper floors. On the street front the ground floor was occupied by shops. The façade above mas usually of brick, pierced by rows of simple windows, a style of apartment housing that persisted into modern Italy. Sometimes the upper stories projected dangerously.



FROM MAU, "POMPEII, ITS LIFE AND ART"; REPRODUCED BY PERMISSION OF THE MACMILLAN COMPANY

FIG. 3.— PLANOF SMALL POMPEIIAN HOUSE

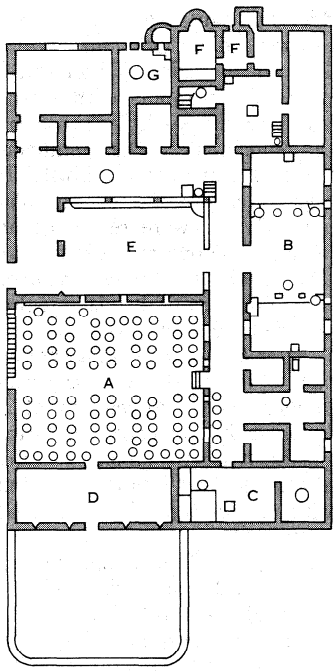
(A) Vestibulum (outer entrance court), (B) atrium (inner entrance court), (C) impluvium (skylight), (D) ala (side hall), (E) tablinum (library), (F) andron (passage), (G) peristylum (court), (H) exedra (hall)

The Roman tradition lingered for many centuries. Provincial villas of the Roman style, built in the 7th century, are found in the south of France and Syria. In Britain the atrium was unsuited to the climate. It appeared only rarely, as in Bath, and in the Britons' hands the style degenerated. (See ROMAN ARCHITECTURE; VILLA.)

Medieval. — Until the 13th century the serfs of Europe lived in unrelieved squalor; sod huts partially dug out of the earth, or hovels made of low stone walls surmounted by roughly thatched roofs were typical dwellings. The early Norman castles of England were heavily fortified, dark and dirty and not intrinsically more livable than the poor man's abode. In the 13th century the manor house (*q.v.*) developed a little rugged comfort. It was centred on the hall (*q.v.*), a survival from Saxon times, to which were added buttery, pantry, larder and subsidiary compartments at one end and the solar at the other. The hall was sometimes 60 ft. by 20 ft., stone paved, with a central fireplace, small high windows, and a low dais at one end on which the family and guests

took their meals. The solar was the withdrawing room and bedroom, the private family room. Walls were thick, of brick or stone and an increasing amount of half-timber work (*q.v.*). Window glass was a luxury; openings had shutters, pointed to match the Gothic arches.

The new bourgeois or middle class of the middle ages lived in houses of two or three stories packed into the narrow streets of expanding towns. Typical three-story houses of the 12th century are found at Cluny, France. In such a house a central light court cuts the narrow plan in two, with only a gallery connecting the front to the rear rooms. The front room on the ground floor is a shop, the rear a kitchen. The floor above has living rooms in the front, sleeping rooms in the rear. An attic fills the high roof space. The "Musician's house" at Rheims (*c.* 1240) has a facade typical of the simple charm of the time, made notable by statues of musicians set in niches. The "Jew's house" at Lincoln is an early English town house with richly carved window arches in the Norman Romanesque manner. With their sensible plans and rudimentary plumbing these medieval town houses of northern Europe were potentially comfortable, and they changed little in 500 years. In the north of Italy town life matured earlier. Tall, sophisticated city palaces enclosed arcaded courts. The security of Venice permitted a more extroverted plan, with wider openings to the canal at the front and to the garden at the back. Walls were ornate in coloured marble and were animated by balconies, loggias and long ranges of windows, embroidered with Gothic tracery.



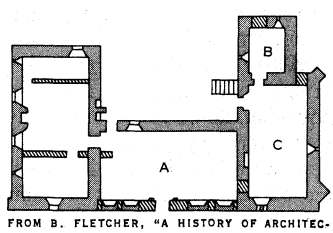
FROM MAU, "POMPEII, ITS LIFE AND ART"; REPRODUCED BY PERMISSION OF THE MACMILLAN COMPANY

FIG. 4.—PLAN OF ROMAN FARMHOUSE. VILLA RUSTICA, BOSCOREALE, IT.

(A) Store for oil jars, (B) oil press, (C) wine press, (D) stable, (E) court, (F) bath, (G) kitchen

In rural areas the peasant's lot gradually improved and the farm-building complex developed, with barns, sheds and dwelling contained within a fence. Stone was usual in southern Europe, and wood in the north.

House planning, in the modem sense, began with a concern for the privacy of certain members of the household and for the accommodation of certain functions of living in English manors and the European burghers' houses. Between the 14th and 17th centuries rooms were increased in number and were more clearly differentiated. In England the great hall grew asymmetrical wings as required by function. Until the 16th century, however, circulation was tortuous, through rooms and up and down many stairs. The French chbteau (*q.v.*) at this period was a century ahead of the English manor. With its romantic, pointed roofs and round corner turrets, its symmetry and elegance reflected in a wide decorative moat, it made a graceful transition from the grimly fortified Gothic castle to the open, formal Renaissance mansion. The English manor's wings, growing from each end of the great hall, eventually linked to enclose a courtyard (*e.g.*, Compton Wynyates, Warwickshire, 1520). Late in the 16th century the wings opened into a U-shape, releasing the confined courtyard. At the same time the moat was abandoned (*e.g.*, Hatfield bouse, Hertfordshire, 1607–11). The great hall decreased in size and importance; the main passage, expanded to a wide glazed gallery, became the biggest and most pretentious room. It was graced with wood paneling, coloured window glass, black and white checker marble floor, restrained plaster ceiling and elaborate chimney pieces. The exterior, while often retaining the pointed arch and a free disposition of windows, was more composed and symmetrically balanced, gradually adopting the formalism of the Renaissance. (See ROMANESQUE ARCHITECTURE; GOTHIC ARCHITECTURE; CASTLE.)



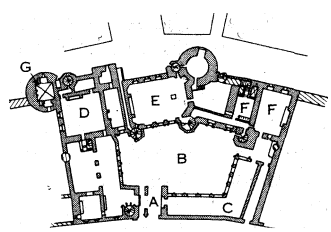
FROM B. FLETCHER, "A HISTORY OF ARCHITECTURE"; REPRODUCED BY PERMISSION OF THE ATHLONE PRESS, UNIVERSITY OF LONDON

FIG. 5.—PLAN OF CHARNEY-BASSETT, BERKSHIRE, ENG., 1270

(A) Hall. (B) chapel (upper story), (C) solar (upper story)

Renaissance.—In Italy the architectural formality that persisted even through the middle ages grew easily into a full-blown classic revival. The master of residential architecture was Andrea Palladio (1518–80). In buildings such as the Villa Rotunda near Vicenza he adapted the temple form to domestic use without sacrificing classic symmetry, proportion, scale or ornament. The use of giant porticos resulted in precise geometric plans based on the circle and the square, which were developed into three dimensions in accordance with mathematical doctrines. The Renaissance was received enthusiastically by the French court and yielded houses of elegant conception and charming detail. The style came late to England, delayed by Henry VIII's break with Rome and the consequent anti-Italian prejudice. During the 16th century a classic quality entered via northern Europe, and the first English professional architect (John Shute) and the first architectural historian (Henry Wotton) appeared. But the English Renaissance proper began with Inigo Jones (1573–1652), self-trained artist and scholar and generally considered to be the first major English architect. He introduced the Palladian (from Andrea Palladio) style of pure form and the revived classic order (*q.v.*). The plan concept ruled the elevation and all was "masculine and unaffected," as Jones noted during his Italian travels. His monumental houses for the nobility usually consisted of a simple cubical block dominated by the pavilion, or classic loggia, with its single order of tall columns. (See RENAISSANCE ARCHITECTURE; TUDOR PERIOD; ELIZABETHAN STYLE; JACOBEAN STYLE.)

Baroque and Neoclassical.—England's most famous architect, Sir Christopher Wren, was mainly occupied with monumental work, but during his time the "Wrenish" style, a reserved baroque, eclipsed Palladianism. For two prosperous generations of country-house building the classic orders gave way to some originality. Still the house had a rectangular plan, rigid symmetry, a hipped roof and eave cornices broken by central pediments. Early in the 18th century the Palladian style returned, to be replaced about the middle of the century by the characteristically English neo-classical manner known as Georgian. This was an elegant, simplified, lightly ornamented style looking to Rome and Greece for inspiration, and relying for effect on harmonious proportions in the severe rectangles of the façades and the fine, regular glazing bars of the windows.

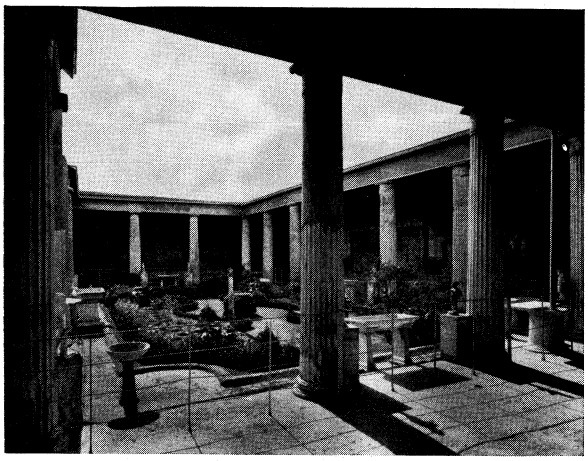


FROM T. HAMLIN, ARCHITECTURE THROUGH THE AGES; REPRODUCED BY PERMISSION OF G. P. PUTNAM'S SONS, N.Y.

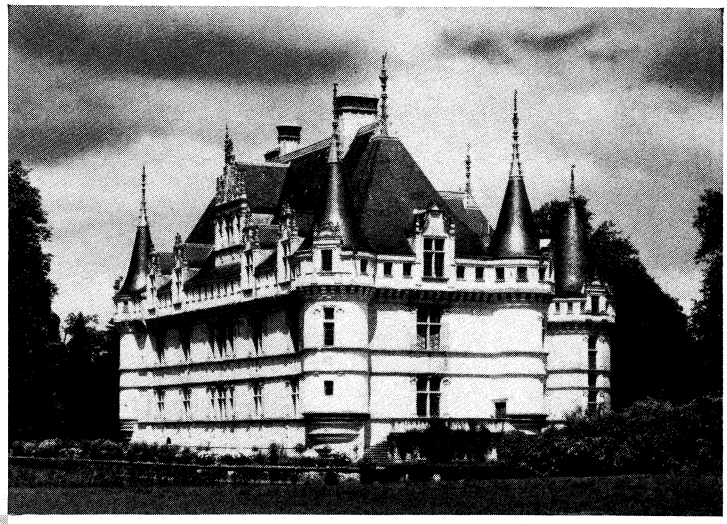
FIG. 6.—PLAN OF THE HOUSE OF JACQUES COEUR, BOURGES, FRANCE, 15TH CENTURY

(A) Main entrance, (B) court, (C) gallery, (D) secondary hall, (E) great hall, (F) kitchen, (G) bedroom

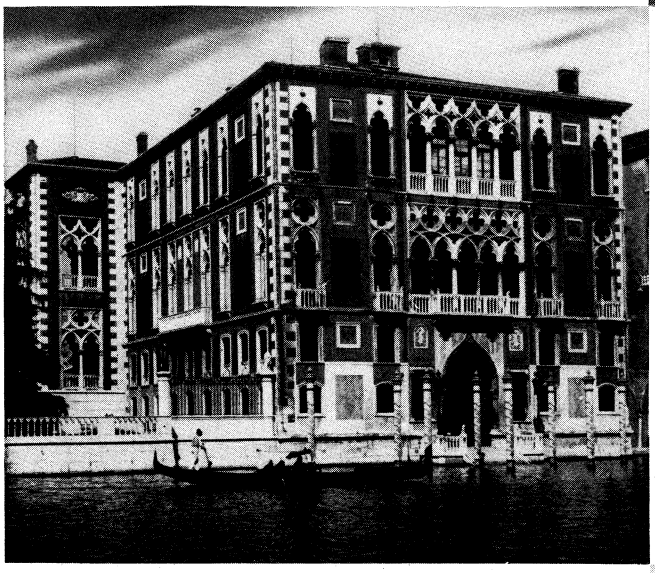
Robert Adam perfected a graceful personal style drawn from Greek and Roman precedents, plain in form but delicate in ornament, which was accused by its more robust opponents of being effeminate and paper-thin. A rich London house by Adam at 20 St. James street, a typically medium-sized house of its day and class, had seven main living and entertaining rooms on its tall ground floor, and bedrooms above. Within the narrow rectangular confines of the structure Adam shaped the music room as an oval and the dressing room as a circle. At the rear was a garden court enclosed by the stables and coach house. Smaller town houses, foregoing individuality, combined to form long façades, as in the magnificent curve of Royal Crescent at Bath. The typical house was plain red brick with simple windows, a thin cornice



Peristyle of the House of the Vettii, Pompeii (partly rebuilt and planted)



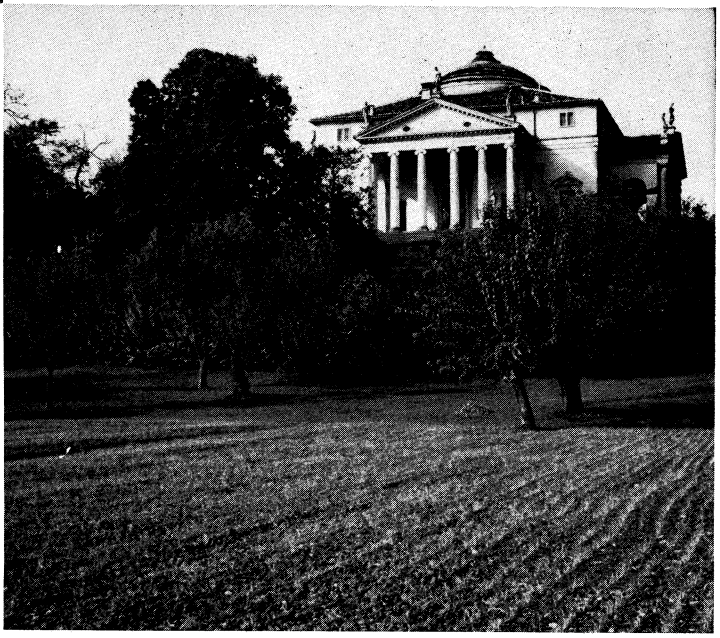
Azay-le-Rideau, near Tours, France, chateau built during the reign of Francis I (1515–47)



Palazzo Cavalli (Franchetti) on the Grand canal, Venice; 15th century

Typical half-timbered farmhouse of Normandy in the 15th and 16th centuries

Tre so-called "Jew's house," Lincoln, England, a late Norman Romanesque town house of the 12th century

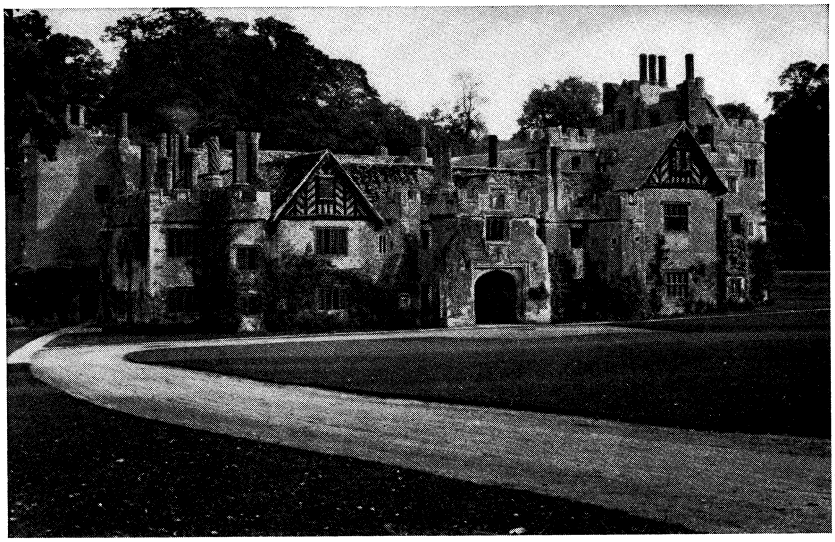


Villa Rotunda, near Vicenza, Italy, late 16th century; designed by Andrea Palladio, completed by V. Scamozzi

HOUSE DESIGN: ROMAN TO RENAISSANCE

PHOTOGRAPHS, (TOP LEFT) F. ARBORIO MELLA, (TOP RIGHT. CENTRE LEFT) EWING GALLOWAY, (CENTRE RIGHT) FROM "STUDIOS VIE A LA CAMPAGNE" LIBRAIRIE HACHETTE. (BOTTOM LEFT) DONALD MCLEISH, (BOTTOM RIGHT) G. E. KIDDER SMITH

RESIDENTIAL ARCHITECTURE



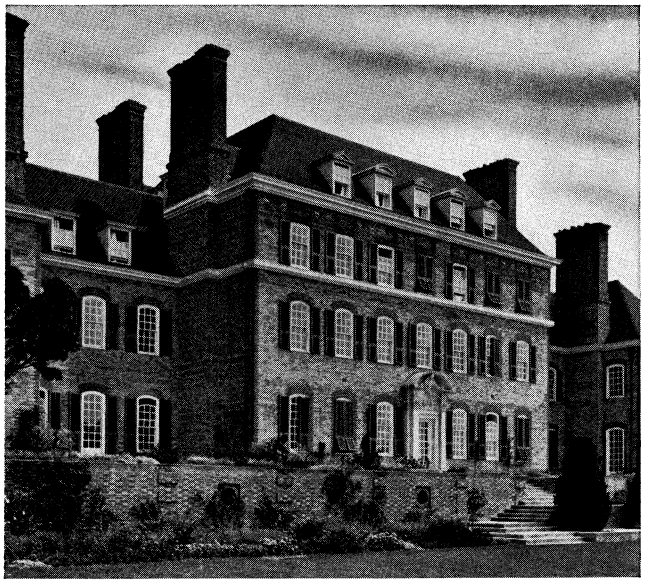
Compton Wynyates, c. 1520, large manor house of Tudor England

Hôtel de Bourgtheroulde, Rouen, France, flamboyant Gothic town house, 1475

Chantrey house, Castle Donington, Eng., gabled half-timber house of the 16th century

Cabot-Endicott-Low house, Salem, Mass.; English colonial, 18th century

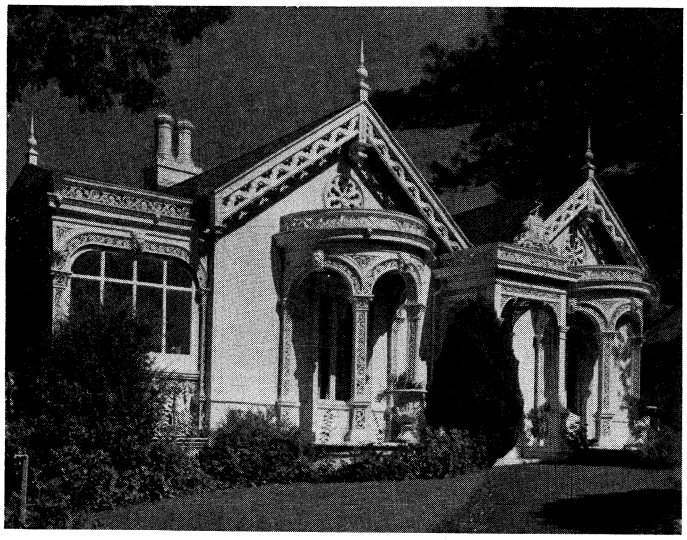
House in Ruhpolding, Bavaria, in the chalet style, typical of southern Germany and Switzerland from the 17th century



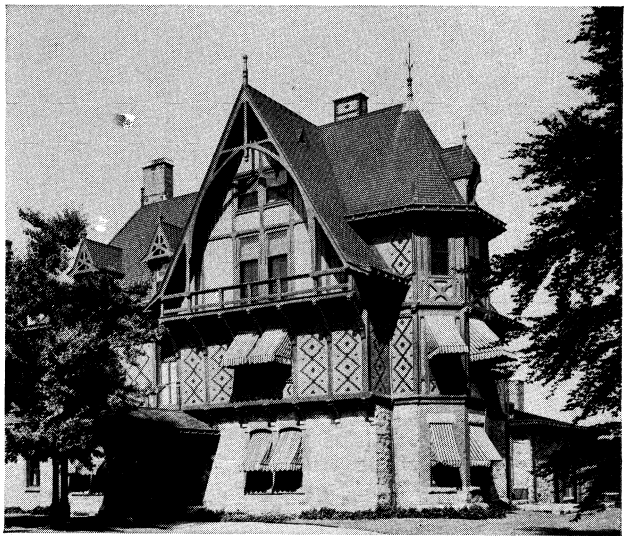
Great Maytham, Kent, Eng., by Sir Edwin Lutyens (1869–1944); a 20th-century re-creation of a Georgian manor house

RESIDENTIAL STYLES OF THE 15TH TO 18TH CENTURIES

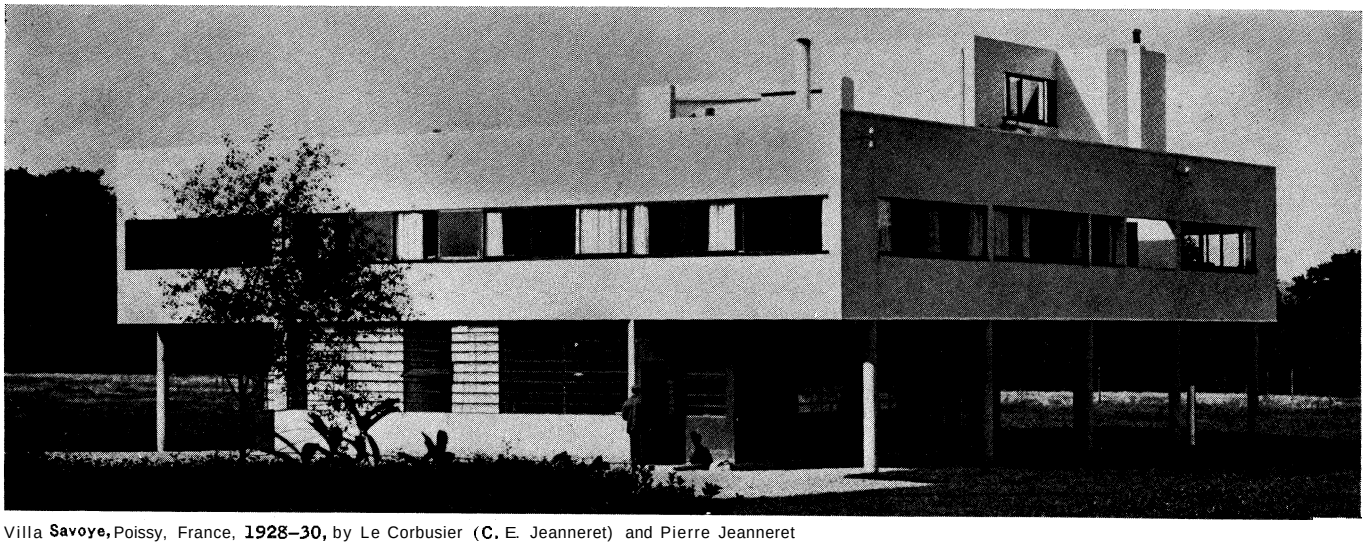
BY COURTESY OF (TOP LEFT) NATIONAL BUILDINGS RECORD LONDON. (CENTRE RIGHT) ESSEX INSTITUTE, (BOTTOM RIGHT) COUNTRY LIFE FROM WEAVER, "HOUSES AND GARDENS BY SIR EDWIN LUTYENS"; PHOTOGRAPHS, (TOP RIGHT) ELLEBÉ, ROUEN, (CENTRE LEFT) EDGAR AND WINIFRED WARD, (BOTTOM LEFT) EWING GALLOWAY



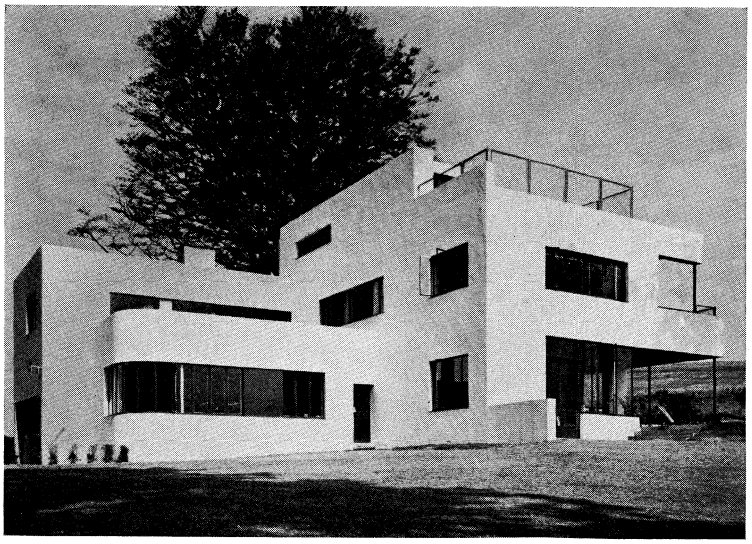
"Corio Villa," 19th-century cottage of prefabricated cast iron (imported from England), Geelong, Austr.



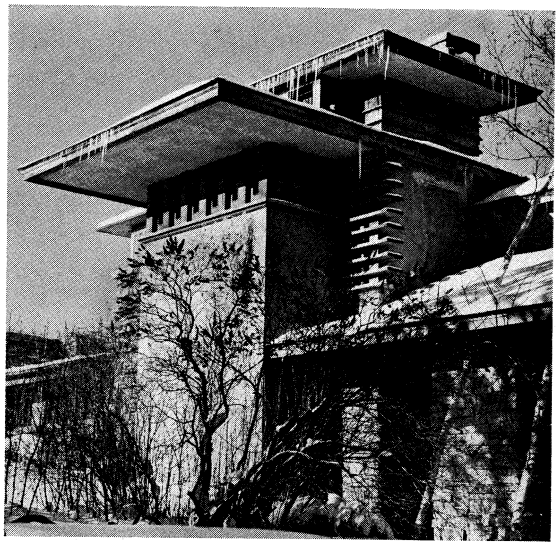
H. G. Marquand house, Newport, R.I., about 1875, by R. M. Hunt



Villa Savoye, Poissy, France, 1928–30, by Le Corbusier (C. E. Jeanneret) and Pierre Jeanneret



Residence for the headmaster. Dartington hall, Eng. (1932–33), by William Lescaze (1896–)

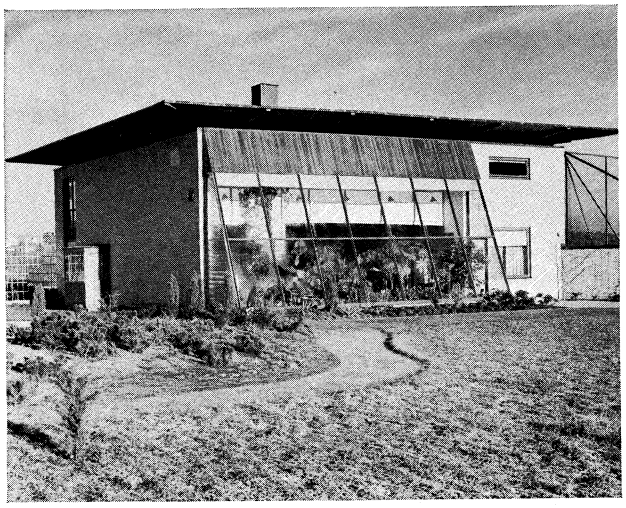


"Taliesin," home of Frank Lloyd Wright near Spring Green. Wis., 1925

19TH- AND 20TH-CENTURY HOUSES

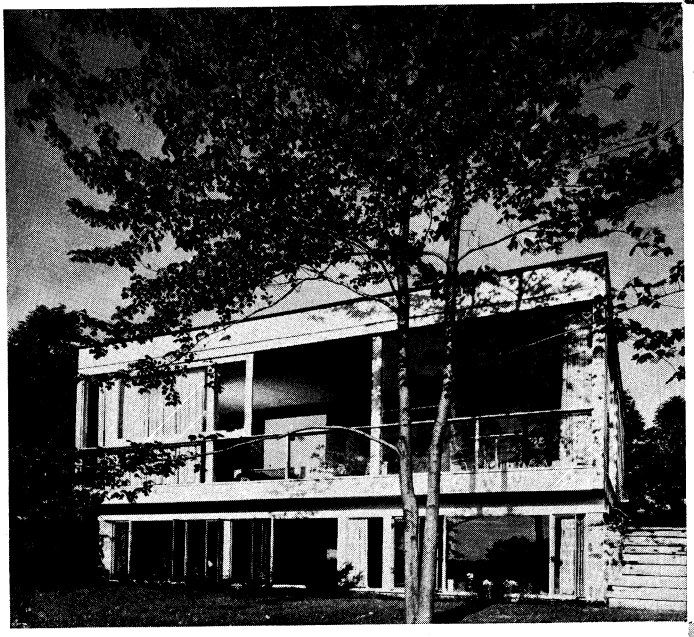
BY COURTESY OF (CENTRE) MUSEUM OF MODERN ART, NEW YORK; PHOTOGRAPHS, (TOP LEFT) E. GRAEME ROBERTSON, (TOP RIGHT) WAYNE ANDREWS, (BOTTOM LEFT) R. SHARP. INC. (BOTTOM RIGHT) P. E. GUERERRO

RESIDENTIAL ARCHITECTURE

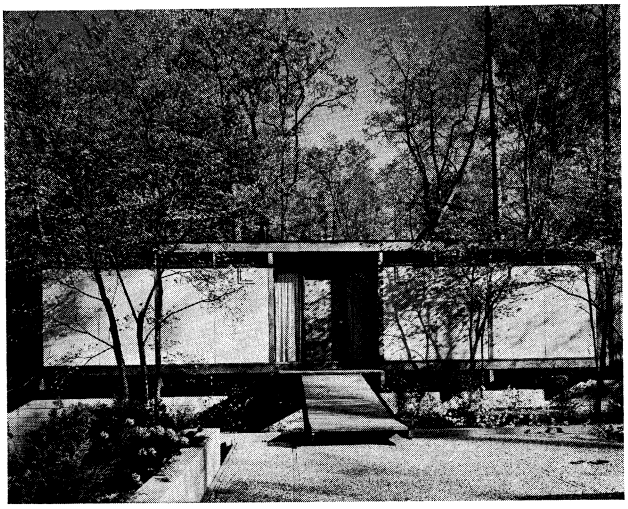


House at Vastberga, Swed., by S. M. Backstrom (1903–) and L. A. Reinius (1907–)

Farnsworth house, near Plano, Ill., by Ludwig Mies van der Rohe (1886–)

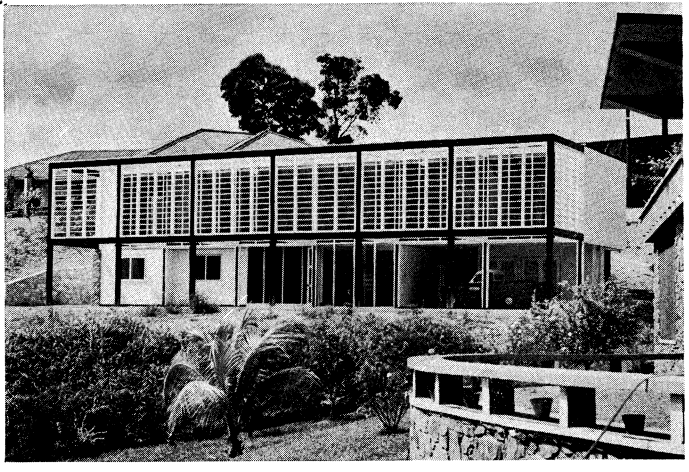


House at New Canaan, Conn., by J. M. Johansen (1916–)



Home of architect George Matsumoto (1922–), Raleigh, N.C.

House of architect E. F. Catalano (1917–), near Raleigh, N.C.



House for U.S. employees of a company at Port of Spain, Trinidad, by P. M. Bolton (1920–) and H. Barnstone (1923–)

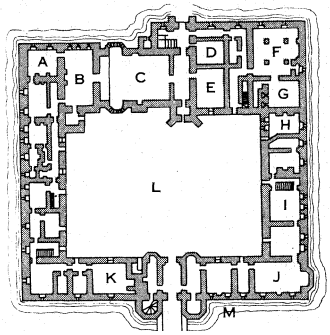
CONTEMPORARY 20TH-CENTURY HOUSES

BY COURTESY OF (TOP LEFT) "ARCHITECTURAL FORUM" AND G. E. KIDDER SMITH. (TOP RIGHT) LUDWIG MIES VAN DER ROHE PHOTO BY HEDRICH-BLESSING, (CENTRE LEFT) "MCCALL'S MAGAZINE." PHOTO BY ROBERT DAMORA. (CENTRE RIGHT) GEORGE MATSUMOTI. PHOTO BY JOSEPH W. MOLITOR. (BOTTOM RIGHT) BOLTON AND BARNSTONE, ARCHITECTS. HOUSTON, TEX., COLIN LAIRD. SUPERVISING ARCHITECT, PORT OF SPAIN, TRINIDAD: PHOTOGRAPH, (BOTTOM LEFT) © EZRA STOLLER

and a neat stringcourse above the arched, fan-lighted doorway.

Early in the 19th century the firm Georgian style divided into the Romantic movement with its exotic Gothic and eastern conceits, and the Regency style, with its plain stucco walls, curved bays and spidery shadows of delicate iron balconies.

Colonial. — Through the 17th and 18th centuries European colonists carried their local house styles to the Americas, Asia and the antipodes, changing them no more than was necessary to adapt them to new materials and changed climatic conditions. After a temporary phase of primitive shelter Early American house types appeared. In the densely forested lands of the north, clearing was an essential first task and wood the obvious choice for building. The lapped horizontal weatherboard or clapboard, hardly known in England, was used generally. The rectangular, frame house with two low stories and a high gable roof was centred on a brick chimney stack. Later a lean-to addition at the rear produced a "salt box" profile. The Cape Cad style grew from an ingenuous functional plan of four rooms on each floor clustering around fireplaces in the stack; a small stairway rose between the stack and the central front door. In Virginia, which was warmer and richer, the plan was longer and thinner and there was a chimney at each end. Brick was more common. The stair hall cut through the centre of the house and opened to front and back.



FROM B FLETCHER "A HISTORY OF ARCHITECTURE"; REPRODUCED BY PERMISSION OF THE ATHLONE PRESS UNIVERSITY OF LONDON

FIG. 7.—PLAN OF OXBURGH HALL, NORFOLK, ENG., 1482

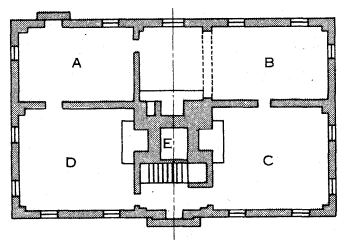
(A) Drawing room, (B) dining room, (C) great hall, (D) napery, (E) buttery, (F) kitchen, (G) bakery, (H) servants' hall, (I) breakfast room, (J) library, (K) laundry, (L) courtyard, (M) moat

As early as 1667 Palladian books and plan publications carried more sophisticated architectural ideas across the Atlantic. Architects arrived early in the 18th century; a John James was practising in Boston in the 1730s. Soon the American Georgian style appeared, closely following the English model. In the north the style was adapted to wood construction with slender columns or flat pilasters. The rooms were tall, the plan compact. Fine moldings dressed the eaves cornice, fanlights. stairaays and shuttered window trim. In the colonies at New Tork and Pennsylvania, German and Dutch influences were strong; in Virginia and Maryland great plantation homesteads settled in spacious lawns on river estates. These 'big houses were generously conceived and graciously furnished. They were characterized by the hospitable, heroic scale of a two-story portico in a single classic order. As far south as Charleston the Virginian influence was felt, but there the houses turned crabwise for protection: a formal Georgian end faced the street and tiers of veranda faced the private side garden.

In Mexico the Spanish colonial houses had plastered and pastel-washed rubble walls under sun-baked tile roofs. Rooms were arranged around terraces, arcaded courts, and fountains playing in private patios. *(See* IBERO-AMERICAN ARCHITECTURE.)

The Georgian and Regency styles were adapted in various ways to Australia. New Zealand and the islands of British colonization in the late 18th and early 19th centuries. The typical Australian country house was single-storied with a low, hipped shingle roof. It was surrounded by a wide, slim-posted veranda onto which the tall windows of the main rooms opened. *(See* COLONIAL ARCHITECTURE.)

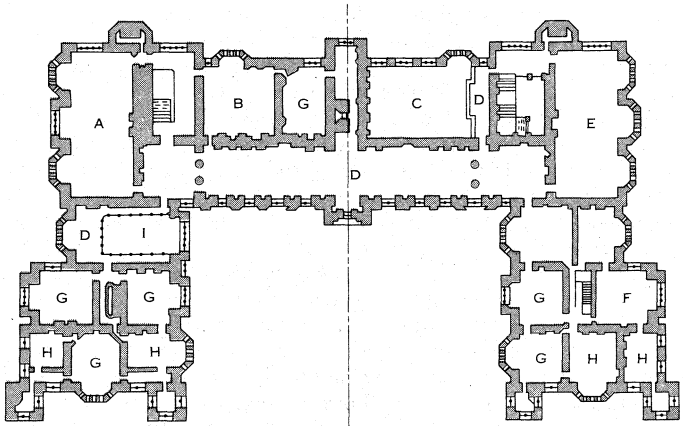
Victorian. — During the second half of the 18th century, the most cultivated phase of European residential architecture, a profound change occurred in the poor-man's house. In the middle of the century the artisan. weaver, miller or farmer lived in essentially the same conditions as the freeman worker of earliest civilization. His house was also his workshop. and his children's place of work. By the end of the century the Industrial Revolution had interrupted the slow evolution of this house, not by transforming its building techniques but by upsetting the function of the home and the nature of family life. Most members of poor families spent days in the factory and nights in mass housing not unlike that of imperial Rome. Four- or five-story walk-up tenements gathered around the factories. They were ill-lit, poorly ventilated and the only outdoor living area they provided was on the pavement of a narrow street. The construction was brick, unencumbered with ornament or plumbing. By the middle of the 19th century, slum areas were extensive in most big cities. Room areas diminished and ingenious plans were devised to save space (*e.g.*, the New York "railroad" aaartments with rooms packed four deep, only the end ones seeing daylight). Meanwhile the citv was dissolving at the edges. Rail transport permitted middle-class workers to live away from their places of employment. Suburbs usually developed around the rail centres and radiated like spokes from the city. The typical Victorian suburban mansion was as elaborate as the palaces of earlier eras. but reduced in scale for a single family with servants and guests. The newly prosperous, hospitable manufacturers and merchants had no patience with cultivated tradition. Georgian and Regency taste was called mawkish and simplicity was seen as a poverty of dress unbecoming in the home of a man of substance. Ambition and acquisitiveness complicated the desire for comfort, sometimes resulting in a clutter of ornamentation unique in the world's history. The multiplying members of the lower middle class moved to the suburbs to nominally detached houses on narrow strips of land. The less successful man was able to emulate the mansion's ostentation effectively, thanks to the machinery of mass-produced moldings. pressings, printings and castings; any desired decorative effect could be reproduced cheaply. The ordinary man began to reap some of the benefits of industry. Built-in equipment and mechanical appliance, including the fitted English bathroom, were novelties in expensive homes early in the century and gradually became commonplace toward the end of the Victorian era. The great increase in personal possessions produced a storage problem that was solved by the built-in cupboard, closet and pantry. Cellar central heating was introduced in the U.S. in the 1830s and was fairly general in mid-century American homes. as were centrally supplied water and gas. Waterborne sewerage began in Hamburg in 1843 but was not adopted by many cities until late in the century. Electricity had



FROM A F BEMIS & BURCHARD "THE EVOLVING HOUSE" VOL I REPRODUCED BY PERMISSION OF THE TECHNOLOGY PRESS

FIG 9.—PLAN OF CAPE COD HOUSE WITH LARGE CENTRE CHIMNEY, AMERICAN COLONIAL

(A) Storeroom, (B) kitchen, (C) parlour, (D) bedroom, (E) chimney



FROM B. FLETCHEP, "A HISTORY Of ARCHITECTURE"; REPRODUCED BY PERMISSION OF THE ATHLONE PRESS. UNIVERSITY OF LONDON

FIG. 8.— FIRST-FLOOR PLAN OF HATFIELD HOUSE. HERTFORDSHIRE, ENG.. 1607–1611

(A) Library, (B) winter dining room, (C) upper part of hall, (D) gallery, (E) King James's room. (F) state bedroom, (G) bedroom, (H) dressing room, (I) chapel

been proved an effective source of power by 1900. Industrial techniques did not, however, extend to the construction of the house. The promise, popularly recognized in the Crystal Palace in 1851, of a new world of mass-produced metal and glass homes, did not materialize as expected. (It had not yet arrived, but was still imminently expected, a century later.) No part of a wall or ceiling was left undecorated. During construction, handicraft ornament supplemented machine-made ornament. Graining, imitating expensive wood or marble, was often painted on plaster or plain boards, a practice about which John Ruskin (1819–1900) commented: "There is no meaner occupation for the human mind." Ruskin and William Morris (1834–1896) were among the few Englishmen who protested against commercialised design and the decline of taste. They sought a return to simple, natural ornament and an appreciation of genuine handcraft. In the U.S. the sculptor Horatio Greenough (1805–1852) called for the elimination of all ornament. These pleas had little effect. Ruskin helped to inspire the Gothic Revival, and Morris' medieval decorations helped it grow. In residential architecture the Gothic Revival usually manifested itself in tall gables with intricate fretwork ornament and pointed-arch windows, later enriched by polychromatic brickwork and ornate lead lights. It was the principal rival to a coarsened neoclassical style in the "battle of the styles," but there were many other revivals. Eclectic architects and builders raked history for embellishments and added to their houses distorted fragments of Norman castles, French châteaux, Swiss chalets. etc. The nadir of taste was reached in England about mid-century, in the U.S. after the Civil War.

Two major, separate revolts began toward the end of the 19th century. One was the art nouveau (q v.) movement initiated in Brussels, an attempt at a new nonhistorical style in which form and ornament were to be based on nature's shapes. This produced only a popular passing fashion of superficial sinuous lines on the trimmings of a house. The other revolt slowly developed toward a rational, styleless architecture shaped to the function of the shelter by the nature of the construction, devoid of ornament. These concepts were the basis of nearly all of international modern architecture as it gradually evolved during the next half-century in the work of temperamentally diverse architects in widely separated localities. (See also MODERN ARCHITECTURE; ARTS AND CRAFTS MOVEMENT, THE.)

20th Century. — The roots of 20th-century residential architecture may be traced in Morris' aim to elevate domestic taste, in the quasi-rational theories of the Frenchman E. Viollet-le-Duc (1814–1879), and in C. F. A. Voysey's big English country houses of the '90s, with their boldly composed roofs and plain white walls. Some of the most important formative steps were taken by nondomestic architects: Louis Sullivan in Chicago, Otto Wagner in Austria, Peter Behrens and Walter Gropius in Germany. Auguste Perret in France, and others. But the crystallization of the movement and a great number of the most auspicious early designs were in the residential field. Many of the best-known architects of the century, including Frank Lloyd Wright, Mies van der Rohe and Le Corbusier, first established their personal styles in houses.

A house on the Geneva water front in 1904 by Adolf Loos, exemplifying his passionate distaste for ornament, introduced the functionalist house. California houses in the early 1900s by Bernard Maybeck and Greene & Greene developed a carpenter-rationale unknown in Europe. However, the U.S. prairie houses by Wright (1869–1959) were published in Germany and injected a new enthusiasm into the European movement.

Although Holland was slow at first to accept the new movement, the vociferous de Stijl group appeared there in 1917. It formalized the theories of functionalism; it probably was largely responsible for the development in Europe through the 1920s and '30s of the naked white-plastered modern house in easily comprehensible cubist shapes. Plain blocks were fashionable for the first and only time; after half a century of ornamental excesses they seemed artistically satisfying, even when not accompanied by any creative idea.

In a postwar atmosphere the Bauhaus (*q.v.*) school was founded in Germany in 1919 by Walter Gropius. With its all-embracing concept of the creative simultaneity of technology and all the arts of living, it had untold influence on the development of house design throughout the world.

In France the Swiss-born architect Le Corbusier (1887–) contributed influential writings to the journal *L'Esprit* Nouveau. In 1930 he built his most famous house, the Villa Savoye, at Poissy; a wide white box, whose hollowness was emphasized by its open decks and by its being elevated on poles. It was one of the most vigorous expressions at that time of the new interest in negative form; *i.e.*, the composition of spaces rather than the proportioning of masses.

In Russia shortly after the revolution constructivism was a style recommended for the huge housing blocks. It was an experimental branch of modern architecture following structural methods. It soon met official reaction, and after 1930 the Soviet government adopted severe neo-Renaissance façades for its bulky apartment buildings.

The Stockholm exhibition of 1930 introduced modern architecture to Scandinavia. Sweden accepted the principles more thoroughly and naturally than any other country, and for many years the simplicity, without self-consciousness, of its houses and household wares received world-wide attention. Central urban-planning control, exceptionally high and level living standards, and a tradition of first-rate craftsmanship aided the development. Generally, 12-story elevator apartments were built near the cities, and 3-story walk-up flats and single-family houses formed satellite groups. All units were well planned and equipped to give comfort, if not privacy, and care was given to the external architectural relationships and the preservation of the best qualities of the landscape. Notwithstanding a certain monotony which developed later, Sweden thus produced the most cultivated and fully pervasive national pattern of housing in history.

Germany under Hitler called for a nationalistic style and outlawed the new architecture. Many of its leading designers left for England and later the U.S., where eventually they were responsible, with American confreres, for a revolution of taste against historic revivals. After World War II Germany returned to its earlier rational architectural principles for the design of many enormous apartment blocks. Its comparatively few single-family houses, however, tended to be designed in the traditional pattern of German country houses.

While the European functionalist phase developed through the early part of the century, most English-speaking countries persevered with architectural eclecticism. It was more restrained than in the 19th century and extremes, such as the Gothic Revival, were rare. But exotic effects continued to dress the faces of houses, such as, Italianate villa, Spanish mission and English style (outside England). At the same time more and more people wanted private, detached houses. In the 1930s some were "modernistic"; *i.e.*, ornamented with parallel grooves or streamlined curves or skyscraper profiles on the chimney tops.

During this time Frank Lloyd Wright built numerous houses of remarkable individuality, his artistic range including the wide, reposeful roofs of the Robie house, Chicago (1909), as well as the striking suspension of "Fallingwater" (1936–38) over a mountain stream in Pennsylvania. His favourite materials were wood and stone, his line horizontal, his spaces wide and subtly interrelated. He made each house an artistic idealization of free family life. In his retention of ornament and his increasing romanticism he steadily drew away from the Europeans. Not until after World War II was his art popularly recognized in the U.S.; then it had at least superficial influence on many houses.

During this period it was often possible for the poor to possess the ancient symbol of independence, the private house. The cities' suburbs, which had been growing slowly for a century, escaped urban control. Young married people sought immediately to own a home, and the home was the centre of nearly all social contacts and entertainment. A new nomadic segment of the U.S. population rebelled and took to living in car trailers which compressed all the mechanical aids of the 20th century into the area of an Inca hut. Town housing remained comparatively stable in the U.S. The more prosperous cities proceeded slowly with slum-clearance

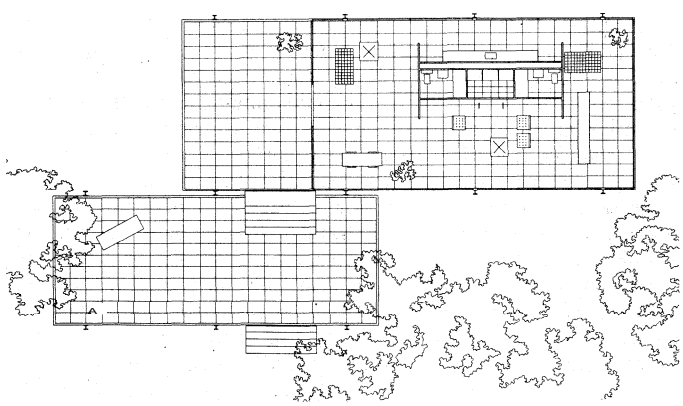
schemes for their crowded tenement areas, usually rehousing the same number of people in taller blocks set apart on lawns. In many European and Latin-American countries, on the contrary, big new apartment blocks continued to increase the density of urban populations.

Most suburban houses were built without architects' guidance. Standard designs were repeated tirelessly with minor fashion changes and some colouring by local idioms. Mechanical equipment constantly increased and improved. Buckminster Fuller in 1927 designed a fully industrialized house hung on a central mechanized mast, and later many other proposals nere made in the same vein. But society resisted radical change from the traditions of wood and brick.

Architectural character continued to be dominated by a few creative men whose well-publicized ideas carried to suburbs everywhere. Some were bent on perfecting anonymous, universal shelters in which each owner could create an environment to his taste. Most residential architects, however, still aimed to compose in spaces and textures a delightful background for the kind of life the occupants liked to lead.

Asiatic. — Before contact with the west and modern technology, antique rules of building in Asia descended unchanged from one generation of builders to another.

Indian. — Building rules were recorded in Sanskrit about A.D. 500 in a code determining sizes, proportions, structure and details of design down to the doors, windows and drains. The poor peasant of the plains had a single hut. The villager had a house of four huts — one each for the men, women and cattle, and one for cooking and storage — on four sides of a courtyard. The Hindu multifamily group repeated the court and its rooms for each brother. A rich-man's house extended the system again with extra stories. In the thickly populated areas around great rivers the floors and walls were made of clay, the roofs thatched. In the arid northwest the walls were brick or stone, the flat roofs were of an indigenous cement. In the western Himalayas the court was



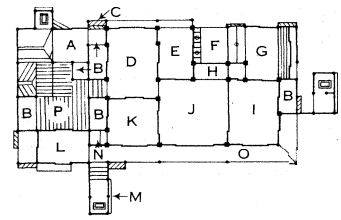
BY COURTESY OF LUDWIG MIES VAN DER ROHE

FIG. 10. — PLAN OF FARNSWORTH HOUSE (1952). PLANO. ILL.. BY LUDWIG MIES VAN DER ROHE

omitted, the stone walls rose two floors under a slate roof. In some parts intricate carvings adorned the balconies and surrounded the door and window openings.

The English in India developed a single-story house with a shaded veranda and well-ventilated rooms. It was known in the vernacular as a bungalow, a name which later came to mean in other countries a single-story house of any design. (See also INDIAN ARCHITECTURE.)

Chinese. — The traditional Chinese house was a single-story row of rooms linked by a narrow veranda and surrounded by a high wall. A screen directly inside the entrance gate balked devils, who cannot negotiate corners. Brick was common, and adobe faced with brick made the thicker walls. The top halves of some interior partitions were open latticework with paper panels. Windows usually had decorated paper panes. The roofs had a characteristic drooping gable, suggestive of tent origins. Houses of the rich had black ebony carvings against their brick walls and beneath their green glazed tile roofs. The plain interiors were often



FROM MORSE, "JAPANESE HOMES AND THEIR SURROUNDINGS," PUBLISHED BY HARPER & BROTHERS

FIG. 11. — PLAN OF JAPANESE HOUSE (A) Servants' room, (B) closets. (C) cases for storing wooden shutters in daytime, (D) dining room, (E) hall, (F) vestibule, (G) study, (H) tokonoma (alcove), (I) library, (J) parlour, (K) sitting room, (L) bedroom, (M) sliding screen, (N) shrine, (O) veranda, (P) kitchen

well decorated with fine sandlewood or teak furniture and elaborate embroideries and porcelain. (See CHINESE ARCHITECTURE.)

Japanese. — In Japan the traditional vernacular house was based on an order of design that western civilization first approached in the 20th century. The house was light, adjustable, unpretentious, virtually unadorned and planned on a precise mathematical concept. The standard grass floor mat, about 6 ft. by 3 ft., was the module for all planning. Whether square or oblong each room was a multiple of the mat size (*e.g.*, a four-mat room). Posts on the perimeter of the veranda and at the corners of rooms supported the hipped or gabled roof frame. The roof was tiled or thatched on top and lined on its flat underside with boards or panels of wood. Some external walls. such as those for the kitchen and privies. were permanent in bamboo, boards or plaster. But the unique feature in the traditional Japanese house is that most exterior walls and nearly all interior partitions were movable screens sliding in grooves which ran in the floor and the ceiling between structural posts. These screens permitted the rooms to open to the veranda and to each other as required, and allowed for supervision of family activities by the patriarch.

The modern Japanese adoption of U.S. fashions threatened to end the tradition, but some Japanese architects have succeeded in advancing the structural principles of the unpainted wood and paper idiom without destroying its order, flexibility or unaffected artistry. See JAPANESE ARCHITECTURE.

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RESINS are among the most versatile of all chemical compounds, and their industrial applications are still expanding. Natural resins range from pitch and asafetida to frankincense, myrrh and the fossilized form of resin known as amber. Synthetic resins are the bases of products as varied as nylon, billiard balls and equipment for softening or desalting water.

Prior to the introduction of synthetic resins, the term resin was applied exclusively to certain sticky substances which exude in the form of yellow or brown deposits from certain trees, particularly from the pine and the fir. As knowledge gradually accumulated concerning the nature of such natural resinous products as well as the means by which similar compositions could be made by known chemical reactions, a large and ever-increasing number of products have been included in the category of resins. At first these products of the laboratory were hesitatingly referred to as resinlike products, then as artificial resins and as resin substitutes and finally as synthetic resins. In almost every respect, the natural resin can be replaced by one of the synthetic varieties in many of the industrial applications, especially in the molding and the coating industries. Through the study of chemical reactions which lead to resinification! a better insight mas gained concerning the chemical transformation which takes place in the natural product with the result that, in certain instances, it became possible to combine chemically the natural and the synthetic product leading to the formation of a new material possessing unique properties.

At one time resins were recognized by certain well-known attri-

butes, that is, by their transparency and amorphousness and by their brittleness and conchoidal fracture. Synthetic resins of all types are known, and certain of them fail to exhibit any of these characteristics. Some of the latter preparations are tough and colourless, whereas others are opaque and crystalline. There appears to be only one property which is common to both natural and synthetic resinous products—in one stage of their existence both products are plastic.

The distinction between resins and plastics is at best arbitrary since many of the later synthetic materials can be called both resins and plastics. Historically, it appears that the term resin was applied to those products which were primarily used as substitutes for the natural product entering into coating compositions, whereas the term plastic was used to designate those compositions which involved a molding operation in their fabrication. It is generally recognized that resins, plastics, rubbers and fibres are part of one large group of chemical compounds, and by suitable transformations it is possible to change any one member of this group into another.

NATURAL RESINS

The resin formation in a tree occurs as a result of injury to the bark inflicted by wind, fire, lightning or other means. Initially this secretion is fluid in nature and appears in the form of an oleoresin or as a balsam. In contact with air certain of the more volatile components evaporate, and the residue oxidizes, polymerizes and gradually converts to a soft, resinous product which is readily soluble in appropriate media. As the natural resin gets older, it becomes more insoluble. When the resin flow from the tree is copious, some of the secretion passes into the ground, with the result that many of the fossil resins are found as buried deposits. Even in the case of the recent fossil resins, the chemical reaction leading to resinification may have proceeded for thousands of years. For example, the kauri pines are known to attain an average age of 1,000 years; and since resin can now be found in areas where the original forest has wholly disappeared, it is obvious that the resin must be extremely old. This resin is still soluble. The fossil resin, amber, is of a less soluble type. The very existence of this resin indicates that the process and time of polymerization from the oleoresin to resin, to recent fossil resin, to fossil resins must, in the case of amber, be reckoned in geological periods.

Resinous deposits are found in many parts of the world, and many varieties derive their names from the locality where they are collected. Not only are these products derived from many lands, but they have been known and used technically for long periods of time. Certain tree emanations were utilized by the Chinese and the Japanese in their preparation of oriental lacquers. There is reason to believe that the Incas and the Egyptians used varnishlike materials. The Carthaginians, Phoenicians and Greeks were acquainted with resinous products, and the association between resins and varnishes can be seen in the derivation of the word varnish. This term appears to originate from Berenice, queen of Cyrene, the name the Greeks applied to amber. The term Berenice became corrupted gradually to Pheronice and then Verenice and Vernis.

Amber is not used in the preparation of varnishes but is mainly employed in the fabrication of beads and in decorative wear. In certain respects amber can be handled in very much the same manner as that employed in the fabrication of cast plastics.

Any mucilaginous exudation of a tree is considered a gum. Shellac is a distinctive product inasmuch as it is an insect secretion. True gums, as distinct from varnish gums, are soluble in water; for example, gum arabic which is used in the manufacture of adhesives. The true gums are related to sugars and carbohydrates. These products are soluble in water and insoluble in organic liquids and on heating decompose without fusion. They differ from glues in that they are soluble in cold water. Varnish gums, on the other hand, are resinous materials related to terpenes and essential oils. They are soluble in oils and organic liquids but are insoluble in water. On heating they generally melt and decompose and become more readily soluble. Although the tendency has been to decry the use of the word gum for varnish resins, the term is too well established to be eradicated. Moreover, there are certain natural products which take on the properties of both gums and varnish resins. From Indian frankincense or olibanum, a water-soluble gum has been isolated as well as terpenes and a resinlike product.

Natural varnish resins, as has been noted, can be recognized by their transparency and translucency, by their brittleness and conchoidal fracture and by their brown or yellow coloration. As a rule they possess no taste or smell in the solid state. On heating they melt and often give off a distinctive aromatic odour; on burning they yield a smoky flame. Certain of these gums will dissolve directly in various organic liquids such as alcohol or turpentine. In dispersing the more insoluble resins in oils, it is necessary to preheat the resin—a process referred to as running or sweating. No generalization can be made concerning the chemical changes which occur during the running operation, but it involves complex and deep-seated chemical rearrangements such as cracking, decarboxylation and dehydration. All of these changes are accompanied by a loss in weight; it is by such heat treatment that the resins become more readily dispersible in oil.

Solubility and hardness are the chief criteria used technically in classifying resins, and on the basis of solubility resins can be divided into the spirit-soluble and oil-soluble types. Spirit-soluble means what the word implies, solubility in commercial spirit or ethyl alcohol. Many new powerful organic solvents have been developed for the preparation of cellulose lacquers, and a number of these liquids can likewise be employed in the preparation of solutions of natural resins. Congo is substantially insoluble in all liquids. Kauri and Manila are soluble in alcohols but are insoluble in hydrocarbons. Dammar is soluble in hydrocarbons but only partly insoluble in alcohols. Accroides and sandarac are soluble in alcohol but insoluble in hydrocarbons, whereas mastic and elemi are soluble in aromatic hydrocarbons.

Spirit-Soluble Resins.—As the name balsam implies, these resins are of a fluid character and have found their chief use in healing preparations as well as for other phases of materia medica. Certain of the more aromatic varieties have been incorporated into incense. Balsams are generally considered to be solutions of resins dispersed in benzoic- or in cinnamic-acid esters, whereas oleoresins are considered to be solutions of resins in essential oils. However, it is difficult to draw a rigid distinction between balsams and oleoresins, although the latter are usually considered to be slightly more fluid. Canada balsam. which is used in cementing lenses, is not a true balsam in that it does not contain benzoic acid or its ester, but is really an oleoresin derived from *Abies canadensis*. Certain of the true balsams are the balsam of Tolú, the balsam of Peru, as well as the Sumatra and Siam benzoins and storax. The storax balsam is of particular interest from the standpoint of synthetic resins in that it was from this material that M. Bonaster in 1831 first isolated styrene, and doubtlessly this product arose through decarboxylation under heat of the cinnamic acid present in the balsam. Another variety of balsam is derived from the grass trees of Australia, and these products are referred to as the Xanthorrhoea balsams. The most important varieties are the yellow and red types, often referred to as accroides gum. This resin contains phenolic bodies which appear to possess some medicinal values, particularly for treating infections of the mucous membranes.

As stated above, oleoresins are solutions of resins dispersed in essential oils; various of these oleoresins are known as turpentines. Venice turpentine is a pale green, viscous liquid which is collected from the larch (*Pinus larix, Larix decidua*). A liquid of lemonlike odour known as Strasbourg turpentine is derived from the *Pinus picea*, whereas Bordeaux turpentine is an oleoresin derived from the *Pinus maritima* or pinaster. The chief American varieties yielding oil of turpentine are the loblolly pine. *Pinus taeda*, and the slash pine, *Pinus caribaea*. On evaporation of the oleoresin a solid resin results, together with a volatile component or spirit of turpentine. The residue from distilling Bordeaux turpentine is known as Burgundy pitch and is used in medicinal plasters.

Mastic is a soft resin melting at about 105° C. and is derived from the tree of the *Pistacia* genus which grows in the islands of the Greek archipelago. When dissolved in turpentine, it is used as a varnish for the protection of paintings; and when dispersed in bodied linseed oil, it is known as megilp and is used as a colour vehicle. Dragon's blood is a black-brown resin in bulk, but in thin films it is transparent and of a deep crimson-red colour. The resin is found on the fruits of the rattan palm growing in the East Indies. It is soluble in alcohol and benzene, but not in ether or turpentine. The resin has been used as a varnish by Italian violin makers and as a dye to colour spirit varnishes a deep red. Another resin used as a colour vehicle and in medicine is gamboge.

Dammar is one of the harder resins and is usually secured in the form of clear, pale-yellow beads, melting at about 140° C. Various other coloured varieties are obtained from the *Dammara orientalis,* which is indigenous to Malaya and the East Indies. The resin is insoluble in alcohol but dissolves in both aliphatic and aromatic hydrocarbons. Excellent varnishes can be made from these solutions, and the resulting films have a light colour and a good lustre. The resin is also readily soluble in oils without preliminary thermal processing. This resin in combination with nitrocellulose enabled the formulation of rapid-drying lacquers.

From the cypress pine, *Callistris*, which grows in Australia, North Africa and North America, one can obtain the hard resin called sandarac which is solubie in alcohol as well as in the more-powerful lacquer solvents. The resin melts at 150° C. and is used as a spirit varnish for coating paper, leather and metal. Although the initial film is somewhat brittle, it can be readily modified to yield elastic films by the addition of elemi.

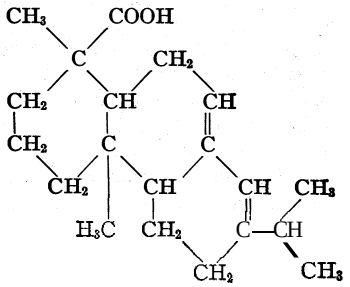
Shellac has been considered a zoochemical substance, inasmuch as it is a secretion of an insect known as *Laccifer lacca.* The word lac appears to be derived from *laksa,* an early Sanskrit word meaning 100,000. The term shellac has been used incorrectly to cover generically all of the lac products. Insects growing on certain of the trees of the genus *Acacia* produce a scaly substance known as stick-lac This material is ground, washed and filtered hot, the filtrate passing onto water-cooled drums from which it is removed in the familiar flakelike form. The button lac is a lac which has been allowed to fall on a flat surface Lac is one of the widely used resins in industry. It is also used in electric insulation as a coating for wood and metal and as a binding agent for molding composition. Certain varieties are incorporated into sealing waxes. The bulk of the shellac manufactured bears the mark T.N.

Chemically, shellac consists of a mixture of polyhydroxy acids. Two varieties have been isolated, one a hard lac and the other a softer material which appears to act as a plasticizer for the harder component. The softer portion consists primarily of uncombined acids, whereas the harder material consists of polyesters. A major portion of the hard lac was found to be a monobasic ester which could be made to undergo hydrolytic fission to aleuritic acid and lacollic lactone. Other acids which have been isolated from shellac are a tetrahydroxy'acid known as kerrolic acid, as well as shellolic acid, together with a natural yellow dyestuff known as erythrolaccin. Aleuritic acid is considered to be 9,10,16-hexadecanetriol acid ($HO-CH_2-(CH_2)_5-(CHOH)_2-(CH_2)_7-COOH$). Although the solubility of shellac is usually associated with alcohol, it is also dispersible in aqueous solutions. There appears to be some indication that on long standing alcohol may react with shellac. A white variety can be made by a bleaching process from which colourless, transparent lacquers can be made.

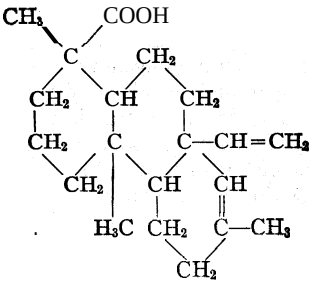
Oil-Soluble Resins.—Upon distillation of the oleoresin from the longleaf pine two materials are obtained: one a volatile component or spirit of turpentine and the other a nonvolatile, resinous residue or rosin. The word rosin is used for this product rather than resin because the latter is a term used generically to cover all of the compounds of this type. Depending on the source of the oil of turpentine, it is possible to have either gum turpentine and gum rosin or wood turpentine and wood rosin; the former variety originates from the turpentine which is secured by tapping the trees. By solvent extraction of the stumps, wood rosin is obtained, and this is generally of a darker colour. Various designations are employed to distinguish the colour of the product. The colour of French rosin is designated by the letter **A,** and the greater the number of As used the paler the grade. The U.S. designation is more arbitrary, and the better classes are known as WW (water-white) and WG (window glass). Rosin is a brittle resin which powders readily and becomes sticky when warm. Its specific gravity is about 1.070 to 1.080, and it dissolves in the usual organic liquids. Rosin is also known by the name of colophony or colophonium (from the Greek Kolophonios). The suggestion that the term was derived from two Greek words meaning sound-glue because of its use for treating violin bows does not appear satisfactory.

At one time much of the rosin was used untreated, but the trend is to subject it to chemical processing before it is offered for sale. The chief constituent of rosin is an acid known as abietic acid, and many of the uses of rosin are dependent upon its acidic properties. Combined with alkalies or with metallic oxides, soaps are obtained. The sodium soap is water dispersible and is employed in sizing paper. Sodium abietate is mixed with other alkali soaps in the manufacture of laundry soap. The lime and zinc salts find use as so-called gloss oils in the paint industry, whereas the metallic soaps derived from lead, cobalt and manganese are used as driers in paints and varnishes. When rosin is esterified with glycerol (glycerine), the resulting product is known as ester gum. Somewhat harder esterification products are made through a conjoint ester of rosin with glycerol and with phthalic anhydride. Partial decarboxylation of acid occurs when rosin is heated to elevated temperatures; such products are known as rosin oils.

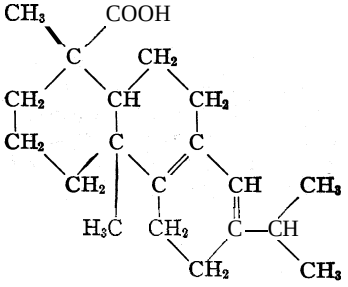
The acids isolated from rosin include abietic acid,



pimaric acid,



and laevopimaric acid,



It will be noted that certain of these acids appear to possess a system of conjugated double bonds which may account for the ease with which rosin oxidizes when it is exposed to air. By chemically combining rosin with hydrogen it is possible to obtain a product which exhibits greater stability and is less subject to discoloration on storage. The abietic acid in rosin can be made to undergo hydrogen disproportionation leading to the so-called dehydrogenated rosin. This type of chemically modified rosin, as the sodium soap, was used extensively during World War II as the emulsifying agent in the preparation of synthetic rubber. The

properties of the modified rosin were such that it could be allowed to remain in the coagulated rubber. Hydrogenation and disproportionation both cause rosin to crystallize more readily, and consequently the hydrogenation is carried only to the point where satisfactory stability can be secured without crystallization. By combining rosin chemically with certain unsaturated types of dibasic acids, such as maleic and fumaric acid, it is possible to destroy the unsaturation without inducing crystallization. It is probable that the character of the varnish which can be made from China wood oil, and rosin derivative may reside in the chemical combination that takes place between the unsaturated components of both products.

The copals form an important group of varnish resins. The word copal appears to have been derived from the Spanish or Mexican word copalli—incense. Various types of products are known—the recent varieties as well as the fossil types. Soft Manila copal is readily soluble in organic solvent liquids and in oils or, as in the case of the pontianak variety, it requires running before it can be dispersed in oil. There are several varieties which are employed in the varnish trade: kauri copal, melting at about 150° C., is derived from the New Zealand pine; Congo copal originates in the Belgian Congo; while Zanzibar copal is dug from the mainland opposite the island of Zanzibar. Some of the South American copals derived from Brazil and Colombia have attracted some attention. Copal has been esterified with glycerol in a manner similar to that employed in making ester gum. Because of the high melting point of the copal gum, it is necessary to conduct this thermal decomposition to a point much further than is customarily employed when the resin is to be dissolved in oil, and temperatures as high as 330°–340° C. are employed. Two acids have been isolated from Congo copal; one is the dibasic congocopalic acid ($C_{36}H_{58}(COOH)_2$), and the other is the monobasic congocopalolic acid ($C_{27}H_{32}(OH)COOH$).

Amber, the hardest natural resin known, finds little use in the varnish industry because of its lack of solubility. When it is incorporated in oil, so much discoloration takes place during the running operation that the resulting varnish is of a poor colour. The resin is found in the so-called blue earth, in east Prussia in the Baltic region. The fact that it is derived from a variety of *Pinus* indicates that over a sufficiently long period of time under appropriate conditions an oleoresin can be converted into a heat-infusible product.

Oriental lacquers are a distinct product derived from the Rhus *vernicifera,* a tree which is indigenous to China The process was introduced into Japan and remained secret for centuries. A milk-like emulsion secured from the tree is concentrated by evaporation to a viscous liquid which resembles a bodied oil. When this is applied as a thin film. it hardens in about a day to form a tough skin. The composition is peculiar in that it will dry only in the dark and in a moist atmosphere; exposed to light and warmth, the varnish remains tacky. The varnish contains a skin irritant, and this material may be the urishiol which is similar to a product isolated from the Rhus toxicodendron or poison ivy, which is common in the Gnited States.

Another product containing phenolic bodies is derived from the nuts of the cashew tree (*Anacardium* occidentale); the oil known as the cashew-shell-nut oil possesses materials which lead to vesicant action, but by appropriate chemical treatment the irritant is destroyed. This product has found some commercial importance in the United States.

SYNTHETIC RESINS

Synthetic resins possess most of the physical characteristics of natural resins and in addition have many unique properties of their own. Chemically there is a certain degree of resemblance between the synthetic resins of phenol-formaldehyde and the natural phenolic resins found in oriental lacquer and in accroides gum. Moreover, one can trace a certain amount of resemblance between the polyester resins known as alkyds and the polyesters found in shellac. Although it has usually been considered that the synthetic resins possess the unique characteristic of becoming insoluble and infusible on heat treatment, it is known that shellac will become insoluble on prolonged heating. and the same phenomenon has been observed with certain of the other gums. The synthetic resins are of industrial interest not only as substitutes for natural resins in the coating industry but also because they find extensive use as adhesives, textile impregnants, binders, as agents for removing ions from water solutions and as binders in the plastics molding industry (see PLASTICS).

Thermoplastic and Thermosetting Resins.—Physically it is possible to classify synthetic resins according to their solubility. There are those resins which remain permanently soluble and those which are initially soluble but become insoluble and infusible under the action of heat. The first type is known as the thermoplastic type of synthetic resin, whereas the latter is known variously as heat hardenable, thermosetting or thermocuring resins.

Linear and Three-dimensional Resins.—The permanently soluble or thermoplastic resins consist of molecules which are more or less linear in form. During solution in an organic medium, the solvent penetrates between the threadlike molecule; irrespective of the size of the resin molecule. solution will eventually occur. Under the influence of heat the threadlike molecules can be forced to move, and on cooling the impressed form is retained. On the other hand, the thermosetting resins consist of resinous molecules which are tied together three-dimensionally into a network pattern. In the initial stages where the network is small, solvent can readily penetrate the interstices of the network. but after chemical combination has taken place and a large three-dimensional network is formed, the resin becomes insoluble. Since the network is tied together rigidly, the resulting molecular structure is infusible.

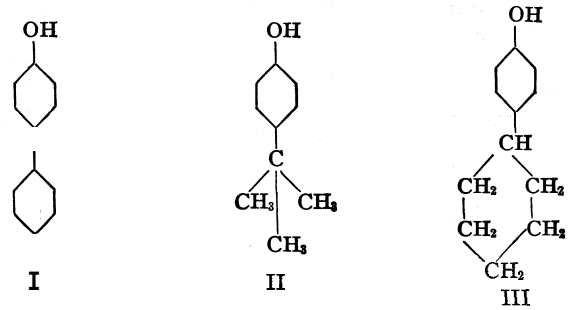
Condensation and Polymerization Resins.—Two main classes may be distinguished under chemical classification: first, the condensation resin, such as the phenol-formaldehyde or melamine-formaldehyde type, in which the molecules unite with the elimination of water; and second, the polymerization resin, in which chemical reaction takes place through loss of unsaturation, without the evolution of any low-molecular-weight material.

Coating Resins: 1. *Phenol-Formaldehyde* Resins.—The chemical combination of phenols with aldehydes was noted by many investigators in the 19th century. Among the organic chemists who had studied the reaction were C. F. Gerhardt (1853), Adolf von Baeyer (1872) and A. Michael (1883), but it was only after the advent of cheap formaldehyde in 1891 that a more extensive investigation was made toward the commercial utilization of this resin. Various investigations were made by W. Kleeberg, by A. Smith and by A. Luft, and certain of the methods employed resembled the technology which had proved successful with thermoplastic nitrocellulose plastics but which failed when such procedures were extended to thermosetting compositions. The first successful work in this field was carried out by L. H. Baekeland. Through a study of the various stages of resinification and through the utilization of a so-called bakelizer, he was able to mold many products, and in 1910 he organized the General Bakelite company. Much of the plastic entered into electrical goods. Meanwhile, the possibility of employing this condensation product to replace shellac in phonograph records was considered by J. W. Aylsworth of East Orange, N.J. On the basis of his development work, the Condensite Company of America was established at about the same time. Still another concern for the manufacture of phenolic resins was started by the Redmanol Chemical Products company, based on the studies of L. V. Redman. After much patent litigation these various companies pooled their resources.

In spite of the marked commercial success of these resins in molding, in casting and in laminating, they were not suitable for coating compositions. While it was possible to make a phenolic varnish for laminating purposes, this varnish could be dissolved only in alcohol and could not be dispersed in cheap solvents or in drying oils. The first successful attempt to use phenol-formaldehyde resins directly as substitutes for natural resins in coating composition was the result of the work of Dr. K. Albert of Germany. He found that by a preliminary heating or fluxing of the phenol-formaldehyde resin with rosin or colophony, it was possi-

ble to disperse the resulting mixture in drying oils. These products, when dispersed in China wood oil, possessed rapid drying characteristics and formed films possessing good durability.

In 1928 the first so-called oil-soluble phenolic resin appeared on the market. Through the use of appropriately substituted phenols and the combining of such substituted phenols with formaldehyde, it was possible to obtain a resin which was directly soluble in oil without preliminary fluxing with rosin. These oil-soluble phenolic resins found wide acceptance in the varnish field. Among the phenols useful for such purposes are phenyl phenol I, tertiary butylphenol II and cyclohexylphenol III, as well as certain of the



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tar acids which boil in the xylenol range. The resins are incorporated into the oil by adding resin in increments at a rate at which frothing can be controlled. After addition of the resin the temperature is raised until satisfactory increase in viscosity occurs. The European procedure favours the addition of the resin to the pretreated oil, and, while it appears to yield lighter coloured and less viscous products, the resulting films appear to be less resistant chemically. Other combinations are known, certain of which consist in substituting an alkyd resin for a part of the drying oil. Durable finishes have been made from alkyd-phenol-formaldehyde oil combinations.

2. Alkyd Resins.—These resins are reaction products of polyhydric alcohols and polybasic acids, and various modifications can be made by adding monohydric alcohols or monobasic acids to the polyester composition. The derivation of the term alkyd becomes apparent when it is pointed out that the "cid" from acid was changed to "kyd" for the sake of euphony. J. J. Berzelius prepared glycerol tartrate in 1847; J. M. van Bemmelen prepared a resin by reacting succinic acid with glycerol in 1856; M. P. E. Berthelot esterified glycerol and sebacic acid in 1854; while M. A. von Lourenço prepared a resin from glycerol and citric acid in 1863. The most important dibasic acid employed in the manufacture of alkyd resins is phthalic acid. The phthalic acid (or phthalic anhydride) is obtained readily by the catalytic oxidation of naphthalene. and once this synthesis was properly worked out a ready source of this valuable commodity was available at a reasonable price. While the reaction product of glycerol and phthalic anhydride is of limited utility by itself, it is upon this structural vertebra that such ingredients as natural resin acids as well as drying and nondrying varieties of vegetable fatty-oil acids can be hung. Other dibasic acids are used where specialized properties are required. Maleic acid is obtained by the vapour-phase oxidation of benzene, while its geometrical isomer, fumaric acid. is obtained either by rearrangement of the maleic acid or by fermentation processes. Succinic acid can be prepared by the reduction of maleic acid. Sebacic acid and azelaic acids are incorporated into alkyd resins where exceptional flexibility is required. and these acids are manufactured commercially by treatment of castor oil or cottonseed oil, respectively, with caustic at elevated temperatures. Adipic acid is also available by the oxidation of cyclohexanol, which in turn can be derived from phenol. Glycerol is by far the most important polyhydric alcohol used, but ethylene glycol, diethylene glycol and pentaerythritol are used for merits of their own.

The drying-type alkyd resins first came into commercial prominence when it was demonstrated by R. H. Kienle that it was possible to form a new type of product by recombining the component parts of a drying oil. that is, the glycerol and the drying-oil acid in the presence of a saturated dibasic acid such as phthalic. Under these conditions, the cocondensation of glycerol, phthalic acid (as anhydride) and a drying-oil acid yielded a high-molecular-weight resinous condensation product in which the unsaturation of the drying-oil acid was substantially unimpaired. The result was that the resin would dry in a manner similar to the natural drying oil. Such resins in organic liquids yield solutions which resemble varnish and can be used as such Since the resins could be dispersed in relatively cheap organic liquids, these varnish solutions found wide acceptance in coating various metals, as priming paints and as enamels. They are used to finish transportation equipment such as automobiles, streetcars and railway coaches and, because of their good chemical resistance, find acceptance as enamels for coating refrigerators and washing machines. Similar resin solutions are used in ornamental hardware, to coat metal furniture. metal signs and farm equipment, and, because of good heat resistance, these resins are employed to cover radiators, smokestacks and light reflectors. They find wide acceptance as architectural enamels, traffic paints and as printing-ink ingredients.

These resins are often used alone, but they show excellent compatibility characteristics with a wide variety of other film-forming agents such as nitrocellulose, natural resins, phenolic resins and urea and melamine-formaldehyde resins With nitrocellulose it is possible to secure films possessing toughness, hardness and durability, as well as good gloss. It was this combination with nitrocellulose and alkyd resins which initially permitted the formulation of automotive finishes possessing an enamel-like quality and having excellent outdoor durability. When these resins are modified with natural resins, the melting point and hardness are increased; since such compositions release solvent very readily, they are used as rubbing and sanding vehicles. When mixed with urea-formaldehyde and melamine-formaldehyde condensation products, the alkyd resin becomes harder and more mar-resistant.

3. Polyester Resins.—While closely related to alkyd resins, the polyester materials differ from the conventional alkyd resins in that the cure is associated with a low-molecular-weight unsaturated organic liquid The polyester resins, or anhydrous thermosetting resins, usually comprise an unsaturated alkyd resin prepared from a polyhydric alcohol with an unsaturated acid such as maleic or fumaric acid. This alkyd resin is then dispersed in an organic liquid such as monomeric styrene or with diallyl phthalate. This solution, appropriately stabilized for shipping, is treated with a peroxide catalyst just before use. The catalyzed resinous material is then employed in saturating various fibrous materials such as fabric or glass fibre. The cured composite structure of resin and glass fibre found use in such widely differing applications as plastic armour, trays, radar housings, luggage and lightweight boats.

The term polyester resin has also been used for an entirely different type of product derived from terephthalic esters. Because of the high symmetry of this acid, the resulting polyesters are high-melting crystalline compositions and, when properly oriented, form a self-supporting film structure of high transparency and strength. The same resin, in oriented fibrous form, finds application both in England and in the United States as a textile fibre.

Still another polyester possessing unusual physical properties has been prepared by reacting phosgene with a phenolic substance commonly designated as bisphenol-A. In this instance the phenolic body serves as the dihydric alcohol to yield resins of outstanding toughness. Initially developed in Germany, a number of American firms are developing markets for this product.

4. *Epoxy* Resins.—When this same bisphenol-A is reacted with epichlorohydrin, one has the basis for the preparation of a curing resin where the reaction occurs without the elimination of water. Such resins have been used not only as coating materials but as potting compositions. Currently they are being utilized as textile finishes.

5. Urea-Formaldehyde Resin$.—The chemical condensation of urea and formaldehyde yields resins which are of great value both in the molding and in the coating industry. The resins are characterized by extremely light colour, and products fabricated from

such materials can be made into moldings which are colourless. The fundamental chemical investigations of Hanns John laid the foundation for the use of this resin in the plastics industry; but insofar as coating resins are concerned, it was the observation of Kurt Ripper that proved most valuable. He found that under suitable conditions the water-soluble condensation product of urea and formaldehyde could be dispersed in organic liquids. To make the resin soluble in varnish solvents for coating use, it was first necessary to conduct the condensation of urea and formaldehyde in a solvent such as alcohol and then to remove the water of condensation as an azeotrope with the alcohol. The resin thus formed in alcoholic solution could then be diluted with aromatic solvents.

By themselves, films and coatings of the unmodified urea resins are hard and marproof and possess good colour and gloss but lack distensibility. From the standpoint of their use in enamels the resins are neutral, and consequently any type of pigment can be admixed with them. When these urea resins are blended with alkyd resins, they become flexible and adhere to metal surfaces. This combination of urea-formaldehyde resins and alkyd resins is in many ways a unique combination whereby the urea resins improve certain of the deficiencies of the alkyd resins such as increasing hardness and eliminating the tendency of the oil-modified alkyd resins to wrinkle on rapid drying. The urea-formaldehyde resins under the influence of heat contribute hardness, colour and gloss to the cured film, while the alkyd resins produce flexibility, drying ability and adhesion to metal surfaces.

6. Melamine-Formaldehyde Resins.—Many of the excellent characteristics exhibited by the urea-formaldehyde resins in coatings are also shown by the melamine-formaldehyde resins. Melamine, or polymerized (trimerized) cyanamide, is a heterocyclic compound which reacts with and cures rapidly in combination with formaldehyde. Unlike urea, which is low melting and soluble in water, melamine possesses a high melting point (354° C.) and dissolves very slightly in water. It is characterized by an exceptionally stable ring system of alternate carbon and nitrogen atoms —a stability which is reflected in the resins made from it. The melamine and formaldehyde resin can be dispersed in organic solvents by procedures similar to those employed for the urea-formaldehyde condensation product. When used in admixture with alkyd resins a much faster heat cure can be secured than when urea-formaldehyde is used. The outstanding characteristics which urea resins supply to films are further enhanced with melamine resins; these are superior in resistance to various chemical reagents, outdoor durability and colour retention on exposure to both heat and light. These properties, in addition to porcelain-like appearance and resistance to abrasion, enabled such finishes to enter into automotive coatings and industrial finishes.

7. Polyethylene.—While the large majority of uses of polymerized ethylene are in moldings and in self-supporting films, there are certain newer developments whereby the thermoplastic product is converted to a thermosetting variety. When the polymer is exposed to radiation, such as the y-rays, a certain amount of hydrogen is knocked out of the system; and under appropriate conditions, depending on whether the polymer is in aerobic or anaerobic environment, the fragments will reunite to form an insoluble product. This infusible material possesses about the same electrical characteristics as the unmodified material. When this radiation is performed in the presence of polyethylene which has been milled with carbon black, one may secure an infusible, filled, molded composition.

8. Coumarone-Indene Resins.—From the light oils present in the distillation of coal tar, it is possible to secure a fraction rich in indene, coumarone and related isomers. This mixture can be polymerized by means of sulfuric acid into resins of soft or hard consistency. These synthetic resins are one of the oldest-known synthetic products and have been available from the time of the initial investigations of G. Kraemer and A. Spilker in 1890. The resins exhibit good compatibility characteristics with a wide variety of other polymeric products, both synthetic and natural, and have been used in coating of concrete, in the manufacture of antifouling ship-bottom paints, as additives to paraffin wax, in admixture with bitumens and as compounding agents in butadiene-styrene synthetic rubber.

9. Silicones.—The silicone resins are based on the silicon-oxygen skeleton rather than upon the carbon-oxygen chains or upon the carbon chain found in the conventional resins. This siloxane linkage, as the silicon-oxygen combination is called, introduces a degree of resistance to heat that is not found in those chains possessing carbon atoms exclusively. Naturally, those same reagents which can break the silicon-oxygen bridge in silicate minerals are also instrumental in causing the silicone resins to undergo cleavage; both hydrofluoric acid and strong caustic will cleave the siloxane chain in the silicone resins. Through the proper choice of ingredients, groupings can be introduced into the molecular structure whereby growth may be made to occur essentially linearly as, for example, through the introduction of saturated dialkyl-siloxy groups, or three-dimensionally through the utilization of the monoalkyl-siloxy groupings.

Various silicones can be made by changing the nature of the alkyl group, but most of the commercial production is restricted to the methyl silicones. Various polymeric structures have been made, certain of which are viscous liquids, others resinous; and even rubbery products have been produced. The liquids have found use as hydraulic oils and as instrument and transformer oils. Some of the higher-molecular-weight materials have found further application as varnishes as well as in high-temperature-resisting paints and enamels and as coatings for electrical insulation. When applied to the surfaces of glass or ceramics and baked, the silicones yield surfaces which are water repellent.

10. Fluorine Resins.—Even though elementary fluorine is a relatively reactive gas, when this element is united with carbon in the form of an unsaturated monomer and when this product is polymerized, compositions of remarkable heat and chemical resistance are formed. Compositions are commercially available where only carbon and fluorine exist in the polymer matrix, but in certain instances chloride may replace a portion of the fluorine. Two of the resins which have achieved the greatest success are tetrafluoroethylene polymer and trifluorochloroethylene derivatives. In certain instances modification has involved the use of perfluorinated propylene. While most of the applications are directed toward plastics, outstanding coatings and fibres have been prepared from these compositions. Polytetrafluoroethylene possesses an extremely low coefficient of friction, and this characteristic has been used in the fabrication of composite metal bearings. Even though only one surface is coated, the friction is reduced. Through the use of fluorinated diolefins, heat-resistant rubber compositions have been formulated.

Resin Adhesives: 1. Plywood Adhesives.—Prior to the introduction of synthetic resins for plywood construction, laminated wood was susceptible to deterioration by water and high humidity. The natural protein products such as albumin and casein could not be rendered insoluble to the same extent as later became possible with various condensation products such as phenol-formaldehyde, urea-formaldehyde and melamine-formaldehyde resins. The new resin adhesives permit the construction of plywood in which the glue line is strong, resistant to water and immune to attack by the action of fungi, molds and vermin. Such plywood can be used not only for architectural and automotive purposes but also for aeronautical and marine construction. Phenolic-resin adhesives became commercially available about 1935; urea condensation products were introduced about 1937.

Two types of synthetic glues are manufactured—cold-setting and hot-setting. Certain of the resins are supplied in powder form which requires solution prior to use, whereas other types are already dispersed in a liquid medium. Extenders such as cereal flour and wheat flour are sometimes employed where maximum strength and waterproofness are not essential. Phenolic resins yield an especially durable bond, but the resin is coloured, and the colour may bleed through thin veneers. Such colour is also a disadvantage where the glued edges are exposed. The urea resin is characterized by a rapid cure at low temperature and is widely employed in the preparation of cold-setting adhesives. The urea-resin, moreover, is colourless and will not change the colour of

the wood. Melamine resins likewise possess excellent colour characteristics, and in addition the glue line formed from this resin is resistant to cold as well as to boiling water.

Keeping pace with the development of new adhesives were new fabricating and molding techniques which allowed the construction of complicated shapes particularly necessary in aeronautics and in boat construction. Flat sheets can be "post-formed" into simple curves, but for construction of compound curved surfaces a molding procedure is preferred. This is accomplished by applying the glue to the veneers and allowing them to dry in order to permit easy handling. A mold is constructed with the exact contours needed in the finished assembly, and the coated wood veneers are placed in the mold and fastened by staples. The laminates are enclosed in a rubber bag which is evacuated in order to keep the veneers rigidly in place, and the assembly is placed in an autoclave and heated in order to render the resin insoluble and infusible. Such procedures enabled rapid construction of large aircraft parts, pontoons and motor torpedo boats.

2. *Wood Impregnation.*—Wood which has been subjected to reduced atmospheric pressure to remove occluded air can be impregnated with various resin solutions dissolved in water or in alcohol. After drying, the temperature is raised, whereupon curing of the resin occurs in the interior of the wood, rendering it harder, stronger and more resistant to water and water vapour. Through the addition of appropriate accelerators prior to impregnation the cure can be effected at a lower temperature with less damage to the structure of the wood. Phenol-formaldehyde, urea-formaldehyde and a mixture of the two resins have been employed for this purpose.

3. Other Adhesive Applications.—Many other resinous and rubbery compositions, dispersed in water or dissolved in organic liquids, are used to bind metals, plastics, glass, rubber, paper, brickwork, leather, fabrics and cork. Others are used in the manufacture of shoes, gaskets, furniture construction, lighting assemblies, sound insulation and upholstery. Certain of these adhesives have natural or synthetic rubber as a base, whereas others involve the use of synthetic thermoplastic and thermosetting resins. During World War II the reinforcement of starch by urea-resin adhesives in paperboard manufacture allowed the fabrication of paper containers which had a high resistance to water.

Resins for Textile *Applications: 1.* Continuous Coating.--One of the methods of separating electrical conductors is by means of a covering of cotton or silk, and so long as anhydrous conditions exist such insulation is satisfactory. In a humid atmosphere, the textile absorbs water, and its insulating efficiency is markedly decreased. To overcome this disadvantage, the dried fabric is treated with a varnish subsequently cured, thereby sealing the fabric. The varnish is selected in order that the water vapour transmission through the film of resin will be as small as possible. Among the resins which have been employed, the phenolic resins are the best known, although almost every type of natural and synthetic resin has been tested at some time or another for this type of insulating varnish.

2. Impregnation *of* Fabrics.—Resins are applied to fabrics for purposes other than to produce insulation; for instance, to improve the finish of cotton and rayon and to render them non-shrinking and crushproof. Resins have also been employed to bind pigments to the fabric, to minimize bleeding and crocking of dyes and as mordants for dyeing cellulosic fibres with wool dyes (animalized cellulose). Since no resin discoloration can be tolerated in uses of this type, the thermosetting resins which have enjoyed widest acceptance in this field are the urea-formaldehyde condensation products. In numerous applications, superior results can be secured only with the melamine-formaldehyde resins. Among the more notable achievements of the latter resin, the following may be mentioned: shrinkage control of cotton and wool; improvement in the crease resistance of cotton and rayon; production of durable glazes on chintz; preparation of binders to prevent thread slippage; and minimizing of gas fading of acetate colours. Many of these effects are achieved by treating textiles with low-molecular-weight water-soluble condensation products and then causing resin formation to occur on the fabric.

Quite different effects are secured by using high-molecular-weight water-insoluble thermoplastic resins which are dispersed in water. Such resins render the fabric stiff, crisp and full, and when properly formulated such properties are not destroyed by the laundering operation. Other thermoplastic resins impart good draping characteristics and improve the abrasion resistance of the textile, whereas still others are employed for upholstery finishing, raincoats, shower curtains and other waterproofing applications.

Through suitable modification of resinous ingredients, particularly through the use of phosphorous or compounds of phosphorous and halogen, it has been possible to devise finishes for cotton in which there is substantial resistance to flame. This statement does not imply that the fabric is fireproof; but when the appropriate phosphorous compounds are combined chemically with cellulose, such materials will yield water and carbon at elevated temperatures. When the flame is removed, the charred cellulose will not propagate combustion, and there is no flaming or afterglow.

Resins Possessing Ionic Charges: 1. Ion-Exchange Resins.—By the introduction of strong acid groupings such as carboxyl and sulfonic acid into a three-dimensional polymer, high-molecular-weight resins can be made up where the resin is ionic in character and where the ion is chemically bound in the resin molecule. These ionic resins in the form of sodium salt can be used as a means of softening water whereby the calcium ions of the hard water are replaced by the sodium ions from the resin. In this respect the synthetic ion-exchange resins, generally known as cation resins, behave like the natural zeolites; and, like the zeolites, the resins when used under such conditions do not change the amount of dissolved salt in the water.

Condensation products can also be prepared synthetically where basic groupings such as amino- and guanido- are bound in the resin molecule, and these so-called anion resins can replace anions. It follows that a combination of the acidic and basic resins or a cation and an anion resin can completely eliminate the mineral content of water by first allowing the cation-exchange resin in the form of a free acid to react with the salt and subsequently reacting the effluent with an anion exchanger.

Once the resins become saturated with minerals, they can be regenerated chemically and used over again as often as required. The process works most expediently where the concentration of a mineral matter is low, but the scavenging is so complete that the method has found favour not only in producing a so-called demineralized distilled water but in numerous industrial processes where the removal of ionic impurities is not possible by distillation. Ion-exchange resins have been used to remove mineral impurities from pharmaceutical preparations, dyestuffs, sugar, syrups, enzyme preparations, emulsions and glycols and formaldehyde. Other industrial uses include the recovery of valuable metals and various other inorganic and organic materials from industrial wastes. The resins have also been employed as catalysts in chemical reactions, particularly in the inversion of sugar.

Water soluble resins might most properly be designated as gums. The alternative nomenclature appears more attractive even though the definition distorts the initial distinction between resins and gums. Since the same raw materials are so closely allied with the resin industry, this terminology is useful to distinguish these synthetic products from the natural water-soluble gums. In the same way that resins may be modified, various water-dispersible functional groups may be introduced into the polymer molecule; these groups may be ionic or nonionic. By suitable adjustment a wide range of physical properties may be incorporated into the final polymer, permitting it to be more or less sensitive to accompanying ions. The carboxyl group is the preferred ionic residue, where this functional group is introduced using either acrylic and methacrylic acid or maleic anhydride. Of the nonionic residues, a much wider range of components are available such as the alcohol group, methoxides, pyrrolidone and amides. Considerable attention had been directed to various copolymers of acrylamide and acrylic acid. One of the newer outlets for these water-soluble colloids has been approved for removing the "chill haze" in beer. Polyvinylpyrrolidone will precipitate tannins and other complex proteins from beer and wine. The polymeric acids also

have applications in a number of unusual outlets such as in soil stabilization and in drilling muds. There are a number of soils which are fine powders when dry and slimy muds when wet. If, to these soils, one adds a small concentration of these polymeric acids, the mud seems to dry up yielding a friable soil permitting water to drain away without serious erosion. In drilling muds these polymeric acids allow the mud to retain water and prevent its loss of unusual formations where water loss might cause seizure of the drilling bit.

2. Resins *for* the Treatment *of* Paper.—Another resinous ion which has attracted attention is the cationic melamine-formaldehyde resin. Unlike the ion-exchange resins, the cationic melamine resin is initially dispersible in water solution. The large ion is attracted toward and adheres to the cellulose fibre. It can be incorporated into paper by adding—as an acidic dispersion to a paper-pulp suspension and after migration to the paper fibre, the resin becomes insoluble and infusible during the drying of the paper stock. The resulting product is characterized by superior fold resistance and by a nonlinting behaviour when dry, and when wet it does not disintegrate as does untreated paper. Water-dispersible urea resins with ionic properties have been developed and can be added to paper stock in a similar manner. Certain of these resins are anionic, *i.e.*, they contain sulfonic acid groups and are flocculated on the fibres through the use of aluminum sulfate while others are cationic and need no flocculation agent.

See also Index references under "Resins" in the Index volume.

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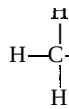
RESISTENCIA, a city of northeastern Argentina, capital of the province of Chaco (*q.v.*), is situated on the Barranqueras stream that connects with the Parana river at Barranqueras, its port. Pop. (1956 est.) 76,400. It is the administrative centre of the province and the nucleus of a zone of frontier settlement extending toward the northwest. Cotton, quebracho. leather. cattle and lead are the main industries in the area. A railroad runs west to Metán and Rosario de la Frontera, and south to Santa Fe, 348 mi. distant. (J. L. TR.)

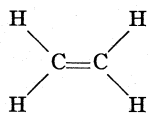
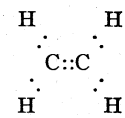
RESONANCE, a term used in physics and related fields originally denoting a prolongation or increase of sound because of sympathetic vibration of some body capable of moving in the proper period. An example is the oscillation induced in a violin or piano string of a given pitch when a musical note of the same pitch is sung or played nearby. For resonance in acoustical theory and experiment, see SOUND; in rooms and buildings, see ACOUSTICS OF BUILDINGS; as a theory of hearing, see HEARING; in violin construction, see VIOLIN. The term has been extended by analogy to the familiar selective mechanical resonance of a springboard or bridge to certain frequencies of jumping or walking; and to the selective electrical resonance of a tuned radio circuit to the radio frequency transmitted by a single radio station. At the high frequencies used in microwaves and radar (*q.v.*), the tuned circuit is actually constructed most easily in the form of a small metal cavity resonator not unlike the cavity of an acoustical resonator such as an open-mouthed bottle. (J. R. PT.)

RESONANCE, THEORY OF, in chemistry. is an extension of the theory of valence (*q.v.*), which contributed greatly to the understanding of the structure of molecules and the structural interpretation of the chemical and physical properties of substances. The concept of resonance has been applied in chemistry in the elucidation of the nature of the covalent bond. of the partial ionic character of bonds and of other aspects of valence. Its most important chemical applications have been to aromatic molecules. molecules containing conjugated systems of double bonds, hydrocarbon free radicals, and. other molecules to which no satisfactory single structure in terms of single bonds, double bonds and triple bonds can be assigned.

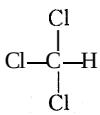
For many molecules it is possible to formulate valence-bond structures which are so reasonable and which account so satisfactorily for the properties of the substances that they are generally accepted and are used as the basis for chemical reasoning. Examples of such molecules are:

hydrogen, H—H or H:H

methane,  or 

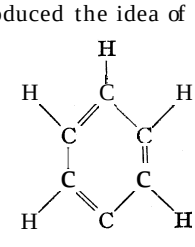
ethylene,  or 

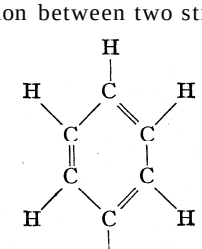
acetylene, H—C≡C—H or H:C:::C:H

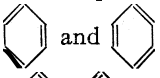
chloroform,  or 

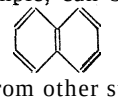
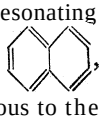
It is sometimes found, however, that a choice cannot be made between two or more conceivable structures which are expected to be about equally stable and of which no one accounts in a completely satisfactory way for the properties of the substance. The concept of quantum-mechanical resonance provided the solution to this problem; namely, the actual normal state of such a molecule can be described as corresponding not to any one of the alternative reasonable structures but rather to a combination of them, their individual contributions being determined by their nature and stability. The molecule is then said to resonate among the several valence-bond structures or to have a structure which is a resonance hybrid of these structures. The molecule is stabilized by this resonance, its energy being less than the energy which would be expected for any one of the structures among which it resonates. This stabilization is characteristic of the phenomenon of quantum-mechanical resonance, which was discovered by Werner Heisenberg in 1926 (see below). The physical and chemical properties of the substance and the configuration of the molecule are determined by the nature of the resonating structures; these properties arc, however, not the properties averaged for the resonating structures but are instead the averaged properties as influenced also by the effects of resonance and in particular by the additional stability resulting from the resonance energy.

The aromatic substance benzene provides not only an illuminating but also the most important example of the application of the concept of the resonance of molecules among two or more valence-bond structures. The formulation of the structure of benzene as a six-membered ring of carbon atoms with attached hydrogen atoms was made by F. A. Kekulé in 1865. To make the structure compatible with the quadrivalence of carbon he introduced alternating single and double bonds in the ring, and later, in 1872, in order to account for the nonobservance of isomeric orthodisubstituted benzenes (differing in having a single bond or a double bond between the substituted carbon atoms), he introduced the idea of an oscillation between two structures:

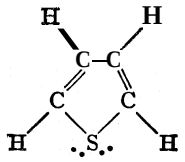




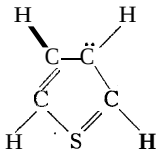
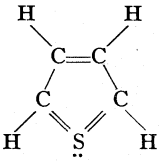
The Kekulé structure for benzene is unsatisfactory in that the substance does not show the properties of unsaturation to be expected for a molecule containing double bonds. After a period during which the centric structure of H. E. Armstrong and Adolf von Baeyer, the diagonal structure of A. Claus and the structure of J. Thiele based on his theory of partial valence were proposed, an important advance was made in the years following 1920 in the theory of intermediate stages proposed by F. Arndt and the theory of mesomerism developed by Sir Robert Robinson, C. K. Ingold and other English and U.S. chemists. The suggestion of these investigators, induced from the facts of chemistry, was that the true state of a molecule may be intermediate between those represented by several different valence-bond structures. Complete clarification of the structure of benzene was then provided in 1931 through the application of the theory of resonance and the consideration of the effect of resonance energy. According to the quantum-mechanical discussion of the structure of benzene, the normal state of this molecule can be represented as a hybrid of the two Kekulé structures  and three diagonal structures of the form  (the para bond in these structures being a weak bond, almost equivalent to a free valence on each of the para carbon atoms) and other structures which make smaller contributions. The configuration of the molecule should be a suitable average of those configurations corresponding to the individual structures. Because of the resonance the six carbon-carbon bonds are equivalent, and because of the stereochemical properties of a double bond the molecule as a whole is planar; hence the benzene molecule is predicted to be a planar hexagonal molecule, in agreement with observations made by the electron diffraction, X-ray diffraction and spectroscopic methods. Moreover, each carbon-carbon bond should be intermediate in length between a single carbon-carbon bond and a double carbon-carbon bond, the lengths of which, in molecules represented by a single valence-bond structure, are 1.54 Å and 1.33 Å, respectively. The observed value in benzene, 1.39 Å, is compatible with this prediction. Moreover, the benzene molecule is predicted from the quantum-mechanical considerations to be stabilized by resonance energy to the extent of about 40 kg.cal. per mole, relative to the value expected for one of the Kekulé structures. The amount of resonance stabilization can be estimated experimentally by measurement of the heat of combustion or heat of hydrogenation of benzene and related substances. For example, the heat of hydrogenation of cyclohexene is 28.6 kg.cal. per mole; if each of the three double bonds in benzene were the same as the double bond in cyclohexene, the heat of hydrogenation of benzene would be 85.8 kg.cal. per mole, whereas in fact the observed value is 49.8, indicating that the benzene molecule is stabilized relative to a Kekulé structure by the amount of energy 36 kg.cal. per mole, in approximate agreement with the quantum-mechanical prediction. The characteristic chemical stability and non-reactivity shown by benzene, relative to simpler unsaturated substances, may be attributed to this stabilization by resonance. It is possible, moreover, by the detailed consideration of the resonating structures to explain in a reasonably satisfactory way the other striking chemical properties of benzene, such as the influence of one substituent in determining the position of attachment of further substituents to the ring.

The structures of polynuclear aromatic hydrocarbons are similar. Naphthalene, for example, can be described as resonating among the three structures  ,  and  , with small contributions from other structures analogous to the para-bonded structures of benzene, and the resonance energy of naphthalene is found to be about 75 kg.cal. per mole.

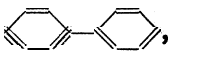
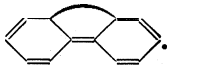
The stabilization of the aromatic heterocyclic molecules such as thiophen results from resonance of the most important structure



with structures such as

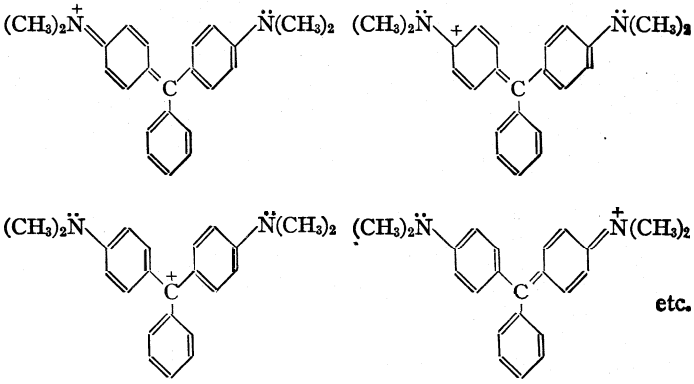
 and 

The resonance energy for thiophen is about 30 kg.cal. per mole.

The characteristic properties of substances which contain conjugated systems of double bonds can be readily accounted for by the theory of resonance. A molecule such as biphenyl,  , is stabilized not only by Kekulé resonance but also by the resonance energy of conjugation, resulting from the contributions of the somewhat less stable structures of type  .

For biphenyl, phenylethylene and butadiene the resonance energy of conjugation is about five kg.cal. per mole. There are two stereochemical effects of this conjugation: the carbon-carbon distance for the single bond involved in the conjugated system is decreased from the single-bond value, 1.54 Å, to about 1.48 Å, as the result of the contribution of the conjugated structures with a double bond in this position; and the double-bond character of this bond also finds expression in the tendency to hold the adjacent bonds in the planar configuration. Thrse molecules are observed to be planar or nearly planar, except when planarity is prevented by the arrangement of valence bonds or by steric effects, in which case the properties of the substance show that there is interference with the conjugation.

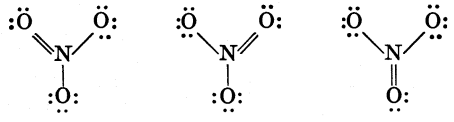
The phenomenon of resonance can be invoked in the discussion of the colour of dyes and other organic substances. The normal state of the cation of malachite green, for example, involves resonance among all structures of the sort shown below, in which the positive charge is located on different atoms within the molecule:



The excited states of the molecule are similar resonating states involving these structures. The absorption of light by the molecule, with its transition from the normal state to an excited state, occurs with great ease; the quantum-mechanical molecule can be compared with a classical oscillator in which a positive charge is resonating through a large amplitude, from one nitrogen atom across to the other, and from this comparison it can be predicted that the molecule should show intense absorption of light of suitable wave lengths.

Resonance also provides an explanation of the properties of many inorganic substances. For example, the carbon-monoxide molecule is a far more stable molecule than would be expected

from the apparent bivalence of carbon, and there was formerly discussion as to whether its structure should be written as :C=Ö:, containing a double covalent bond, or as :C≡O:, similar to the nitrogen molecule. The molecule can be assigned a hybrid structure based upon these structures, and its stability can be attributed to resonance stabilization. For carbon' dioxide the structure :Ö=C=Ö: was for many years accepted without question; later, however, evidence of interatomic distances and other properties showed that this structure is in resonance with the two structures :O≡C−O: and :O−C≡O:. Nitric oxide, which is surprisingly stable for a molecule containing an odd number of electrons, can be described as achieving this stability through resonance between the structures :N̈=Ö: and :N̈=Ö:, and may be said to have a double bond plus a three-electron bond between its two atoms. The nitrate ion, NO_3^-, resonates among the three structures



making each of the nitrogen-oxygen bonds a hybrid between a single bond and a double bond.

The general rules regarding the resonance of a molecule among alternative valence-bond structures are the following: Equivalent structures contribute equally to the normal state of the resonating molecule. The more stable structures in general make larger contributions to the normal state, and less stable structures make smaller contributions. The electronic state of the resonating molecule applies to a definite configuration of the atomic nuclei; accordingly the energy values of the individual structures to be considered in connection with the foregoing statements are those calculated for the nuclear configuration of the actual state of the molecule and not for nuclear configurations which would be the most stable for the individual structures. The strain involved in this change in configuration in some cases makes structures unimportant which otherwise might be important. All of the structures which contribute to a resonance hybrid structure must have the same number of unpaired electrons; significant resonance does not occur, for example, between a structure with no unpaired electrons (singlet state) and a structure with two unpaired electrons (triplet state).

The basis of the theory of resonance is the fundamental principle of quantum mechanics that the wave function representing a stationary state of a system can be expressed as a sum of wave functions which correspond to hypothetical structures for the system, and that, in particular, the wave function representing the normal state of a system is that sum which leads to a minimum calculated energy of the system. The concept of resonance was introduced into quantum mechanics by Werner Heisenberg in an illuminating discussion of the stationary states of the helium atom (*Z.* f. Physik, vol. 38, p. 411; vol. 39, p. 499 [1926]). Heisenberg discussed certain excited states of this two-electron atom in terms of structures in which one electron occupies an inner orbit, close to the helium nucleus, and the second electron occupies an outer orbit; and he showed that an actual stationary state can be represented by a wave function obtained by adding to or subtracting from the wave function for this structure another wave function, representing the structure in which the second electron occupies the inner orbit and the first electron the outer orbit. On the basis of analogy with the classical system of resonating coupled harmonic oscillators, he assigned the name quantum-mechanical resonance to this concept (see ATOM; QUANTUM MECHANICS; SPECTROSCOPY).

The special usefulness of the harmonic oscillator in the interpretation of quantum mechanics results from the fact that when this system is treated by the methods of classical mechanics and the old quantum theory, with the number ½ added to the integral values of the quantum number, many of the calculated properties of the system are the same as those given by quantum mechanics. The simplest system illustrating resonance consists of two equivalent harmonic oscillators with a weak Hooke's-law coupling between them. The potential energy for this system may be represented by the expression $2\pi^2 m\nu_o^2 x_1^2 + 2\pi^2 m\nu_o^2 x_2^2 + 4\pi^2 m\lambda x_1 x_2$, and the kinetic energy by $\frac{1}{2}mx_1^2 + \frac{1}{2}mx_2^2$, where m is the mass of each oscillator, x_1 and x_2 are the displacements of the oscillators from their positions of rest, ν_o is the characteristic frequency of oscillation of each oscillator when there is no coupling ($X = o$), and λ is a parameter determining the strength of the coupling. The classical equations of motion for this system can be solved in terms of the normal co-ordinates

$\xi = \frac{1}{\sqrt{2}}(x_1 + x_2)$ and $\eta = \frac{1}{\sqrt{2}}(x_1 - x_2)$. Each of these normal co-ordinates varies harmonically with the time, t, the integrated equations of motion being $\xi = \xi_o \cos(2\pi\sqrt{\nu_o^2 + \lambda}\, t + \delta_\xi)$ and $\eta = \eta_o \cos(2\pi\sqrt{\nu_o^2 - \lambda}\, t + 6_\eta)$ in which ξ_o, η_o, δ_ξ and 6, are the constants of integration. It is seen that the characteristic frequencies for ξ and η, $\sqrt{\nu_o^2 + \lambda}$ and $\sqrt{\nu_o^2 - \lambda}$ respectively, differ from ν_o. The co-ordinates x_1 and x_2 are then given by the equations

$$x_1 = \frac{\xi_o}{\sqrt{2}}\cos(2\pi\sqrt{\nu_o^2 + \lambda}\, t + \delta_\xi) + \frac{\eta_o}{\sqrt{2}}\cos(2\pi\sqrt{\nu_o^2 - \lambda}\, t + \delta_\eta)$$

and

$$x_2 = \frac{\xi_o}{\sqrt{2}}\cos(2\pi\sqrt{\nu_o^2 + \lambda}\, t + \delta_\xi) - \frac{\eta_o}{\sqrt{2}}\cos(2\pi\sqrt{\nu_o^2 - \lambda}\, t + \delta_\eta).$$

If η_o is zero, the two oscillators carry out, exactly together in phase, a simple harmonic motion with amplitude $\frac{\xi_o}{\sqrt{2}}$ and frequency $\sqrt{\nu_o^2 + A}$; and if ξ_o is zero, they carry out, with phase difference a, a similar harmonic motion with amplitude $\frac{\eta_o}{\sqrt{2}}$ and frequency $\sqrt{\nu_o^2 - \lambda}$; but if neither η_o nor ξ_o vanishes, each of the oscillators vibrates in a complex way, the amplitude changing slowly from $\frac{\xi_o + \eta_o}{\sqrt{2}}$ to $\frac{|\xi_o - \eta_o|}{\sqrt{2}}$. This is the phenomenon described as classical resonance.

The rules of the old quantum theory with zero-point energy lead to the value $(n_\xi + \frac{1}{2})\, h\sqrt{\nu_o^2 + \lambda} + (n_\eta + 3)\, h\sqrt{\nu_o^2 - \lambda}$ for the energy of this system, and to the equations

$$\xi_o = \{(n_\xi + \tfrac{1}{2})h/2\pi^2 m\sqrt{\nu_o^2 + \lambda}\}^{\frac{1}{2}}$$

and $\eta_o = \{(n, + \frac{1}{2})h/2\pi^2 m\sqrt{\nu_o^2 - \lambda}\}^{\frac{1}{2}}$

for the amplitudes. Each of the quantum numbers n_ξ and n_η can assume the values 0, 1, 2, ... Since neither ξ_o nor η_o can vanish, even when the quantum number is zero, the oscillators show the phenomenon of classical resonance in every quantized state.

The stationary states of a harmonic oscillator in quantum mechanics are described by wave functions $\psi_o(x)$, $\psi_1(x)$, $\psi_2(x)$, ..., $\psi_n(x)$, ..., corresponding to the energy values $(n + \frac{1}{2})h\nu_o$, with integral values for the quantum number n. The wave functions $\psi_n(x)$ are the successive Hermite orthogonal functions. The system of two equivalent coupled harmonic oscillators (with the same frequency) can be treated rigorously by use of the co-ordinates ξ and η, and the correct wave functions for the system are $\psi_{n\xi}(\xi)\psi_{n\eta}(\eta)$, the energy values being the same as for the old quantum theory, as given above. In this discussion of the system there is no need to mention resonance. However, the system may also be treated by a perturbation method, based on the wave functions $\psi_{n'}(x_1)\psi_{n''}(x_2)$ for the unperturbed system, with no coupling between the oscillators. For the normal state of the system, with $n' = n'' = 0$, there is only one wave function. There are, however, two independent wave functions, $\psi_o(x_1)\psi_1(x_2)$ and $\psi_1(x_1)\psi_o(x_2)$, for the next energy level; these functions correspond to states in which one oscillator has small energy, $\frac{1}{2}h\nu_o$, and the other has larger energy, $3/2h\nu_o$. It is found on treating the system of coupled oscillators that these functions are not satisfactory approximations to the correct wave func-

tions representing the two slightly different energy levels of the system, but that their normalized sum and difference, $\frac{1}{\sqrt{2}}[\psi_0(x_1)\psi_1(x_2) + \psi_1(x_1)\psi_0(x_2)]$ and $\frac{1}{\sqrt{2}}[\psi_0(x_1)\psi_1(x_2) - \psi_1(x_1)\psi_0(x_2)]$, are satisfactory; the first wave function, symmetrical in the two coordinates x_1 and x ~ reprcscnts the more stable of the two states, and the second, antisymmetrical in x_1 and x_2 (changing sign when x_1 and x_2 are interchanged), represents the less stable state. Each of these states is a hybrid of the two structures represented by $\psi_o(x_1)\psi_1(x_2)$ and $\psi_1(x_1)\psi_o(x_2)$, and, from analogy with the classical system, it has become customary to describe these hybrid states as resonance hybrids. This description is applied also to other quantum-mechanical systems which are conveniently discussed by a similar perturbation method, even though there is no close classical analogue for them.

The arbitrary nature of quantum-mechanical resonance is evident from the foregoing paragraphs. The system of coupled harmonic oscillators can be treated rigorously without mentioning resonance. It is for convenience, resulting from knowledge of the unperturbed wave functions, that these functions are used in the perturbation treatment. Quantum-mechanical resonance is not a property of a system, but of a system in relation to structures which are assumed as the basis for its discussion. In chemistry the theory of resonance is used primarily as an aid in discussing the structure and properties of complex molecules in terms of simple molecules. Simple structures similar to those which have been assigned to simple molecules are assumed as the basis for the discussion of complex molecules; and often when no one of the simple structures is satisfactory, a resonance hybrid can be formulated which represents the complex molecule in a satisfying and useful way.

The arbitrariness mentioned above is not characteristic of the theory of resonance in chemistry, but is shared by it with other branches of structural theory. It is recognized now that the structures of molecules may be correctly described by the quantum-mechanical wave functions pertaining to their normal states, and that the structural formulas assigned by chemists are symbols for the wave functions. For nearly a century chemists have written the simple valence-bond formulas H — H for molecular hydrogen, Cl — Cl for molecular chlorine and H — Cl for hydrogen chloride. The dash in the formulas H — H and Cl — Cl is a symbol for wave functions describing the normal states of these diatomic molecules formed of identical atoms. The normal state of the hydrogen chloride molecule is, of course, correctly described by its wave function, and this wave function is not rigorously related to the wave functions of the hydrogen molecule and the chlorine molecule. Nevertheless, chemists have found it convenient to assign the structural formula H — Cl to the molecule with use of a dash like that used in the formulas H — H and Cl — Cl, and to describe the hydrogen chloride molecule, like the hydrogen molecule and the chlorine molecule, as involving a single valence bond. Thus the valence-bond structural theory, which has been of great value in the development of chemistry, is an arbitrary approximate representation of the wave functions that alone correctly represent the molecules. It is conceivable that a system of symbols much different from the valence-bond dashes could be developed that would correspond just as well to the wave functions, but in fact a satisfactory alternative system of this sort has not been discovered, and chemists continue to use the valence-bond theory.

The theory of resonance in chemistry has been subjected to criticism because of its arbitrariness. The critics may not have recognized that, as mentioned above, the same criticism applies to the whole of structural theory. A structural formula for a nonresonating molecule such as ethane is a rough description of the wave function in terms of wave functions involving first a hydrogen nucleus, a carbon nucleus and a pair of electrons, and second two carbon nuclei (each with its inner shell of K electrons) and a pair of electrons. In the same way the structural formula for the resonating molecule benzene is a rough description of the wave function of benzene as a sum of valence-bond wave functions similar to the one assigned to ethane: the two Kekulé structures and other structures that are hybridized in the resonance representation of the benzene molecule do not correspond separately to states of the benzene molecule, but are symbols that. taken together, provide a rough description of the wave function of the molecule in its normal state.

The theory of resonance is of value in chemistry in the discussion not only of the configuration of molecules, interatomic distances, electric dipole moments, force constants of bonds and similar molecular-structural properties, but also of thermodynamic stability (as of aromatic substances, conjugated systems, free radicals), strengths of acids and bases, existence of tautomers. and chemical properties in general.

See L. Pauling, *The Nature of the Chenzical Bond and the Structure of Molecules and Crystals,* 3rd ed. (1959); G. W. Wheland, *Resonance in Organic Chemistry* (1955). (L. C. P.)

RESONANCE ENERGIES, also resonance potentials, are general expressions denoting energy differences between the stationary states of atoms. molecules and atomic nuclei. The term resonance was first applied because of the apparent analogy between acoustical or electrical resonance (*q.v.*) and the selective absorption or emission of certain light frequencies by these microscopic systems. Since the energy absorbed is proportional to the frequency, the microscopic system can only absorb or emit particular selected amounts of energy, which carry it from one stationary state of internal energy (or potential) to another; this holds whether the energy is the radiant energy in a particle of radiation or the kinetic energy of motion in a colliding particle of matter which hits the microscopic system.

In structural chemistry, however, the "resonance energy" of a molecule has quite a different meaning. It refers to the deviation of the energy of formation of a molecule from a hypothetical ideal energy which is conceived as the sum of the energies of its parts. Here the term resonance is supposed to be drawn from a branch of quantum theory and is only distantly related to acoustical or mechanical resonance. (J. R. Pt.)

RESORCINOL, also called resorcin, is a commercially important organic chemical. It was first obtained in 1864 by H. Hlasiwetz and L. Barth by the potash fusion of certain natural resins (galbanurn. asafetida, etc). Resorcinol. metadihydroxybenzene, $C_6H_4(OH)_2$, crystallizes in colourless rhombic prisms or plates, which dissolve readily in water, alcohol or ether. and sparingly in benzene. It melts at 110.7° C. and boils at 281° C.; its specific gravity is 1.2710. It has an unpleasant sweet taste, and its aqueous splution gives a deep-violet coloration with ferric chloride.

Resorcinol is manufactured in large quantities from benzene. The general procedure consists in sulfonating benzene with fuming sulfuric acid to benzene metadisulfonic acid and fusing the sodium salt of this acid with caustic soda.

Resorcinol is used in the manufacture of resins, plastics. adhesives, dyes, photographic-developers, explosives, cosmetics and pharmaceuticals, and as an intermediate in the synthesis of many other organic compounds. It is used medicinally as a dehydrant, antiseptic, antiferment and bactericide.

By the mid-1950s the biggest use for resorcinol was in making adhesive resins and plastics. Resorcinol-formaldehyde-type resins are used extensively as pre-dip before impregnating rayon and nylon with rubber. They are used in bonding when a cold set is necessary; *e.g.,* in bonding wooden members that are too thick to be heated.

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RESPIGHI, OTTORINO (1879–1936), Italian composer, was born at Bologna on July 9. 1879, and studied at the Liceo of Bologna, at St. Petersburg (Leningrad) under Rimsky-Korsakov and in Berlin under Max Bruch. In 1913 he was made professor at the Conservatorio di S. Cecilia in Rome, and in 1923 director.

The operas *Semirama* (1910) and *La Bella addormentata* (1922) were followed by the successful *Belfagor* (1923), which reflects in the eclecticism of its style the cosmopolitan character of the composer's training. His orchestral music includes the symphonic poems *Fontane di Roma* (1917), *Pini di Roma* (1924) and *Vetrate di chiesa* (1927): in the way of chamber music he wrote a sonata for violin and pianoforte and two string quartets, while a *Concerto gregoriano* for violin and orchestra may also be mentioned.

RESPIRATION is the transfer of gases between living organisms and their environment. It goes hand in hand with metabolism. a process akin to combustion, whereby foodstuffs are oxidized. just as fuel is. with the release of energy for the needs of the organism. The gaseous exchange for man is the same basically as that for a fire, oxygen being taken out of the environment and carbon dioxide released to it. Yet biological oxidations go on at temperatures hundreds of degrees lower than those of a fire: owing to the presence of enzymes (chemical catalysts) in the tissues of animals, plants and bacteria.

Diffusion of Gases in Respiration. — Virtually every living animal. he it amoeba or whale, receives its oxygen, and gets rid of the carbon dioxide produced. by means of diffusion (*q.v.*). This process refers to the net movement of molecules, by virtue of their constant random activity, from regions of higher toward those of lower concentration. Transfer of substances by diffusion, however, is characteristically slow except over extremely short distances. This is illustrated by Fick's law of diffusion, which in simplified form is:

$$\frac{Q}{t} = \frac{D.A(C_1 - C_2)}{x}$$

where $\frac{Q}{t}$ = quantity of substance diffusing per unit time; D is the diffusion coefficient, a constant depending on the nature of the substance diffusing, on the material it is in. and on the temperature; A = the area of the surface; $(C_1 - C_2)$ refers to the concentration difference across the material; and x equals its thickness. Thus. the rate of diffusion is directly proportional to the surface area and to the concentration difference, and inversely proportional to the thickness of the substance across which diffusion is occurring.

Respiratory Adaptations in Evolution. — Sufficient gas exchange for an amoeba (diameter 0.j mm.) can be provided by diffusion across the surface membrane. With increasing size of spherical organisms, the mass of metabolizing tissue increases more rapidly than the surface area, a point being reached at a diameter of about one millimetre when the diffusing area is not large enough to meet the need. As a result, there has evolved in the majority of metazoa, or multicellular organisms, some kind of specialized respiratory system, and with it a circulatory system. These are well-suited to their function by virtue of the thin walls and large surface areas of the layers separating the circulating fluid (usually blood) from the external environment (water or air) on the one hand and from the active cells on the other.

Four chief means for respiration have appeared:

1. The first and simplest is by the way of the surface membrane, mentioned above in the case of the protozoan amoeba. Diffusion across the surface layer also suffices in certain of the more primitive metazoa, both aquatic and terrestrial. Convection often aids diffusion, by movement of sea water, as in sponges, and by the constant stirring of blood which occurs in animals with circulatory systems.

In some cases the skin shares the burden of respiration with specialized organs. Thus in cold surroundings eels and frogs can obtain most of their oxygen through the surface of the body but, when the temperature is higher, need their gills and lungs, respectively. In mammals, including man, however, the amount of oxygen received through the skin is negligible (usually less than 1%).

2. Gills represent a second chief means for respiration. Most gills are motile and are located, usually inside the body, in a moving current of water, the gas exchange being enhanced by the "countercurrent" principle, whereby the blood flows in a direction opposite to that of the water. (Purification of the blood would be much less complete were the two to go in the same direction.)

3. Third are lungs, usually aerial, though sometimes water-filled. One of the simplest forms is seen in the African pulmonate land snail, in which the lung consists of a simple air sac half a litre in volume. This is called a diffusion lung, because there is no active ventilation.

Ventilatory lungs are those in which there is a bellows function, air being moved in and out by mechanical movements. There are positive pressure lungs, in which air is pushed into the lung while the nostrils are closed, as in frogs, contractions of abdominal muscles causing expiration. Negative pressure lungs are those in which air is pulled in by expansion of a bony thoracic cage, as in man and other mammals.

With increasing demands for energy the surface area available for diffusion becomes increased by subdivision of the lung into progressively smaller and smaller air sacs. called alveoli. Thus the lung of an amphibian such as a frog contains a few hundred alveoli, whereas that of a man or a large animal contains hundreds of millions.

Greater efficiency per unit of diffusing surface exists in birds through improved ventilation. This is achieved by means of two unique anatomical features, including a tubular diffusing system (in contrast to the dead-end alveoli of mammals) and a group of air sacs located beyond the lung. An idea of this arrangement is given in fig. 1. Airways called parabronchi lead off each main bronchus and continue through the lung into one of several pairs of air sacs, located in the neck, thorax. abdomen and even inside the long bones. Each air sac is also connected to the bronchus by way of a mesobronchus. Diffusion of gases takes place in air capillaries. which, connecting adjacent parabronchi, are surrounded by a rich network of minute blood vessels.

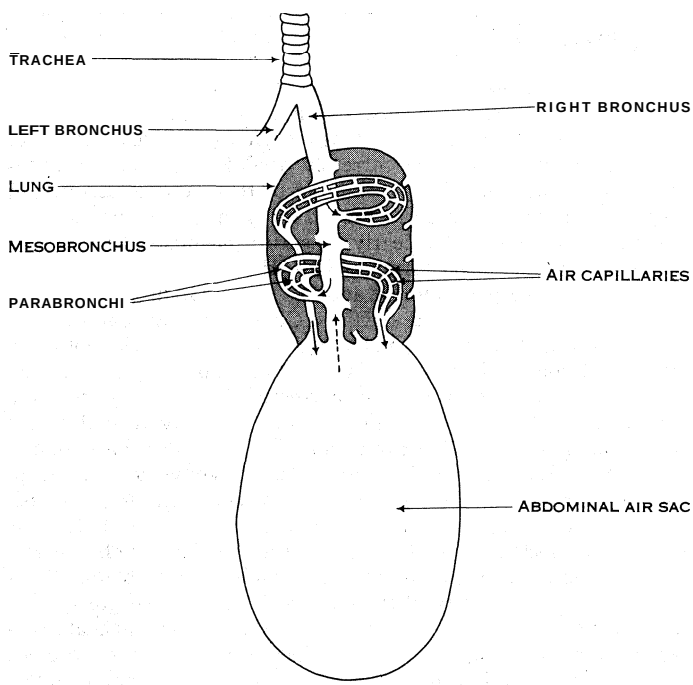


FIG. 1.— RESPIRATORY SYSTEM IN BIRDS SHOWING RIGHT LUNG AND ONE OF THE SEVERAL AIR SACS CONNECTED TO IT

Solid arrows indicate pathway of air flow during inspiration; dashed arrow, pathway during expiration

By means of rapid gas analyzers for oxygen and carbon dioxide, R. H. Shepard showed that in the chicken inspired air passes almost solely through the parabronchial diffusing system and on into the air sacs. Air leaves the lattei during expiration by way of the mesobronchus, without passing back over the respiratory surfaces, as suggested by earlier investigators. The path is therefore mouth-lung-air sacs-mouth, a process requiring a valvelike action despite the absence of anatomical valves.

4. The fourth type of respiratory mechanism consists of the tracheae of insects, narrow, air-filled, branching tubes which open

to the outside of the body by way of spiracles. A circulating fluid such as blood is of minor importance for breathing in these organisms. the air being piped directly to the tissues. Tracheal respiration has served the insects well. but because gases diffuse slowly along a narrow tube, it has limited their size, the largest apparently being the dragonfly. *(See* INSECT: *Physiology: Respiration.)*

VENTILATION OF THE LUNGS IN MAN

Distribution of Gas and Blood to the Lungs. — Incoming air is filtered by hairs in the nose. which remove larger dust particles, and is warmed and moistened as it passes down through the pharynx. becoming fully saturated with water vapour by the time it reaches the trachea (windpipe). The trachea branches into the right and left main stem bronchi. the branching continuing with the secondary bronchi. the bronchioles. and finally the respiratory bronchioles which lead into the primary lung lobule, the functional unit of the lung. The incoming air is thus distributed to the 100,000,000 or so alveoli. where exchange of oxygen and carbon dioxide between air and blood takes place. Each alveolus, 0.1–0.3 mm. in diameter. consists essentially of a bundle of capillary blood vessels suspended in air. The majority of its surface is covered by these vessels. the total length of which is about 1,500 mi.. spread out so as to provide 40 to 60 sq.m. of diffusing surface, only about 0.3 μ in thickness. The blood in each capillary is renewed each 0.9 second at rest and each 0.3 second or less during exercise. The total blood flow through the lung is about j l. per minute at rest and up to 20 to 27 l. during severe exercise. About 4 l. of air reach the alveoli each minute during rest and as much as 100 1. during exercise.

Diffusion of Oxygen and Carbon Dioxide Across the Lung. — In the closed swim bladders of the physoclist fish, a special gas gland in conjunction with a *rete mirabile* ("wonderful net" —of blood vessels) is able to secrete oxygen at concentrations up to 87% and at several atmospheres pressure. Partly because of this fact. C. Bohr and later J. S. Haldane postulated that oxygen was secreted by the lungs of human beings under certain conditions. Repeated experiments. however, have indicated that the oxygen concentration is always higher in the air of the lung than in the blood (the reverse being true for the outgoing carbon dioxide), a fact consistent with diffusion and not with secretion.

The concentration of a gas at a given temperature is expressed in terms of partial pressure. in millimetres of mercury (as indicated under *Dalton's Law of Partial Pressures and Its Application to Respiration*, below). During rest, the partial pressure of oxygen in the air of the lung is about eight to ten millimetres higher than the average partial pressure of the blood in the capillaries of the lung. This diffusion gradient increases as the oxygen consumption goes up. reaching as high as 50 mm. during severe exercise. Even with so large a mean gradient, however, the partial pressure of oxygen in the blood leaving the lung is normally only a few millimetres less than that of the air in the lung. This is because the average partial pressure of oxygen in the pulmonary capillary lies somewhere between that of venous and arterial blood.

It is customary to speak of the difiusing capacity ($D_{L_{O_2}}$) of the lung as a whole, defined as the number of millilitres of O_2 diffusing each minute, as a result of a one-millimetre difiusion gradient ior O_2. At rest. $D_{L_{O_2}}$ = approximately 2j (*i* e , 2jo ml. of O_2 diffuse across the lung per minute when the diffusion gradient equals ten millimetres). During exercise. the $D_{L_{O_2}}$ may rise to as high as 80, due presumably to enlargement of existing lung capillaries and the opening up of new ones. The $D_{L_{CO_2}}$ is about 20 times as great as the $D_{L_{O_2}}$ because CO_2 is more soluble in tissues and blood than O_2 and thereiore diffuses more readily.

Mechanics of Respiration. — Air is moved in and out of the lungs as the result of changes in the volume of the thoracic cavity, the lungs playing an entirely passive role and neither expanding. nor contracting by themselves Thus the energy required for breathing comes from muscles located entirely outside the lungs. These include. first. the powerful muscle knonn as the diaphragm. on the bottom. and, second. numerous muscles of the thoracic and abdominal walls. The lungs are nonetheless elastic sacs constantly tending to collapse. Suspended within the barrellike thoracic cape, they are prevented from doing so by the arched structure of the ribs at the sides and by the contractions of the diaphragm below.

Approximately 500 rnl. (about a pint) of air is taken in with each breath as a result of two mechanical events:

1. Impulses descending the phrenic nerve, which goes solely to the diaphragm. cause the latter to contract and move downward. Since the descent averages 1.25 cm. and the surface area equals 250 sq.cm., about 300 ml. of air (60% of the total) is taken by this means.

2. Contractions of several sets of muscles which originate at the spine and run forward and downward to the ribs elevate the latter during inspiration. causing an increase in the internal volume of the chest. About 200 ml. of air is taken in by this means. The expansion is due to the arrangement of the rihs. which are semicircular strips of bone, hinged posteriorly at the spine. the plane iormed by their circumference inclined downward and outward. Each rih may be compared to the handle of a pail. Raising the handle increases its horizontal distance from the pail. Similarly, raising the ribs increases the antero-posterior diameter of the chest. Because the rihs are hinged obliquely to the spine, the lateral dimension of the chest is also increased, the enlargement being accommodated by the flexible rib cartilages which connect the forward ends of the ribs to the sternum breastbone).

At the end of inspiration. with normal, quiet breathing (eupnea), the nervous activity originating in the respiratory centre of the brain ceases. and the chest collapses as a result of the elastic recoil of the lungs. Horn-ever. during hyperpnea — the rapid. deep breathing seen in exercise or disease — expiration becomes active. involving various thoracic muscles which pull the ribs down and abdominal muscles which push the diaphragm upward to facilitate the expulsion of air.

The mechanical factors involved in respiration have been evaluated by measuring the hydrostatic pressures in certain parts of the respiratory system, together with the volume of air breathed in or out and the rate of air flow. As a result. quantitative information is available regarding the elastic properties of the lungs. the resistance to air flow within the airways, and the mechanical work of breathing.

The significant hydrostatic pressures are: (1) Atmospheric (barometric) pressure. the reference level to which other pressures are compared. and that of the inspired air. (a) Intrapulmonic pressure, defined as the pressure inside one of the airways of the respiratory tree. The location must be specified. because as a consequence of the resistance offered by the air passages to the flow of gas (*i.e.*, air) there is a gradient of pressure in the direction of flow, just as in a river the level falls on approaching the sea. During inspiration, therefore, the pressure is lowest of all in the alveoli, rising progressively at points farther upstream to a value only slightly below atmospheric in the nostrils. (3) The intrapleural. or intrathoracic, pressure is measured within the

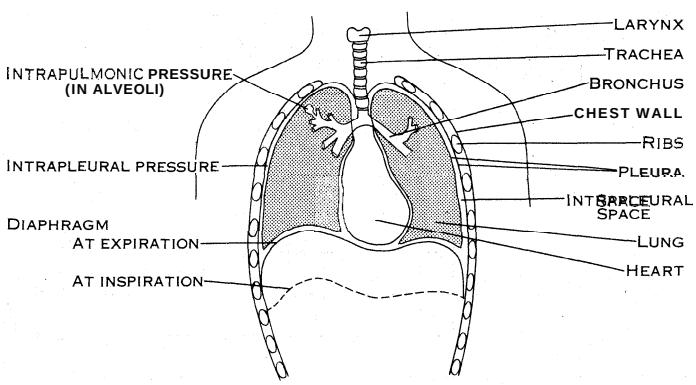


FIG. 2. — DIAGRAM OF CHEST SHOWING HOW LUNG IS ENLARGED AND AIR TAKEN IN BY DESCENT OF DIAPHRAGM DURING INSPIRATION
The process is aided by expansion (not shown) of chest wall. Intrapleural pressure and intrapulmonic pressure in alveoli are important, in the mechanics of breathing

pleural cavity. a potential space lying between the surface of the lung and the chest wall and normally filled with a layer of intrapleural lymph fluid. Thus the lungs of mammals are not attached directly to the rib cage but resemble a sac suspended within another sac (fig. 2).

If a hollow needle is inserted between adjacent ribs into the pleural cavity, the pressure is found to be subatmospheric (averaging about −3cm. of water at the end of expirationj, due to the collapsing force of the elastic tissues within the lung. If the subject now takes in a deep breath and holds it, the mouth and glottis (vocal cords) being kept open, the intrapleural pressure falls to −20 cm. of water or even lower, due to the further stretching of the pulmonary elastic tissue.

The relation of the volume of air inhaled to the change in intrapleural pressure is called the "compliance" or ease of expansion of the lung, and is expressed as litres of change in lung volume per centimetre of water. Values for normal subjects average 0.225 l./cm. (*i.e.*, after inhalation of 0.22 j l. of air the intrapleural pressure falls 1 cm. H_2O). The compliance decreases in illnesses in which fibrous tissue invades the lung.

When a given volume of air is flowing, the resulting drop in pressure is proportional to the resistance of the airways. or: $\frac{\text{pressure}}{\text{flow}}$ = resistance. (This is equivalent to Ohm's law for an electrical system.) The resistance, *R*, is expressed in centimetres of water per litre per second, and averages 2 cm./l./sec. for normal subjects. (This means that if air is being exhaled at the rate of one litre per second, the pressure in the alveoli will be 2 cm. H_2O higher than atmospheric.)

The dynamic events occurring during one respiratory cycle are shown in fig. 3. The highest air flow during inspiration and expiration = 0.5 l./sec. in this example. As predicted by the equation relating pressure to flow (assuming R = 2 cm./l./sec., as above), intra-alveolar pressure reaches peak values of ±1 cm. of water.

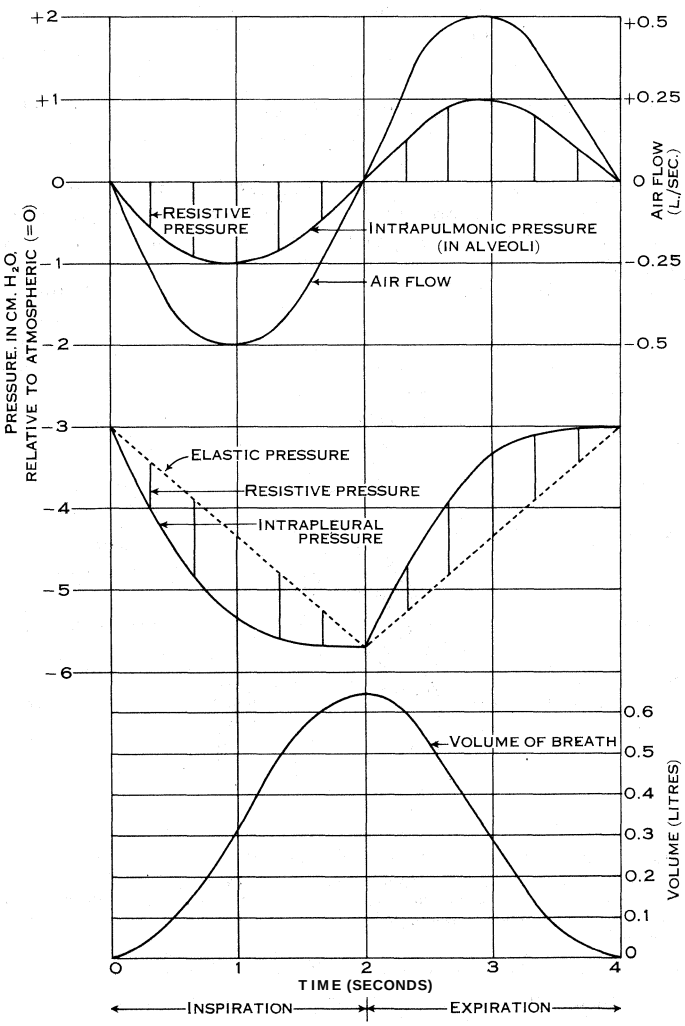
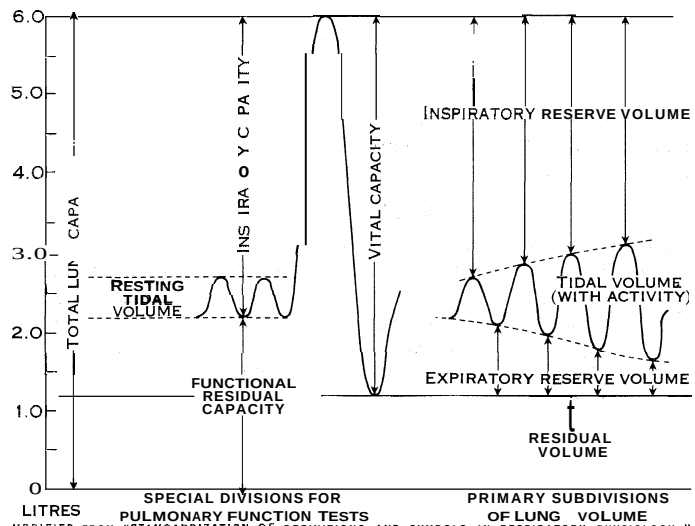


FIG 3.— INTRAPULMONICPRESSURE IN ALVEOLI, INTRAPLEURAL PRESSURE AND VOLUME OF AIR BREATHED. PLOTTED DURING ONE RESPIRATORY CYCLE. NUMERICAL VALUES SHOWN ARE FOR A NORMAL SUBJECT



MODIFIED FROM "STANDARDIZATION OF DEFINITIONS AND SYMBOLS IN RESPIRATORY PHYSIOLOGY" FEDERATION PROCEEDINGS, VOL 9

FIG. 4.— LUNGVOLUMES AS THEY APPEAR ON THE TRACING OF A SPIROMETER (VOLUME MEASURING DEVICE)

The vital capacity is the volume of a largest single breath: the tidal volume that of a normal breath. Inspiratory capacity is the volume which can be inhaled at the end of normal expiration; expiratory reserve, the volume exhaled at the end of normal expiration; and residual volume, the air remaining even after a forced expiration. The latter volume cannot be measured by a spirometer, but by an indirect method involving collection of an inert gas such as nitrogen

The changes in intra-alveolar pressure due to resistance to the flow of air are transmitted through the lung so as to influence intrapleural pressure in the same direction. Thus, the curve for intrapleural pressure is made up of two components. elastic and resistive.

During heavy breathing accompanying exercise, the rapid flow of air causes greater swings in intra-alveolar and intrapleural pressures. The mechanical work required to inflate and deflate the lung, equal to change in intrapleural pressure times volume of air breathed, is therefore increased. It is also increased, even to the point of exhaustion. in patients with asthma, due to the wide swings in pressure needed to overcome the increased resistance to air flow which accompanies this condition.

Lung Volumes. — The lung of a man weighing 175 lb. holds about six litres of gas. called the total lung capacity. This is subdivided into components as indicated in fig. **4.** Measurement of vital capacity and of the other lung volumes is an important diagnostic procedure in pulmonary disease.

Dalton's Law of Partial Pressures and **Its** Application to Respiration. — Certain physical properties of gases in general must be considered in relation to gas exchange in the body. Whether a gas such as oxygen will combine with the hemoglobin of the blood and will diffuse from air to blood and thence to the tissues depends on the molecular concentration of the oxygen.

Chemical analysis of atmospheric air has shown that it contains the following percentages of gases, expressed as volumes of dry gas per 100 volumes of dry air: O_2. 20.94%; CO_2, 0.03%; N_2 (including the rare gases such as argon). 79.03%; totaling 100%. These percentages are surprisingly constant, not only all over the surface of the earth, but up to altitudes of approximately 2j mi.

Yet the percentage composition of a gas does not alone determine its molecular concentration. This is illustrated by the fact that a man breathing air suffers from oxygen lack at an altitude of 18,000 ft., and without an extra source of oxygen will die if he goes higher than about 25,000 ft. (*See* also HYPOXIA.j The percentage of oxygen is still 20.94, but its molecular concentration is much lower than at sea level. This is because the're is less atmosphere pressing down from above, hence the barometric pressure is less, and the molecules of oxygen and other gases are spread

farther apart.

John Dalton (1766–1844) explained this behaviour of gases by an expression which now bears his name. According to Dalton's Law of Partial Pressures. in a mixture of gases each gas behaves as if it alone occupied the total volume of the gas mixture. and exerts a pressure, its partial pressure. independent of the other gases present. The sum of the partial pressures of the individual gases equals the total pressure of the gas mixture. At a given temperature, the partial pressure provides a measure of the molecular concentration of a gas. The partial pressure, P, of a gas, G, may be calculated by Dalton's law as follows:

$$P_G = \frac{(\%\text{ concentration of G in dry gas})\ (\text{total P. of dry gases})}{100}.$$

If air at sea level were dried, then the partial pressures of its constituent gases would be:

$P_{O_2} = 20.94/100 \times 760 = 159.0$ mm. Hg
$P_{CO_2} = 0.03/100 \times 760 = 0.3$ mm. Hg
$P_{N_2} = 79.03/100 \times 760 = 600.7$ mm. Hg
Total: $P_{O_2} + P_{CO_2} + P_{N_2} = 760.0$ mm. Hg = Barometric pressure

However, air normally contains some water vapour, which exerts a partial pressure of its own. The air in all parts of the lungs is saturated with water vapour. the tension of which is related to the temperature, being equal to 47 mm. at 37° C. (= 98.6° F., body temperature). This vapour tension must be subtracted from the barometric pressure in order to get the total pressure of the dry gases in the lung. One may then calculate the partial pressures of any dry gas G. in the lung from Dalton's law (per cent concentration of each constituent gas being expressed always in terms of volumes of dry gas per 100 volumes of the dry gas mixture) as follows:

$$P_G = \frac{(\%\text{ concentration of G})\ (\text{Bar. P.} - 47)}{100}.$$

The French physiologist Paul Bert pointed out in 1878 that it was the partial pressure and not the per cent composition which determines the physiological effects of a gas. Dalton's law, he indicated, explains why it is difficult to breathe at high altitudes. The barometric pressure falls, and with it the partial pressures of all the gases. Only that of oxygen affects respiration, the P_{CO_2} in atmospheric air being negligibly low and the nitrogen gas inert. At 18,000 ft. the Po, in moist air entering the lung has fallen to only 69 mm., which is not enough to oxygenate the blood adequately. Even breathing pure oxygen, the Po, has again fallen to 69 mm. at an altitude of 44,000 ft., which is close to the "ceiling" above which a man cannot go without a pressurized cabin or flying suit.

The data in the table illustrate what happens to atmospheric air as it is breathed into the lungs. In the moistened air of the trachea the Po, is (20.94/100) (760–47) = 150 mm. However, less than this tension of O_2 is available for diffusion into the blood because the incoming air is diluted by the CO_2 leaving the alveoli, while at the same time the O, diffuses out of the air, further reducing the O, tension. Thus, there is exchanged (in almost equal quantities) O_2 for CO_2, as the incoming gas moves on down into the depths of the lung. into the alveolar ducts, the atria which open into the alveoli, and finally the alveoli themselves. The air here is called alveolar gas and is defined as gas which, in contact with the respiratory epithelium, is essentially in equilibrium with the blood leaving the lung. That is, the Po, in the gas is almost the same as in the purified blood; and similarly for the P_{CO_2}.

Thanks to the researches of Haldane, it is easy to sample alveolar gas in a normal person. The subject has only to breathe out forcefully through a long rubber tube, then the last portion of the gas exhaled is withdrawn and the percentage of carbon dioxide and oxygen present can be determined by analysis. From these data the corresponding partial pressures may be calculated by means of Dalton's law.

As indicated in the table, the P_{O_2} of alveolar gas = 100 mm., P_{CO_2} = 30 mm. These values are remarkably constant at rest at sea level and deviate only slightly during exercise. This, as will be shown below, results from the fact that the respiratory centre in the brain seems to be set to a Pco, close to 40 mm.

Respiratory Dead Space and Alveolar Ventilation. — As indicated in the table, expired gas has a higher Po, and lower Pco, than alveolar gas, because it consists of alveolar gas mixed with atmospheric air from the respiratory dead space. This term refers to that inspired air which does not come in contact with the alveolar membranes but simply fills the air passages, including the nose, pharynx, trachea, bronchi and bronchioles. At the beginning of expiration this atmospheric air is simply breathed out again, having taken no part in respiratory exchange. The dead space can be measured anatomically in a cadaver by filling the air passages with water. which presumably goes down to but does not enter the alveoli. The volume of the water is measured. and equals. on the average, 150 ml. In living subjects, the anatomical dead space may be determined by measuring the volume of gas exhaled before the tension of carbon dioxide rises sharply. Indicating the boundary between dead space and alveolar gas, this rise is detected by a rapid-acting gas analyzer nhich operates on the physical principle that carbon dioxide absorbs infrared light.

The physiological dead space is more closely related to the efficiency of ventilation because it includes not only the gas in the anatomical dead space but also that ventilating alveoli with relatively poor or no blood flow. It may be calculated from the partial pressure of carbon dioxide, as determined by chemical analysis in (1) arterial blood, (2) expired gas and (3) inspired gas (P_{CO_2} is essentially zero when breathing air), and from the tidal volume (V_T), using the so-called Bohr formula:

$$V_D = \frac{V_T\ (P_{CO_2},\ \text{arterial blood} - P_{CO_2},\ \text{expired gas})}{(P_{CO_2},\ \text{arterial blood} - P_{CO_2},\ \text{inspired gas})}.$$

For example, Pco, in arterial blood was 40 mm.. in expired gas 28, and in inspired gas 0, and tidal volume was 600 ml. Then:

$$V_D = \frac{600\ (40-28)}{(40-0)} = 180\text{ ml.} = \text{the physiological dead space.}$$

The volume of gas effectively ventilating the alveoli with each breath is equal to the difference betneen the tidal volume and the physiological dead space and when multiplied by the number of breaths per minute (f) gives the alveolar ventilation,. V_A, expressed in litres per minute. Or, in arithmetic form. $V_A = (V_T - V_D)$ f. It is V_A, rather than the total volume of gas exhaled per minute (V_E), which determines how well the-air in the lungs is being renened. With rapid, shallow breathing V_E must be larger in order to provide a given alveolar ventilation than with slow, deep breathing. This point is illustrated if we resort to a *reductio* ad *absurdum,* decreasing the tidal volume to that of the dead space. Then (V_T–V_D) = o and regardless of hon rapid the breathing is. alveolar ventilation is zero. Of course this situation is not compatible with life; no oxygen could reach the lung or carbon dioxide leave until the tidal volume was again increased. In the rapid, shallow panting of dogs. V_T is only slightly greater than V_D, the panting serving to move large volumes of air over the tongue to facilitate cooling by evaporation, without V_A being increased to the point where the lungs are overventilated and the blood carbon dioxide tension lowered below normal.

Pressures of Gases in the Respiratory Tree and in the Tissues, expressed in mm. Hg.

Sample of gas	P o	P_{CO_2}	P_{N_2}	P_{H_2O}	Total P
Inspired	158	0.3	596	5.7	760
Tracheal	150	0.3	562.7	47	760
Expired	116	32	565	47	760
Alveolar	100	40	573	47	760
Arterial blood	95	40	573	47	755
Venous blood	40	46	573	47	706
Tissues	30	50	573	47	700

Modified from Fulton, *A Textbook* of Physiology, 17th ed., p. 827 (1955).

CARRIAGE OF OXYGEN AND CARBON DIOXIDE BY THE BLOOD

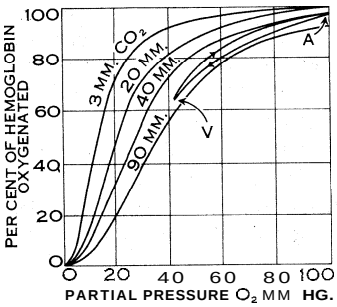
An average man at rest uses over half a pint (250 ml.) of pure oxygen per minute and gets rid of almost as much carbon dioxide, the chief by-product of the combustion of foodstuffs. These two

gases are transported in the blood largely because of the activity of hemoglobin, one of the most remarkable chemical substances produced during the course of evolution. Located inside the red blood cells, hemoglobin combines reversibly with oxygen as indicated by the reaction: $Hb + O_2 \rightleftarrows HbO_2$. Over 9j$T, of the oxygen is carried in this form; the rest being dissolved in the blood.

A much smaller fraction (about 25%) of the carbon dioxide produced is carried in direct combination. as "carbamino" hemoglobin, the majority of the CO, being transported as the result of a series of chemical reactions dependent on the special properties of hemoglobin.

Oxygen Dissociation Curve.— As the arterial blood passes through the tissues, each roo ml. gives up about 5 ml. O_2, and as it does so the Po, falls from 100 mm. to near 40, that of venous blood. This unloading of large quantities of oxygen as a result of a relatively small fall in Po, is one of the unique properties of hemoglobin. Without it. the oxygen could theoretically be carried in dissolved form, much as carbon dioxide is dissolved in soda water. But. only 0.2 ml. of O_2 would be given up under conditions comparable with those outlined above, and 25 times more blood would have to be pumped through the body, requiring an impossibly large circulatory system.

The quantity of oxygen combining with hemoglobin at various tensions of O_2 is given by an oxygen dissociation curve (fig. 5). Each point on the curve is obtained by exposing a sample of blood to a gas containing oxygen in a glass vessel. The vessel is rotated at body temperature long enough to equalize the oxygen tensions in blood and gas. The volume of oxygen in the blood sample and the Po, of the gas are then determined by chemical analysis. For example, the hemoglobin in roo ml. of blood was found to hold 14.8 ml. O_2 at a Po, of 40 mm. Another portion of the same blood was exposed to a gas with a Po_2 high enough (150 mm.) to oxygenate essentially all of the hemoglobin. The latter sample held 20 ml. O_2 per 100 ml. The oxygen saturation of the first sample was therefore 74% (14.8/20 × 100). Thus 74% of the hemoglobin molecules were combined with oxygen, the remaining 26% being reduced: *i.e.*, without oxygen. (The term oxygen saturation refers only to the oxygen combined with hemoglobin and not to dissolved oxygen.)



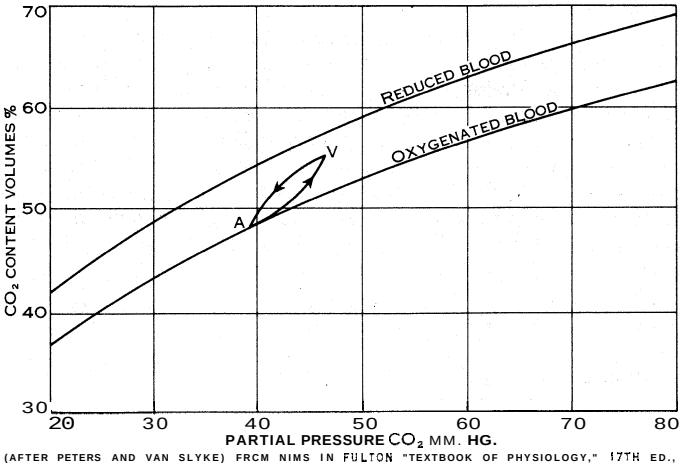
FROM J. BARCROFT'S "THE RESPIRATORY FUNCTION OF THE BLOOD" (1928): REPRODUCED BY PERMISSION OF THE CAMBRIDGE UNIVERSITY PRESS

FIG. 5.—OXYGEN DISSOCIATION CURVES FOR WHOLE BLOOD

Increase in Pco, shifts curve to right, an illustration of the Bohr effect. Loop labeled A (arterial) and V (venous) shows approximate actual curve followed in the body

Because of the unique properties of hemoglobin, the carriage of oxygen is related to that of carbon dioxide and vice versa. Each process helps the other. This is illustrated by the fact that the position of the oxygen dissociation curve is shifted to the right by an increase in the tension of carbon dioxide (fig. 5). That is, adding CO_2 to the blood tends to drive oxygen out. This is known as the Bohr effect. It helps to deliver oxygen to the tissues. For a given fall in Po, more O_2 is released than if a dissociation curve at constant Pco, were followed. Conversely, as CO_2 is given off in the lungs, the uptake of O_2 is facilitated.

CO, Dissociation Curve and Carriage of CO_2.—There is a converse of the Bohr effect: adding oxygen to blood drives' carbon dioxide out. This. known as the Haldane effect, may be demonstrated by means of carbon dioxide dissociation curves, determined first for oxygenated and then for reduced blood. It will be noted (fig. 6) that the latter holds considerably more CO_2 at a' given Pco_2 than the former. Carriage of carbon dioxide is facilitated by the Haldane effect in much the same manner as the carriage of oxygen is facilitated by the Bohr effect. As the arterial blood gives up part of its oxygen to the tissues it is able to take up more carbon dioxide for a given increase in Pco_2 than if it remained fully oxygenated. This is shown in fig. 6 by the loop labeled "A" (arterial) "V" (venous), which describes the pathway followed by the blood as it goes from artery to vein.



(AFTER PETERS AND VAN SLYKE) FRCM NIMS IN FULTON "TEXTBOOK OF PHYSIOLOGY," 17TH ED., 1955. PHILADELPHIA, W. B. SAUNDERS COMPANY

FIG. 6.— CARBON DIOXIDE DISSOCIATION CURVES FOR REDUCED AND OXYGENATED BLOOD

Though the CO, dissociation curve makes it possible to predict the volume of CO_2 contained in blood at a given Pco_2, it does not describe how carbon dioxide is carried in the blood. Actually it is carried in several ways, as follows:

1. About 10% is carried in dissolved form (as carbon dioxide is in soda water).

2. About 25% is in direct combination with hemoglobin as carbamino hemoglobin.

3. About 10% is carried as carbonic acid (H_2CO_3). This splits into hydrogen ions (H^+) and bicarbonate ions (HCO_3^-). The latter, nontoxic ions, are carried inside the red blood cell and in the plasma (the clear portion of the blood). Hydrogen ions. however, which in their active state would cause damage to tissue cells, are buffered; *i.e.*, "soaked up" by the blood proteins including hemoglobin. A buffer solution (see HYDROGEN IONS), of which proteins are one example, resists change in acidity by combining with added hydrogen ions and essentially inactivating them. Because not all of the added acid can be removed from the solution, the acidity does rise slightly, but only a fraction of what it would were the buffer not present.

4. The remaining 55% or so of the carbon dioxide is also carried as carbonic acid, except that the hydrogen ions are buffered in a special way by the hemoglobin as the latter gives up its oxygen. This process is related to the Haldane effect, and depends on the fact that when hemoglobin gives up its oxygen it becomes less acid, and can therefore take up most of the hydrogen ions produced in the tissues without any change in acidity at all. This is known as the isohydric exchange.

Were carbon dioxide carried entirely in solution, no hemoglobin being present. the hydrogen ions produced from carbon dioxide would make the venous blood 800 times more acid than the arterial, the pH changing from 7.4 to 4.j. In actual fact the pH falls only 0.03 units. thanks to the two buffering mechanisms described.

The series of chemical reactions involved in the transport of oxygen and carbon dioxide by the blood are often referred to as the chloride shift (fig. 7).

The sequence of events is as follows: In the tissues, foodstuffs such as carbohydrates are oxidized, the by-products of this energy-producing reaction being carbon dioxide and water. The carbon dioxide produced immediately dissolves in the water of the blood. and 10% of it will be carried in that form to the lungs. Now, dissolved carbon dioxide reacts with water to form carbonic acid: $CO_2 + H_2O \rightleftarrows H_2CO_3$. This "hydration" of carbon dioxide takes place very slowly in water or in plasma. For this reason most of the carbon dioxide, in the form of molecular carbon dioxide. diffuses through the plasma and into the red blood cells. In the latter there is a high concentration of the enzyme carbonic anhydrase, which catalyzes (*i.e.*, speeds up) the hydration of carbon dioxide to carbonic acid inside the red cells. The car-

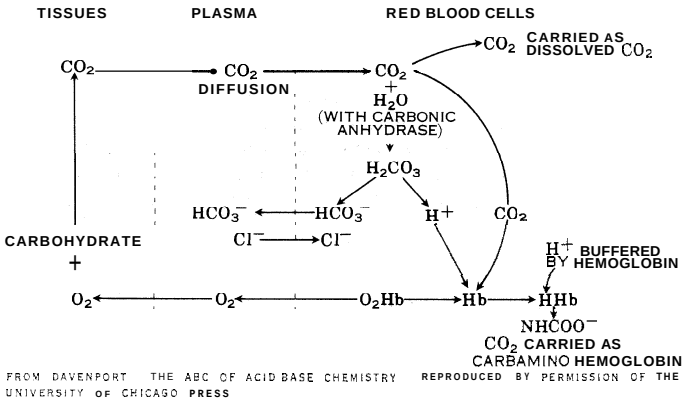
bonic acid ionizes slightly; that is. it splits into positively and negatively charged particles as follows: $H_2CO_3 \rightleftarrows H^+ + HCO_3^-$. The hydrogen ions are immediately taken up by the hemoglobin by the buffering mechanisms described.

A portion of the dissolved carbon dioxide combines directly with hemoglobin to form carbamino-hemoglobin. In the process. a hydrogen ion must he buffered by the hemoglobin.

More and more bicarbonate ions accumulate inside the red blood cell and are carried to the lung. A somewhat greater portion is carried as bicarbonate in the plasma. having diffused out of the red cell as a result of increasing concentration.

The plasma now contains excessive negative charges. in the form of bicarbonate ions. Unless there is an equal number of positive and negative charges in any solution, enormous electrostatic forces will be built up. Compensation for such inequality always occurs. In this case a number of negatively charged chloride ions, equal to that of the bicarbonate ions entering the plasma. are drawn by electrostatic forces into the red blood cell.

These events take place in the blood passing through the tissues. The reverse processes occur in the lungs as the blood gives off carbon dioxide and takes up oxygen.



FROM DAVENPORT THE ABC OF ACID BASE CHEMISTRY REPRODUCED BY PERMISSION OF THE UNIVERSITY OF CHICAGO PRESS

FIG 7 —SEQUENCE OF CHEMICAL EVENTS BY WHICH CO_2 IS CARRIED BY THE BLOOD FROM TISSUES TO LUNGS THE REVERSE PROCESSES OCCUR IN THE LUNGS AS THE BLOOD GIVES OFF CO_2 AND TAKES UP O_2

RESPIRATORY CENTRE AND NERVOUS ORIGIN OF RESPIRATION

Since the early part of the 19th century it has been known that a small region in the medulla oblongata at the base of the brain is essential to breathing and hence to life. Occupying in a man a volume no larger than that of a good-sized grape. the respiratory centre consists of motor nerve cells imbedded in a crisscrossing matrix of nerve ,fibres. This reticular formation. as it is called. serves to co-ordinate the activity of the widely spaced respiratory muscles.

Three basic experimental approaches have been used in order to analyze in anesthetized animals the respiratory function of various parts of the medulla oblongata and a region forward of it called the pons (see BRAIN). These are: (1) effects of removal or localized destruction of discrete areas: (2) effects of stimulation by electric shocks or injected chemical solutions; and (3) recording of action potentials. the tiny electrical impulses set up by all active nerve cells. In spite of extensive studies. in the early 1960's it still was not entirely clear (*a*) how the impulses irom the respiratory neurons originate, or (b) why these bursts of impulses are rhythmically interrupted every few seconds at a rate corresponding to that of breathing.

With regard to (a) it is not surprising that reflex activity has been considered. When, for example, a person steps on a nail: nerve impulses ascend to the spinal cord and stimulate motor nerve cells there so that the foot is reflexly (*i.e.,* automatically) withdrawn.

As early as 1836 Marshall Hall stated that the medullary respiratory centre was not spontaneously active but was merely stimulated reflexly by various sensory nerves. As evidence, he cited the familiar observations that dashing cold water in the face, bathing in the cold sea or pinching certain nerves during an experiment on an animal all cause "an act of inspiration to be excited."

Subsequent inveitigation has shown, however, that reflex activity. though capable of profoundly modifying respiration. is not the prime mover. The activity of the respiratory centre is truly spontaneous, as shown by the fact that complete isolation of the medulla and the pons from all incoming nerve impulses does not abolish rhythmic breathing provided the phrenic nerves which go to the diaphragm are left intact.

Reflex activity having been eliminated. it has been suggested that the spontaneous firing of a motor neuron could be due to a steady flow of current. in the external medium. from axon (the nerve fibre) to cell body, which periodically neutralizes the normal electrical charge on the cell membranes and thus sets up nerve impulses. A similar depolarization might be caused by certain chemical substances present in the nervous system. by slowly fluctuating potentials generated by neighbouring nerve cells. or by spontaneous leaking away of the charge owing to an inherent porosity of the membrane itself.

This problem represents one of the main challenges of neurophysiology. spontaneous. repetitive activity being by no means unique to the respiratory centre. It occurs also in the neurons of the cerebral cortex. in various sensory receptors including those for touch. taste and smell. and in the sperialized muscle cells of the "pacemaker" of the heart.

More particularly the domain of the respiratory physiologist are theories concerning the manner in which rhythmicity of respiration arises. Tn·o divergent theories have been proposed and extensively evaluated. The first assumes that the medullary respiratory centre is not by itself inherently rhythmic, but produces only a steady stream of impulses. These are supposed to be periodically inhibited or turned off by influences outside the medulla, much as. in a steam erigine. the flow of steam to the moving piston is turned on and off by the valve. According to the second theory the neurons of the respiratory centre have the inherent capacity to fire in regularly repeated bursts. apart from outside influences. Such a process resembles the ticking of a watch. with the balance wheel. driven by the escapement, turning to and fro at its own natural rhythm.

Evidence for the first theory goes back to Hering and Breuer, who in 1868 discovered that inflation of the lungs with a bellows caused inspiratory activity to be inhibited, the resulting apnea or lack of breathing lasting for a considerable period. They found .that this effect was abolished when the tenth cranial nerves (the vagi) were cut. It has since been shown that receptors in the lung are stimulated by inflation. sending impulses up the vagi which cause the inhibition. The Hering-Breuer reflexes could. as their discoverers pointed out. permit a tonic (steady) inspiratory drive to be converted into a rhythmic process. Supporting evidence was obtained in 1887 by Marckwald, who discovered that, if the pons is transected in its mid-region, breathing remains normal so long as the vagi are intact. If they are then cut, the experimental animal takes a deep breath and holds it until he dies. But if the brain stem is initially severed higher up. leaving the entire pons intact, the animal continues to breathe even after the vagi are cut, though more slowly and deeply than before. Thus Marckwald had obtained evidence for a second inhibitory mechanism. in addition to the vagal one, located in the rostral (forward) part of the pons. Though either mechanism could convert the tonic inspiratory drive into a rhythmic process, it was the vagal one which was considered to be involved in normal breathing.

Much evidence in support of this periodic inhibition theory has subsequently been gathered. Lumsden in 1923 located and gave names (still used) to: (1) the pneumotaxic centre. located in the rostral pons. responsible for inhibiting the steady activity of (2) the apneustic centre, in the caudal (rearward) pons, responsible for sustained inspiration. which Lumsden called apneusis.

As a result of a comprehensive series of studies on the medullary-pontine respiratory complex. Pitts in the 1930s and '40s located by electrical stimulation a centre responsible for inspiratory activity in the reticular formation of the medulla. and a separate expiratory centre situated close to it. He obtained evidence that the

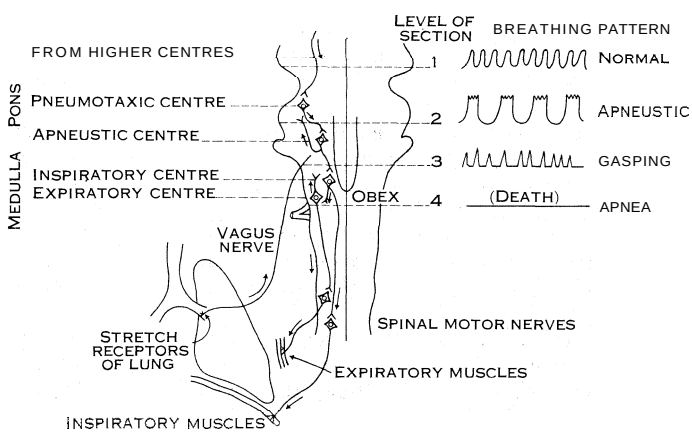
inspiratory centre was dominant to the expiratory centre. the two being interconnected by nerve fibres so that stimulation of one caused inhibition of the other, an example of reciprocal innervation as in the spinal cord.

Confirming the existence of apneusis after midpontine section and vagotomy. Pitts like Marckwald concluded that the medullary respiratory centres were not inherently rhythmic. sustained activity of the inspiratory centre being converted to periodic breathing by the vagal stretch reflexes from the lungs and, following vagotomy. by the pneumotaxic centre. This concept of the genesis of rhythmic respiration became widely accepted during the next ten years, tending almost entirely to replace the "pacemaker" theory. In the late 1940s and early '50s, however, Hoff and Breckenridge produced evidence in favour of the latter theory. They pointed out, as had some of their predecessors, that apneusis was neither permanent nor total after midpontine section and vagotomy. Superimposed on the deep. prolonged inspirations were small. rhythmic respiratory movements capable of keeping the experimental animal alive for an hour or more. More important. when they sectioned the brain stem below the pons so as to isolate the medulla. rhythmic respiration, sometimes normal. though often gasping in character, appeared. Existence of this inherent rhythmicity of the medulla was confirmed by other workers.

Hoff and Breckenridge interpreted these findings to mean that normal respiratory movements are generated by a pacemaker action. They considered the so-called apneustic and pneumotaxic centres to be simply portions of the reticular formation which serve to modify the existing spontaneous activity of the medullary respiratory centre, and similarly for the vagal afferent impulses. These did not, they believed. turn off each inspiration according to the Hering-Breuer concept.

Supporters of the periodic inhibition theory adopted the point of view that the activity of the isolated medulla is no more than the manifestation of a dormant, primitive rhythm left over from an earlier stage in the evolution of mammals.

It cannot be stated which of the two theories. periodic inhibition or pacemaker, is more nearly correct. Much research involving electrical stimulation. recording of action potentials and steady potentials. localized destruction and correlated histological examination is necessary before a clear understanding of rhythmic



MODIFIED FROM NIMS IN FULTON "TEXTBOOK OF PHYSIOLOGY," 17TH ED., 1955, PHILADELPHIA, W. B. SAUNDERS COMPANY

FIG. 8.— SCHEMATIC REPRESENTATION OF THE MEDULLARY-PONTINE RESPIRATORY CENTRES INVOLVED IN RHYTHMIC BREATHING

Arrows show direction of nerve impulses involved in the periodic inhibition theory for the origin of rhythmic breathing

breathing can be obtained.

Fig. 8 summarizes the localization of function of the medullary-pontine respiratory centres as outlined above.

REGULATION OF PULMONARY VENTILATION

Chemical Control of Breathing.— The respiratory system provides the body with oxygen and eliminates carbon dioxide. It is also one of the chief mechanisms maintaining a relatively constant internal environment, a condition essential to the survival of complex organisms, as stated by the great French physiologist Claude Bernard. Thus, it counteracts the threat of low oxygen or high carbon dioxide in the environment, and minimizes excess acidity or alkalinity of the blood caused by metabolic disorders. It performs these tasks by constantly regulating the volume of air breathed. called the pulmonary ventilation. which is the product of the rate and depth of respiration.

This process is called the chemical control of breathing because it is carried out by specialized nerve cells, sensitive to the chemical composition of the blood. which vary the activity of the medullary respiratory centre. These cells are called chemoreceptors. or sometimes chemostats. because they stabilize the internal chemical environment much as a thermostat maintains a constant temperature in a room.

Though a man will die if deprived of oxygen for only chiefly a few minutes. his pulmonary ventilation is normally regulated by the tension of carbon dioxide in the blood. rather than by that of oxygen. These facts were first discovered by Haldane and J. G. Priestley in 1905. Having developed a method for obtaining alveolar gas (which has essentially the same P_{CO_2} and P_{O_2} as arterial blood), they proceeded to analyze hundreds of samples obtained from normal subjects at various altitudes relative to sea level. and consequently at varying barometric pressures. even including that in a compressed air chamber used to treat certain respiratory disorders. In the laboratory at Oxford. at a barometric pressure (P_B) of 755 mm.. the alveolar P_{CO_2} was 42.1 mm. It remained within 1.4 mm. of that figure on a mountain 4,400 ft. high ($P_B = 646$). at the bottom of a mine ($P_B = 832$) and in the compressed air chamber ($P_B = 1.260$). Yet the corresponding alveolar oxygen tensions varied widely, being 99 in the laboratory and 79, 115 and 203 mm.. respectively, at the other locations.

These simple data, from what has come to be known as a classic experiment in respiratory physiology, indicate that the pulmonary ventilation is normally regulated by the P_{CO_2} and not by the P_{O_2}.

Confirmatory evidence was obtained by adding small quantities of carbon dioxide to the inspired air. With 3% CO_2, the alveolar ventilation was doubled, the alveolar P_{CO_2} rising only 1.5 mm.. indicating the extreme sensitivity of the respiratory centre to increases in P_{CO_2}. The increase in ventilation occurring when carbon dioxide is inhaled is compensatory, tending to minimize a rise in alveolar P_{CO_2}.

Haldane then reasoned that if a small rise in alveolar P_{CO_2} would double the ventilation, a corresponding fall might be expected to cause breathing ta cease. This was investigated by having subjects hyperventilate (*i.e.*, breathe deeply and rapidly), thereby reducing the alveolar P_{CO_2} from the normal value of 40 down to 15 or even 10 mm. Apnea (absence of breathing) invariably ensued, its duration. often of several minutes, being related to the degree oi lowering of the P_{CO_2}. That it was due to this factor was shown by keeping the P_{CO_2} essentially normal by having the hyperventilating subject breathe air containing 5% carbon dioxide. following which no apnea occurred. Nor did it occur on quietly breathing pure oxygen, thus eliminating increased P_{O_2} as a cause of posthyperventilation apnea as had been suggested by a previous investigator, who had believed that respiration was normally regulated by the oxygen tension of the blood.

That oxygen lack is at best a poor stimulus to respiration, by no means as effective as a rise in carbon dioxide, was emphasized by Haldane. Little increase in ventilation occurs until the alveolar P_{O_2} falls from its normal value of 100 mm. down to about 70 mm., equivalent to an altitude of between 6,000 and 7,000 ft. Yet the hyperpnea cannot be accounted for in terms of CO_2, since the tension of the latter falls, by ten millimetres or more. during hypoxia. It was proposed. but never proved. that lactic acid might be the stimulus. the lack of oxygen causing its production inside the medullary respiratory centre. Even in Haldane's time the latter was known to be the site where carbon dioxide exerted its influence on respiration, and it was natural to expect hypoxia to act there too.

The explanation was not forthcoming until the early 1930s, when C. Heymans and his associates demonstrated the existence of respiratory reflexes originating from the carotid arteries in the

neck. Close to uhere the latter branch into the internal and external carotid arteries lie, first. a set of pressoreceptors important in the regulation of blood pressure (*see* CIRCULATION OF BLOOD) and also influencing respiration, and, second. a set of chemoreceptors sensitive to decreases in the oxygen tension of arterial blood and to a lesser extent to rises in P_{CO_2} and acidity. Similar sets of presso- and chemoreceptors are located at the arch of the aorta The carotid and aortic bodies or glomi, as these chemoreceptors are called. consist of rounded epithelioid receptor cells. richly innervated by nerve fibres and provided with a profuse supply of arterial blood Impulses are generated in the receptor cells nhen the P_{O_2} falls sufficiently Carried by nerves to the medullary respiratory centres. these impulses increase the activity of the centre and thus increase pulmonary ventilation.

That oxygen lack stimulates respiration almost entirely by way of these peripheral chemoreceptors has been shown by the fact that after their nerves are cut the inhalation of nitrogen almost always decreases respiration. due to depression of the medullary respiratory centre. whereas normally the ventilation is more than doubled.

Though these chemoreceptors serve chiefly an emergency function, normal respiration being controlled mainly by the action of CO_2 (and probably acid also) on the medullary respiratory centre, evidence exists for a slight degree of ventilatory drive due to O_2 even at sea level.

It is of some interest to speculate what would happen were respiration controlled in man not largely by P_{CO_2}, but by P_{O_2}, as it appears to be in lizards, snakes and fishes. Assuming the alveolar P_{O_2} to be held at 100 mm., the normal value at sea level, the pulmonary ventilation would be approximately doubled on the 4,400-ft mountain referred to by Haldane, and would be reduced to less than one third in the pressure chamber. Values for alveolar Pco, would be approximately 20 and 140 mm.. respectively. Corresponding acidity of arterial blood, expressed in terms of pH, would be 7 6 (alkaline) and slightly below 7 (markedly acid). Such marked deviations from the normal Pco, of 40 and pH of 7.4 would probably lead to muscular spasms, known as tetany, in the first instance and to CO_2 narcosis and anesthesia in the second.

Nature of the Chemical Stimulus to the Respiratory Centre.——After Haldane's discovery of the importance of carbon dioxide in the control of respiration, physiologists sought to find its mode of action When, as the result of new measuring techniques, data relating rise in arterial acidity to rise in P_{CO_2} became available. Winterstein, and Haldane himself, came to believe that the pulmonary ventilation was regulated by the arterial hydrogen ion concentration rather than by the Pco, This reaction theory, as it came to be called, gained further support from the fact that in metabolic acidosis, as in diabetes. respiration was increased even though the P_{CO_2} was found to be below its normal value of 40 mm.

There were, however, experiments of a quantitative nature which cast doubt on the reaction theory. Krogh found that for a given increase in acidity produced by the acid-producing salt ammonium chloride, the hyperpnea was trifling compared to that accompanying inhalation of CO, Similarly, Hooker perfused the medulla of an anesthetized animal with blood kept at constant acidity, first by adding hydrochloric acid and second by adding carbon dioxide, the increases in pulmonary ventilation being 128 and 3,069, respectively. The inference to be drawn from these and similar experiments is that carbon dioxide has a marked stimulating effect on respiration in addition to its property of increasing the acidity of the blood.

That a special property of molecular carbon dioxide did not need to be postulated was illustrated by the experiments of Jacobs in the early 1920s. The flowers of certain carnations mere known to be blue in alkaline media and red in acid Blue flowers immersed in acid solutions remained blue for long periods, but in solutions saturated with carbon dioxide and buffered to the alkaline side with sodium bicarbonate. the flowers turned red immediately. The explanation was that dissolved carbon dioxide was able to diffuse freely into the interior of the cell, rendering it acid With the floners in acid solution, however, the acid went in very slowly, because the cell membrane was relatively impermeable to the positively charged hydrogen ions. The same effect was observed in living sea urchin eggs Jacobs' investigations made it clear that the acidity inside the cells of the respiratory centre might differ aidely from that of the arterial blood.

On the basis of these findings, Winterstein modified his original reaction theory so as to identify the acidity inside the cells of the respiratory centre, rather than that in the blood. as the unique stimulus to respiration. Gesell pursued this idea, and found evidence for disparities between the acidity of the blood and that of the cerebrospinal fluid nhich surrounds the central nervous system. including the medullary respiratory centre These differences are known to be due to the blood-brain barrier, composed of the meninges covering the brain which prevent free passage of many substances including hydrogen ions

In spite of numerous investigations, there remained two schools of thought regarding the "unique" chemical stimulus to the respiratory centre, if indeed there is one The Scandinavian group, led originally by Krogh and later by M. Nielsen, advocated P_{CO_2} as the stimulus, the hyperpnea of metabolic acidosis being explained on the basis of increased sensitivity of the respiratory centre to P_{CO_2} as a result of the acidosis. On the other hand, Winterstein, Gesell and others advocated intracellular pH.

An ingenious attempt to resolve the dilemma is provided by the multiple factor theory of J. S. Gray, according to which each chemical stimulus to respiration acts in its own right, the existing level of ventilation being the resultant of the additive effects of the known stimuli, namely P_{CO_2}, hydrogen ions (acidity) and, during hypoxia. P_{O_2}. For example, the marked response to breathing CO_2 could be due to the effect of increased P_{CO_2} plus that of the increased acidity produced by adding CO_2 to the blood. On the other hand, the much smaller response which accompanies an equal degree of acidity produced by metabolic acidosis could be due to the difference between a stimulus, increased acidity, and an antagonist, decreased P_{CO_2} (below normal in this condition). In other words, the addition is algebraic in this instance.

The concept of an antagonist—i e., a less than normal contribution of a respiratory stimulus—though implicit in the finding by Haldane of apnea following hyperventilation when the Pco, was only slightly reduced, is one of the keystones of Gray's theory. According to him, there is no unique stimulus, all three combining their effects.

Gray's theory is basically descriptive, without specifying how or where CO_2 or hydrogen ions exert their actions Each could act as a specific stimulus inside the cell, the two effects being combined. Or CO_2 could act simply as an acid inside the cell. modifying, together with acid from other sources. the intracellular pH in keeping with the Winterstein-Gesell acid theory. Clear answers to these problems probably must await development of a direct means for measuring the pH inside the cells of the respiratory centre.

Regulation of Ventilation During Physical Exercise.—Haldane proposed that carbon dioxide was responsible for the increase in breathing which accompanies exercise. The experimental data, however, have not supported him. The highest ventilation produced by increasing the P_{CO_2} is about 70 l. per minute during breathing of 7.5% CO_2, the alveolar P_{CO_2} then being 60 mm., which is 20 mm. above normal. In severe exercise, not only is the minute volume considerably higher, 100 to 120 l. per minute, but, what is more striking, the P_{CO_2} is actually below its normal value of 40 mm. Hence an elevated P_{CO_2} cannot possibly explain the great increases in ventilation observed during severe exercise, and can account only partially for the hyperpnea of moderate exercise, when the Pco, is only slightly (two to four millimetres) above normal.

No known simple factor can explain the increase in ventilation occurring during exercise. Several stimuli appear to combine their effects and in such a way that the volume of air breathed increases in direct proportion to the increase in work done and the oxygen used. It is difficult to conceive of so precise a regulation without the intervention of a chemical factor uhich, produced as a result of the exercise, acts so as to increase the ventilation. Yet no such agent has been found. It is true that an increase in blood acidity

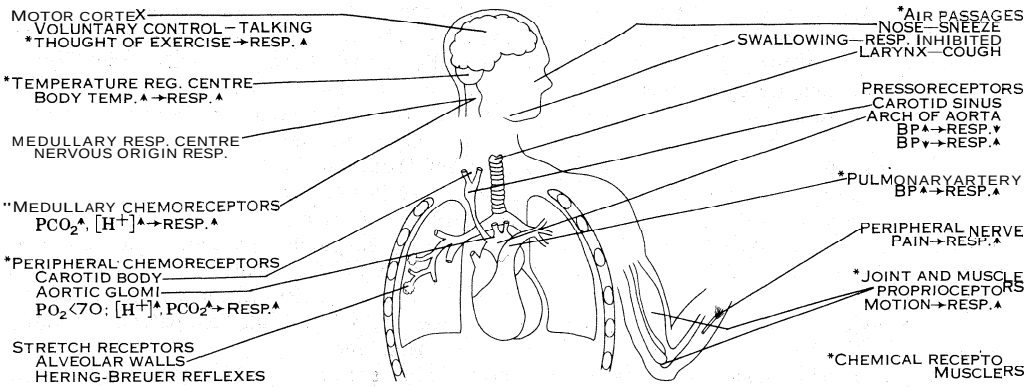


FIG. 9.—DIAGRAM SUMMARIZING PROCESSES INVOLVED IN THE NERVOUS AND CHEMICAL CONTROL OF RESPIRATION

Asterisks indicate factors probably contributing to the increased breathing of exercise. Horizontal arrows (→) denote "leads to"; vertical arrows indicate increase (↑) or decrease (↓) in the factor referred to. Bp is the symbol for blood pressure

occurs during severe exercise and could be a factor in that condition alone. An increase in sensitivity of the respiratory centre to P_{CO_2} has also been postulated. A rise in body temperature can produce such an increase. and the body temperature does 'rise 1° or 2° C. or more during severe exercise. One investigator found an 11 litre. increase in ventilation per degree rise in body temperature, due at least partly to increase in sensitivity of the medullary respiratory centre to CO_2.

Nervous reflexes also contribute their share. Passive motion of the limbs in man or animals produces an increase in ventilation. The effect is abolished n-hen the sciatic nerve to the leg is anesthetized by injection of procaine or if it is cut. The impulses responsible are known to arise in the special "position-sense" nerve endings (proprioceptors) located in joints and muscles. which permit an individual to tell whether a joint is extended or flexed and how much. The effect of such afferent impulses from moving limbs is not great, however. accounting at most for only about 20% of the increased ventilation.

Probably nerve impulses from the motor regions of the cerebral cortex which control the muscles involved in exercise also influence the respiratory muscles by a process of irradiation. or spread in the reticular substance of the midbrain. Psychic factors also serve to increase ventilation. the latter rising considerably even before the start of a competitive athletic event. Yet such factors could hardly account for the observed correlation between minute ventilation and oxygen consumption.

Other nervous and chemical factors have been proposed to help account for the hyperpnea of exercise. These include afferent impulses initiated by movement of air through the smaller air passages. nerve impulses originating as the result of a rise in the blood pressure in the pulmonary artery. impulses produced by nerves sensitive to accumulation of metabolites such as lactic acid in exercising muscles, or to rises in temperature of these muscles. Yet the experimental evidence for these other nervous and chemical reflexes is dubious at best. It is entirely possible that physiologists are at a stage in attempting to explain the hyperpnea of exercise similar to that existing before the discovery of the peripheral chemoreceptors. when many theories were proposed to account for the stimulation of ventilation by hypoxia, though none proved adequate.

Those reflexes which may contribute to the hyperpnea of exercise are marked by an asterisk in fig. 9. This diagram also gives some idea of the many other factors which influence breathing.

See also RESPIRATORY SYSTEM, ANATOMY OF; RESPIRATORY SYSTEM, DISEASES OF; CIRCULATION OF BLOOD; etc.

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RESPIRATORY SYSTEM, ANATOMY OF. The respiratory tract, including all the organs concerned in the act of breathing, consists of the nasal cavities, pharynx (throat), larynx: trachea. bronchi and lungs (see fig. 1). In ordinary breathing the nasal cavities warm, moisten and filter the inspired air (*see* OLFACTORY SYSTEM). The pharynx. which lies between the nasal cavities and mouth. above. and the larynx and esophagus, below, is a transitional zone in which the pathways of swallowing and breathing cross each other (*see* THROAT). In certain mammals in which the sense of smell is all-important, breathing through the nose is made obligatory by an interlocking of the epiglottis and the uvula of the soft palate. In man there is a gap between the two; consequently food is sometimes misdirected into the larynx and windpipe.

Larynx.—When the physician looks into the throat with a laryngoscope. he is examining the mucous surfaces of the interior of the voice box. Reflected in his mirror are the structures shown in fig. 2: a lid-shaped epiglottis that can be folded backward over the larynx: the aryepiglottic folds, backward extensions of the epiglottis that help prevent spilling of food into the larynx; the pear-shaped piriform recess, through which food is guided into the esophagus; the vallecula ("little valley"). n-hich separates the epiglottis from the tongue; the ventricular folds or false vocal cords; and beneath them the glottis ("mouthpiece of a flute"). The latter consists of the vocal folds (or cords) and the slit between them, the *rima* glottidis.

The ventricular folds point downward and. when closed by action of sphincter muscles, form an exit valve that permits the building up of abdominal pressure, as in straining at stool or in expulsion of the fetus. Coughing is produced by releasing the air explosively. Between the ventricular and vocal folds of each side is a pitlike cavity. the ventricle. which is prolonged into an appendix or saccule. In the great apes these saccules become enormous accessory organs of respiration.

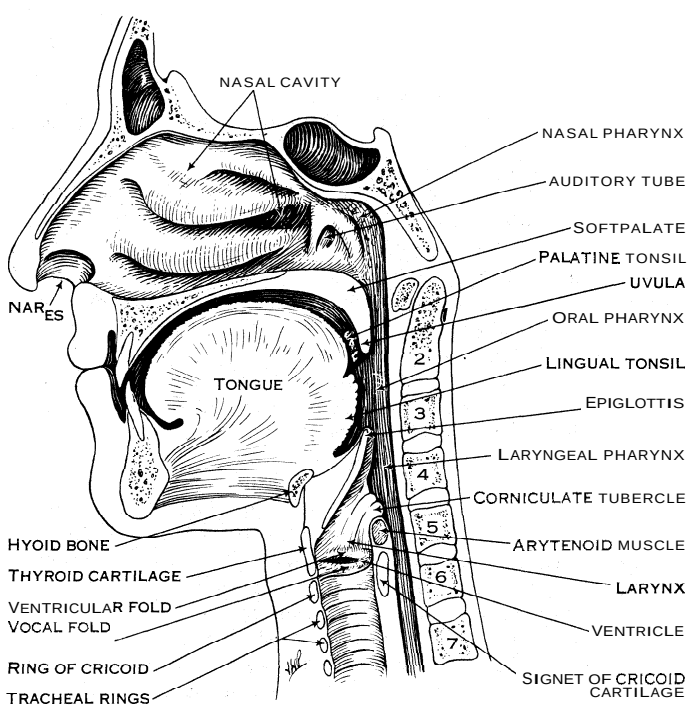
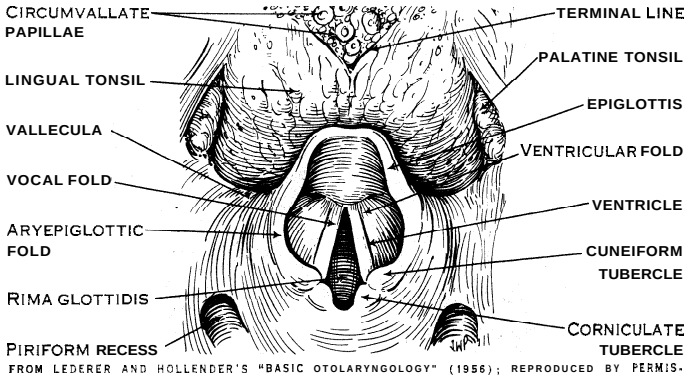


FIG. 1.— SAGITTAL SECTION OF HEAD AND NECK

Numbers indicate the cervical vertebrae



FROM LEDERER AND HOLLENDER'S "BASIC OTOLARYNGOLOGY" (1956); REPRODUCED BY PERMISSION OF F. A. DAVIS COMPANY

FIG. 2.— LARYNGOSCOPIC VIEW OF LARYNX

The vocal iolds are whiter than the ventricular folds because their areas of contact with each other are covered by stratified scalelike epithelium. These are the hard membranes that vibrate to produce sound. In breathing. they approach each other rhythmically. When closed by the surrounding muscles they form an inlet valve that prevents the entrance oi air during fixation of the ribs for movements of the arms.

The physician examines the cords for evidence of inflammation, for the presence of tumours and ior paralysis of muscles that regulate their action. They stretch across the interior of the voice box from the shieldlike thyroid cartilage, in front. to the vocal process of the pitcher-shaped arytenoid cartilage. behind (see fig. 1–3). The arytenoids are the key to the understanding of the movements of the cords. These cartilages slide and rotate upon the signet portion of the ringlike cricoid cartilage (see fulcrum, fig. 3), abducting or adducting the cords in response to muscles that insert upon the muscular process of each arytenoid. Tensing and loosening of the cords are produced, respectively, by the crico-thyroid muscles, which tilt the thyroid cartilage forward. and by vocal muscles within the cords that shorten the distance between thyroid and arytenoid cartilages. (For action of the laryngeal muscles in the production of sounds, see VOICE.)

Injury of the recurrent laryngeal nerves, or their more central connections, results in paralysis of all laryngeal muscles except the crico-thyroids.

Trachea. — The trachea, or windpipe, is the tube that connects the larynx and the bronchi (see fig. 4); it is from 4 to 4 in. long and lies partly in the neck and partly in the thorax. It begins where the larynx ends. at the lower border of the sixth cervical vertebra (see fig. 1), and divides into its two bronchi opposite the fifth thoracic vertebra. The tube is kept open by rings of cartilage. shaped like horseshoes and embedded in an external fibroelastic membrane. Behind. where the trachea rests upon the gullet, there is a layer of smooth muscle that can draw the open ends of the rings together and so diminish the calibre of the tube.

Inside there is plentiful submucous tissue containing submucous glands and much lymphoid tissue. The whole is lined internally by columnar ciliated epithelium. These cilia form one segment of a continuous field of upward stroking lashes that carry mucus and inspired material irom the lungs to the larynx. At this upper level it can be coughed up.

The cervical part of the tube is not much more than an inch in length, but it can be lengthened by throwing back the head. This is the region in which tracheotomy is performed. At the bifurcation oi the trachea the lowest cartilage forms a carina, or keel. In birds the bifurcation is converted into a vocal organ. the syrinx, consisting of vibrating membranes controlled by special muscles. In man, the topographic relations, at this level, are of special importance (see fig. 4). If the aorta is pathologically enlarged it may compress the esophagus, causing difficulty in swallowing; or press against the left bronchus, causing difficulty in breathing; or put traction upon the left recurrent laryngeal nerve where it curves around the arch oi the aorta, thus affecting the voice.

Below the bifurcation right and left primary bronchi diverge to enter the hilum of the lung. Since the right bronchus more nearly continues the direction of the trachea than the left, foreign bodies swallowed inadvertently by children fall more commonly into the right than into the left lung.

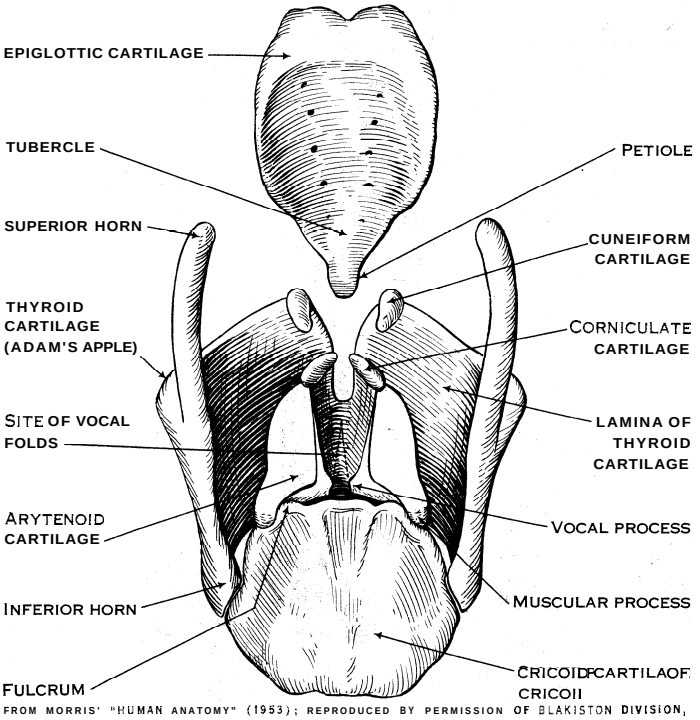
As each primary bronchus enters the lungs it is accompanied by a large pulmonary artery, carrying venous blood to the lung, and a large pulmonary vein conveying oxygenated blood to the heart (see fig. 5). In addition there are small bronchial arteries, lymphatics and nerves.

Lungs. — These are the organs that are formed when right and left bronchial buds of the embryo push out into that portion of the body cavity that later becomes the pleural cavity (see COELOM AND SEROUS MEMBRANES). Each lung, therefore, represents the total branching of the primary bronchus plus its supporting tissue: its associated arterial and venous trees and the layer of pleura that surrounds it. Medially it is attached by a reflection of the pleura to the mediastinum, the vertical wall that divides the chest into right and left compartments.

Grossly. each lung is a somewhat conical organ having an apex, which extends into the neck; a base. which rests upon the diaphragm; and other surfaces that are costal and mediastinal. Superficially the right lung is cleft by horizontal and oblique fissures into three lobes; the left lung is cleft into two lobes. This asymmetry is characteristic of most mammals. Equally significant divisions are the bronchopulmonary segments, first recognized as such in 1932. These are polyhedral wedges of tissue separated from each other by veins and thin connective tissue membranes. They represent the zones of distribution of the larger secondary bronchi. On the right side ten such segments have been recognized. On the left the number is restricted to nine. since apical and posterior segmental bronchi have developed into a single shrublike unit. Although segments are not demarcated by surface fissures they are nevertheless surgical units that can be excised individually, thus making possible the preservation of adjacent healthy tissue that formerly was sacrificed when surgeons were compelled to remove entire lobes in order to remove small lesions.

Commonly, three techniques are available for determining the site of tumours or other lesions in lobes and segments: (1) X-rays of the chest; (2) direct examination of the orifices of the segmental bronchi by means of a bronchoscope lowered into the trachea; and (3) X-rays of the bronchial tree (bronchograms) made after the tree has been filled with a radiopaque fluid.

Bronchial Divisions. — Each of the segmental bronchi divide



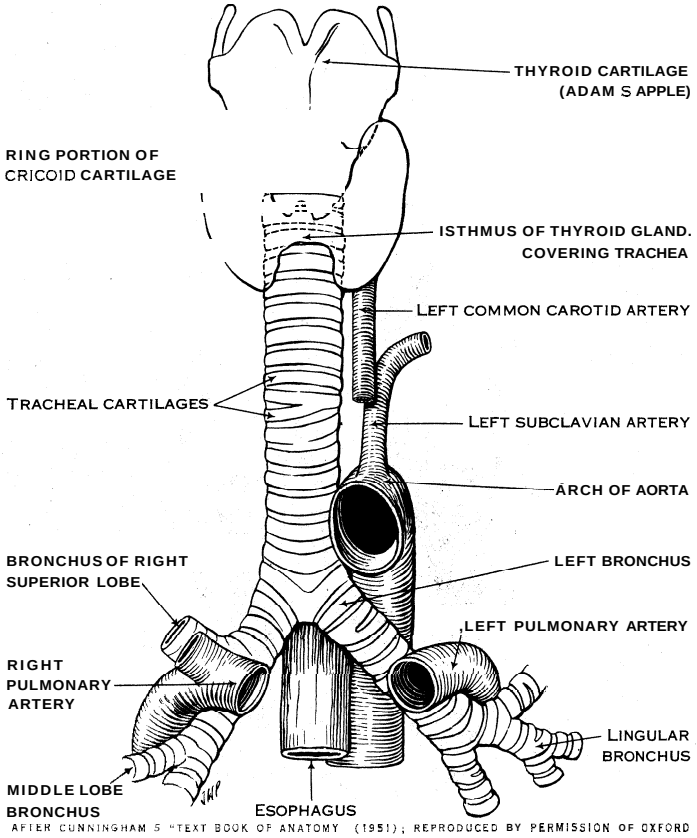
FROM MORRIS' "HUMAN ANATOMY" (1953); REPRODUCED BY PERMISSION OF BLAKISTON DIVISION, MCGRAW-HILL BOOK COMPANY, INC

FIG. 3.— CARTILAGES OF LARYNX SEEN FROM BEHIND

more or less dichotomously until there are from 20 to 25 generations of branches ending in the terminal bronchioles. The first ten generations are widely spaced divisions and occupy two-thirds to three-fourths of the way to the periphery. These are secondary bronchi, lined by ciliated, pseudostratified epithelium. In their walls are cartilage plates, to keep the air passages open; mucous glands to moisten the ducts; and a mesh of smooth muscle fibres to regulate the calibre of the tubes. These tissues are supplied by bronchial arteries of aortic origin, and by nerves; and are drained by lymphatic vessels and veins. The remaining 10 to 15 generations are bronchioles. These branches have no cartilages. are more closely spaced and have a fairly uniform diameter (3–1 mm.). They end in terminal bronchioles, which give rise to the respiratory portions of the tree.

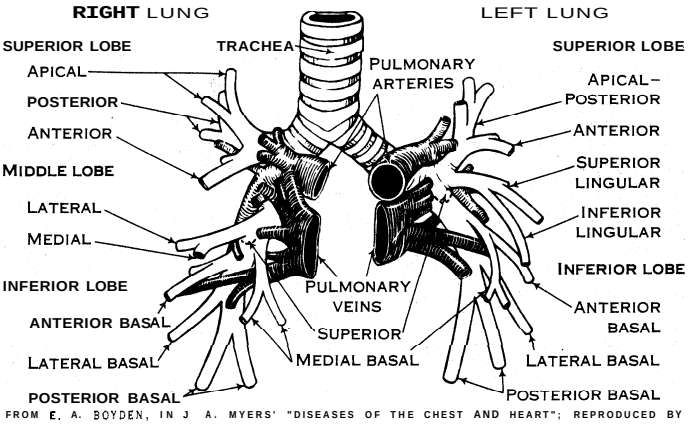
Finer *Structure* of *Lung.*—The terminal bronchioles are small tubes, 0.6 to 0.7 mm. in diameter. They are lined by ciliated columnar epithelium and completely invested by smooth muscle. Spasms of these muscles, as in asthma, can shut off the passage of air. Each of these short tubes gives rise to several generations of respiratory bronchioles (see fig. 6), so named because they contain scattered alveoli. Each of these bronchioles gives rise to from 2 to 11 alveolar ducts, and each of these to five or six alveolar sacs lined by polyhedral alveoli. It has been estimated that there are from 300,000,000 to 400,000,000 alveoli in the lung. These are the functional units (see RESPIRATION). Each is $\frac{1}{5}$ to $\frac{1}{4}$ mm. in diameter and is lined by an extremely thin epithelial membrane, outside which is a rich capillary plexus. As seen under the electron microscope. adherent alveolar and capillary walls measure only $\frac{1}{2500}$ mm. in thickness. It was the first sight of blood corpuscles circulating through these capillaries in 1661 that led Malphigi to exclaim. "I see with my own eyes a certain great thing" (Sir Michael Foster. *Lectures* on *the* History of *Physiology*, p. 96, Cambridge University Press, 1901).

According to W. S. Miller. all the branches of an alveolar duct form a primary lobule. Other investigators start with the respiratory bronchiole. Hundreds of these primary lobules constitute a secondary lobule. The latter can be identified on the surface of the lung as one of many irregular polygons marked out by pigment and measuring from 1 to $2\frac{1}{2}$ cm. in diameter. So far, the finer structure of the lung has been presented as a pattern of aborization. However, it should be realized that these peripheral respiratory units become so crowded together that the lung appears in microscopic sections as a meshwork of thin walls separating air spaces.



AFTER CUNNINGHAM'S "TEXT BOOK OF ANATOMY (1951); REPRODUCED BY PERMISSION OF OXFORD UNIVERSITY PRESS

FIG. 4.— LARYNX. TRACHEA AND PRIMARY BRONCHI



FROM E. A. BOYDEN, IN J. A. MYERS' "DISEASES OF THE CHEST AND HEART"; REPRODUCED BY PERMISSION OF CHARLES C. THOMAS, PUBLISHER

FIG. 5.— SEGMENTAL BRONCHI AND PULMONARY VESSELS

Development of Lungs.—The rudiment of the tracheobronchial tree appears as early as the 25th day of intra-uterine life in the form of a laryngeotracheal groove on the ventral side of the tubular foregut just below the pharynx. A day or so later, two epithelial lung buds push out from the lower end of this groove, indenting the pleural cavities. These are the primitive lung sacs or primary bronchi. This period is a critical one. for occasionally one lung fails to appear. In rats, this condition has been produced experimentally by feeding the mother a diet deficient in vitamin A.

By the 31st day each bronchus has developed secondary buds, which become the lobar bronchi. Meanwhile the laryngeotracheal groove is being separated from the esophageal portion of the gut by a wall that moves progressively upward from the level of the bronchial buds to the larynx. As each lobar bronchus continues to grow it divides dichotomously. By the 36th day all ten segmental buds have appeared, giving the exterior of the lung a scalloped appearance. By the 40th day several additional generations of branchings have appeared. so that a model of the bronchial tree resembles great clusters of grapes.

This period of branching of epithelial tubes continues through the fourth month of fetal life and is known as the glandular period. Some 17 generations of branching are then established. The last seven of these are lined by cuboidal epithelium. Between the fourth and sixth months—the canalicular period—capillaries protrude into the lumina of the more peripheral bronchi, pushing connective tissue fibrils ahead of them to separate the cuboidal cells. Such protrusions give rise in time to the malls of alveoli. At six months there are no alveoli as yet, but the number of capillaries protruding into the lumina is sufficient to support for several hours the life of an infant born prematurely at this age. In the alveolar period—seven months to term—vascular walls have protruded far enough into the lumina to outline shallow alveoli. From this time on the premature infant is viable.

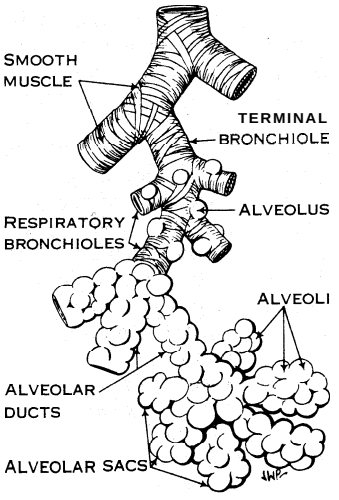


FIG 6.—TERMINAL RESPIRATORY UNITS OF BRONCHIAL TREE

Obviously, birth is another critical period. The first respira-

tions expand only a limited area. Full expansion requires several days, and sometimes weeks. Not infrequently portions of the lung never dilate (congenital atelectasis).

In premature infants, and those delivered by caesarean section, a hyaline membrane of unknown origin sometimes lines the alveoli, preventing respiration. Nor is it known whether aspiration of amniotic fluid before birth is a normal or abnormal occurrence. These and other problems dealing with respiration at birth await solution.

After birth, the lung grows rapidly, partly by lengthening and thinning of its walls and partly by increase in size of individual alveoli and in the number of branches. At maturity nonrespiratory generations of branches have increased from about 17 to 25. How this is accomplished is not known.

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(E. A. BN.)

RESPIRATORY SYSTEM, DISEASES OF, Respiratory diseases may involve the upper respiratory tract from the nose, with its accessory sinuses, through the pharynx and larynx to the lower respiratory tract, which includes the trachea, bronchi and lungs. From beginning to end the mucous membrane of the entire tract is continuous. The anatomy and physiology of the respiratory tract are described in the articles RESPIRATORY SYSTEM, ANATOMY OF and RESPIRATION. This article is concerned mainly with diseases of the lower respiratory tract. For the upper respiratory system, see THROAT, DISEASES OF. The diseases affecting the lungs are approached somewhat differently in LUNG, DISEASES OF, and PLEURA, DISEASES OF deals with the disorders specifically affecting the pleura. An inflammation of the lung from any cause may be called pneumonia, hence see also PNEUMONIA.

Disease **Barriers.**—Normally, inspired air is warmed and moistened as it passes over the nasal turbinates, which act as baffles. This mechanism is interfered with when infection or allergy causes swelling of the mucous membrane. Particles in the inspired air are usually deposited in the nose, from which they are eliminated. A circle of lymphoid tissue surrounds the pharynx, acting as a barrier against the dissemination of infection. The mucous membrane of the trachea and bronchi is supplied with minute hairs, the cilia, which beat upward away from the lungs. This cleansing device raises to the pharynx inhaled foreign particles, which can then be expectorated. Toxic agents may slow or paralyze ciliary action; dehydration or infection may so thicken the secretions that the ciliae cannot beat freely. Some noxious particles actually reaching the air sacs or alveoli of the lungs are engulfed and disintegrated by special cells and then brought to the ciliary stream. Cough is a mechanism for forcible ejection of foreign matter and infected secretions.

Interference with any of these mechanisms predisposes to disease. In addition, there are local and general factors of resistance involving nutrition, hormones, previous experience with disease, chilling, unconsciousness due to anesthesia or inebriation, etc.

INFECTIONS

Infections can be grouped most easily by causative organisms.

Viral Diseases.—Great difficulty occurs in attempts to correlate respiratory diseases with their viral causes. One virus may be responsible for several different illnesses, and one disease may be caused by several different viruses. This is a field of active research, and new viruses are being discovered.

Influenza has a short incubation period and occurs in epidemics, usually of relatively minor significance but occasionally in pandemics of great severity, as in 1918 and 1957. The later world-wide influenza1 outbreak was caused by a substrain of type A virus named the Asian strain because the first recognized cases occurred in the orient. There is no effective treatment for pneumonia produced by the influenza virus. Total prevention as for smallpox, yellow fever and rabies, is not available, but partial control may be achieved through vaccination, provided the responsible strain has been included in the vaccine. Antibodies against one influenza virus are ineffective against another type of the same strain. One of the great medical feats of the 20th century was the world-wide co-operation that resulted in the prompt identification of the Asian strain of type A influenza virus, its incorporation into vaccines, and the use of vaccine on a mass scale so that protection was available immediately during the 1957–58 Asian- influenza epidemic. Immunity from an attack of influenza is short lived. (See also INFLUENZA.)

Another viral disease is pleurodynia, caused by the Coxsackie B virus. It occurs in small epidemics and is associated with severe chest pain made worse by deep breathing.

Primary atypical pneumonia is caused by more than one virus, is characterized by a normal white blood cell count (as are most viral infections) and by the presence of cold hemagglutinins, antibodies rarely present in other diseases. Like all viral diseases, it is resistant to treatment.

Rickettsia1 **Pneumonias.**—Bronchopneumonia may occur in louse-borne typhus (*q.v.*), a disease of world-wide distribution caused by Rickettsia *prowazeki.* Pneumonitis is a feature of many cases of Q fever (*q.v.*), a disease caused by *Coxiella* burneti and first recognized in Australia. It is transmitted mostly by inhalation through octupational exposure to infected sheep, cattle or goats, or by working with the rickettsiae in the laboratory. Many cases have been reported from California, Montana and Texas as well as from Africa, Europe, the middle east and Panamá. The rickettsia1 diseases respond well to treatment with the tetracyclines or chloramphenicol.

Bacillary Infections.—The commonest bacillary infections of the nasopharynx are due to hemolytic streptococci and staphylococci, and to pneumococci. (See also BACTERIAL AND INFECTIOUS DISEASES.)

Streptococcal sore throats are of great significance, since serious distant effects include kidney infections and flare-ups of rheumatic fever, with its possible sequel of rheumatic heart disease. Fortunately, excellent antibiotic treatment is available, penicillin being most effective. Early diagnosis is important, and for persons with a history of rheumatic fever prophylactic drug therapy during cold weather is desirable.

Staphylococcal infections occupy a major place among the pneumonias because of their rapid and often fatal course. The emergence of staphylococci resistant to many of the most potent antibiotics has presented a grave problem in treatment. Many staphylococcal infections are acquired in the hospital: resistant staphylococci have been cultured from throats and fingernails of hospital personnel, from air emerging from hospital laundry chutes and operating rooms, from blankets and from "clean" glasses and water bottles delivered to patients. Most hospitals have committees which not only review each case of staphylococcal infection but also draw up housekeeping procedures designed to prevent the transmission of such infections.

Pneumococcal pneumonias appear to be less common than they once were. It is not apparent whether this is due to a true reduction in prevalence or to the fact that cases are being successfully treated at home with the many antibiotics available. Friedländer's pneumonia, caused by Friedlander's bacillus or *Klebsiella pneumoniae,* remains a grave infection seen mostly in older men, frequently in alcoholics or grossly malnourished persons.

Tuberculosis.—This is a disease with a declining death rate—in the United States the rate fell from 202 per 100,000 population in 1900 to 8.4 in 1956, in South Australia it fell from 90 per 100,000 in 1899 to fewer than 5 in 1956. However, in many areas, including eastern Europe, Asia and the Pacific Trust Islands, the disease is still rampant. In remote or over-populated places diag-

nosis is often erroneous and statistics are inadequate, so that the true magnitude of the problem is unknown.

The number of persons suffering from active tuberculosis constitutes a better measure of the problem than the number of persons dying from the disease, particularly since modern treatment is effective. Though morbidity rates are slowly diminishing in the economically advanced countries. the problem remains of considerable magnitude. For a full discussion of this disease, see TUBERCULOSIS.

Fungus Infections. — Certain geographic areas are endemic foci of fungus diseases, many of which affect the lungs. In the U.S., portions of the south and the whole Mississippi valley have high rates of infection with *Histoplasma capsulatum.* A ten-year study of histoplasmin and tuberculin reactors among kindergarten children in Kansas City, Mo., reported by L. E. Wood and his co-workers in 1958, revealed a higher prevalence of histoplasma infection than of tuberculous infection. Histoplasmosis is a serious problem in these endemic areas. Its behaviour closely resembles that of tuberculosis. Amphotericin B gives promise of being effective in therapy. As with tuberculosis, some cases of histoplasmosis run a benign course. Miliary calcifications result from benign disseminated disease; their X-ray appearance remains unchanged over years. Localized epidemics of histoplasmosis have occurred in association with the soil of chicken houses, and the disease has been reported in association with bat dung.

In the western and southwestern United States, northern Mexico and certain areas of South America, infection with *Coccidioides immitis* is prevalent; nearly all residents are infected, many without ever having had symptoms. Coccidioidomycosis is contracted by inhaling chlamydospores (the Coccidioides reproductive organs) in dust. About half the cases exhibit respiratory symptoms. The pneumonitis which develops may clear entirely or may leave characteristic thin-walled cavities. Small cavities tend to close slowly. Larger cavities frequently give rise to expectoration of blood-stained sputum and occasionally rupture; hence surgical removal is often advised. There is no effective medication for coccidioido~nycosis. It may be prevented by avoiding endemic areas, particularly during dry. dusty seasons.

Less common fungus diseases of the respiratory tract include actinomycosis, due to *Actinomyces* bovis, a fungus harboured in the mouths of most persons; nocardiosis, due to *Nocardia asteroides*; and blastomycosis, due to *Blastomyces* dernzatitides. In actinomycosis the lesions tend to penetrate the chest wall. Effective treatment for both actinomycosis and nocardiosis consists of large doses of penicillin, either alone or with sulfadiazine. Surgical drainage is indicated for abscesses. For blastomycosis, sulfadiazine is the drug of choice. Cryptococcosis, caused by *Cryptococcus* neoformans, may begin with a mild respiratory infection and progress to involvement of the lungs and to meningitis. No satisfactory treatment is available, though amphotericin B seems promising. (See also FUNGUS INFECTIONS.)

OTHER DISEASES

Parasitic Infestations of the Lung. — Chronic pulmonary schistosomiasis (*q.v.*) has been reported from Egypt, Brazil and other countries. Infections with blood flukes are widely distributed in Japan, China, the Philippines, Africa, Brazil, Dutch Guiana and several islands of the West Indies. With the slow northern advance of the *Schistosoma,* the disease has come to be of interest in the United States. Exposure occurs through contact with water infested by snail hosts, through bathing, laundering, etc.

Amebiasis occurs all over the world, mostly in the tropics and where sanitation is poor. Prevention consists of avoiding contaminated water and raw foods which may have been washed with such water. Pulmonary abscesses occur secondary to amebic abscesses of the liver. (See also PARASITIC DISEASES.)

Allergic Diseases. — Vasomotor rhinitis, hay fever and bronchial asthma are a triad of common allergic diseases of the respiratory tract.

Vasomotor rhinitis, characterized by copious watery nasal discharge, is nonseasonal, in contradistinction to hay fever, which is seasonal and caused by pollens. Hay fever is associated with sneezing, itching of the eyes and nose, outpouring of watery secretions from the eyes and nose and an abrupt onset when the causative pollen first becomes airborne. While it is not in itself serious, it is annoying. interferes with sleep and appetite as well as with the normal functions of the nasal mucosa and thus predisposes to infection. (See also HAY FEVER.)

Bronchial asthma, the most serious of the allergic diseases of the respiratory tract, is characterized by sporadic attacks of wheezing due to spasm of the involuntary muscles in the bronchial walls. The wheezing is bilateral, intermittent and changeable, in contrast to the unilateral fixed wheeze of tumour, ulcer or scarring of a bronchus. Clear tenacious secretions are difficult to raise. Allergies include a wide variety of exogenous materials such as dust and feathers, but, especially in cases in which the onset of asthma occurs in middle age, endogenous bacteria are often causative. There are usually multiple factors. The actual attack may be precipitated by an emotional upset, a sudden marked change of temperature or a respiratory infection. During an attack air hunger is acute, the spasm of the smaller bronchi exerting a ball-valve effect by which air gets in but cannot get out because the spasm increases the normal shortening and narrowing of the bronchi on expiration. The mucoid secretions may actually plug some bronchi. Occasionally the patient goes into a serious prolonged life-threatening episode called status asthmaticus. Most attacks of asthma can be successfully treated by adrenaline or adrenalinlike drugs and can be averted by avoidance of allergens, infections, rapid changes of temperature and by the achievement of emotional tranquility. While recurrent asthmatic attacks are usually not grave, they lead over the years in many cases to a state of chronic overdistention of the lung and to emphysema. (See also ASTHMA.)

Chronic Bronchitis and Emphysema. — Repeated attacks of acute bronchitis (*q.v.*) predispose to chronic bronchitis characterized by chronic cough productive of sputum. Such persistent productive cough tends to be associated with recurrent bouts of respiratory illness, during which fever is often present and expectoration increases. Ultimately, wheezing is heard and, in an unknown but probably significant percentage of cases, overdistention of the lungs with thinning of the alveolar walls—emphysema (*q.v.*)—develops. Shortness of breath gradually increases until the slightest physical effort is followed by great difficulty in breathing. This major crippling disease of the lungs is progressive and results in total incapacitation. Death finally occurs either from heart failure or from an acute episode of infection. Drugs relieve bronchospasm, and antibiotics produce brilliant results in combating the pneumonias from which emphysema patients suffer recurrently, but there is no cure. Criteria for early diagnosis are lacking. In the absence of definitive information as to cause, measures which prevent bronchial irritation and cough may help in prevention.

Occupational Diseases of the Lungs. — The pneumoconioses are lung diseases due to inhalation and retention in the lungs of industrial dusts, with the production of fibrosis. Silicosis (*q.v.*), the most important pneumoconiosis, occurs as a result of inhalation of fine particles of quartz. Disability is due to the emphysema associated with the progressive fibrosis. Silicotics are more susceptible to tuberculosis than are nonsilicotics. Asbestosis may develop in those exposed to inhalation of asbestos fibres. Over a protracted course, it involves the pleurae and pericardium — the coverings of the lungs and heart — and causes heart failure. Prevention of inhalation of such dusts is important, since there are no successful cures once the fibroses have actually developed. Berylliosis. an acute disease associated with extreme shortness of breath, was largely caused by the inhalation of beryllium phosphors in the manufacture of fluorescent lamps; cases even occurred in persons living in the neighbourhood of such plants. The industry has changed its manufacturing process so that fewer and fewer cases are seen. Treatment with steroid hormones is suppressive. A number of other less common pneumoconioses occur due to exposure to diatomaceous earths, finely divided tin, etc.

"Farmer's lung" is an acute pneumonitis resulting from the

handling of a variety of dusty, moldy, organic materials. Repeated exposure produces recurrence. "Silo filler's disease," another uncommon disease reported among agricultural workers, is a pneumonitis apparently caused by the inhalation of certain oxides of nitrogen. Bagassosis occurs as a result of inhaling bagasse, a residue from sugar cane. (See also DANGEROUS OCCUPATIONS; PNEUMONOCONIOSIS.)

Nonoccupational Disseminated Diseases of the Lung.— Sarcoidosis, a widespread disease which often involves the lungs, is characterized frequently by dramatic bilateral chest X-ray abnormalities in the presence of few or no respiratory symptoms. The causative agent is unknown. Most of the patients have come from the southeastern United States, and the U.S. public health service has postulated a relationship to some of the pollens of pine forests in that area.

M. Bergmann and his co-workers applied the term thesaurosis to a disease they reported, implying that it resulted from the storage of macromolecules of resins used in hair spray and inhaled by the sprayer. Two cases of bilateral lung disease were found associated with the use of hair spray. Bergmann produced experimental granulomas in guinea pigs by injecting into them the residue from a well-known hair spray suspended in saline solution.

Tumours.— A dramatic rise in the incidence of lung cancer occurred after about 1930 in the United States, England and Wales, Australia, Canada, Denmark, Japan and Turkey. The rise was much more marked in men, among whom, in the United States, lung cancer became the commonest cancer. A statistical association with smoking has been pointed out by numerous British and U.S. investigators. Since lung cancer is found in urban rather than in rural areas, the possible causative role of air pollutants needs study also. As of the early 1960s the only cure for the disease was surgical removal before distant spread has occurred. Five-year survival rates reported by surgeons were less than 10%.

See CANCER; TUMOUR; LARYNGITIS; LUNG, DISEASES OF; *see* also Index references under "Respiratory System, Diseases of" in vol. 24. (K. R. B.)

RESSEL, JOSEF LUDWIG FRANZ (1793–1857), an inventor of the screw propeller for steamships, was born at Chrudim, Bohemia, June 29, 1793. He first tried a small boat fitted with a screw propeller at the bow, turned by two men (1826). Ressel obtained his Austrian patent in 1827, and a British patent, believed to have been also on his behalf, was obtained in 1828 by Charles Cummerow. Ressel tried his steamboat, the "Civetta" of 48 tons' displacement, at Trieste in 1829. The screw propeller was of copper, 5 ft. 2 in. diameter, and placed at the stern. The vessel attained a speed of six knots. Ressel died of malaria in the night of Oct. 9–10, 1857, at Laibach (now Ljubljana, Yugos.). In 1924 his native town. Chrudim. raised a monument to his memory.

See Ferdinand Thomas, *Josej Ressel, der Erfinder der Schiffsschraube* (1880). (H. P. St.)

RESTAURANT. The medieval forerunner of the modern restaurant uas the tavern, and to a lesser extent, the cookshop In London cookshops certainly existed in the 12th century, for William Fitzstephen in 1183 described one by the riverside nhere hot cooked viands of all kinds could be bought, and visiting strangers could "refresh themselves, each after his own manner" In John Lydgate's London Lickpcnny (*c.* 1450), we read how the cookshopkeepers of Westminster Gate pressed food and wine upon the ballad's hero and hastened to spread "a fayre cloth" for him, but. for lack of money he was obliged to refuse. The principal business of these shops was the sale of cooked meats which customers carried away with them, but from the foregoing references it would appear that meals were sometimes served also on the premises.

It was. however, in the taverns that the custom of providing a daily meal, or "ordinary," at a fixed hour first developed, and it was in one of these that England's earliest dining club (*see* CLUBS) normally met in the 15th century.

By the middle of the 16th century the dining-out habit was well established among townsmen of all classes. Most taverns offered a good dinner for 1*s*. or less, with wine and ale as extras Tobacco was also sold there after its introduction into England in 1565. Men resorted to taverns for companionship as well as refreshment. and some of the better houses became regular meeting places and unofficial clubhouses for particular groups. Among the more famous Tudor taverns in London were the Mermaid. frequented by William Shakespeare: Ben Jonson and their friends; the Boar's Head. traditionally associated with Falstaff; the Mitre in Bread street (not to be confused with the later house of the same name in Fleet street, frequented by Samuel Johnson and James Boswell); the Devil by Temple Bar, where the celebrated Apollo club was afterward founded: and the Falcon on Bankside, where actors and theatre managers foregathered.

In 1650 the first English coffeehouse was opened in Oxford, and two years later Pasqua Rosee opened another in St. Michael's alley. London. Thereafter similar establishments sprang up everywhere. Their principal trade was in coffee. tea and chocolate (all new drinks at this period). but many also supplied wine and ale. Horace Benedict De Saussure observed in 1726, "What attracts enormously in these coffee-houses are the gazettes and other public papers. Workmen habitually begin the day by going to coffeehouses in order to read the latest news. . . Some coffee-houses are a resort for learned scholnrs and wits; others are the resort of dandies. or of politicians. or again of professional newsmongers; and many are temples of Venus." Apparently food was sometimes served there. for we hear of Oliver Goldsmith eating his supper at the Grecian. As a rule: however. they were concerned only with light refreshments and J. Macky (*Journey Through* England, 1714) remarks that "the general way here is to make a party at a coffeehouse to go to dine at the tavern."

Macky also mentions certain "ordinaries" run by Frenchmen in Suffolk street which seem to have been nearer the modern idea of a restaurant than the contemporary taverns and coffeehouses. The word restaurant was. however. unknown until about 1765, when it was first applied to a Parisian house serving meals and light refreshments which Boulanger opened in the Rue des Poulies. The immediate success of this venture led to its imitation by others. and the use of the new name for many similar establishments in France. In England the word was not generally used until toward the end of the 19th century.

The food supplied in public eating-houses in Stuart and Hanoverian times was usually both generous and cheap. Samuel Pepys paid 10*d*. on one occasion for hot meat. bread and ale at "an ordinary hard by Temple Bar." Johnson in the following century "dined very well for *Sd."* at the Pineapple, paying 6d. for meat. 1*d*. for bread and 1*d*. to the waiter. His companions paid 1*s*., but they had wine as well. Simpson's Fish Dinner house, founded 1723, served a 2*s*. "fish ordinary" which inrluded mutton. soup and cheese as well as fish. Workmen and servants on board wages often patronized underground "dives," where they could eat adequately for as little as 2½*d*. or 3d. On the other hand, Daniel Defoe says that dinner at Pontack's normally cost 4s. or 5*s*. and might cost as much as a guinea.

By the late 19th century the long reign of tavern and chophouse was drawing to its end. In 1884 the first A.B.C. teashop was opened near London Bridge, and ten years later a similar shop mas opened by J. Lyons and Co., Ltd., in Piccadilly. These were the forerunners of a vast chain of teashops where originally teas, and later more substantial meals, were served. Their immediate popularity was largely due to women. who could not frequent taverns unless escorted and had previously had no place where they could eat alone in public. In 1873 Whiteley's store opened a restaurant for their customers and the idea rapidly spread to other shops. Six years later the Great Northern railway ran the first English restaurant car between London and Leeds.

By the beginning of Edward VII's reign: the restaurant habit was fully established in England. Restaurants of all types flourished in London and the larger towns. including the French and Italian houses for which the Soho district of London became renowned and the cafes which were beginning to supplement the humbler teashops. Most large hotels ran restaurants of an elaborate kind and grillrooms were coming into fashion. The attraction of the grillroom was that. while food and service were equal to that of the fashionable restaurants, evening dress was not obligatory.

The first London grillroom was started about 1865 by Spiers and Pond. whence the idea spread first to the Savoy hotel and afterward to most other hotels and restaurants.

A feature of the modern large restaurant faintly reminiscent of the old group gatherings in taverns and coffeehouses is the inclusion in the building of banqueting halls and smaller rooms where organizations can hold festival dinners. or meet for other purposes.

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CONTINENTAL EUROPE

There are in all European capitals a number of luxury hotels where the rich and the great ones of the world are given every opportunity of enjoying all that is best, regardless of cost, and also of showing friend and foe alike how great and how rich they are. Such hotels with their international character are, however, much alike in their style of comfort and in the food they serve.

There is, happily, a greater measure of individuality in the best restaurants of Europe! This is particularly true of France. probably on account of the more general and more critical appreciation there of the happy partnership that should exist between fine fare and good wine. In Paris. the fame of such restaurants as Maxim's, La Tour d'Argent and Lapérouse is world-wide; and also among the best restaurants must be mentioned Grand Véfour.

In the French provinces. well-deserved fame belongs to the Pyramide at Vienne. below Lyons: and in Lyons itself there are half a dozen good restaurants, none better than Mère Brazier. Farther south, on the may to Monte Carlo, there is the Relais de l'Empereur, at Montélimar, a hotel with a first-class restaurant. Provided the cost matters little, superb fare may be had in the Salons privés du Casino. at Monte Carlo, and Chez Reynaud at Nice: but good restaurants abound on the Cdte d'Azur, as indeed they are to be found in all the larger towns of France, for each of the old provinces is celebrated for its gastronomic specialities and style of cooking. For remarkably fine regional cooking, partnered with the best local wines. one may dine at such restaurants as Dubern at Bordeaux; Les Trois Faisans at Dijon: La Maison des Têtes at Colmar; La Rdtisserie at Nantes; A la Sole Normande at Trouville; Lyonnais at Tours; and Hdtel de la Poste, Avallon.

In Switzerland. there are many perfectly managed hotels and restaurants but it is difficult to single out those which are really outstanding for both fine fare and an adequate choice of fine wines. The Ziirich airport restaurant may not be the most glamorous in the land but it is certainly one of the best for cuisine and Swiss wines. German food is substantial and the portions served generally are plentiful, but the cooking can also be first-class, and the fine wines of the Rhine and the light and dark beers of the country are justly famous. Throughout Germany, and particularly in the Rhineland, in small towns as well as in the cities, may be found restaurants with a specially personal, local character.

In Italy. the best restaurants. those possessing first-class chefs, a good cellar and a personality entirely their own, are mostly to be found in Venice, and after Venice, in Turin: in Venice. the Gritti and Danieli hotels, and the Taverna al La Fenice may be mentioned; in Turin. the Caval 'd Bronz. In Rome, for local colour the restaurants by Sta. Maria in Trastevere may be enjoyed, but the most fashionable is Palazzi (in the former home of Claretta Petacci). In Milan Giannini's and in Florence the Bucha di San Rufillo are noted. Among restaurants which are reputed to excel in the service of local or national dishes are the following: Amsterdam. Neth.. Die Port van Cleve and the "Five Flies"; Barcelona, Sp., Casa Agustín; Brussels, Belp.. the Astrid; Copenhagen. Den., Drachman's Kro. at Lorry's; Munich, Ger.. Schwarzwälder; Daun (Eifel. Ger.), Weier's; Jerez de la Frontera, Sp., Los Cisnes; Madrid, Sp., La Barraca. (A. L. S.; X.)

UNITED STATES

Among the earliest restaurants on record in the United States were in Philadelphia. Pa.. the Blue Anchor Tavern (1683 or 1684), Ye CoffeeHouse (1700), The London Coffee House (1701), William Bradford's second London Coffee House (1754), and the City Tavern (1773). In New Tork. the famous Fraunces' Tavern at Broad and Pearl streets still stands. Other famous early restaurants were Brown's Chop House, a favourite rendezvous of journalists, authors, actors and painters: the Old St. Denis, Fleischman's Vienna Gardens. Dorlon's. the old Hoffman House, Café Martin, the old Holland House, Delmonico's and Sherry's. In New Orleans. La.. Antoine's and Bégué's are still fashionable favourites. San Francisco. Calif.. had many renowned restaurants such as Don's. the El Dorado House (Spanish cooking); the Iron House made of sheet iron brought in a sailing vessel around the Horn, Tehama House. Marchand's and the Mint. Few of these survived the San Francisco fire of 1906.

Great economic changes brought about by World Wars I and II changed the restaurant industry drastically. Whereas originally restaurants had catered only to a fashionable society clientele?they came to serve the general public as well. Although there are still many famous fashionable restaurants, night clubs and hotel dining rooms, the largest number of restaurants have built their success by serving meals in pleasant surroundings at popular prices to the general public. In 1955 there were 186,275 commercial restaurants, cafeterias, taverns, coffeeshops, luncheonettes, sandwich shops and refreshment stands. (This total excluded dining rooms in hotels, clubs, steaniships, trains. air line terminals, hospitals. department or variety stores and institutions of various kinds.) Sixty million meals a day were served in restaurants. There was one restaurant for every 704 persons in the C.S. Its equipment cost an average of $500 per seat. Restaurants employed 1,300,000 people or one out of every six engaged in the retail trades.

The restaurant business reported sales of $8,917,000,000 in 1955, according to the U.S. Business Census, thus qualifying as the third largest retail business. A marked change was the swing from individually-owned restaurants to chains, of which there were more than 198 controlling over 900 units in the latter 1950s. These provided more than 800,000 seats and were responsible for between 11% and 15% of all restaurant sales volume. Among the chains operating in the east were Schrafft's. Longchamps, Howard Johnson's. Brass Rail. Savarin's. Child's (owners of Sherry's); bracketing the east and midwest was Stouffer's; in Washington, D.C., the S. & W's: in Cleveland, O., the Colonnade; in Chicago, Ill., and westward Fred Harvey's; in Los Angeles, Calif.. the Clinton chain. Union News restaurants and Greyhound Post houses were widespread.

F. W. Woolworth Company operated one of the largest chains comprising over 1,400 units whose sales were not included in the above figures.

Whereas originally fine American restaurants were staffed by European-trained chefs and waiters and relied upon Europe for a steady supply of trained employees, World Wars I and II modified this situation. In the latter 1950s many courses in commercial catering at both high school and college level were available in the U.S. Among the courses conducted by the universities were those at Cornell university (Ithaca. N.Y.), Michigan State university (East Lansing), University of Denver (Denver, Colo.). University of New Hampshire (Durham), The University of Chicago (Chicago, Ill.), Mississippi State college (State College. Miss.). Florida State university (Tallahassee). Oklahoma Agricultural and Mechanical college (Stillwater), Tuskegee institute (Tuskegee Institute. Xla.), State College of Washington (Pullman). City College of San Francisco (San Francisco), and at several branches of State University of New York (Albany, N.Y.), including Community college in Brooklyn. N.Y. In addition courses were offered by the Culinary Institute of America in New Haven. Conn., and Clinton's in Los Xngeles. Calif. At the high school level. the Isaac Del Gado Trade school in New Orleans: Food Trades high school in New York and Edison Technical high school in Seattle, Wash., were among those offering instruction in commercial catering. Short

courses were sponsored by various state restaurant associations, such as the ones conducted at The University of Chicago. Rutgers university (Newark, N.J.), and those conducted under the direction of the Illinois and Wisconsin State Restaurant associations. Under the bill providing funds for distributive education many high schools and trade schools offered courses for waiters and waitresses.

Research in methods for improving food and food service was also conducted by the National Restaurant association and the results were made available to all member restaurants throughout the U.S. (C. M. DL.)

RESTIF, NICOLAS EDME (1734–1806), called RESTIF DE LA BRETONNE, French novelist, son of a farmer, was born at Sacy (Yonne) on Oct. 23, 1734. He was educated by the Jansenists at Bicêtre, and on the expulsion of the Jansenists was received by one of his brothers, who mas a curé. Owing to a scandal in which he was involved, he was apprenticed to a printer at Xuxerre, and, having served his time, went to Paris. There he worked as a journeyman printer, and in 1760 he married Anne or Agnes Lebègue, a relation of his former master at Xuxerre. Restif produced about 200 volumes, many of them printed with his own hand, on almost every conceivable subject. He drew on the episodes of his own life for his books, which display an extraordinary licence in choice of subject and in treatment. They provide useful documents for the history of the underworld of the period. They include: *Le Pied de Fanchette*, a novel (1769): *Le Pornographe* (1769), a plan for regulating prostitution which is said to have been actually carried out by the Emperor Joseph II, while not a few detached hints have been adopted by continental nations; *Le Paysan perverti* (1775), a novel with a moral purpose, sufficiently horrible in detail; *La Vie de mon père* (1779); *Les Contemporaines* (42 vol., 1780–1785), a vast collection of short stories; *Ingénue Saxancour*, also a novel (1783); and, lastly, the extraordinary autobiography of *Monsieur Nicolas* (16 vol., 1794–1797; the last two are practically a separate and much less interesting work), in which at the age of 60 he has set down his remembrances, his notions on ethical and social points, his hatreds, and above all his numerous loves, real and fancied. The original editions of these, and indeed of all his books, have long been bibliographical curiosities owing to their rarity, the beautiful and curious illustrations which many of them contain, and the quaint typographic system in which most are composed.

Just before his death (Feb. 2, 1806) Napoleon gave him a place in the ministry of police.

See J. Assézat's selection from the *Contemporaines*, with excellent introductions, 3 vol (1875), and the valuable reprint of *Monsieur Nicolas*, 14 vol. (1883–84).

RESURRECTION PLANT (*Anastatica hierochuntica*), a small herb of the family Cruciferae, called also rose of Jericho, native to Arabia, Iran and Egypt.

Cpon the ripening of the seeds during the dry season, the leaves fall off and the branches curve inward so that the dry plant assumes a globular form. It then rolls about in the manner of a tumbleweed (*q.v.*) until the rainy season. When wet the branches unfold and it assumes for a time the appearance of a living plant

The name is also given to two other plants. One is the mosslike *Selaginella lepidophylla* which also dries up into a ball and expands when wet. It is called also bird's-nest moss and is found from Texas southward to Peru. The other is the resurrection fern (*Polypodium polypodioides*), the commonest epiphytic fern in Florida

RESZKE, JEAN DE (1850–1925), Polish operatic singer, who was noted for his Wagnerian roles, was born at Warsaw on Jan. 14, 1850. His father was a state official and his mother a capable amateur singer, their house being a recognized musical centre. He studied law before adopting singing as his profession and going to Italy to study.

He made his first public appearance, as a baritone, at Venice in Jan. 1874 as Alfonso in *La Favorita*, and in the folloning April he sang for the first time in London, appearing at Drury Lane theatre, and a little later in Paris He was not entirely successful and retired for a further period of study, during which his voice gained remarkably in the upper register; so that when he made his first reappearance at Madrid in 1879 it was as a tenor, in the title role of *Robert le Diable*.

Reszke's great fame as a singer, especially in Wagnerian parts, dates from this time. He appeared at the Metropolitan Opera house, New York, N.Y., from 1893 to 1899, In 1904 he retired, but he continued teaching almost to the day of his death on April 3, 1925.

RETABLE, a term of ecclesiastical art and architecture, applied in modern English usage to an altar ledge or shelf which is raised slightly above the back of the altar or communion table and on nhich are placed the cross, ceremonial candlesticks and other ornaments.

Retables may be lawfully used in the Church of England (*Liddell & Beale*, 1860, 14 P.C.).

RETAILING is the final business service that makes consumer goods and services available to ultimate consumers. It is the sale of merchandise through stores or vendors to those who buy to consume rather than to resell or to reprocess. Actual retailing establishments vary so greatly in size and in types of items of merchandise offered for sale that classifications of retail stores are not particularly useful. The peddler who sells shoelaces or handkerchiefs from a cardboard tray he carries is as clearly a retailer as is the department store.

Historical Background.— Retailing emerged as a separate business function from the fairs the bazaars and the guild-controlled shops of the middle ages, and it developed as the concept of competition grew. Yet merchants themselves have usually sought to avoid facing competition from new or larger types of stores. During the middle ages competition was virtually eliminated from retailing. Most consumer merchandise was made by master workmen under minute guild specifications and sold at prices determined by the guild. Competition between master workmen was limited by limitation of their number in each locality. Fairs were typically of short duration and offered merchandise that did not compete with the products of the guild craftsmen. The limitation on competition is indicated by the three major commercial crimes of the middle ages: forestalling, or buying before the market officially opened or from vendors before they reached the market; regrating, or reselling at a price higher than that originally paid for merchandise; and engrossing, or buying in larger than retail lots, hence implying the intention of reselling.

As long as merchandise was individually made, large-scale trade was impossible. Early textile manufacturers, for example, produced textiles in units called "cloathes," pieces of fabric of varying length and width and of varying quality. Detailed inspection of each cloathe was necessary. Other items of early trade were equally difficult to deal with in quantity. Not until goods could be manufactured to uniform specifications and sold by description could retailing develop to great importance.

Small shops and stores and often custom manufacture therefore remained the rule until the Industrial Revolution introduced a flow of machine-made products of uniform character.

In the United States, up to 1850 (to choose an arbitrary date), men's and women's clothing were made at home or by dressmakers or tailors from textiles and trimmings purchased at stores. Most furniture was custom-made at least as late as that time, with the exception of certain wardrobes and chests. Most foodstuffs were available in stores only in bulk or in the form of raw materials until nearly the start of the 20th century.

The development of retailing as a major business activity was made possible (1) by the development of mechanization, which enabled manufacturers to produce large quantities of consumer's goods; (2) by a steady increase in urbanization, which made a constantly greater proportion of the public dependent on stores for most or all goods and services needed; and (3) by increases in population, which provided mass markets for large-scale manufacturing and retailing. Moreover, the introduction in the United States of formalized consumer credit plans in the early and mid-1920s further improved markets for consumer durable goods and made possible a consequential growth in the field of retailing.

Competition. — The objection to competition that characterized the rudimentary forms of retailing during the middle ages has persisted. The department store, developing and growing during the second half of the 19th century, was widely viewed as an unfair type of institution that threatened other types of retailing. The development of mail-order firms with the introduction of parcel post service by the United States post office was expected to put rural and small-town merchants out of business. Chain stores, or multiple shops (that is, multiple retail establishments under the same ownership and management), were thought to threaten the solvency of all independent merchants, and in the United States some states actually established discriminatory taxes in the effort to prevent the operation of chain store companies within their borders. Supermarkets (large retail establishments organized around food items. but growing to include limited inventories of clothing, household hardware, electrical goods! toys, often drugs and even optical goods) have been regarded as a disrupting influence on more conventional types of retailers. After the mid-1940s the discount house, a retail establishment that has curtailed its retailing services to the point at which it is able to sell consumer durable merchandise at considerable real or apparent reductions in price, was described as a threat to retailers selling consumer durable goods.

Particularly in the United States, groups of retailers have sought to curtail competition through obtaining the enactment of one or another kind of limiting legislation. Many municipalities. particularly small towns, have adopted the so-called Green River ordinance (named for Green River. Wyo., which is said first to have enacted it), which forbids or limits the sale of merchandise by peddlers, house-to-house salesmen or other vendors who are from outside the municipality. Many localities have enacted stringent licensing laws that have the effect of limiting retail competition; such laws often affect barbers. stores selling drug sundries (as contrasted with medicines and prescription goods), plumbers and others. So-called fair-trade legislation has long been sought in the United States and has intermittently been possible, though U.S. supreme court decisions during the 1950s cast doubt on the legality of some forms of fair-trade legislation. Fair-trade legislation, as understood in the United States, allows a manufacturer to prevent "price cutting" by all retail vendors handling his merchandise if he signs and publishes a contract with one retailer or a very small number of retailers, in a particular state, agreeing to maintain certain retail prices *(see* FAIR TRADE LAWS). This type of avoidance of competition at the retail level is far commoner in Europe than in the Cnited States, but even in Europe. and particularly in France. Great Britain and West Germany. the trend in legislation is away from restrictions and toward a more open and rigorous type of competition.

Economic Aspects. — Since retailing is the business service that makes consumer goods and services available to the consuming public, it is, therefore, the last step in the chain of production by which items are brought from a state of nature to the point of consumption and is clearly a part of the process of production. It is, however, one of the more costly parts of the process of production. About half the consumer's cost is taken up in paying for marketing or distribution, and a large part of this amount is attributable to retailing.

The high cost of retailing can be explained by the requirements of seeking out goods from many sources in many locations; of providing wide ranges of choice for retail customers in sizes. colours, types and brands of merchandise; and of keeping merchandise in inventory over periods of weeks or months. In general, the proportion of gross profit or gross margin (the difference between the cost price and the selling price, usually expressed as a percentage of the selling price) varies directly with the rapidity with which merchandise can be sold. This rate is called the rate of stock turn. For some items of food the merchandise may turn weekly or oftener; whereas for some items of jewelry or of hardware the rate of stock turn may be only two or three times a year. It is obvious that retailing merchandise of the latter type is far more costly than retailing merchandise that turns rapidly.

Department stores, jewelry stores and other stores that handle merchandise with a slow rate of stock turn have a higher overall average gross margin. In the United States, department stores require from 35% to 40% of the retail price of the merchandise to pay their costs. Hardware stores also have a low rate of stock turn. On the other hand, pharmacies can do business on a much louer gross margin, and well-organized food stores can do business often on gross margins of 14% or 15%.

Gross margin constitutes a payment by the consumer for retail services. When the gross margin for a particular type of retail store increases, the consumer is very likely to respond to competitive offers and supply his needs from other types of stores. It becomes necessary, therefore, for retailers to become and to remain highly cost-conscious and to take advantage of whatever economies they can.

The net profit earned by retailers is not necessarily influenced by the size of the gross margin. Because retailers may rent their premises and their equipment, may hire delivery on a contract basis and may buy their merchandise on credit. the actual amount of investment in a retail establishment is a difficult matter to calculate and virtually impossible to compare among stores. For this reason, profits for retailing establishments are very likely to be calculated as a percentage of net sales. In general, if all costs are taken into consideration, profits are likely to vary from 0.5% of net sales to as much as 5% of net sales. The differences in rates of profit are for the most part due to different degrees of efficiency rather than to differences in gross margin or in type of merchandise handled.

In the United States, classifications of stores by volume of sales by merchandise lines is difficult because many types of stores carry varied lines of merchandise. Supermarkets, though built around food lines, distribute many other kinds of merchandise. Variety stores, which formerly sold low-priced lines of miscellaneous merchandise. have become competitors of department and hardware and furniture stores. Drugstores sell an increasingly wide variety of merchandise. Slightly more than a quarter of all retail sales in the United States, however, are made by retail outlets specializing in automobiles and automobile and petroleum supplies; this large proportion of retail trade does not take into consideration the sales of the large number of automotive repair shops. The second largest concentration of sales is in grocery stores, which account ior a little more than a fifth of all retail sales. Department stores, which formerly were among the largest volume outlets, by the early 1960s accounted for somewhere near 6% of all retail sales.

Figures ior other countries are less readily available, but insofar as they are available show a far smaller concentration on automotive goods retailing. Aside from this, the biggest difference in retailing, as betneen the United States and Europe, is in the greater reliance on co-operative stores in the Scandinavian countries, Great Britain, Germany and Switzerland. A publication (1958) of the Swiss Cooperative union shows the follouing per capita sales by co-operative retail societies (in Swiss francs): Denmark 181; West Germany, 48; Great Britain and h'orthern Ireland, 215; Finland, 744; h'orway, 194; Sweden, 321; Switzerland, 238. In the Lnited States consumer co-operative associations have made very little headway. They have been most conspicuous in food store retailing, a field in which private enterprise has been at its highest pitch of efficiency *(see* CO-OPERATIVES).

Current Trends. — Trends in retailing appear to be well established and world-wide. Although retailing has reached greater development in the western democracies than elsenhere, even in the communist countries, where sales effort is not supposed to be necessary, the same trends appear in less-advanced stages of development.

The first discernible trend is toward a constantly increasing variety of merchandise, as standards of living rise. The application of the electric motor to household appliances and of synthetic fibres and plastics to home furnishings and clothing, added to a large number of new products, and further advances in the application of chemistry and electronics have continued this process. Not only does this increased variety help to increase the volume of retail sales — and hence to stimulate the

economy—but it adds appreciably to opportunities in the field of retailing.

With improvements in manufacturing techniques, it has been possible for an increasing number of suppliers to manufacture merchandise of high quality. Consumer preference for particular brands of merchandise, therefore, is increasingly based on certain product characteristics. When competition has brought a kind of parity to competing products in a given market. the retailer's support rather than the manufacturer's brand may become the basis for selective demand. This has caused many retailers in the food, clothing, hardware and other fields to introduce their own brands, which they can sell successfully in competition with broadly distributed and widely advertised brands. Such private brands offer retailers a slightly higher margin of profit.

Partially in response to greater urbanization of consumers and partially in response to high labour costs, there has been a marked tendency toward packaging a wide variety of goods in consumer sizes. Canned foods, breakfast cereals and the like have been packaged for a number of decades, by the 1950s and 1960s fresh produce and meats also were offered in prepackaged form, and many items of clothing and household supplies were offered in separate consumer packages. Such packaging greatly reduces the cost of labour applied at the retail store and allows the packaging to be done at central points with automatic machinery at much lower cost. Moreover, the unit of purchase is often increased, thus increasing the volume of business for the retailer. A consequence of this development in packaging has been a great increase in sales by display and in self-service. Self-service is penetrating into more and more types of retail establishments, thus decreasing retail costs and often increasing the satisfaction of the retail customer.

Such consumer packaging requires a great degree of transparency of package and a considerable amount of descriptive information on the label; thus. information on the part of the retail salesperson tends to be of relatively little importance. If no particular facilities or no particularly informed sales personnel are needed to sell merchandise packaged primarily for self-service selling, then such merchandise does not need to be sold in specialized types of retail establishments. An increasing breakdown therefore occurs in the lines of demarcation between types of stores. Dentifrices, for example, may be found in the inventories of drugstores, food stores, variety stores, mail-order firms, department stores and, doubtless, other kinds of stores as well. Other items of merchandise can be found as widely distributed.

There appears to be a tendency toward seeking economies of scale by attempting to operate at large size. In the United States, Great Britain and Europe there is a strong tendency for food retailing, with the addition of accompanying lines of merchandise, to be carried on by chain store companies. Even among the cooperative societies there appears to be a tendency toward the operation of retail outlets at multiple locations. Department store and mail-order firms are tending to establish branches. The economies of central management have brought about national chains in the variety store field. Only in those fields such as furniture, where merchandise is bulky and often locally manufactured, is large size and chain or branch organization not in evidence.

With the growth in size, retailing organizations are finding it possible to introduce laboursaving mechanization. Electronic computers perform many clerical operations; scales weigh merchandise, compute price and affix price tags automatically; materials handling equipment of considerable efficiency is in wide use. In fields where personal service is highly important, nevertheless, the individual merchant can make his service of greater importance than the economies that can be introduced with large size.

See CHAIN STORE; DEPARTMENT STORE; DISCOUNT AND DISCOUNT HOUSES; MAIL-ORDER BUSINESS; SHOPPING CENTRE; see also Index references under "Retailing" in vol. 24.

(L. C. L.)

RETAINER, properly the act of retaining or keeping for oneself, or a person or object which retains or keeps; historically, a follower of a house or family and particularly used of armed followers attached to the barons of the middle ages.

Retainer of Counsel.—In the United States the term retainer is used to refer to the preliminary fee given a counsel to take or defend proceedings. In England the retainer is much more formal. When it is considered desirable by a litigant that the services of any particular counsel (barrister) should be obtained for the conduct of his case, it is necessary to deposit with counsel a form of retainer together with the necessary fee in cash, from which time counsel is bound to give the party who has thus retained him the first call on his services in the matter in which he has been retained.

Retainers are either general or special. A general retainer retains counsel for all proceedings in which the person retaining is a party. A special retainer is one which only applies to some particular cause or action.

See ADVOCATE.

Retainer of Debt.—In connection with the administration of an estate under a mill, it is the right of the personal representative —whether executor or administrator—of a deceased person to retain in respect of all assets which have come into his hands a debt due to himself in his own right whether solely or jointly with another person as against creditors of an equal degree, and this even though his debt is barred by the Statutes of Limitation.

The appointment of a receiver deprives the representative of his right except in regard to assets which came to his hands prior to the appointment of the receiver.

RETALHULEU, a department in southwestern Guatemala on the Pacific lowland. Area 717 sq.mi.; pop. (1950) 66,861. Coffee is grown on the slopes of the highlands at the northern end of the department. In the lowlands at the base of the highlands there are plantations of sugar cane, cotton, rice and cacao. Much land is devoted to the feeding of beef cattle. Retalhuleu, the departmental capital, is served by rail and highway. A railroad connects with the port of Champerico. (P. E. J.)

RETARDED CHILDREN. The phrase "retarded child" means one whose rate of development has been in any way slower than average. The retardation may be either physical, mental, educational or emotional. With earlier psychological writers, however, the phrase, when used without further qualification, usually refers to backwardness in general intelligence. In studying mental defectives in Paris, Alfred Binet noticed that in their intellectual processes they commonly resembled children three or four years younger and inferred that their condition resulted from the fact that their rate of mental growth had been retarded from birth onward. Accordingly, he suggested that a child's level of intelligence might be measured in terms of a mental age, with the difference between mental age and chronological age indicating the severity of the retardation. However, a backwardness of (say) two years would mean very different things at the age of 5 and 15; and a baby of 12 months could not be retarded by that amount. Later investigations showed that, in point of fact, the range of individual variation increases from birth to puberty in rough proportion with chronological age. Hence, it was suggested that instead of taking the difference between the mental and chronological ages it would be better to take the quotient or ratio. Expressed as a percentage, the index so obtained is known as a mental ratio or (more frequently) an intelligence quotient (I.Q.).

With later writers the term retarded child is used in a broader sense to include all those whose educational progress, from whatever cause, has been slower than that of an average child of the same chronological age. This is the definition suggested by the (British) Joint Committee on Mental Deficiency. Since the passing of the Education act of 1944, however, the designation more frequently adopted in British official publications is "educationally subnormal." Occasionally the child's educational age is compared not with his chronological but aith his mental age. In such cases an educational or achievement quotient is taken as the measure. With this interpretation a child whose innate intelligence was well above average would still be called retarded if his attainments in the chief school subjects were no more than those of the child whose intelligence was average for his age. There are many chil-

dren who in their emotional behaviour show the impulsiveness, the lack of control and the general modes of reaction distinctive of children several years younger: such children are often described as emotionally retarded, though here the term emotionally immature is more commonly employed. Finally, when a child's physical characteristics—height, weight, proportions, teeth, pubertal manifestations—are those of a younger child, he is sometimes described as physically retarded. Generally all types of retardation tend to go together.

Borderlines.—Since retardation is necessarily a matter of degree, the line between the retarded and the nonretarded must be a matter of convenience and convention. A pupil whose educational level is equivalent to that of children in the class below that which would be normal for his years needs no special treatment. Thus a child of 10, if normal, would be placed in a class containing children whose ages ranged from 9.5 to 10.5 years. Those in the class below would range in age from 8.5 to 9.5 years. If the pupil is unable to do the work even of these younger children, then, as experience shows, he requires education in a specially organized class with those who are equally subnormal. This implies that at a chronological age of 10 the borderline should be drawn at an educational age of 8.5 or generally at an educational ratio of 85%, which is the line of demarcation usually adopted for administrative purposes.

In the case of purely mental retardation (*i.e.*, retardation in innate intelligence) the upper borderline is similar. But a further classification is plainly desirable. The main division—between the milder cases and the more severe—is usually placed at an I.Q. of about 70. The figure is chosen because pupils below this level need educational provision in a special type of school. In the United Kingdom, before the Education act of 1944, they had to be certified as mentally defective before they could be removed to such a school. The act abolished the need for certification and, provided the children are in some degree educable, for official purposes they are classed with the "merely dull or backward" as belonging to the educationally subnormal, though psychiatrists retain the older nomenclature.

In the United States children whose I.Q. falls below 70 are more usually termed feeble-minded.

Causes.—Educational retardation is due to a wide variety of conditions, and in most instances several factors co-operate, although one usually stands out as the major cause. The commoner factors may be divided into two groups: extrinsic or environmental and intrinsic or personal.

Among environmental causes statistical surveys show that home conditions are more significant than school conditions. Among the lower classes poverty, together with all the handicaps it brings in its train, is one of the most frequently reported. In western countries, however, its influence has steadily diminished. The cultural conditions of the home—a low intellectual level or a lack of educative interests among the parents—appears far more important. But even in a comfortable and cultured home emotional disturbances within the family may at times so upset the child as to affect his work in the classroom. Of conditions more closely connected with the school, irregular attendance is the commonest. Almost equally frequent are inadequate organization of the classes and inefficient or inappropriate methods of teaching.

Of conditions obtaining aithin the child himself, physical defects are less important than is popularly supposed; ill health forms a major factor in only about 10% of the cases. Innate inferiority of general intelligence occurs in well over three-quarters of the cases, and in about one-half it constitutes the major cause. Of more specific disabilities the most obvious are uncorrected defects in sight and hearing. More easily missed are defects in visual and auditory perception or imagery: some children are lacking in verbal facility, others in numerical ability, but by far the commonest defect is in mechanical memory. Temperamental conditions, notably emotional instability, are found among about 7%, often conjoined with certain moral weakness: the child is lazy and ill disciplined in the classroom and prone to petty delinquencies in his life out of school.

Treatment.—The first step is to ascertain the cause. Where the educational retardation is due primarily to innate weakness in general intelligence, it is to that extent irremediable, but much may be done by suitable training in a special school or institution. With milder cases, reclassification for specific subjects, individual coaching, attendance at a special centre (*e.g.*, for speech training) or transfer to a special class may be advised. In the investigation and treatment of special disabilities, assistance commonly is needed from an educational psychologist or child guidance clinic. See also INTELLIGENCE; MENTAL DEFICIENCY.

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RETFORD (officially EAST RETFORD), a market town and municipal borough in the Bassetlaw parliamentary division of Nottinghamshire, Eng., 30 mi. N.N.E. of Nottingham by road. Pop. (1951) 16,316. Area 7.3 sq.mi. Retford (Redforde in Domesday Book) owes its beginnings to its position near one of the Roman roads and on the river Idle, where there was a ford. In 1086 the archbishop of York owned a mill at Retford. It was a borough by prescription.

The earliest charter in the possession of the corporation is that of Edward II (1313) but charters were granted by Henry III (1246) and Edward I (1276). Other charters uhich have survived are those of Edward III (1329), Richard II (1378), Henry IV (1401), Elizabeth I (1562), and James I (1607). East Retford returned two members to parliament from 1315 to 1330 and again from 1571 to 1830.

The borough was joined with the hundred of Bassetlaw and two members were returned until 1885 when the representation was reduced to one member.

The town has flourishing markets and engineering, rubber, wire and dyeing and cleaning works, iron foundries and paper and corn mills. Coal is mined in the vicinity.

RETHEL, ALFRED (1816–1859), one of the few exponents of monumental painting and historical subjects of 19th-century Germany, was born at Aix-la-Chapelle (Aachen) on May 15, 1816. At 13 he entered the Dusseldorf academy, which was at that time flourishing under the direction of Wilhelm von Schadow-Godenhaus. From 1836 until 1847 he lived in Frankfurt, where artistic life centred around Philipp Veit, and occupied himself with sketches for the Charlemagne frescoes in the restored council house of Aix-la-Chapelle. Having won the competition with his sketches, he was commissioned to commence this work in 1847. From that year until 1852 Rethel used to work in Aix-la-Chapelle in summer and Dresden in winter. He died, mentally deranged, at Diisseldorf on Dec. 1, 1859.

His assistant Joseph Kehren continued Rethel's work on the half-finished series of the Charlemagne frescoes, and five of the original eight frescoes survive. Rethel is best known for his powerful series of woodcuts entitled "The Dance of Death," suggested by the Belgian insurrections of 1848, and two woodcuts, "Death as Friend" and "Death as Foe."

See K. Zoege von Manteuffel, *Aljred Rethel, Radierungen und Holzschnitte* (1929); *H.* Franck, *Alfred Rethel* (1937). (H. FH.)

RETZ, JEAN FRANÇOIS PAUL DE GONDI, CARDIKAL DE (1614–1679), French churchman and agitator, was born at Montmirail in 1614. The family was one of those which had been introduced into France by Catherine de Médicis, but it acquired great estates in Brittany and became connected with the noblest houses of the kingdom. Retz himself always spelled his designation "Rais." He was the third son and was destined for the church.

He studied at the Sorbonne, and when he was scarcely 18 wrote the remarkable *Conjuration* de Fiesque, a little historical essay, of which he drew the material from the Italian of Augustino Mascardi, but which is all his own in the negligent vigour of the style and the audacious insinuation, if nothing more, of revolutionary principles.

Retz received no preferment of importance during Cardinal Richelieu's life, and even after the minister's death, though he was

presented to Louis XIII and well received, he found difficulty in attaining the coadjutorship with reversion of the archbishopric of Paris. But almost immediately after the king's death, Anne of Austria appointed him to the coveted post on All Saints' Eve, 1643.

Retz acquired great influence with the Parisians, which he gradually turned against Jules Cardinal Mazarin. No one had more to do than Retz with the outbreak of the Fronde (q v.) in Oct. 1648, and his history for the next four years is the history of that movement. Of the two parties who joined in it Retz could only depend on the bourgeoisie of Paris. But although he had some speculative tendencies in favour of popular liberties, and even perhaps of republicanism, Retz represented no real political principle, and when the breakup of the Fronde came he was left in the lurch. having more than once in the meantime been in no small danger from his own party. One stroke of luck, however, fell to him before his downfall. He was made cardinal almost by accident and under a misapprehension on the pope's part. In 1652 he was arrested and imprisoned, first at Vincennes, then at Nantes; he escaped, however, after two years' captivity, and for some time wandered about in various countries. He made his appearance at Rome more than once, and had no small influence in the election of Alexander VII. In 1662, he was received back again into favour by Louis XIV and on more than one occasion he served as envoy to Rome. Retz, however, was glad in making his peace to resign his claims to the archbishopric of Paris. In compensation he received the rich abbacy of St. Denis and restoration to his other benefices.

The last 17 years of Retz's life were passed partly in his diplomatic duties, partly at Paris, partly at his estate of Commercy. but latterly at St. Mihiel in Lorraine. His debts were enormous, and in 1675 he resolved to make over to his creditors all his income except 20.000 livres, and, as he said. to "live for" them. He died at Paris on Aug. 24, 1679.

One of the chief authorities for the last years of the life of Retz is Madame de Sévigné, whose connection he was by marriage. Retz's *Memoirs* were certainly not nritten until the last ten years of his life, and they do not go farther than the year 1655. They are addressed in the form of narrative to a lady who is not known. They display. in a rather irregular style and with some oddities of dialect and phrase. fine narrative skill and a high degree of ability in that special art of the 17th century — the drawing of verbal portraits or characters.

Besides these memoirs and the historical essay previously mentioned, Retz left diplomatic papers, sermons, Mazarinades and correspondence.

RETZIUS, the name of a family of Swedish scientists renowned for their work in natural history and medicine.

ANDERS JAHAN RETZIUS (1742–1821) was born in Kristianstad on Oct. 3, 1742. He taught at the University of Lund from 1764, was made extraordinary professor in 1777 and ordinary professor of natural history in 1781; later he taught economics and chemistry. In 1812 he transferred to the Carolinian institute in Stockholm, where he died Oct. 6, 1821. A species of plant (*retzia*) was named for him.

ANDERS ADOLF RETZIUS (1796–1860), son of Anders Jahan, was born in Lund on Oct. 13, 1796, and studied in the university of that city until the age of 19, when he transferred to the Copenhagen university. He returned to his native city to receive his medical degree in 1819 and then studied surgery at the Carolinian institute, served four years as a military surgeon and was made professor of comparative anatomy in the Veterinary school of Stockholm. In 1824 he was appointed to the chair of human anatomy and physiology in the Carolinian institute and was later made rector. He made several trips abroad, cultivating close personal friendship and scientific collaboration with Purkinje, Johannes Miiller and many other medical scientists of Europe. In 1839 he was appointed professor of anatomy in connection with painting at the Royal Academy of Fine Arts. In 1858 he was elected president of the Royal Swedish Academy of Science at Stockholm. He died April 18, 1860. Retzius is best remembered as an anthropologist, having introduced the new science of craniometry, which permitted a classification of races on the basis of cephalic measurements. The titles of his publications, dealing with a wide variety of scientific fields, fill three closely printed pages in the Swedish Biographical Lexicon. Named for him are the prevesical space (space of Retzius), dental striae (contour lines of Retzius), convolutions in the brain (gyri of Retzius), a ligament of the ankle (ligament of Retzius) and the veins of Retzius, which unite the radicles of the portal vein with the branches of the inferior vena cava.

MAGNUS CHRISTIAN RETZIUS (1795–1871), another son of Anders Jahan, was born on March 22, 1795. He was professor of obstetrics in the Carolinian institute and director of the lying-in hospital of Stockholm. He died Oct. 1, 1871.

CARL GUSTAF RETZIUS (1798–1833), also son of Anders Jahan, was born April 28, 1798. He was adjunct in chemistry at the University of Lund and professor at the Veterinary school of Stockholm. He died Feb. 23, 1833.

GUSTAF MAGNUS RETZIUS (1842–1919), son of Anders Adolf, was born Oct. 17, 1842, in Stockholm. He was an anatomist and anthropologist, best known for his studies on the histology of the nervous system. He died in Stockholm, July 21, 1919.

(HD. ST.)

REUBEN, according to Gen. xxix. 32, was the eldest son of Jacob. by his first wife. Leah. From this it may be inferred that at one time Reuben ranked as the foremost of the Hebrew tribes. But for reasons which are obscure the tribe lost this pre-eminence at an early period of the history.

In Gen. xxxv, 22 Reuben is said to have been intimate with his father's concubine, and the story. which breaks off abruptly. probably went on to record a curse pronounced upon him in consequence. This would be regarded as a sufficient explanation of the decline of the tribe (cf. Gen xlix, 4, and see I Chron. v. 1). It is possible that the story may be a personification of some aggressive move made by the tribe Reuben against the Bilhah clan. The subsequent history of the tribe is obscure. The territory which later traditions assign to it east of the Dead sea is not clearly delimited or distinguished from the territories of Gad and Moab.

A Reubenite name is found on the west of the Jordan (Josh. xv, 6; xviii, 17), and the reference to Reuben in the Song of Deborah (Judg. v, 15–17) would naturally mean that Reuben was a pastoral tribe on the west of the Jordan, since of the next tribe mentioned it is definitely stated "Gilead abode beyond Jordan."

(W. L. W.)

REUCHLIN, JOHANN (1455–1522), German humanist and Hebraist, was born on Feb. 22, 1455, at Pforzheim in the Black Forest, where his father was an official of the Dominican monastery. The name was graecized by his Italian friends into Capnion. Reuchlin constantly writes himself Phorcensis. He learned Latin at the monastery school at Pforzheim. and spent a short time in 1470 at the University of Freiburg. His fine voice gained him a place in the household of Charles I, margrave of Baden. and he was chosen to accompany to the University of Paris the young prince Frederick.

In Paris Reuchlin learned Greek, and he attached himself to the leader of the Paris realists, Jean Heynlin, or à Lapide (d. 1496), whom he followed to the vigorous young University of Basel in 1474.

At Basel Reuchlin took his master's degree (1477), and began to lecture, teaching a more classical Latin than was then common in German schools, and also explaining Aristotle in Greek. His Greek studies were continued at Basel under Andronicus Contoblacas, and he became acquainted with the bookseller, Johann Amorbach, for whom he prepared a Latin lexicon (*Vocabularius Breviloquus,* 1st ed., 1475–76).

Reuchlin soon left Basel to study under George Hieronymus at Paris. He then studied law at Orleans (1478), and at Poitiers, where he became licentiate in July 1481. On his return to Germany he was engaged as interpreter by Count Eberhard of Württemberg, for a tour in Italy. They started for Florence and Rome in February 1482.

His connection with the count became permanent,

and after his return to Stuttgart he received important posts at Eberhard's court. About this time he appears to have married, but little is known of his married life. He left no children; but in later years his sister's grandson Melanchthon was almost as a son to him till the Reformation estranged them.

In 1490 he was again in Italy. Here he saw Pico della Mirandola, to whose Cabbalistic doctrines he afterwards became heir, and also made the friendship of the pope's secretary, Jakob Questenberg. On an embassy to the emperor Frederick at Linz in 1492, he began to read Hebrew with the emperor's Jewish physician Jakob ben Jehiel Loans. In 1494 his rising reputation had been greatly enhanced by the publication of *De Verbo Mirifico*.

In 1496 Eberhard of Wiirttemberg died, and Reuchlin was glad to accept the invitation of Johann von Dalberg (1445–1503), bishop of Worms, to Heidelberg, which was then the seat of the "Rhenish Society." In this court of letters Reuchlin made translations from the Greek authors. He was during a great part of his life the real centre of all Greek teaching as well as of all Hebrew teaching in Germany. Reuchlin pronounced Greek as his native teachers had taught him to do, *i.e.*, in the modern Greek fashion. This pronunciation, which he defends in *Dialogus de Recta Lat. Graecique Serm. Pron.* (1519), came to be known, in contrast to that used by Erasmus, as the Reuchlinian.

At Heidelberg Reuchlin had many private pupils, among whom Franz von Sickingen is the best known name. With the monks he had never been liked; at Stuttgart also his great enemy was the Augustinian Conrad Holzinger. On this man he took a scholar's revenge in his first Latin comedy *Sergius*, a satire on worthless monks and false relics.

Through Dalberg, Reuchlin came into contact with Philip, elector palatine of the Rhine. who employed him to direct the studies of his sons, and in 1498 sent him on a mission to Rome. He came back laden with Hebrew books, and found when he reached Heidelberg that a change of government had opened the way for his return to Stuttgart, where his wife had remained all along. His friends had now again the upper hand, and knew Reuchlin's value. In 1500, or perhaps in 1502, he was given high judicial office in the Swabian League, which he held till 1512, when he retired to a small estate near Stuttgart.

For many years Reuchlin had been increasingly absorbed in Hebrew studies, which had for him more than a mere philological interest for as a good humanist he could not rest satisfied with the Vulgate text of the Old Testament. In 1506 appeared his epoch-making *De Rudimentis Hebraicis*—grammar and lexicon—mainly after Kimhi, yet not a mere copy of one man's teaching. The edition was costly and sold slowly. One great difficulty was that the wars of Maximilian I. in Italy prevented Hebrew Bibles coming into Germany. But for this also Reuchlin found help by printing the Penitential Psalms with grammatical explanations (1512), and other helps followed from time to time. But his Greek studies had interested him in those fantastical and mystical systems of later times with which the Cabbala has no small affinity. Reuchlin's mystico-cabbalistic ideas and objects were expounded in the *De Verbo Mirifico*, and in the *De Arte Cabbalistica* (1517).

Unhappily many of his contemporaries thought that the first step to the conversion of the Jews was to take from them their books. This view had for its chief advocate the bigoted Johann Pfefferkorn (1469–1521), who secured the ear of the emperor Maximilian. In 1510 Reuchlin was summoned in the name of the emperor to give his opinion on the suppression of the Jewish books. He proposed that the emperor should decree that for ten years there be two Hebrew chairs at every German university for which the Jews should furnish books. The other experts proposed that all books should be taken from the Jews; and, as the emperor still hesitated, the bigots threw on Reuchlin the whole blame of their ill success. Pfefferkorn circulated at the Frankfort fair of 1511 a gross libel (*Handspiegel wider und gegen die Juden*) declaring that Reuchlin had been bribed; and Reuchlin retorted as warmly in the *Augenspiegel* (1511). His adversary's next move was to declare the *Augenspiegel* a dangerous book; the Cologne theological faculty, with the inquisitor Jakob von Hochstraten (d. 1527), took up this cry, and on Oct. 7, 1512, they obtained an imperial order confiscating the *Augenspiegel*. Reuchlin was timid, but he was honesty itself. He was willing to receive corrections in theology, which was not his subject, but he could not unsay what he had said; and as his enemies tried to press him into a corner he met them with open defiance in a *Defensio contra Calumniatores* (1513). The universities were now appealed to for opinions, and were all against Reuchlin. Even Paris (August 1514) condemned the *Augenspiegel*, and called on Reuchlin to recant. Meantime a formal process had begun at Mainz before the grand inquisitor, but Reuchlin by an appeal succeeded in transferring the question to Rome. Judgment was given in July 1516; and then, though the decision was really for Reuchlin, the trial was simply quashed. The result had cost Reuchlin years of trouble and no small part of his modest fortune, but the obscurantists received a crushing blow in Germany. No party could survive the ridicule that was poured on them in the *Epistolae Obscurorum Virorum*.

Reuchlin did not long enjoy his victory in peace. In 1519 Stuttgart was visited by famine, civil war and pestilence. Reuchlin sought refuge in Ingolstadt and taught there for a year as professor of Greek and Hebrew. He was now called to Tiibingen and again spent the winter of 1521–22 teaching in his own systematic way. He died at the baths of Liebenzell on June 30, 1522, leaving in the history of the new learning a name only second to that of his younger contemporary Erasmus.

See L. Geiger, *Johann Reuchlin* (1871), which is the standard biography; also D. F. Strauss, *Ulrich von Hutten;* S. A. Hirsch, "John Reuchlin, the Father of the Study of Hebrew among the Christians," and his "John Pfefferkorn and the Battle of Books," in his Essays (London, 1905). Some interesting details about Reuchlin are given in the autobiography of Conrad Pellicanus (*q.v.*), which was not published when Geiger's book appeared. *See* also the article on Reuchlin in Herzog-Hauck, *Realencyklopadie*, and literature there cited.

RÉUNION, an island and French overseas *département* in the Indian ocean, 425 mi. S.E. of Tamatave, Madagascar, and 130 mi. S.W. of Port Louis, Mauritius. It is elliptical in form and has an area of 970 sq.mi. It lies between 20° 51′ and 21° 22′ S. and 55° 15′ and 55° 54′ E.

The coast line is little indented, high and difficult of access, and the harbours are usually sunken craters. The narrow coastlands, from $\frac{2}{3}$ to 2 mi. wide, are succeeded by hilly ground which gives place to mountain masses and tableland, occupying most of the island. The main axis and watershed runs northwest-southeast, and divides the island into windward (eastern) and leeward (western) districts. The whole relief is complex because of its volcanic nature. First was formed a mountain whose summit is approximately represented by Piton des Neiges (10,069 ft.), an immense denuded crater, and later another crater opened toward the east, piling up the mountain mass of Le Volcan. The oldest erupted rocks belong to the type of the andesites; the newest are varieties of basalt. The two massifs are united by high tablelands. In the older massif the most striking features are now three areas of subsidence--the cirques or mountain amphitheatres of Salazie, Mafatte and Cilaos—which lie northwest and south of Piton des Neiges. The first, which may be taken as typical, is surrounded by high, almost perpendicular walls of basaltic lava. Somewhat lower plateaus (the Plaine des Cafres and the Plaine des Palmistes) extend between Piton des Neiges and Le Volcan.

The second massif, Le Volcan, is cut off from the rest of the island by two "enclosures," each about 500 or 600 ft. deep. The outer enclosure runs across the island in a north and south direction; the inner forms a kind of parabola with its arms stretching east to the sea and embracing not only the volcano proper but also the great eastward slope known as the Grand Brûlé. The 30 mi. of mountain wall round the volcano is perhaps unique in its astonishing regularity. It encloses an area of about 40 sq.mi. known as the Grand Enclos. There are two principal craters, each on an elevated cone—the more westerly, now extinct (8,596 ft.), and the more easterly, called the Burning Crater or Fournaise (8,294 ft.). Eruptions, though not infrequent (30 were registered between 1735 and 1860), are seldom serious. The volcano is of Hawaiian type and its lava runs down to the sea. Following 40 years' inactivity, it reawakened in 1925 and erupted several times thereafter. Hot mineral springs are found on the flanks of Piton

des Neiges; the Source de Salazie, 2,860 ft. above sea level, has a temperature of 90° F., and discharges water impregnated with bicarbonate of soda, carbonates of magnesium, lime, iron, etc.; that of Cilaos is 3,650 ft. above the sea with a temperature of 100°; and that of Mafatte at 2.238 ft. and 87°.

Climate. — The year divides into two seasons — that of heat and rain from November to April, that of dry and more bracing weather from May to October. The prevailing wind is the south-east trade wind, which sometimes veers around to the south and more frequently to the northeast; the west winds are not so steady (307 days of east to j8 of west wind in the year). As over all the Indian ocean, cyclonic storms are frequent at the change of seasons. The relief of the land causes appreciable climatic differences, the leeward side getting much less rain than the windward. On the coast and lower zones on the windward side the mean temperature is about 73° in the "winter" and 78° in the "summer." On the leeward side the heat is somewhat greater. In the Salazie cirque the mean annual average is 66"; on the Plaine des Palmistes 62". On the mountain heights snow falls every year. Hill stations (Hellbourg, Cilaos) have been established in the cirques.

Flora and Fauna. — The heat. humidity and fertility of the volcanic soil have given Reunion an abundant and varied vegetation. In the forest region of the island there is a belt. from 4 500 to 5,000 ft. above the sea, characterized by the prevalence of dwarf bamboo (*Bambusa alpina*); and above that is a similar belt of Acacia heterophylla. Besides this last the best timber-trees are *Casuarina laterifolia, Foetida mauritiana, Elacodendron orientale, Calophyllum spurium* (red tacamahac), *Terminali borbonica, Parkia speciosa.* A species of coffee plant is indigenous. Fruits grown include banana, coconut, breadfruit and jackfruit. Forests originally covered nearly the whole island; most of the land has been cleared, but the administration in part replanted the higher districts with eucalyptus and rubber trees.

The fauna of Réunion is not very rich in variety of species. Among the mammals are several bats, a wildcat, the tenrec (*Tenrec ecaudatus*), introduced from Madagascar, rats, etc. Among the more familiar birds are the Bourbon flycatcher (*Tchitrea bourbonnensis*), the Réunion merle (*Mieroscelis borbonica*), the Bourbon manioc bird (*Malacirops borbonicus*), the cardinal (*Foudia madagascariensis*). various swallows, ducks, etc. Lizards and frogs of more than one species are common, but only one snake (*Lycodon aulicus*) is known in the island. Various species of gobies, a gray mullet that goes into fresh water, a freshwater mullet (*Agonostomus eyprinoides*), *Doules fuscus* in brackish water and *Osphronamus olfax* (introduced into the island) are among the fishes found.

History.—Réunion is usually said to have been discovered on Feb. 9, 1513, St. Apollonia's day, by the Portuguese navigator Pedro Mascarenhas, and his name is still applied to the Mascarene Islands, the archipelago of which Réunion forms a part. The island itself was at first called Santa Apollonia or Mascarenhas. The French later called it Bourbon, then, after the Revolution, "la Réunion des Patriotes." When in 1638 the island was taken possession of by Captain Goubert, of Dieppe, it was uninhabited.

The first inhabitants were a dozen mutineers deported from Madagascar by Jacques Pronis. In 1664 the Compagnie des Indes Orientales initiated a regular colonization scheme. In 1717 there were only about 2,000 inhabitants, of whom 1,100 were Malagasy and Kaffir slaves. They lived on excellent terms with the pirates who frequented Madagascar. Mocha coffee, introduced at that time, quickly made the island prosperous. At the end of the century sugar replaced it as the principal crop.

From 1810 to 1815 the island was occupied by the English. In the enthusiasm of the 1848 revolution slavery was abolished. At that time there were 105,000 inhabitants, including 60,000 slaves who now received French citizenship. Under the Second Empire Indian coolies were brought in. Réunion became an overseas *département* of France in 1946.

Réunion has been called *colonie colonisatrice* because its inhabitants were among the first French settlers in Mauritius, Rodriguez and the Seychelles (in the 18th century), Madagascar and the Austral Islands of the Indian ocean (in the 19th). People from Réunion have also gone as colonists to Cochin-China and New Caledonia. It is also called "l'île des poètes": extolled by André de Chénier, it was the birthplace of the Vicomte de Parny, Antoine de Bertin, Leconte de Lisle and Léon Dierx.

Inhabitants.—Réunion, strictly speaking, has no indigenous population. The inhabitants include Creoles, mulattoes, Negroes, Indians and other Asians. The Creole population is descended from the first French settlers, chiefly Normans and Bretons. Much of the population is of mixed descent. Three kinds of Creole are recognized — those of the towns and coasts, those of the mountains and the *petits blancs*, originally a class of small farmers living in the uplands, now reduced to a condition of poverty and dependence on the planters. The crkoles de villes, the typical inhabitants of the island, are in general of a somewhat weak physique, quick-witted and of charming manners, and very proud of their island. The Creole patois is French distorted by Malagasy and Bantu pronunciation. The population numbered 242,067 at the 1946 census (1950 est., 261.647). The density is 270 persons to the square mile or, if only the settled areas are counted, 64; to the sq.mi.; the birth rate is high. Madagascar has been a receiving country for Réunionais emigrants, but overpopulation remains a problem. Indians and Chinese together number about 30,000.

Towns and Communications. — St. Denis (pop., 1950 est., 39,057), the capital of the island, lies on the north coast. It is built in the form of an amphitheatre, and has several fine public buildings and centrally situated botanic gardens. The only anchorage for vessels is an open roadstead. St. Pierre (pop. 24,652), the chief town on the leeward side of the island, has a small artificial harbour. Between St. Pierre and St. Denis, and both on the leeward shore, are the towns of St. Louis (pop. 23,925) and St. Paul (pop. 27,585). A few miles north of St. Paul on the south side of Cap Pointe des Galets is the port of the same name, the only considerable harbour in the island. It was completed in 1886, covers 40 ac., is well protected and has 28 ft. of water. A railway serving the port goes around the coast from St. Pierre, by St. Paul, St. Denis, to St. Benoît.

A road runs around the island. Lateral roads give access to the cirques and the hill stations.

Agriculture and Industry. — Most of the coastal region is occupied by sugar-cane plantations, vanilla and cocoa. Sugar cane, introduced in 1711 by Pierre Parat, is now the staple crop. In the 18th century the first place belonged to coffee (introduced from Arabia in 1715) and to the clove tree, brought from the Netherlands Indies by Pierre Poivre at the risk of his life. Both are now cultivated on a limited scale. Vanilla, introduced in 1818, is cultivated mostly in the more humid eastern part. In the highlands, which have a Mediterranean climate, geraniums and vetiver (from which essential oils for perfumes are extracted), maize, legumes and fruit trees are cultivated.

The sugar industry suffered greatly from the competition with beet sugar, the effects of bounties and antiquated methods of manufacture. It was not until 1906 that steps were taken to set up central sugar mills and refineries. By 1954 the industry was concentrated into 13 well-equipped plants. This concentration of industry is paralleled by a concentration of property: an aristocracy of millowners and big proprietors employs a proletariat of tenant farmers and farm workers. Rum is distilled and forms an important item of export.

Administration.—Réunion is a dkpartement of France. It sends three deputies and two senators to the French legislature, and a councillor to the assembly of the French union. All nonalien inhabitants are French citizens. At the head of the local administration is a prefect who is assisted by a secretary-general, a *procureur général* and a *conseil général* elected by the suffrage of all citizens, which, after 1946, had powers no greater than those of *conseils généraux* of French metropolitan *départements*. The technical services are administered by the several metropolitan ministries, and French metropolitan legislation as a whole extends to the island. For administrative purposes the island is divided into two arrondissements, the Windward. with five cantons and nine communes, and the Leeward, with four cantons and seven communes. The towns are subject to the French municipal law.

The island's revenue and expenditure are wholly accounted for within the French metropolitan budget.

Economy.— The Banque de la Réunion issues notes valued in francs Colonies Françaises d'Afrique (1 fr. C. F. A. = 2 fr. metropolitan). Exports in 1953 mere valued at 5,354,000,000 fr. C. F. A., including 4,487,000,000 fr. C. F. A. for sugar (149,557 metric tons), 334,000,000 fr. C. F. A. for rum (41,614 hl.), 452,000,000 fr. C. F. A. for geranium and other essences (112 metric tons) and 51,000,000 fr. C. F. A for vanilla (34 metric tons). The main destinations of exports were France (3,374,000,000 fr. C. F. A.), Indochina (503,000,000 fr. C. F. A.) and Morocco. Reunion's imports cost 6,415,000,000 fr. C. F. A. in 1953. Almost all foodstuffs are imported, notably rice and meat from Madagascar (6,415,000,000 fr. C. F. A.). Nearly all manufactured goods come from France (3,984,000,000 fr. C. F. A. in 1953).

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REUNION, CHURCH: *see* ECUMENICAL MOVEMENT.

REUS, a city of northeast Spain, in the province of Tarragona, on the Saragossa-Tarragona railway, 4 mi. N. of Salou, its port on the Mediterranean. Pop. (1950) 35,950 (mun.). Reus consists of two parts, the old and the new! separated by the Calle Arrabal, which occupies the site of the old city wall. The earliest records of Reus date from about the middle of the 13th century. Its modern prosperity is traced to about the year 1750, when a colony of English settled there and established a trade in woollens, leather, wine and spirits. The principal incidents in its political history arose out of the occurrences of 1843 *(see* SPAIN: *History),* in connection with which the town received the title of city, and Generals Zurbano and Prim were made counts of Reus. The city was the birthplace of General Prim (1814–70) and of the painter Mariano Fortuny (1839–74). The city has important flour, wine and fruit export houses.

REUSCH, FRANZ HEINRICH (1823–1900), German theologian, was born at Brilon, Westphalia, on Dec. 4, 1823. He studied general literature at Paderborn and theology at Bonn, Tiibingen and Munich, where he was a friend and pupil of Döllinger. In 1854, he became *Privatdozent* in the exegesis of the Old Testament in the Catholic theological faculty at Bonn; in 1858 he was made extraordinary and in 1861 ordinary professor of theology in the same university. From 1866 to 1877 he was editor of the *Bonner Theologisches Literaturblatt.* In the controversies on the infallibility of the Pope, Reusch, who had been ordained priest in 1849, attached himself to Dollinger's party, and he and his colleagues Hilgers, Knoodt and Langen were interdicted by the archbishop of Cologne in 1871 from pursuing their courses of lectures. In 1872 he was excommunicated. For many years after this he held the post of Old Catholic *cure'* of Bonn, as well as the position of vicar-general to the Old Catholic bishop Reinkens, but resigned both in 1878, when. with Dollinger, he disapproved of the permission to marry granted by the Old Catholic Church in Germany to its clergy.

He was made rector of Bonn university in 1873. In 1874 and 1875 he was official reporter of the reunion conferences held at Bonn. He produced with Döllinger the *Geschichte der Moralstreitigkeiten in der Romisch-Katholischen Kirche seit dem XVI. Jahrhundert* and the *Erorterungen über Leben und Schriften des hl. Liguori.*

Reusch died on March 3, 1900.

REUSS, EDOUARD GUILLAUME EUGENE (1804–1891), German Protestant theologian, was born at Strasbourg on July 18, 1804. He studied philology in his native town (1819–22); theology at Gottingen under J. G. Eichhorn; and oriental languages at Halle under Wilhelm Gesenius, and afterward at Paris under Silvestre de Sacy (1827–28). He taught at Strasbourg from 1828 until 1888, for 60 years, having become full professor in 1836. His most important works are: *Geschichte der heiligen Schrijten Neuen Testaments* (1842), *Histoire de la théologie chre'tienne au siècle apostolique* (1852); *L'Histoire du canon des saintes écritures dans l'église chre'tienne* (1863); *La Bible, nouvelle traduction avec commentaire* (1874, etc.); and *Geschichte der heiligen Schriften Alten Testaments,* a veritable encyclopaedia of the history of Israel from its earliest beginning till the taking of Jerusalem by Titus. He died at Strasbourg on April 15, 1891. For many years Reuss edited with A. E. Cunitz (1812–86) the *Beitrage zu den theologischen Wissenschaften.* With Cunitz and J. W. Baum (1809–78), and after their deaths alone, he edited the monumental edition of Calvin's works (38 vol., 1863 ff.). His critical edition of the Old Testament appeared a year after his death.

See the article in Herzog-Hauck, *Realenzyklopädie,* and *cf.* Otto Pfleiderer, *Development of Theology in Germany Since Kant* (1890).

REUSS, the name of two former German principalities (Reuss-Greiz and Reuss-Schleiz-Gera) which after 1918 were amalgamated into Thuringia (*q.v.*).

History.— The princes of Reuss traced their descent to Henry (d. about 1120), who was appointed by the emperor Henry IV imperial bailiff (Ger. *Vogt,* from Lat. *advocatus imperii)* of Gera and of Weida. His descendants called themselves lords of Weida. The land under their rule gradually increased in size, and it is said that the name of Reuss was applied to it because of the fact that one of its princes married a Russian princess, their son being called *der Russe,* or "the Russian." In 1564 the family was divided into three branches by the sons of Henry XVI (d. 1535). One of these died out in 1616, but those of Reuss-Greiz and Reuss-Schleiz-Gera survived as sovereign houses till the revolution of 1918. The lords of Reuss took the title of count in 1673; the head of the elder line became a prince of the empire in 1778, and the head of the younger line in 1806. In 1807 the two princes joined the confederation of the Rhine, and in 1815 the German confederation. In 1866 both principalities became members of the north German confederation.

A curious custom prevailed in the house of Reuss. The male members of both branches of the family all bore the name of Henry (Heinrich), the individuals being distinguished by numbers.

See H. von Voss, *Die Ahnen des reussischen Hauses* (Lobenstein, 1882); O. Liebmann, *Das Staatsrecht des Fürstenthums Reuss* (1884); C. F. Collmann, *Reussische Geschichte: Das Vogtland im Mittelalter* (Greiz, 1892); B. Schmidt, *Die Reussen, Genealogie des Gesamthauses Reuss* (Schleiz, 1903).

REUTER, FRITZ (1810–1874), German novelist, made Plattdeutsch a literary language. Born Nov. 7, 1810, at Stavenhagen, in Mecklenburg-Schwerin, he studied at Rostock and at Jena, where he was a member of the political students' club, or German Burschenschaft, and in 1833 was arrested in Berlin by the Prussian government. Although the only charge which could be proved against him was that he had been seen wearing the Burschenschaft colours, he was condemned to death for high treason. The sentence was commuted to imprisonment for 30 years in a Prussian fortress. In 1838, through the personal intervention of the grand duke of Mecklenburg, he was handed over to the authorities of his native state, and in 1840 was set free by a general amnesty.

In 1850 he settled as a private tutor at the little town of Treptow in Pomerania. There he married Luise Kunze, the daughter of a Mecklenburg pastor. Reuter's first publication was a collection of miscellanies, written in Plattdeutsch and entitled *Lauschen un Riemels* ("Anecdotes and Rhymes," 1853; a second collection folloued in 1858). There followed *Polterabendgedzchte* (1855) and *De Reis' nah Belligen* (1855). In 1856 Reuter left Treptow and established himself at Neubrandenburg. His next book (published in 1858) was *Kein Hüsung,* an epic in which he presents with great force and vividness some of the least attractive aspects of village life in Mecklenburg. This was followed, in 1860, by *Hanne Nüte un de liitte Pudel,* the best of his verse compositions. In 1860 he published the first series of his *Olle Kamellen* ("Old Stories of Bygone Days"), which contained *Woans ick tau'ne Fru kam* and *Ut de Franzosentid.* Later volumes were entitled *Ut*

mine Festungstid (1861); *Ut mine Stromtid* (3 vols. 1864); and *Dorchliiuchting* (1866)—all written in the Plattdeutsch dialect of the author's home. *Ut mine Stromtid* is by far the greatest of Reuter's writings. *Ut de Franzosentid* describes the deep national impulse under which Germany rose against Napoleon. Ut *mine Stromtid* deals with the revolution of 1848.

In 1863 Reuter moved to Eisenach; and here he died on July 12, 1874.

Reuter's *Sämtliche Werke,* in 13 vols., were first published in 1863–68. To these were added in 1875 two volumes of *Nachgelassene Schriften,* with a biography by A. Wilbrandt; and in 1878 two supplementary volumes to the works appeared. A popular edition in 7 vols. was published in 1877–78 (new edition, 1902); there are also editions by K. F. Muller (18 vols., 1905), and W. Seelmann (7 vols., 1905–06). See *Briefe* F. *Reuters an seinen Vater,* ed. F. Engel (2 vols., 1895); A. Romer, F. *Reuter in seinem Leben und Schaffen* (1895); *G.* Raatz, *Wahrheit und Dichtung in Reuters Werken* (1895); *E.* Brandes, *Aus* F. *Reuters Leben* (1899); *K.* F. Muller, *Der Mecklenburger Volksmund und F. Reuters Schriften* (1902). A complete bibl. will be found in the *Nzederdeutsche Jahrbuch* for 1896 and 1902.

REUTER, GABRIELE (1859–1941), German novelist, was born at Alexandria, Egypt, on Feb. 8, 1859. Her first novel, *Glück und Geld,* appeared in 1888. One of her early novels, *Aus guter Familie,* had reached its 25th edition in 1907. Among her works are *Frauenseelen* (1901); *Jugend eines Idealisten* (1916); and *Benedikta* (1923). She died at Weimar in Nov. 1941.

REUTER, PAUL JULIUS, BARON DE (1816–1899), founder of Reuters news agency, was born at Cassel, Germany. At the age of thirteen he became a clerk in his uncle's bank at Gottingen, where he met Gauss, whose experiments in telegraphy were then attracting some attention. In 1849 there was a gap between the end of the new German telegraph line at Aix-la-Chapelle and that of the French and Belgian lines at Verviers. Reuter organized a news-collecting agency at each of these places and bridged the interval by a pigeon-post. On the establishment of through telegraphic communication, Reuter endeavoured to start a news agency in Paris, but finding that the French government's restrictions would render the scheme unworkable, removed in 1851 to England and became a naturalized British subject. The first submarine cable—between Dover and Calais—had just been laid, and Reuter opened a news office in London. At first, however, his business was practically confined to the transmission of private commercial telegrams to places not connected with the new system. He appointed agents at the telegraph termini on the Continent to forward these despatches by rail or pigeon-post to the addresses. His efforts to induce the English papers to publish his foreign news telegrams were unsuccessful, until in 1858 *The Times* published the report of an important speech by Napoleon III. forwarded by Reuter's Paris agent.

Reuter now .extended his sphere of operations all over the world. He laid down a special cable from Cork to Crookhaven, Ireland. which enabled him to circulate news of the American Civil War several hours before steamers could reach Liverpool. A concession for a cable beneath the North Sea to Cuxhaven was granted him by the king of Hanover in 1865, and in the same year a concession was granted him for a cable between France and the United States, the line being worked jointly by Reuter and the Anglo-American Telegraph Company. Reuter was in 1871 given the title of baron by the duke of Saxe-Coburg and Gotha, and by a special grant of Queen Victoria he and his heirs were authorized to have the privileges of this rank in England. Reuter died at Nice on Feb. 25, 1899.

REUTERHOLM, GUSTAF ADOLF, BARON (1756–1813), Swedish statesman. After a brief military career he was appointed *Kammerherr* to Sophia Magdalena, queen consort of Gustavus III., and became intimately connected with the king's brother, Charles, then duke of Sudermania. He was imprisoned for a time in 1789 with other malcontents opposed to Gustavus III. On the death of Gustavus and the assumption of the regency by Charles he was made a member of the council of state and one of the "lords of the realm." His policy became increasingly reactionary and on the accession of Gustavus IV. he was expelled from Stockholm. He died in exile in Schleswig on Dec. 27, 1813.

See *Sveriges Historia* (Stockholm, 1877–81), vol. v.

REUTERS, the principal British and international news agency, founded in 1849 by Baron Paul Julius de Reuter (*q.v.*), who established a system of offices and correspondents throughout the world. He concentrated in London the news from these correspondents and then redistributed it. In 186 j Reuter transferred his business to a joint stock company, of which he became the governing director; he was succeeded in 1879 by his elder son, Baron Herbert de Reuter (1852–1915). Mark F. Napier was chairman of the company from 1910 to 1919, and in conjunction with him, Sir Roderick Jones, chairman and managing director, for national reasons arising out of World War I, converted the agency from a public company into a private trusteeship. This involved buying out the then existing shareholders for a sum of considerably over half a million sterling. Ten years later Sir Roderick reorganized the trusteeship in conjunction with the Press Association to ensure the passage ultimately of the complete ownership of Reuters to the newspapers of the United Kingdom. The principal news agency in every country in the world is affiliated with Reuters. Reuters' correspondents resident in the respective countries enjoy the exclusive call for Reuters' purposes upon the news of these agencies.

Where Reuters do not supply their telegrams direct to the newspapers, they deliver their service to these agencies to be disposed of by them in their territories. In addition to their services of imperial and foreign political news Reuters have greatly extended, especially to the Continent, to the East, the Far East and to the empire their services of commercial and financial prices and intelligence. (H. B. C.; X.)

REUTLINGEN, a German town, in the Swabian Alps of Wiirttemberg, Hohenzollern, on the Echatz, an affluent of the Neckar, 36 mi. by rail S. of Stuttgart. Pop. (1959 est.) 65,313. Reutlingen, which is first mentioned in 1213, became a free imperial town in the 13th century and was fortified by the emperor Frederick II. It came into the possession of Wiirttemberg in 1802. Its industries include cotton spinning and weaving, dyeing and bleaching; also the manufacture of leather and machinery.

REVAL: *see* TALLINN.

REVELATION, BOOK OF (variously called the REVELATION TO JOHN, the REVELATION OF ST. JOHN THE DIVINE and the APOCALYPSE OF ST. JOHN THE APOSTLE), last (and the only apocalyptic) book of the New Testament, is a symbolic presentation of the life of the church in a hostile world and a "prophecy" of the final end of all things.

Revelation is one of a group of Jewish and Christian books, called apocalypses. that describe, in elaborate symbols, the victory of God over an evil world. Such other apocalyptic books as Daniel in the Old Testament and II Esdras in the Apocrypha (IV Esdras in the Vulgate), and noncanonical books such as Enoch and Baruch, as well as many parts of the Dead sea scrolls from Qumran, provide an indispensable background for understanding the point of view of Revelation. (*See* also APOCALYPTIC LITERATURE.)

The apocalyptic perspective viewed the world as so decisively alienated from God that its structures of life and power (*e.g.*, structures of politics, economics, prestige and success) could not be recovered to obedience to God but would have to fall under God's judgment and be destroyed. Though created by God, the world had come under the domination of an evil power—Satan—so that its life was demonically perverted, while human decision and responsibility also contributed to the evil situation of men. In the world, though apart from it, lived a community of believers that was despised and often persecuted by the world but that was yet supported by God in all its trials. In the near future, it was believed, God would overthrow the powers of evil ("this present age"), both in their satanic dimension, which pervaded the whole physical and spiritual cosmos, and in their visible political dimension; and then God would establish a new world ("the age to come"). Such a faith is dualistic, since it views life as a struggle between two irreconcilably opposed principles—God and the demonic power of evil (*see* DUALISM). But it is not an absolute dualism, for it looks toward the speedy victory of God; and it is not a dualism of body and spirit, for in it evil is a perverted form of selfhood.

Central to the apocalyptic vision is the hope for a perfect community (a "holy city"). in which men will be free to serve God and each other. The failure of the power structures of "this world" to make possible total obedience to God and true community among men is the centre of the world's opposition to God, and the reason why this world must be destroyed to make way for a better one.

The author of Revelation uses a traditional stock of symbols. In particular he draws on the Old Testament, especially Daniel, Ezekiel and Zechariah. Perhaps ancient astrology supplied some symbols (especially in ch. xii) that came ultimately from near eastern creation myths. Jewish and Christian liturgy probably suggested many elements in the book. The author's own visions may have suggested other elements, though as they stand the visions in the book are too carefully integrated with each other and too dependent on tradition to be reports of immediate religious experience.

Since many apocalyptic books present, in symbolic form, a history of the struggles of the faithful, it has often been suggested that the symbols in Revelation represent succeeding historical events. No doubt the actual historical struggles of the church with Roman persecution are reflected in the book, especially in ch. xiii and xvii. Nonetheless, the repetitive nature of the images and the lack of concern for strict consistency suggest that the cosmic dimension of the struggle, the conflict of the powers of light and darkness, was more in the author's mind than an ordered series of historical incidents.

Outline.— An outline can only suggest the rich, interwoven texture of the book which does not have mechanical symmetry but is woven together in complex patterns of threes, sevens and other numbers. No one outline can claim to be final.

i, 1–20:	introduction
i, 1–3:	heading: a revelation of God through Christ
i, 4–20:	introductory letter: a vision of Christ
ii, 1–iii, 22:	counsel to the church: the seven letters (varied praise, warning, threat and promise)
ii, 1–7:	Ephesus
ii, 8–11:	Smyrna
ii, 12–17:	Pergamum
ii, 18–29:	Thyatira
iii, 1–6:	Sardis
iii, 7–13:	Philadelphia
iii, 14–22:	Laodicea
iv, 1–xvi, 21:	the beginnings of Judgment: God's people persecuted; God through Christ protecting his people and destrovinr his enemies
iv, 1–v, 14:	introduction: a vision-of God's world; the 24 elders and the Lamb
vi, 1–viii, 1:	the first cycle of images: the Seven Seals, the first four of which (vi, 1–8) reveal the "four horsemen of the Apocalypse" (symbolizing the lust ior conquest and its inevitable consequences of war, famine and death; traditionally identified as War, Striie, Famine and Pestilence) (*interlude* of the setting apart of the faithful and the reward of the faithful in heaven, vii, 1–17)
viii, 2–xi, 19:	the second cycle of images: the Seven Trumpets (*interlude* of the seer, x, 1–11; and the measurement of the temple, xi, 1–4 and the witnesses to God's message, xi, 4–14)
xii, 1–xv, 1:	the third cycle of images: the Seven Visions (*interlude?* of the vision of the Lamb and his worshipers, xiv, 1–5)
xv, 2–xvi, 21:	the fourth cycle of images: the Seven Plagues
xvii, 1–xix, 10:	the Judgment of this world
xvii, 1–18:	a woman sitting on a beast; explanation of the seven heads and ten horns of the beast
xviii, 1–24:	doom pronounced on "Babylon"; her friends lament her
xix, 1–10:	*interlude:* praise to God for the judgment of Babylon; proclamation of the marriage of the Lamb
xix, 11–xxii, 5:	the final purpose oi God
xix, 11–16:	the Word of God riding a white horse
xix, 17–21:	the victory of Christ
xx, 1–3:	the dragon bound for a thousand years
xx, 4–6:	the millennium
xx, 7–15:	the final deicat of Satan and final Judgment
xxi, 1–xxii, 5:	the new heaven and new earth
xxii, 6–21:	conclusion
xxii, 6–17:	concludinq words of prophecy: the end is near
xxii, 18–20:	warning not to tamper with the book
xxii, 21:	benediction

Main Themes.—*Endurance.*—The overarching practical theme of Revelation is a summons to resolute endurance in the face of coming persecution. Courageous loyalty, separation from the evil world and enduring hope for God's destruction of evil and new creation of a good world are taught through the seven letters, the interludes. the dramatic struggle and the vision of a new heaven and a new earth.

Cosmic Christ.—The vision of a struggle of cosmic dimensions is paralleled by an understanding of Christ as a pre-existent, heavenly being, capable of overcoming the most pervasive demonic opposition. Of Christ's earthly life, only his death and resurrection are mentioned, but these events reveal the eternal purpose of God (i, 18; v, 9).

God's Presence in an *Evil* World.—In Revelation, even though Christ's triumph still lies in the future, faith in Christ can span the gap between present and future and participate, even in the midst of suffering, in the joy and peace of God's presence. The "interludes" in the action are thus not an irregularity in the plan of the book but an important means by which the author communicates his faith that the movement of time can be momentarily halted, as the believer participates, by anticipation, in the end.

Roman *Empire* as *Manifestation* of Evil.—The concrete manifestation of satanic power is the government under which the author lived, the Roman empire. Rome is symbolized (though many details are obscure) by the beasts of ch. xiii and by the beast of ch. xvii. The seven heads and ten horns (xiii, 1; xvii, 3 and 9–14) represent (in a way about which there is little agreement) individual rulers of the 1st century A.D. The author's sense of the hopelessness of a constructive appeal to Rome is one reason for his view that in general the powers of evil must be destroyed rather than converted.

The *Millennium.*—The most controversial element in the Apocalypse is its prediction of a thousand years' rule of Christ on earth. The author looked forward to a real earthly kingdom, of Christ's, to come soon. That he presented it as temporary shows his conviction that this world, even perfected, could not adequately manifest the glory of God.

The *New* Jerusalem.—The vision of a true community under God. as God's ultimate purpose, is powerfully presented in the symbols of Rev. xxi, l–xxii, 5. This vision. here set in an "otherworldly" framework, has also motivated forms of Christian faith which looked for a partial realization of the hope within the structures of this world.

Literary History.—The author is John (i, 4); though most apocalyptic works were published under assumed names, this one does not seem to have been. The author regards himself as a prophet (i, 3) but does not call himself an apostle. Strong early tradition identified him with the apostle John (*e.g.*, Justin, c. A.D. 155). Yet Papias (c. A.D. 140) seems to have reported an early martyrdom for the apostle John, and some early tradition denies the apostle's authorship. Thus while Roman Catholic and some Protestant scholars support authorship by John the apostle, Protestant scholarship predominantly supports the view that some other John is the author. The differences in language between Revelation and the Gospel of John make it unlikely that the two books come from the same writer. Revelation was written for the churches in the neighbourhood of Ephesus in Asia Minor.

The Apocalypse is usually dated late in the reign of the Roman emperor Domitian (A.D. 81–96) and associated with his persecution of Christians. Since Domitian was the first to insist strongly on divine honours as a living emperor, and since Revelation opposes precisely this form of idolatry (ch, xiii), the traditional date is the most probable. Some scholars maintain an earlier date, usually by identifying the sixth head of the beast, which appears to represent the ruling emperor, with an earlier ruler (xvii. 10). But the author may have taken over and reinterpreted the symbolism of the seven heads from an earlier time, or he may have developed it in such a way that it applied to his own time. The

symbolic number 666 (xiii, 18) may refer to Nero (A.D. 54–68) but does not necessarily point to the time of Nero or even shortly afterward. since the expectation of Nero's return seems to have been a popular belief even late in the 1st century A.D.

Interpretation.— Older interpretation either "spiritualized" Revelation, applying its symbolism to general truths of the Christian religion. or looked for a literal fulfillment of its prophecies in or shortly after the time of the interpreter himself. Either path may find in the book a source of deep spiritual life but will also lead to misunderstanding of its original meaning, which is better grasped by setting the book in the context of the apocalyptic literature. Then Revelation is seen as springing from and relating to a crisis in the life of the early church. Its symbols are not descriptions of events in later history.

Once the original setting and meaning of the book are seen, the interpreter must again confront its meaning for his own time Some students have concluded that the book's lack of hope for "this world" gave it little relevance to the modern world. Others regard its message, originally focused on an ancient crisis, as a valid symbolic representation of the divine purpose. This sort of interpretation may stress the eternal truths of the book, thus standing close to the older spiritual interpretation, and it may emphasize Revelation as a portrayal of the climax of the "sacred history" of God's acts. Then the original situation of conflict with Rome is seen to typify a recurring situation in which the believing community will exist until the final end, when God's will shall be done. Still others would see the contemporary significance of the Book of Revelation in the totality of its claim for obedience. holding that the pictorial vision of the future triumph is of secondary importance and that the call to remain faithful is the enduring message. *See* also BIBLE.

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REVELSTOKE, city. British Columbia, on the Columbia river, a key point on the Trans-Canada highway and a divisional station on the Canadian Pacific railway, 245 mi. N.E. of Vancouver. Pop. (1961) 3.566.

It is the supply centre for a mining and lumbering district, with railway shops, and is surrounded by rich fruit growing and ranching country. A scenic motor road leads up Mt. Revelstoke to 5.000 ft above the town

REVENTLOW, CHRISTIAN DITLEV FREDERICK, COUNT (1748–1827), Danish statesman and reformer, born on March 11, 1748, was educated at Soro and Leipzig, and made an extensive tour of western Europe to study economic conditions before he returned to Denmark in 1770. In 1774 he held a high position in the *Kammerkollegiet,* or board of trade, two years later he entered the Department of Mines, and in 1781 he was a member of the *Overskattedirectionen,* or chief taxing board.

In 1784, he was placed at the head of the *Rentekammeret,* which took cognizance of everything relating to agriculture. He appointed a small agricultural commission to better the condition of the crown serfs. and among other things enable them to turn their leaseholds into freeholds.

Reventlow induced the crown prince Frederick, in July 1786, to appoint a grand commission to take the condition of all the peasantry in the kingdom into immediate consideration. This agricultural commission resulted in a series of reforms of the highest importance. The ordinance of June 8, 1787. modified the existing leaseholds, greatly to the advantage of the peasantry; the ordinance of June 20. 1788. abolished villeinage and completely transformed the much-abused *hoveri* system whereby the feudal tenant was bound to cultivate his lord's land as well as his own; and the ordinance of Dec. 6. 1799. did away with *hoveri* altogether. Reventlow also started public credit banks enabling small cultivators to borrow money on favourable terms.

But the financial distress of Denmark. the jealousy of the duchies, the ruinous political complications of the Napoleonic period, and, above all, the crown prince Frederick's growing jealousy of his official advisers, prevented Reventlow from completing his reforms. On Dec. 7, 1813, he was dismissed, and retired to his estates in Laaland. where he died on Oct. 11, 1827.

See Adolph Frederik Bergsoe, *Grev.* C. D. *F. Rrventlows Virksomhed* (1837); Louis Theodor Alfred Bobe, *Efterl. Papirer fra den Reventlowske Familiekreds* (1895–97).

REVERE, PAUL (1735–1818), American patriot, craftsman and industrialist. best-known for his ride on the night of April 18, 1775, to warn the Massachusetts colonists of the approach of British troops, was born in Boston, Mass., on Jan. 1, 1735. His father Apollos Rivoire (later changed to Revere) was a Huguenot refugee who had come to Boston as a child and had been apprenticed to a silversmith. This craft he taught his son Paul Revere, who became one of America's greatest artists in silver. As a boy Revere received sufficient education to enable him later to read the difficult metallurgical books of his period. When Benjamin Waterhouse was brought to Massachusetts by Harvard college to teach this and allied sciences he thought Revere the only man in America with a competent knowledge in the field. It was in metal that Revere did most of his work. But his energy and skill (and the necessity of supporting an ever growing family) turned him in many directions. He not only made silver but sold spectacles, replaced missing teeth and made surgical instruments. He cut many copper plates. mostly for anti-British propaganda His "Boston Massacre." in spite of its many inaccuracies. is probably America's most famous print. He took an active interest in politics, was a leader of the Boston Tea Party in 1773 and influenced his fellow artisans toward independence.

With the outbreak of the American Revolution in 1775, Revere was called upon to construct a powder mill to supply the colonial troops. Later he and his sons East hundreds of church bells. several of them of great beauty. Although he began making copper hardware for ships soon after the Revolution it was not until 1800 that, after considerable experimentation and great expense, he set up in Canton. Mass.. a rolling mill for the manufacture of sheet copper. From this factory came the sheathing for many American ships, including the "Constitution," and for the dome of the Massachusetts state house. He worked closely with the inventor Robert Fulton on copper boilers for steamboats. With such ventures he became a connecting link between the medieval craftsman and the modern industrialist.

Revere's military career was undistinguished. In 1776, as a lieutenant colonel, he was in command of Boston harbour's principal defense. Castle William. In 1778 he was sent on the Rhode Island expedition. which proved as complete a failure as the Penobscot campaign a year later. In both of these futile attacks on the British the colonial sea and land forces were unable to work together. The retreat from the Penobscot region became such a scandal that most of the officers involved lost their reputations. Revere's good name was restored several years later after his continual demand for a court martial. Largely because of Longfellour's stirring ballad, he is remembered as the man on horseback who warned Middlesex county on "the 18th of April in '75" that the British troops were leaving Boston to seize military stores at Lexington and Concord. Although not good history the poem is still an impressive memorial to him For years Revere had been the principal express rider for Boston's Committee of Safety.

By virtue of his title of colonel, his postwar ventures as an importer, the great importance of his copper mill and the fortune he had amassed. he could have referred to himself by several prouder titles than the simple goldsmith or silversmith that he seems to have preferred to his dying day. This attitude J. S. Copley emphasized in the portrait he painted of him shortly before the Revolution, seated at his work bench, in his shirt sleeves. Gilbert Stuart's portrait of him as an old man emphasizes not only his energy but the generosity and kindness that characterized him throughout his long life. Both of these portraits along with the finest collection of his silver are in the Museum of Fine Arts, Boston. The American Antiquarian society possesses the outstanding collection of his engravings.

The house he lived in or owned for about 30 years before

his death on May 10, 1818, still stands in Boston's North Square.

See Esther Forbes, Paul Revere and the World He Lived In (1942); Clarence S. Brigham, Paul Revere's Engravings (1954). (E. Fo.)

REVERE, a city and resort in Suffolk county. Mass., U.S., on Massachusetts bay, 6 mi. N.E. of Boston. It is the "Coney Island of Boston" with three miles of beach, a dog track and night clubs. Almost from its founding (1636) as Rumney Marsh, it was a Boston resort. Subsequently the development of residential suburbs to the north made it turn almost exclusively to its beach front with its roller coaster and numerous concessions.

Because of the extensive marshes the community developed slowly. It was successively a section of Boston, part of Chelsea (1739) and reincorporated as North Chelsea (1846). The latter changed its name in 1871 in honour of Paul Revere.. Although a city since 1914, and council-manager governed since 1950, Revere is still tied to Boston through the county government. There are large colonies of Russian, Lithuanian and Italian immigrants and their descendants. The 19th-century Slade Spice mill, until 1934 a tidewater mill, is a local point of interest.

Light industry includes electrical equipment, machine parts, chemicals, spices and beverages. For comparative population figures see table in MASSACHUSETTS: Population. (R. C. Mo.)

REVERSING LAYER. It was formerly believed that the solar continuous spectrum originated in hot lower strata of the sun's atmosphere or photosphere and that the dark line spectrum was all produced in an overlying cooler stratum called the reversing layer, in accordance with Kirchhoff's third law of spectrum analysis. Early eclipse observations, especially that by C. A. Young in 1870, apparently substantiated this picture. Later work showed that the dark line and continuous spectra of the sun or stars were formed in essentially the same layers. Weak spectral lines are formed in the same layers as the continuous spectrum; stronger lines are produced predominantly in higher layers; whereas the centres of the strongest lines are formed in the chromosphere. Although the term has been used occasionally to indicate the upper layers of the photosphere where the strongest spectral lines are predominantly formed, it is now infrequently employed. See also SPECTROSCOPY. (L. H. A.)

REVERSION, in biology, an old term referring to the appearance of offspring showing resemblance to a grandparent or more remote ancestor in a character unlike that of the immediate parents. See GENETICS; HEREDITY. For reversion in law, see REMAINDER, REVERSION.

REVILLA GIGEDO, an archipelago comprising a group of rocky islands in the North Pacific, 18° N., 112° W., forming part of the state of Colima, Mex. They are about 500 mi. from the Mexican coast and comprise the large island of Socorro (San Tomás) and the three islets of San Benedicto, Roca Partida and Clarion. See COLIMA.

REVIVALISM in the broadest sense applies to any instance of renewed religious fervour within a group, church or community, whether that group be Christian or non-Christian. However, in common usage it refers primarily to concerted efforts among evangelical churches to revitalize the spiritual ardour of their members and to win new adherents. Revivalism in its modern form can be attributed to that common element in Anabaptism, Puritanism, German pietism and Methodism in the 17th and 18th centuries which stressed personal religious experience (*Herzensreligion*), the priesthood of all believers and holy living, in protest against established church systems which seemed excessively sacramental, sacerdotal and secularistic. Each of these pietistic movements contributed to the revival tradition.

Protesting against the sacramentalism and ritualism of the Church of England, the Puritans who left England carried their fervour for experiential religion and devout living to the new world in 1629. Although this fervour waned toward the end of the century, Jonathan Edwards (*q.v.*), revived Puritan zeal in New England in a period of extraordinary religious excitement from 1734 to 1742. Edwards is sometimes credited with inspiring the first Great Awakening in America (c. 1725–50), but this widespread movement of social, theological and ecclesiastical reorientation actually had its beginnings in Europe and reached America in the 1720s through the Dutch Reformed and Presbyterian churches of New Jersey and the German immigrants in Pennsylvania. While the awakening in New Jersey and Pennsylvania was in part a process of adapting European ecclesiasticism and theology to frontier conditions, it was also closely related to the pietist movement of Philipp Jakob Spener and August Hermann Francke (*qq.v.*) in Germany and to the evangelical revival in England.

Between 1670 and 1730 Spener and Francke had revitalized Lutheranism by forming within the church devout groups of believers who emphasized personal conversion, devotional prayer, asceticism and practical Christian charity. Their influence extended throughout northern Europe, affecting the Reformed churches, the Anabaptists and the revived Moravian church under Count Nikolaus Ludwig von Zinzendorf and August Gottlieb Spangenberg. The Moravian missionaries Spangenberg and Peter Boehler in turn influenced John Wesley (*q.v.*), and his religious conversion in 1738 inaugurated the evangelical revival within the Church of England. Between 1738 and 1791 Wesley traveled throughout the British Isles preaching to large crowds and laying the foundations for what became after his death the Wesleyan Methodist Church. Wesley's preaching emphasized free will and free grace, experiential conversion, the priesthood of all believers, moral perfectionism and philanthropic reform.

His associate George Whitefield (*q.v.*), the founder of Calvinistic Methodism in England, was also influenced by German pietism, and his preaching tours of the American colonies between 1739 and 1770 had a profound effect upon the first Great Awakening in America. Whitefield was welcomed to New Jersey in 1739 by Theodore J. Frelinghuysen. the pietistic leader of the revival among the Dutch Reformed churches; by Frelinghuysen's friend Gilbert Tennent (*q.v.*), the leading revivalist among the Scotch-Irish Presbyterians; and by most of the German-speaking immigrants in the middle colonies. When he toured New England in 1740, Whitefield was also endorsed by Jonathan Edwards and other influential Congregationalists. Throughout America Whitefield's preaching aroused intense religious enthusiasm; however, his emotional mass meetings and the religious disorders aroused by itinerants who imitated his flamboyant methods produced vigorous opposition to the awakening after 1742.

While the first Great Awakening created temporary schisms within almost every denomination in the American colonies, it also stimulated the churches to a vigorous new growth; it paved the way for the separation of church and state; it broke down denominational barriers and helped to unify the colonies; it produced an energetic social and intellectual ferment among the lower classes; and it instituted that emphasis upon religious activism and lay leadership that has since characterized American Protestantism. Like pietism in Germany and Wesleyan evangelicalism in England, the first Great Awakening in America promoted missionary activity. philanthropy, charity and education. Dartmouth college and Princeton and Brown universities were direct outgrowths of this awakening.

Despite the spread of deism during the 18th century the revivalistic impulse continued strong. The evangelical revival flourished in Britain, and at the end of the century a new awakening occurred in America. This second Great Awakening (c. 1795–1835) was divided into three phases: The first phase (1795–1810) was associated with the frontier camp meetings conducted by James McGready, John McGree and Barton W. Stone in Kentucky and Tennessee. The second and more conservative phase of the awakening (1810–25) centred in the Congregational churches of New England under leadership of Timothy Dwight, Lyman Beecher, Nathaniel W. Taylor and Asahel Nettleton. The third and final phase (1825–35) stemmed from the activities of Charles Grandison Finney (*q.v.*), who began his revivalism in small towns in western New York in the 1820s but eventually conducted revival meetings in the largest cities in the U.S. and Britain. During the second Great Awakening revivalistic theology in all denominations shifted from Calvinism to Arminianism as preachers emphasized the ability of sinners to make an immediate decision to save their own souls; theological differences almost disappeared among evangelical churches. Moreover, under Finney's aegis a rationale for

carefully contrived revival techniques evolved. After 1835 an irregular corps of professional revival experts traveled through the towns and cities of America and Britain organizing annual revival meetings at the invitation of local pastors who wanted to reinvigorate their churches. The second Great Awakening produced a great increase in church membership, made soul winning the primary function of the ministry and stimulated a host of moral and philanthropic reforms including temperance, antislavery and foreign missions. In 1857–58 the famous "prayer meeting revival" swept the cities of the United States following a financial panic. It indirectly instigated a revival in Northern Ireland and England in 1859–61 that rivaled the camp meetings in enthusiasm.

The preaching tour of the American lay evangelist Dwight L. Moody (*q.v.*) and his singing companion Ira D. Sankey through the British Isles in 1873–75 marked the beginning of a new outburst of Anglo-U.S. revivalism. And in his subsequent revival activity in the major cities of Britain and America Moody perfected the highly businesslike techniques that characterized the urban mass evangelistic campaigns of 20th-century professional revivalists such as Reuben A. Torrey (*q.v.*), J. Wilbur Chapman, Gypsy (Rodney) Smith and Billy (William A.) Sunday (*see* SUNDAY, WILLIAM ASHLEY). The interdenominationally supported revivalism of Moody and his imitators in 1875–1915 constituted in part a conscious co-operative effort by the Protestant churches to alleviate the unrest of urban industrial society by "evangelizing the masses," and in part an unconscious effort to counter the challenge to evangelical orthodoxy brought by higher criticism of the Bible and Darwin's *Origin of Species* (1859). In the first half of the 20th century most educated evangelical churchmen lost interest in revivalism because of its association with fundamentalism (*q.v.*) and turned their attention to social reform After World War II a renewed interest in mass evangelism appeared. symbolized by the widespread support given to the "revival crusades" of the Southern Baptist evangelist Billy (William F.) Graham (1918–), who preached on all continents and in 1962 addressed 700.000 persons in a 19-day period in Chicago.

Whether mass revivalism has been as helpful to the churches in the long run as its exponents claim is highly debatable, but there is no doubt about its ability to generate at least temporary religious enthusiasm. The best historical explanation for the recurrent nature of revivalism is based upon the inevitable need for theological and ecclesiastical reorientation from generation to generation and the concomitant religious excitement generated by such changes.

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REVOLUTIONARY TRIBUNAL, THE *(le tribunal rkvolutionnaire),* a Eourt instituted in Paris by the Convention during the French Revolution for the trial of political offenders, which became one of the most powerful engines of the Terror. The news of the failure of the French arms in Belgium gave rise in Paris to popular movements on March 9 and 10, 1793, and on March 10, on the proposal of Georges Jacques Danton, the Convention decreed the establishment in Paris, in addition to the ordinary civil and criminal courts, of an "extraordinary" criminal court, which received the official name of the "revolutionary" tribunal by a decree of Oct. 29, 1793. It was composed of a paid jury, a public prosecutor and two substitutes, all nominated by the Convention, and from its judgments there was no appeal. With M. J. A. Hermann as president and Antoine Quentin Fouquier-Tinville as public prosecutor. the tribunal preserved, at first at least, the forms of a court of justice, dealing with political offenses by royalists, refractory priests and all agents of counterrevolution. The excesses of the Revolutionary tribunal increased with the growth of Robespierre's ascendancy in the Committee of Public Safety, and on June 10, 1794, was promulgated, at his instigation, the Law of *22* Prairial, which forbade prisoners to employ counsel for their defense, suppressed the hearing of witnesses and made death the sole penalty. Before *22* Prairial the Revolutionary tribunal had pronounced 1,220 death sentences in 13 months; during the 49 days between the passing of the law and the fall of Robespierre 1,376 persons were condemned, including an increasing proportion of ordinary citizens and government officials. The lists of prisoners to be sent before the tribunal were prepared by the public prosecutor and signed, after revision, by the Committee of General Security and the Committee of Public Safety jointly.

The Revolutionary tribunal was suppressed May 31, 1795. Its celebrated victims included Marie Antoinette, the Hébertists, the Dantonists and finally the Robespierrists.

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REVOLVER: *see* PISTOL AND REVOLVER.

REVUE, a light form of theatrical entertainment, originally deriving from the French street fairs of the middle ages, at which events of the year were passed in review in comic song and spectacle. It differs from continental variety in its use of pointed burlesque and satire, and from musical comedy (*q.v.*) in having no plot. Revue took its present form during the early 19th century, first developed at the Paris Theatre Porte Sant Martin by the brothers Cogniard with their *Folies Marigny.*

In crossing the channel as early as 1825, revue in the London music halls *(see* MUSIC HALL AND VARIETY) took two main forms: first presented at the Adelphi theatre in London, it developed on one hand into a costume display and spectacle, reaching its peak in the Court theatre productions of the 1890s. On the other hand, revue developed into the intimate shows that resulted in the famous Andre Charlot Revues of the 1920s in London and the provinces, the handsome shows at the Hippodrome and especially the performances at Sir Charles Cochrane's Ambassador theatre, which provided continuous bills of topical sketches, monologues, songs and dances from 2 P.M. until midnight. Revues of the intimate club type played an important part in keeping up the morale of Londoners during the blitz of 1940, both at the highly regarded Gate theatre and the famous revuedeville of the Windmill.

In the United States, *The Passing Show,* produced in New York in 1894, and its second edition in 1911, led the U.S. producer Florenz Ziegfeld to initiate the 24 *Follies,* usually built around a star personality. George White and his *Scandals* put more emphasis on comedians and girls, less on spectacle for its own sake. More modest revues have been the *Music Box Revues,* the *Little Shows* of Dwight Wiman, *The Garrick Gaities,* the depression *Pins and Needles* of 1937 and the postwar G.I. show, *Call Me Mister. La Plume de Ma Tante* in 1959–60 returned the revue to its French origins. (R. N. LE.)

REWA, formerly a princely state within the Central India agency. In 1948 it became a part of the union of Vindhya Pradesh (*q.v.*), dominion (later republic) of India, the maharaja being appointed *rajpramukh,* or prince-president, of the union. In 1956 Vindhya Pradesh became part of Madhya Pradesh. Rewa division has an area of 22,870 sq.mi.; its population, mainly Hindu, was 3,410,376 in 1951. Many of the inhabitants of the hilly tracts are Gonds and Kols. More than one-third of the area is covered with forests, yielding timber and lac; the region also possesses valuable coal deposits in the Umaria field. The capital, Rewa city, is 70 mi. S.S.W. of Allahabad, Uttar Pradesh; pop. (1951) 29.623. The history of the state, until it came under British guarantee in 1812, was a record of almost continuous warfare. In the mutiny of 1857, the ruler aided the British. The maharaja's family is a Rajput of the Baghela branch of the Solianki race. The Rewa district (pop. [1961] 772,413) is 2,509 sq.mi. in area.

REWARD is money or other compensation offered orally or in writing either by the government or by an individual to the public generally or to a particular person or class of persons for the performance of a designated service, such as the return of lost property or the apprehension of a suspected criminal. The offer expires a reasonable time after it is made, unless it stipulates otherwise. Prior to substantial compliance with the offerer's terms, it may be withdrawn at any time, even if the claimant is unaware of the withdrawal. The offer may contain such terms, provided they are lawful, as the offerer wishes to prescribe. Where a reward is lawfully offered, the first one who satisfies the prescribed conditions is entitled to it. Performance of these conditions constitutes acceptance of the offer and creates a binding contract, If several persons jointly perform the stipulated act, either by concerted action or, according to some authority, by acting independently, the reward may be equitably apportioned among them. Whether a person who is unaware of the offer at the time he performs the requested act may obtain the reward is disputed. One under a moral or official duty to perform the act usually may not claim a reward unless he was required to perform acts beyond the scope of his duty for the reward. Police officers, therefore, ordinarily may not claim rewards for the apprehension of criminals or the recovery of stolen property, unless a statute provides to the contrary. (RT. K.)

REWBELL, JEAN FRANÇOIS (1747–1807), French politician, was born at Colmar (then in the department of Haut-Rhin) on Oct. 8, 1747. He sat in the constituent and legislative assemblies and in the Convention. He took part in the reactionary movement which followed the fall of Rohcspierre, and became a member of the reorganized committees of public safety and general security. His moderation caused his election by 17 departments to the Council of Five Hundred. Appointed a member of the Directory on Oct. 1, 1795, he became its president in 1796, and retired in 1799. He then entered the Council of Ancients. After the coup d'état of 18 Brumaire he retired from public liie, and died at Colmar on Nov. 23, 1807.

See L. Sciout, *Le Directoire* (1895–97).

REYKJAVIK, the capital of Iceland. is on the northern side of the Seltjarnarnes peninsula on the southeastern corner of the Faxafloi bay in the southwest of Iceland. It stood originally in a hollow between two hills, but has grown far beyond the hills. The harbour is protected on the west and on the east but is open on the north. The first Norse settler to Iceland, Ingolfur Arnarson, built his farm at Reykjavik in the 9th century, and for many centuries Reykjavik had only rural colonization. In 1786 it mas licensed by the king of Denmark with privileges of a market town.

After the restoration at Reykjavik in 1843 of the medieval Icelandic parliament, the althing, the town grew faster (pop. in 1901, 6,682), especially in the 20th century, when its main trade, the fishing industry, was developed by the use of modern vessels and equipment. By mid-20th century Reykjavik had textile, oilskin., rope, shipbuilding, fish meal, margarine, chocolate, biscuit and beer industries,.and most of the imports and exports of Iceland went through its harbour. Hot springs at Reykir make hothouse gardening possible and supply a swimming pool and the houses of Reykjavik with warm water.

In 1944 Reykjavik became the capital of the independent republic of Iceland. The residence of the president is at Bessastadir, outside the town. Reykjavik has a theatre, a museum, a library containing about 125,000 volumes and about 8,000 manuscripts, a cathedral (built in 1847), a university and a number of special schools and a state-owned general hospital. It is the seat of the Icelandic bishop. Reykjavik has regular steamship services with the United Kingdom, Norway and Denmark, and there is an airport at Keflavik, 30 mi. W. Its population, mainly Lutheran, was 56,096 in 1950. (H. LN.)

REYMONT, WLADYSLAW STANISLAW (1868–1925), Polish novelist. was born at Rohiele Wielkie in the county of Piotrkow on May 6, 1868. He spent his youth in various occupations, and his first novels were written when he was superintendent of a small railway sector. *The Comédienne* (1896; Eng. trans. 1921), *Ferments* (2 vol., 1897) and *Lily* (1899) were objective novels describing the everyday life of a troupe of provincial actors. In 1899 appeared *The Promised Land* (2 vol.; Eng. trans. 1928), modelled on Zola and describing industrialism in Lodz. Rcymont's best-known work, *The Peasants,* appeared in four volumes in 1904–09 (Eng. trans. 1925–26). He describes the iour seasons' labours of a peasant and brings to light his primitive instincts, inward dignity and almost religious attachment to the land. This great peasant epic brought Reymont the Nobel prize for literature in 1924. While *The Peasants* was being prepared, a number of novels and short stories appeared, the most important of which are *Before Dawn* (1902), *Konzurasati* (1903), *From a Diary* (1903) and *The Storm* (1907). As a historical novelist, Reymont, primarily an observer of the direct processes of liie, was less successful: the trilogy *1794 (The Last Dirt,* 1913, *Nil Desperandum,* 1916, and *The Insurrection,* 1918), though not lacking in literary merit, revealed a Iack of historical exactness. He died on Dec. 5, 1925. *(See* POLISH LITERATURE.)

See I. Matuszewski, *Tworczosci Tworcy* (Warsaw, 1904); Z. Debicki, *W. S. Reymont* (Warsaw, 192j); J. Lorentowicz, *Ladislas Reymont, prix Nobel 1924* (1925).

REYNARD THE FOX, a beast epic, current in French, Dutch and German literature. The cycle of animal stories collected round the names of Reynard the Fox and Isengrim the Wolf in the 12th century seems to have arisen on the borderland of France and Flanders. The tales, like those oi "Uncle Remus," were amusing in themselves; they were based on widely diffused follilore, and Reynard and his companions were not originally men disguised as animals. Jacob Grimm *(Reinhart Fuchs,* 18,34) maintained their popular origin.

The principal names of the Reynard cycle were German. Reynard himself (Raginohardus, strong in counsel). Bruin thk Bear, Baldwin the Ass, Tibert the Cat, Hirsent the She-Wolf, had German names, most of which were used as person names in Lorraine. But it was in France that the cycle obtained its greatest vogue. The *Roman de Renart* as printed by Méon (4 vol., 1826) runs to more than 40,000 lines. *Renart* was a popular epic parodying feudal institutions as represented in the romances of chivalry.

The early French originals are lost, the most ancient existing fragments being in Latin. The fable oi the lion's sickness and his cure by the wolf's skin occurs in the *Ecbasis cujusdam captivi per Tropologiam* (ed. by *E.* Voigt; Strasbourg, 1875), written about 940. *Ysengrimus* (ed. by E. Voigt; Halle, 1884), a clerical satire written by Nivard of Ghent about 1148. includes the story of the lion's sickness and the pilgrimages of Bertiliana the Goat. Most later versions of Reynard have been derived from the Flemish *Ban den vos Reinarde* (ed. by E. Martin, Paderborn, 1874), written about 1250 in East Flanders by Arnout and Willem. The Flemish epic is a poem of 3,476 lines. The corresponding branch of the French *Ronzan de Renart* (for which *see* FRENCH LITERATURE) is one of the earliest and best of the great French cycle.

The fable was known in England. The English poem of the *Fox and the Wolf* dates irom the 13th century; and the "Nun's Priest's Tale" of Chaucer, in which, however, the fox is Rossel and the ass Brunel, is a genuine Reynard history. A Dutch version of the Reynard poem, *Hystorie van Reynaert die Vos,* mas printed at Gouda in 1479. On this Caxton based his *Historye of Reynart the Foxe* (reprinted by *E.* Arber, 1878), which he finished on June 6, 1481. As a satire on the church, especially on monks and nuns, *Reynard* became popular with reformers, and numerous versions followed in England and Germany. The modern German version (1794) of Goethe has been often reprinted, notably in 1846, with illustrations by Wilhelm von Kaulbach.

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REYNAUD, PAUL (1878–), French conservative statesman, prominent in the last decade of the third republic and throughout the fourth, was born at Barcelonnette, Basses-Alpes, on Oct. 15, 1878. Educated at the Lycée Louis-le-Grand and the faculty of law in Paris, he became a barrister. Deputy for Basses-Alpes (1919–24) and then for Paris (1928–40), he made his name as a financial expert and was finance minister under André Tardieu in 1930. He was colonial minister under Pierre Laval (1931–32) and minister of justice under Tardieu (1932). He served in Édouard Daladier's government of 1938–40 first as minister of justice and then as finance minister. His budgets were austere attempts to restore the solvency of the state and at the same time pay the increasing costs of defense. He advocated firmness toward Nazi Germany, but he did not resign over the Munich agreement, and his friendship with the comtesse Hélène de Portes, associated uith pro-German political and business circles, was considered to have strengthened the cause of appeasement. He appreciated the importance of new weapons and the ideas of Charles de Gaulle. During World War II he was prime minister from March to June 1940 and, when the battle of France was being lost and the appeasers were gaining the ascendancy, he tried in vain to maintain

the British alliance and keep France in the war. After the armistice he was arrested by the Vichy government and spent the rest of the war in French and German prisons.

Re-elected a deputy in 1946, Reynaud soon returned to the fore and enjoyed considerable influence in the national assembly's finance committee and lobbies. He was finance minister in A. Marie's short-lived cabinet in 1948; he was included in H. Queuille's abortive cabinet in 1950; after being rejected by the assembly when he stood for the premiership in 1953, he was a vice-premier in J. Laniel's government of 1953–54. In these years he played an important part in the development of the movements to unite western Europe. A supporter of constitutional reform to strengthen the government, he favoured the return to power of General de Gaulle in 1958 and was appointed chairman of the advisory committee which examined the draft constitution. His efforts to make the fifth republic more parliamentary and less presidential had little success.

Besides books on earlier French history and politics (including *Les Trois glorieuses,* 1927), Reynaud published several volumes of memoirs, among them *La France a sauvé l'Europe,* 2 vol. (1946) and *Au coeur* de *la mêlée* (1951; Eng. trans. 1955). (P. W. C.)

REYNOLDS, JOHN FULTON (1820–1863), U.S. army officer, was born Sept. 20, 1820, at Lancaster, Pa., and graduated from the U.S. Military academy in 1841. During the Mexican War, Reynolds was twice promoted for gallantry in action. He took part in three expeditions into the far west and in 1859 became commandant of cadets at West Point. Soon after the beginning of the Civil War he was promoted to the rank of brigadier general of volunteers. He served as military governor of Fredericksburg and fought at Mechanicsville, Gaines's Mill and the second battle of Bull Run. After being promoted to the rank of major general in Nov. 1862, Reynolds commanded the 1st corps of the army of the Potomac and was among those considered for command of the army after Gen. Joseph Hooker's defeat at Chancellorsville. At the battle of Gettysburg (*q.v.*), Reynolds was killed in the first day's fighting (July 1, 1863) after moving up to support Buford's cavalry, which had first engaged the Confederates. The spot on the field where he fell is marked by a granite shaft erected by the state of Pennsylvania. (O. A. S.)

REYNOLDS, SIR JOSHUA (1723–1792), English painter, perhaps the dominant figure in the history of British art, was born at Plympton, Devon, on July 16, 1723. He was educated at the Plympton grammar school and was well read in classical literature. Influenced by the essays of Jonathan Richardson, Reynolds aspired to become a painter, and in 1740 he was apprenticed for four years to Thomas Hudson in London. In 1743, however, he returned to Devon and began painting at Plymouth dock portraits that reveal his inexperience and that are very much in the tradition then prevailing., Returning to London for two years in 1744, he began to acquire his independent style and his knowledge of the old masters. An outstanding picture of this period is "Capt. the Hon. John Hamilton" (owned by the duke of Abercorn), which shows Reynolds' bolder style combined with a considered use of impasto. Back in Devon in 1746 he painted his large group of the "Eliot Family," which clearly demonstrates his knowledge of the vast picture by Van Dyck at Wilton house, Wiltshire. In 1749 he sailed with his friend Augustus Keppel to Minorca, where he stayed for five months and endured the accident that permanently scarred his lip, the scar being a feature prominent in all his self-portraits. From Minorca he made his way to Rome, where he remained for over two years. There he was able to give full reign to his scholarship and to store his mind with the great masterpieces of classical and modern painting and sculpture. The impressions that he retained from this visit were to inspire his paintings and his *Discourses* for the rest of his life, for he felt that it was by allying painting with scholarship that he could best achieve his ambition of raising the status of his profession. He returned to England via Florence, Parma, Bologna and Venice, where he absorbed and noted the colour and composition of works by Titian, Tintoretto and Veronese. He was immediately seduced by Venetian colouring and, although all his life he preached the need for all young artists to study the classical forms of Michaelangelo and Raphael, his own works are redolent of the light and shade of Venetian colouring.

In 1753 Reynolds settled in London, where he was to live for the rest of his life, first in St. Martin's lane and finally, after 1760, in Leicester square. From the first his success was assured, and by 1755 he was employing studio help, notably Giuseppe Marchi. The first great work from this period is "Commodore Keppel" (in the National Maritime museum, Greenwich, London). The pose is not original, being a reversal of that of the "Apollo Belvedere" statue in the Vatican, but the subject is shown striding along the seashore in a new and vital way. It could be said that with this portrait all of English portrait painting took on a new life and vigour and the tradition of Sir Godfrey Kneller was entirely destroyed. A painter could not always hope to have such a heroic sitter, but Reynolds was equally successful with the more domestic portraits of men and women. In these first years in London his knowledge of Venetian painting is very apparent; *e.g.,* the portraits of "Lord Cathcart" (owned by Lord Cathcart) and "Lord Ludlow" (at Woburn abbey, Bedfordshire). Of his domestic portraits the most enchanting is that of "Georgiana, Countess Spencer, and Her Daughter" (owned by Lord Spencer), painted in 1760, which is one of the greatest English portraits, full of tenderness and careful observation. In the 1760s he mas more and more under the influence of the painters of the Bolognese school, and the pose and clothes of his sitters take on a more rigid, classical pattern, losing in consequence much of the sympathy and understanding he could have given them. It was from these portraits that he hoped to equate portrait painting with the "grand style," and they are indeed an illustration to much that he has to say in his *Discourses.* It has been suggested that the painting of "Garrick Between Tragedy and Comedy" (on loan from Lord Rothschild to King's college, Cambridge) is a parody of his own predicament, Comedy being painted in the softer and more domestic manner of Corregio and Tragedy in the classical manner of Guido Reni.

Reynolds was to realize his ambitions for his profession in a new and public way. Hitherto there had been no public exhibitions of contemporary artists in London, but in 1760 the Society of Artists was founded and the first of many successful exhibitions held. After some internal squabbles the patronage of King George III was sought and in 1768 the Royal Academy was founded. Although Reynolds' painting had found no favour at court, he was the obvious candidate for the presidency and the king confirmed his election and knighted him. Reynolds guided the policy of the academy with skill, and the pattern he set has been followed with little variation ever since. His yearly *Discourses* are some of the wisest words an older painter has offered to those beginning their careers, and they also clearly mirror many of his own thoughts and aspirations, as well as his own problems of line versus colour and public and private portraiture.

From 1769 nearly all of Reynolds' most important works appeared in the academy, and this undoubtedly influenced the rather more public manner of his portraits. In certain exhibitions he included historical pieces, such as "Ugolino" (at Knole house, Kent), which were perhaps his least successful contribution to painting. Many of his child studies are tender and even amusing, though now and again the sentiment tends to be excessive; two of the most enchanting are "Master Crewe as Henry VIII" (owned by Lord O'Neil) and "Lady Caroline Scott as Winter" (owned by the duke of Buccleuch). His most ambitious portrait commission was the "Family of the Duke of Marlborough" (at Blenheim palace, Oxfordshire), which was shown at the academy of 1778. Although not wholly successful it is a monumental group entirely suitable to the house that holds it: a conversation piece enlarged to the scale of a history piece. It may have been the arrival of Thomas Gainsborough in London in 1774 that caused Reynolds to revert to a more informal mood.

In 1781 Reynolds visited Flanders and Holland, where he studied the work of Rubens, and this seems to have affected his own style as from that time the texture of his picture surface becomes far richer. This is particularly true of his portrait of the "Duchess of Devonshire and Her Daughter" (at Chatsmorth house, Derby-

shire). It was this last phase of dramatic and baroque style that influenced John Hoppner and Thomas Lawrence, but they paid perhaps more attention to the painting of silks and satins and rather less to the characterization. Reynolds mas never a mere society painter or flatterer and he never forgot what James Northcote called, when writing of Allan Ramsay, the "mental part" of a portrait. It has been suggested that his deafness allowed Reynolds a clearer insight into the character of his sitters, the lack of one faculty sharpening the use of his eyes. His vast learning allowed him to vary his poses and style so often that the well-known remark of Gainsborough, "Damn him, how various he is!" is entirely understandable. In 1782 Reynolds had a paralytic stroke and about the same time he was saddened by bickerings within the Royal Academy. Seven years later his eyesight began to fail and he delivered his last *Discourse* at the academy in 1790. On Feb. 23. 1792, he died.

Reynolds preferred the company of men of letters to that of his fellow artists. Although his 14th *Discourse* is a tender and moving appreciation of Gainsborough, who stood for so much that he himself disliked in painting, it was in the company of Dr. Johnson and of Edmund Burke and Oliver Goldsmith that Reynolds was happiest. When Goldsmith died, Reynolds could not bring himself to paint for a whole day, and the moving essay he nrote on his friend showed that he could write a portrait as well as he could paint one. Reynolds and his friends were members of "The Club," which he established in 1764. He never married and his house was kept for him by his sister Frances.

Reynolds' state portraits of the king and queen were never considered a success and he seldom painted for them. but the prince of Wales patronized him extensively and there were few distinguished families or individuals who did not sit to him. None the less some of his finest portraits are those of his intimate friends and of fashionable women of a questionable way of life. Unfortunately Reynolds' technique was not always entirely sound, and many of his paintings have suffered as a result. After his visit to Italy he tried to produce the effects of Tintoretto and Titian by using transparent glazes over a monochrome underpainting, but the carmine he used for his flesh tones was not permanent and even in his lifetime began to fade, causing the overpale faces of many surviving portraits. An example of this can be seen in the "Roffey Family Group" (in Birmingham art gallery, Eng.). This paleness has been increased by injudicious cleaning in certain paintings. The most interesting picture to show how Reynolds worked is the unfinished double portrait of "Burke and Lord Rockingham" (in Fitzwilliam museum, Cambridge). In the 1760s Reynolds began to use bitumen more extensively, which mas detrimental to the paint surface. Of his later style the "Duchess of Devonshire and Her Daughter" is in almost matchless condition. Though a keen collector of old master drawings, he was never a draftsman and indeed few of his drawings have any merit, but'there is an interesting early "Self-Portrait" drawing (owned by Lord Harcourt) and a design for "Comedy" (in the Ashmolean museum, Oxford). His ledger books from 1755 to 1789, which, with a few gaps, are preserved, make it possible to date most of his sittings with reasonable accuracy.

His work is represented in most public and private collections and he is splendidly shown in the royal collection. The National gallery, London, has, among other paintings, "Capt. Tarleton," "Lord Heathfield," "The Countess of Albemarle" and "Three Graces Adorning a Term of Hymen." Among his portraits in the National Portrait gallery, London, are those of "Johnson," "Boswell" and his own early "Self-Portrait" shading his eyes. The Wallace collection, London, has "Nelly O'Brien," "Mrs. Carnac" and "Miss Bowles." Private collections particularly rich in his work include those of the duke of Bedford, duke of Devonshire, duke of Buccleuch, earl of Harewood, George Howard, earl of Ilchester, John Wyndham and Lord Spencer. An interesting portrait of Reynolds, not by his hand but by Angelica Kauffmann, belongs to Lord Morley. His work is not richly represented in the United States, although his great portrait of "Mrs. Siddons as the Tragic Muse" is in the Huntington library, San Marino, Calif.; and Washington and New York also have important examples.

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REYNOLDS, OSBORNE (1842–1912), English engineer and physicist, best known for his work in the fields of hydraulics and hydrodynamics, was born at Belfast on Aug. 23, 1842. Gaining early workshop experience and graduating at Queens' college Cambridge in 1867, he became in 1868 the first professor of engineering in the Owens college, Manchester. He was elected a fellow of the Royal society in 1877 and a Royal medallist in 1888. He retired in 1905 and died at Watchet, Somerset, on Feb. 21, 1912.

Reynolds' studies of condensation and the transfer of heat between solids and fluids brought radical revision in boiler and condenser design, while his work on turbine pumps laid the foundation of their rapid development. A fundamentalist among engineers, he formulated the theory of lubrication (1886), and in his classical paper on the law of resistance in parallel channels (1883) investigated the transition from smooth, or laminar, to turbulent flow, later (1889) developing the mathematical framework which became standard in turbulence work. His name is perpetuated in the "Reynolds stress," or drag exerted between adjacent layers of fluid due to turbulent motion, and in the "Reynolds number" (see AERODYNAMICS), which provides a criterion for dynamic similarity and hence for correct modeling in many fluid flow experiments. He developed and exploited corresponding criteria for wave and tidal motions in rivers and estuaries, and made pioneering contributions to the concept of group velocity. Among his other work was the explanation of the radiometer and an early absolute determination of the mechanical equivalent of heat. Reynolds' *Scientific Papers* were published in three volumes (1900–03).

See A. H. Gibson, *Osborne Reynolds and his Work in Hydraulics and Hydrodynamics* (1946). (C. H. B. P.)

REZÁNOV, NICOLAI PETROVICH DE (1764–1807), Russian administrator under Catherine II, Paul I and Alexander I. He was the first Russian to represent his country in Japan (1804), and instigated the first attempt of Russia to circumnavigate the globe (1803), commanding the expedition himself as far as Kamchatka. But Rezánov's monument for many years after his death was the great Russian-American Fur company; and his interest to students of history centres round the policy involved in that enterprise.

Meeting (in 1788) Shelikov, chief of the Shelikov-Golikov Fur company, Rezánov became interested in the merchant's project to obtain a monopoly of the fur trade in those distant dependencies. He became a partner, and, after the death of Shelikov in 1795, the leading spirit of the company, and resolved to obtain privileges analogous to those granted by Great Britain to the East India company. He had just succeeded in persuading Catherine to sign his charter when she died, and he was obliged to begin again with the ill-balanced and intractable Paul. Rezánov's skill, subtlety and address prevailed, and shortly before the assassination of Paul he obtained his signature to the instrument which granted to the Russian-American company, for a term of 20 years, dominion over the coast of N.W. America, from latitude 55° northward; and over the chain of islands extending from Kamchatka northward and southward to Japan. This famous "trust," which crowded out all the small companies and independent traders, was a source of large revenue to Rezánov and the other shareholders, including members of the imperial family, until the first years of the 19th century, when mismanagement and scarcity of food threatened it with ruin. Rezinov, his humiliating embassy to Japan concluded, reached Kamchatka in 1805, and found commands awaiting him to remain in the Russian colonies

as imperial inspector and plenipotentiary of the company, and to correct the abuses that were ruining the great enterprise. He travelled slowly to Sitka by way of the islands.

At the end of a winter in Sitka, the headquarters of the company, he sailed for the Spanish settlements in California, purposing to trade his tempting American and Russian wares for foodstuffs, and to arrange a treaty for the provisioning of his colonies twice a year from New Spain. He cast anchor in the harbour of San Francisco early in April 1806, after a stormy voyage which had defeated his intention to take possession of the Columbia river in the name of Russia. Although he was received with courtesy, he was told that the laws of Spain forbade her colonies to trade with foreign powers, and that the governor of all the Californias was incorruptible. Rezánov, had it not been for a love affair with the daughter of the *comandante* of San Francisco, Don José Arguello, and for his personal address and diplomatic skill, with which he won over the clergy to his cause, would have failed again. As it was, when he sailed for Sitka, six weeks after his arrival, the "Juno's" hold was full of breadstuffs and dried meats, he had the promise of the perplexed governor to forward a copy of the treaty to Spain at once, and he was affianced to the most beautiful girl in California. Shortly after his arrival in Sitka he proceeded by water to Kamchatka, where he dispatched his ships to wrest the island Sakhalin of the lower Kurile group from Japan, then started overland for St. Petersburg to obtain the signature of the tsar to the treaty. He died of fever and exhaustion in Krasnoiarsk, Siberia, on March 8, 1807.

The treaty with California, the bare suggestion of which made such a commotion in New Spain, was the least of Rezbnov's projects. It was sincerely conceived, for he was deeply and humanely concerned for his employees and the wretched natives who were little more than the slaves of the company. His correspondence with the company betrays a clearly defined purpose to annex to Russia the western coast of North America, and encourage immediate emigration from the parent country on a large scale. Had he lived, he might have accomplished his object. The treaty was never signed, the reforms of Rezánov died of discouragement, the fortunes of the colonies gradually collapsed, the Spanish girl who had loved Rezánov became a nun; and one of the ablest and most ambitious men of his time was forgotten in the cemetery of a poor Siberian town.

See H. H. Bancroft, *History of California* (1889) and *History of Alaska* (1887); Tikhmener, *Istoricheskoye obozryeniye obrazovaniya Rossiisko-Amerikanskoi Kompanii* (1861–63); T. C. Russell, ed., *The Rezánov Voyage to Nueva California* (1926); A. Yarmotinsky, "A Rambling Note on the Russian Columbus," *New York Public Library Bulletin,* vol. xxxi (1927). (G. At.)

RHADAMANTHUS, in Greek mythology, son of Zeus and Europa, and brother of Minos, king of Crete. Homer represents him as dwelling in the Elysian fields (*Odyssey,* iv. 564). According to later legends, on account of his inflexible integrity, he was made one of the judges of the dead in the lower world, together with Aeacus and Minos.

RHAGES: *see* RAYY.

RHAMNACEAE, the buckthorn family, a group of thorny shrubs, woody vines and trees found in the warmer parts of both hemispheres. It includes 45 genera and about 550 species of dicotyledonous plants. Large genera are *Rhamnus* with about 230 species, *Zizyphus* with 100 species and *Phylicia* with 90 species. Jujube (*q.v.*), or the Chinese date, native to Asia. is the fruit of *Zizyphus jujube* (*Z. vulgaris*), and the Indian jujube is the fruit of *Z. mauritiana.* The bark of various species of *Rhamnus* is utilized in the practice of medicine, cascara sagrada (*q.v.*) being that of the western American *R. purshiana. Ceanothus,* a genus highly developed in the western United States, is known as the California lilac. *See* also BUCKTHORN. (E. D. Mt.)

RHATICUS (RHETICUS), a surname derived from Rhaetia (Austria), the district of his birth, by GEORG JOACHIM VON LAUCHEN (1514–1576), astronomer and mathematician who, as an associate of Nicolaus Copernicus (*q.v.*), was among the first to adopt and to spread his heliocentric theory. Rhaticus was born at Feldkirch on Feb. 16, 1514. In 1537 he was appointed to a chair of mathematics and astronomy at Wittenberg. He was much attracted by news of Copernicus' heliocentric theory and in 1539 he resigned his professorship and went to Frauenburg, where he studied for two years with Copernicus. Rhaticus published the first exposition of the new heliocentric views in his *De libris revolutionum . . . Nic. Copernici . . . narratio prima. . .* (1541) and for about ten years thereafter produced ephemerides baaed on the Copernican system. He persuaded Copernicus to complete the great *De revolutionibus orbium coelestium* and to permit him to take the manuscript to Nürnberg for publication. Because of the religious objections of Luther and others, Rhäticus left Nürnberg before *De revolutionibus* was actually published in 1543, and moved to Leipzig.

From his time at Wittenberg until his death at Kassa, Hung., on Dec. 5, 1576, Rhäticus worked on his great treatise *Opus Palatinum de triangulis,* which was published posthumously in 1596 by Valentine Otto, mathematician to the electoral prince palatine. The work contains tables of sines, cosines, tangents, etc., in intervals of ten seconds of arc and calculated to ten decimal places. Rhäticus proposed to compute similar tables to 15 decimal places, but did not live to complete the task. The table of sines on this scale was published in 1613 by B. Pitiscus (1561–1613) under the title *Thesaurus mathematicus,* Pitiscus himself completing certain of the calculations. (CN. A. R.)

RHAZES (ABU-BAKR MOHAMMED IBN ZAKARIYA AR-RAZI) (*c.* 865–923 or 932), undoubtedly the greatest physician of the Islamic world, also a philosopher of remarkable independence of mind and a well-known alchemist, was a Persian Mosfem, born in the city of Rayy about 865. The tradition that he was an alchemist before he became thoroughly acquainted with medicine may be reliable. He became chief physician in a new hospital at Rayy and subsequently held a similar position in Baghdad for some time. As so many "intellectuals" in his day, he lived at different small courts enjoying the protection of minor rulers. He claimed to fulfil in his own time the function of a Socrates in philosophy and that of a Hippocrates in medicine. He died in his native city in 923 or 932.

The two most important medical works of Rhazes are the *Kitab al-Mansuri,* which he composed for Mansur ibn Ishak, the ruler of Rayy, and which became well-known in the west in Gerard of Cremona's 12th-century Latin translation; and *Al-Hawi,* the "Comprehensive Book," in which he surveys Greek, Syrian and early Arabic medicine in their entirety, as well as some Indian medical knowledge, adding his own considered judgment and his own medical experience throughout. Among his numerous minor medical treatises, *A Treatise On the Small Pox and Measles* is famous, having been translated into Latin and various modern languages and into Byzantine Greek.

The philosophical writings of Rhazes (*see* ARABIC PHILOSOPHY) were completely neglected for centuries: not until the 20th century did their importance come to be appreciated again. He claims to be a Platonist, and his views are everywhere at variance with the philosophy of such thinkers as al-Farabi, Avicenna and Averroes. He was probably acquainted with Arabic translations of Democritus and followed a similar line in his own atomic theory of matter. His *Autobiography* is rather a spirited defense of the philosophical way of life as he understood it than an account of actual events (Eng. trans. by A. J. Arberry in the *Asiatic Review,* 1949). *On Spiritual Medicine* (Eng. trans. by A. J. Arberry, *The Spiritual Physick of Rhazes,* London, 1950) is a popular ethical treatise. The main alchemical work of Rhazes is the *Secret of Secrets* (German trans. by J. Ruska, 1937).

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RHEA, a Titaness, sister and consort of Cronus and mother of Zeus. For her legend, *see* CRONUS. Very litle cult of Rhea existed, but she was commonly identified in historical times with

Cybele *(see* GREAT MOTHER OF THE GODS). Hence such legends as that in Virgil *(Aen.,* iii, *111),* that Cybele originally came from Crete; and indeed the various mother goddesses of the Mediterranean, while not actually the same, closely resemble one another and are the product of the same class of ideas and practices.

RHEA, the American cousin of the African ostrich (*q.v.*), a giant flightless ratite bird confined to South America. Three species are recognized: *Rhea americana,* ranging from Paraguay to Patagonia; *R. darwini,* confined to Patagonia; and R. *macrorhyncha,* of northeast Brazil. Considerably smaller than the ostrich, about four feet tall, the rheas are further distinguished by the possession of three toes, the absence of fine plumes and the general brownish colour of the feathers, which, in R. *darwini,* are tipped with white. The feathers have a considerable market value. The rhea is polygamous, and the cock bird performs the duties of incubation. Rheas frequently associate with deer or guanacos to form "mixed herds" similar to those formed by the ostrich with zebras and antelopes.

RHEE, SYNGMAN *(1875–*), Korean statesman, first president of the Korean republic, was born on April *26, 1875,* in Whanghae province, Korea. He completed a traditional classical education and then entered a Methodist school, where he learned English and enough western thought to become a confirmed nationalist and ultimately a Christian. He joined with other Korean leaders in *1896* to form the Independence club and served briefly as a member of the privy council. When reactionary elements destroyed the club in *1897,* Rhee was arrested and imprisoned until *1904.* On his release he went immediately to the United States, where he attended George Washington university (A.B. 1907), Harvard (M.A. *1908)* and Princeton (Ph.D. *1910).* He was the first Korean to earn a doctorate degree in an American university. While a student he made frequent but unsuccessful appeals to the United States to save his country from Japan. When he returned home in *1910* he found it impossible to hide his hostility toward Japanese rule, and after short terms as a Y.M C.A. worker and high school principal he returned to the U.S. in *1912.*

For the next *30* years Rhee served as a spokesman for Korean independence, publicizing Korea's plight and trying in vain to win international support for his cause. In *1919* he was elected president of the Korean republic in exile, holding that post for *20* years. He returned to Korea in *1945* after spending the war years in trying to secure Allied promises of Korean independence. Elected president of the Republic of Korea in *1948,* he was re-elected in *1952, 1956* and *1960.*

As president of the R.O K., Rhee's great objective was the freedom and unification of his country. He used his broad powers to remove domestic opposition to his program, and even defied the United Nations when he felt that body threatened those ends (for Rhee's participation in the Korean war *see* KOREAN WAR). He purged the national assembly and outlawed the opposition Progressive party, whose leader was executed for treason. Rhee controlled the appointment of mayors, village headmen and chiefs of police, but in *1956* failed to prevent the election of an opposition vice-president. Government claims that the March *1960* elections gave Rhee over *90%* of the popuiar vote (55% in *1956)* provoked student-led demonstrations resulting in heavy casualties and demands for his resignation, supported by the unanimous vote of the national assembly. Rhee resigned April *27,* and left for exile in Hawaii. A caretaker government pledged new elections and the repudiation of the most widely criticized of Rhee's domestic and foreign policies. *See* also KOREA: *History.* (F. G. WN.)

RHEINBERGER, JOSEPH GABRIEL (1839–1901), German composer. was born at Vaduz, Liechtenstein, on March *17, 183.9* He studied at the Munich conservatorium from 1851 to 1854, and in 1859 became a professor there. He was from *1860* to *1866* organist of the Michelskirche. and then court conductor.

Rheinberger's compositions include the operas Die sieben *Raben* (Munich, 1869) and *Türmers* Tochterlein (Munich, 1873); the oratorio *Christoforus,* op 120; the well-known quartet for piano and strings in E flat, op 38; the nonet for wind and strings, op 139; and 20 organ sonatas Rheinberger's organ music is original in method, and breaks loose from the Bach tradition in many points. He died at Munich on Nov 25, 1901

RHENANUS, BEATUS (1485–1547), German humanist, was born in 1485 at Schlettstadt in Xlsace. where his father. a native of Rheinau (hence the surname *Rhenanus),* was a butcher. He was educated at the famous Latin school of Schlettstadt, and afterward (1503) went to Paris

In 1511 he removed to Basel, where he became intimate with Erasmus, and took an active share in the publishing enterprises of Joaanes Froben (*q.v.*). In 1526 he returned to Schlettstadt, and devoted himself to a life of learned leisure, enlivened with epistolary and personal intercourse with Erasmus (the printing of whose more important works he superintended) and many other scholars of his time. He died at Strasbourg on July 20, 1547.

His earliest publication was a biography of Geiler of Kaisersberg (1510). Of his subsequent works the principal are *Rerum Germanicarum* Libri *III* (1531) and editions of *Velleius Paterculus* (ed. princeps, from a manuscript discovered by himself, 1522); *Tacitus* (1519, exclusive of the Histories); Livius (1535); and *Erasmus* (with a life, 9 vol 1540–41)

RHENIUM is a very rare metallic element discovered by Ida and Walter Noddack in *1925.* The chemical symbol is Re; the atomic number is 75; and the atomic weight is *186.22.* Up to 1924, the annual world production of rhenium was conveniently estimated in kilograms. But an annual U.S. potential of about ten tons is anticipated. The metal and its alloys have found limited application as fountain-pen points. high-temperature thermocouples. catalysts, electrical contact points, instrument-bearing points and in electric components.

Rhenium is widely distributed in a variety of minerals but usually in concentrations below 0.1 part per 1,000,000. It occurs in concentrations as high as 10 to 20 parts per 1,000,000 in molybdenum sulfide ores, and to a lesser extent in sulfidic copper ores. It is probably present as its stable disulfide (ReS_2). The recovery of rhenium follows from the concentration of its volatile heptoxide in the flue dust during the smelting of molybdenite ore, or from its concentration with the platinum metals in the "anode sludge" during electrolytic copper refining. The extracted element is recrystallized as the sparingly soluble potassium perrhenate ($KReO_4$). This material is transposed to the ammonium salt and reduced in hydrogen to give black metal powder. The powder may be compressed and sintered in hydrogen at an elevated temperature to give sintered bars (density. 19). Cold working and annealing permit the fabrication of wire or foil.

The silvery massive metal has a density of *21.9* g. per cubic centimetre, melts at about 3,180° C., and is extremely hard; its near resistance is good and it is not easily corroded. The powder slowly oxidizes in air above 150° C. and rapidly at higher temperatures to form volatile Re_2O_7. This yellow, stable and relatively nontoxic oxide is the anhydride of perrhenic acid ($HReO_4$), which results from dissolution of the metal in hydrogen peroxide or nitric acid. The metal is not soluble in hydrochloric acid. and dissolves only uith difficulty in other acids. The perrhenates, the heptoxide, and perrhenic acid have been extensively studied; unlike the corresponding manganese compounds. the (VII) state of rhenium is its commonest and most stable form. Perrhenate. unlike permanganate, is only a weak oxidant, comparable in strength with ferric ion.

There is some evidence for the existence of rhenium in each of the oxidation states from (VII) through (— 1). The solution chemistry of rhenium is quite complex because of the large number of possible. acid-base sensitive, disproportionation reactions. The best characterized oxides are Re_2O_7; the insoluble red trioxide (ReO_3); and the black dioxide (ReO_2). The existence of an unstable black (possibly impure) sesquioxide (Re_2O_3) is probable, and both a monoxide and a suboxide have been reported. A number of tungsten, arsenic, silicon and other rhenium alloys are known, and the heated metal reacts more or less readily with many nonmetals such as sulfur, phosphorus or the halogens. As does tungsten. it forms numerous anhydrous halides or oxyhalides with fluorine. chlorine or bromine, which are hydrolyzed by water. The hexafluoride (ReF_6). pentachloride ($ReCl_5$) and tribromide ($ReBr_3$) exemplify the highest-state simple halides known for three of the halogens; no simple iodide has been verified. The trichloride ($ReCl_3$) is a dimeric red solid which behaves as a nonelectrolyte in solution; on heating. it emits a green vapour from which metal may be deposited by thermal decomposition. Com-

plex rhenium (IV) halides of the type K_2ReX_6 have been reported for all four of the common halogens.

There are two naturally occurring isotopes with mass numbers: 185, which is stable, and 187, which is radioactive and the more abundant; radioactive isotopes with mass numbers 182, 183, 184 and 188 have been prepared. The arrangement of electrons in the unfilled orbits (O and P) is: $5s^2$, $5p^6$, $5d^5$, $6s^2$.

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(C. L. R.)

RHESUS MONKEY *(Macaca mulata)*, probably the best known of all monkeys, a native of India. It is brown in colour, with long hair and a naked area on the buttocks. and is gregarious. *See* MACAQUE.

RHETORIC, the art of using language in such a way as to produce a desired impression upon the hearer or reader. Rhetoric as an art was taught in Greece by the Sophists (*q.v.*).

The power of eloquent speech is recognized in the earliest Greek writings, but the founder of rhetoric as an art was Corax of Syracuse. In 466 a democracy was established in Syracuse. One of the immediate consequences was a mass of litigation on claims to property, urged by democratic exiles who had been dispossessed by Thrasybulus, Hieron or Gelon. Such claims. going many years back, would often require that a complicated series of details should be stated and-arranged. The claimants also. in many instances, would lack documentary support, and rely chiefly on inferential reasoning. Hence the need of professional advice. The facts known as to the "art" of Corax perfectly agree with these conditions. He gave rules for arrangement, dividing the speech into five parts: proem, narrative, arguments (ἀγῶνες), subsidiary remarks (παρέκβασις) and peroration. Next he illustrated the topic of general probability (εἰκός), showing its two-edged use; *e.g*, if a puny man is accused of assaulting a stronger, he can say, "Is it likely that I should have attacked him?" If vice versa, the strong man can argue, "Is it likely that I should have committed an assault where the presumption was sure to be against me?" This topic of εἰκός, in its manifold forms, was in fact the great weapon of the earliest Greek rhetoric and it was further developed by Tisias, the pupil of Corax, as we see from Plato's *Phaedrus*. Its later developments were largely the work of Gorgias and Lysias and in a greater degree of Antiphon and Isocrates *(see* their separate biographies). But the detailed study of the art begins with Aristotle's *Rhetoric* (written 322–320 B.C.).

Aristotle's **"Rhetoric."**—Aristotle sets out from the proposition that rhetoric is properly an art. because when a speaker persuades. it is possible to find out why he succeeds in doing so. It is. in fact, the popular branch of logic. Hitherto, Aristotle says, writers on rhetoric have concerned themselves mainly with the exciting of emotions. All this is very well, but "it has nothing to do nith the matter in hand; it has regard to the judge." The true aim should be to *prove* your point, or seem to prove it.

Aristotle does not sufficiently regard the question: What. as a matter of experience, is most persuasive? Logic may be more persuasive with the more select hearers of rhetoric: but rhetoric is for the many, and with the many appeals to passion will sometimes, perhaps usually, be more effective than syllogism No formulation of rhetoric can correspond with fact which does not leave it absolutely to the genius of the speaker whether reasoning (or its phantom) is to be what Aristotle calls it, the "body of proof" (σῶμα πίστεως) or whether the stress of persuading effort should not be rather addressed to the emotions of the hearers.

His statement, that the master of logic will be the master of rhetoric, is a truism if we concede the essential primacy of the logical element in rhetoric. Otherwise it is a paradox: and it is not in accord with experience. which teaches that speakers incapable of showing even the ghost of an argument have sometimes been the most completely successful in carrying great audiences along with them. Aristotle never assumes that the hearers of his rhetorician are as οἱ χαρίεντες, the cultivated few; on the other hand. he is apt to assume tacitly—and here his individual bent comes out—that these hearers are not the great surging crowd. the ὄχλος, but a body of persons with a decided, though imperfectly developed, preference for sound logic.

What is the use of an art of rhetoric? It is fourfold, Aristotle replies. Rhetoric is useful, first of all, because truth and justice are naturally stronger than their opposites. When awards are not duly given, truth and justice must have been worsted by their own fault. This is worth correcting. Rhetoric is then (1) *corrective*. Next, it is (2) *instructive,* as a popular vehicle of persuasion for persons who could not be reached by the severer methods of strict logic. Then it is (3) *suggestive*. Logic and rhetoric are the two impartial arts; that is to say, it is a matter of indifference to them, as arts, whether the conclusion which they draw in any given case is affirmative or negative. Suppose that I am going to plead a cause, and have a sincere conviction that I am on the right side. The art of rhetoric will suggest to me what might be urged on the other side; and this will give me a stronger grasp of the whole situation. Lastly, rhetoric is (4) *defensive*. Mental effort is more distinctive of man than bodily effort; and "it would be absurd that, while incapacity for physical self-defence is a reproach." incapacity for mental defense should be no reproach. Rhetoric, then, is corrective, instructive, suggestive, defensive. But what if it be urged that this art may be abused? The objection, Aristotle answers, applies to all good things, except virtue, and especially to the most useful things. Men may abuse strength, health, wealth. generalship.

The Period from Alexander to **Augustus.**—Aristotle's method lived on in the Peripatetic school. Meanwhile the fashion of florid declamation or strained conceits prevailed in the rhetorical schools of Asia, where, amid mixed populations, the pure traditions of the best Greek taste had been dissociated from the use of the Greek language. The "Asianism" of style which thus came to be contrasted with "Atticism" found imitators at Rome. Hermagoras of Temnos in Aeolis (c. 110 B.C.) did much to revive a higher conception. Using both the practical rhetoric of'the time before Aristotle and Aristotle's philosophical rhetoric, he worked up the results of both in a new system—following the philosophers so far as to give the chief prominence to "invention." He thus became the founder of a rhetoric which may be distinguished as the scholastic. Through the influence of his school, Hermagoras did for Roman eloquence very much what Isocrates had done for Athens. Above all, he counteracted the view of Asianism, that oratory is a mere knack founded on practice, and recalled attention to the study of it as an art.

Cicero's rhetorical works are to some extent based on the technical system to which he had been introduced by Molon at Rhodes. But Cicero further made an independent use of the best among the earlier Greek writers, and he could draw, at least in the later of his treatises, on a vast fund of reflection and experience. The result is certainly to suggest how much less he owed to his studies than to his genius. Some consciousness of this is perhaps implied in the idea which pervades much of his writing on oratory, that the perfect orator is the perfect man. The same thought is present to Quintilian, in whose great work, *De Institufione Oratorin,* the scholastic rhetoric receives its most complete expression (c. A.D. 90). He treats oratory as the end to which the entire mental and moral development of the student is to be directed. Thus he devotes his first book to an early discipline which should precede the orator's first studies. and his last book to a discipline of the whole man which lies beyond them. After Quintilian, the next important name is that of Hermogenes of Tarsus. who under Marcus Aurelius made a complete digest of the scholastic rhetoric from the time of Hermagoras of Temnos (110 B.C.) in five extant treatises, remarkable for clearness and acuteness.

Hermogenes continued for nearly a century and a half to be one of the chief authorities in the schools. Longinus (*q.v.*) *(c.* A.D. 260) published an *Art oj Rhetoric* which is still extant; and the more celebrated treatise *On Sublimity* (περὶ ὕψους), if not his work, is at least of the same period. In the later half of the 4th century Aphthonius composed the "exercises" (προγυμνάσματα) which superseded the work of Hermogenes. At the revival of letters the treatise of Aphthonius once more became a standard textbook. Much popularity was enjoyed also by the ex-

ercises of Aelius Theon (of uncertain date). (See further the editions of the Rhetores *Graeci* by L. Spengel and by C. Walz.)

Rhetoric under the Empire.— During the first four centuries of the empire the practice of the art was in greater vogue than ever before or since. First, there was a general dearth of the higher intellectual interests: politics gave no scope to energy, philosophy was stagnant and literature was, as a rule, either arid or frivolous. Then the Greek schools had poured their rhetoricians into Rome. where the same tastes which revelled in coarse luxury welcomed tawdry declamation. The law courts of the Roman provinces further created a continual demand for forensic speaking. The public teacher of rhetoric was called "sophist," which was now an academic title, similar to "professor" or "doctor." In the 4th century B.C. Isocrates had taken pride in the name of σοφιστής, which, indeed, had at no time wholly lost the good, or neutral, sense which originally belonged to it.

Vespasian (A.D. 70–79), according to Suetonius, was the first emperor who gave a public endowment to the teaching of rhetoric. Under Hadrian and the Antonines (A.D. 117–180) the public chairs of rhetoric became objects of the highest ambition. The Rhetorical school (θρόνοι) had two chairs, one for sophistic, the other for political rhetoric. By "sophistic" was meant the academic teaching of rhetoric as an art, in distinction from its "political" application to the law courts. The sophistical chair was superior to the political in dignity as in emolument, and its occupant was invested with a jurisdiction over the youth of Athens similar to that of the vice-chancellor in a modern university. The Antonines further encouraged rhetoric by granting immunities to its teachers. Three sophists in each of the smaller towns, and five in the larger, were exempted from taxation (Dig. xxvii, 1, 6, §2). The wealthier sophists affected much personal splendour. The aim of the sophist was to impress the multitude. His whole stock in trade was style, and this was directed to astonishing by tours de force. The scholastic declamations were chiefly of two classes. (1) The suasoriae were usually on historical or legendary subjects, in which some course of action was commended or censured (cf. Juv. Sat.). These *suasoriae* belonged to deliberative rhetoric (the βουλευτικὸν γένος, deliberativum genus). (2) The controversiae turned especially on legal issues, and represented the forensic rhetoric (δικανικὸν γένος, *iudiciale* genus). But it was the general characteristic of this period that all subjects were treated alike in the style and spirit of that third branch which Aristotle distinguished, the rhetoric of ἐπίδειξις or "display." This academic oratory is shown under various aspects, and presumably at its best, by such writers as Dio Chrysostom at the end of the 1st century, Aelius Aristeides (see ARISTEIDES, AELIUS) in the 2nd (the chief rhetorician under the Antonines) and Themistius, Himerius and Libanius in the 4th. Amid much which is tawdry or vapid, these writings occasionally present passages of true literary beauty, while they constantly offer matter of the highest interest to the student.

The Middle Ages and the Renaissance.— In the mediaeval system of academic studies, grammar, logic and rhetoric were the subjects of the trivium, or course followed during the four years of undergraduateship. Music, arithmetic, geometry and astronomy constituted the quadrivium, or course for the three years from the B.A. to the M.A. degree. These were the seven liberal arts. In the middle ages the chief authorities on rhetoric were the latest Latin epitomists, such as Martianus Capella (5th century), Cassiodorus (5th century) or Isidorus (7th century).

After the revival of learning the better Roman and Greek writers gradually returned into use. Some new treatises were also produced. Leonard Cox (d. 1549) wrote The Art or Craft of Rhetoryke, partly compiled, partly original, which was reprinted in Latin at Cracow. The Art of Rhetorique, by Thomas Wilson (1553), afterward secretary of state, embodied rules chiefly from Aristotle, with help from Cicero and Quintilian. About the same time treatises on rhetoric were published in France by Tonquelin (1555) and Courcelles (1557). The general aim at this period was to revive the best teaching of the ancients. At Cambridge in 1570 the study of rhetoric was based on Quintilian, Hermogenes and the speeches of Cicero viewed as works of art. An Oxford statute of 1588 shows that the same books were used there. In 1620 George Herbert was delivering lectures on rhetoric at Cambridge. where he held the office of public orator. The decay of rhetoric as a formal study at the universities set in during the 18th century. The function of the rhetoric lecturer passed over into that of correcting written themes; but his title remained long after his office had lost its primary meaning. If the theory of rhetoric fell into neglect, the practice, however, was encouraged by the public exercises ("acts" and "opponencies") in the schools. The college prizes for declamations served the same purpose.

Modern Writers on Rhetoric.— The fortunes of rhetoric in the modern world, as briefly sketched above, may suflice to suggest why few modern writers of ability have given their attention to the subject. One of the most notable modern contributions to the art is the collection of commonplaces framed (in Latin) by Bacon, "to be so many spools from which the threads can be drawn out as occasion serves," a truly curious work of that acute and fertile mind, and quite in the spirit of Aristotle's treatise. The popularity enjoyed by Hugh Blair's Lectures on Rhetoric in the latter part of the 18th and the earlier part of the 19th century was merited rather by the form than by the matter. Campbell's Philosophy of Rhetoric, which found less wide acceptance than its predecessor, was superior to it in depth, though often marred by an imperfect comprehension of logic. But undoubtedly the best modem book on the subject is Richard Whately's Elements of Rhetoric. Starting from Aristotle's view, that rhetoric is "an offshoot from logic," Whately treats it as the art of "argumentative composition." He considers it under four heads: (1) the address to the understanding (=Aristotle's λογικὴ πίστις); (2) the address to the will, or persuasion (=Aristotle's ἠθικὴ and παθητικὴ πίστις); (3) style; (4) elocution, or delivery. But when it is thus urged that

> All a rhetorician's rules
> But teach him how to name his tools,

the assumption is tacitly made that an accurate nomenclature and classification of these tools must be devoid of practical use. The conditions of modern life, and especially the invention of printing, have to some extent diminished the importance which belonged in antiquity to the art of speaking, though modem democratic politics and forensic conditions still make it one which may be cultivated with advantage.

BIBLIOGRAPHY.— Among more modern works are J. Bascom, Philosophy of Rhetoric (1885), and numerous books on voice culture, gesture and elocution. For ancient rhetoric see Sir R. C. Jebb's translation of Aristotle's Rhetoric, ed. by J. E. Sandys (1909), and his Attic Orators (1876); also Spengel, Artium *Scriptores* (1828); Westermann, Gesch. der Beredtsamkeit (1833–35); Cope, in the Cambridge *Journal* of Classical and Sacred Philology (1855–57); introductions to Cicero's De *Oratore* (A. S. Wilkins) and Orator (J. E. Sandys); Volkmann, Die Rhetorik der Griechen und Romer in system. *Übersicht*, 2nd ed. (1885); Norden, Die Antike Kunstprosa (1898). (R. C. J.; X)

RHEUMATIC FEVER is a generalized disease commonest in children between the ages of 5 and 15 but occurring with considerable frequency in young adults. The manifestations, severity. duration and aftereffects are highly variable. In a small percentage of patients death may occur because of inflammation of the heart in the acute attack, but in a much larger number the acute attack subsides with a variable amount of cardiac damage. Recurrences are frequent in the absence of appropriate measures for the prevention of streptococcal infection.

Causative Factors.— The exact cause of rheumatic fever was still unknown at mid-20th century, although a close relationship to previous streptococcus infection had been well established. This is based on the high incidence of known streptococcus infection preceding attacks of acute rheumatic fever, the presence of streptococcal antibodies (particularly antistreptolysin) in the blood of patients with the disease, and the prevention of recurrent attacks of rheumatic fever by the continued use of drugs that prevent streptococcus infection. It is generally believed that the disease results from the reaction of the body to the streptococcus rather than the direct effect of streptococcal infection.

Many authorities believe that this illness represents a hypersensitivity reaction, although direct evidence for this view is lacking.

Clinical Characteristics. — The clinical recognition of rheumatic fever is made difficult by the wide variety of symptoms. The most important evidences are those that result from inflammation of the heart, and of these the commonest are certain types of murmurs and increased heartbeat rate. It is frequently difficult to determine whether a given murmur results from active rheumatic fever or a previous attack. With more serious heart involvement there may be rapid enlargement of the heart, heart failure resulting in difficulty in breathing, evidence of inflammation of the membranes overlying the heart (pericarditis) and irregularities of the heartbeat. Additional evidence of cardiac involvement is sometimes obtained on electrocardiographic tracings. The extent and duration of cardiac inflammation is extremely variable in all age groups, but in general tends to be severer in young children than in young adults. Severe cardiac involvement may result in death in a relatively short time.

Involvement of the joints is a common manifestation. This may vary from mild aches and pains to severe swelling, redness, tenderness and limitation of motion. Characteristically several joints are involved, with migration from day to day. The joint symptoms are commoner in older patients than in young children. Joint manifestations are commonest in the early stages and never result in permanent impairment of function.

Nodules may occur beneath the skin, but rarely before the third or fourth week of disease. The presence of nodules is usually associated with involvement of the heart. A variety of skin rashes may be present in acute rheumatic fever, the most characteristic of which is erythema marginatum, which is considered highly specific for the disease by most authorities.

Chorea (St. Vitus' dance; *q.v.*) represents a nervous system manifestation of rheumatic fever. It is characterized by purposeless movements of the arms and legs and inability to perform coordinated movements of muscle groups. Emotional disturbances may also be present. The severity and duration of these symptoms are highly variable.

Fever occurs early in the disease in a relatively large percentage of patients, but it is not necessarily present. A wide variety of other signs and symptoms may also occur, among them nosebleeds. weakness, abdominal pain and weight loss. Examination of the blood usually shows an increase in the rate of sedimentation of red blood cells, and frequently shows anemia and an increased number of white blood cells.

In typical cases a combination of the above symptoms makes diagnosis relatively certain. Many patients have the disease in subtler form. so that the first recognition of the previous rheumatic episode comes from the presence of structural abnormalities of the heart characteristically produced by rheumatic fever.

The length of an individual attack of acute rheumatic fever is variable and is sometimes difficult to ascertain. In certain persons symptoms may be transient, while in others the disease remains obviously active for periods of more than a year.

The degree of cardiac damage sustained during an individual attack is not related simply to the severity of the acute attack, but may be more closely related to the total duration of active disease. The interference with normal heart function, usually referred to as rheumatic heart disease, results in the main from distortion of the valve structure. Although such distortion may lead to extreme cardiac disability, patients with rheumatic heart disease may carry on relatively normal lives. The greatest threat to life is reactivation of the rheumatic process. A large percentage of people have no interference with cardiac function following recovery from acute rheumatic fever.

Pathology. — Although clinical evidences of rheumatic fever may occur in the heart, joints, skin and central nervous systems, the most characteristic pathological findings are seen in the heart. On gross examination the heart is usually dilated. and the surface may be covered by a stringy material that adheres to the membrane covering the heart (pericardium). The heart muscle is paler and softer than normal. Microscopic examination shows evidence of a peculiar type of inflammation in the connective tissue. The most characteristic microscopic lesion is the Aschoff nodule, which consists of an accumulation of large pale cells together with smaller cells surrounding degenerating connective tissue fibres. Aschoff nodules are most characteristically found in the connective tissue of various parts of the heart, but similar lesions have been identified in the connective tissue of other organs.

In later stages of the disease scar formation occurs. Such scarring results in deformity of the valves of the heart. bringing about interference with normal function. The mitral valve is most frequently involved, although the aortic valve is also commonly distorted. The tricuspid valve is rarely affected, while the pulmonary valve is almost never involved.

Treatment. — Until 1949 the usual treatment of rheumatic fever consisted of the use of salicylate drugs. There remained some difference of opinion as to whether these drugs have any specific effect on the rheumatic process. Adrenocorticotropic hormone (ACTH), cortisone and certain synthetic hormones related to cortisone have striking effects on rheumatic fever, but it is not clear whether use of these drugs prevents subsequent development of heart disease and has an advantage over salicylate treatment. Of cardinal importance in treatment is the complete eradication of any streptococcal infection, usually accomplished by large doses of penicillin.

Patients with active rheumatic fever are usually kept at bed rest for the duration of the active disease. In patients with severe cardiac failure, digitalis, mercurial diuretics, restriction of salt intake and oxygen are valuable. Adequate nutrition and good nursing care are important. The administration of prophylactic drugs (usually penicillin or sulfadiazine) has resulted in a considerable reduction in the rate of recurrences by preventing further streptococcal infection.

Surgical treatment is successfully used to relieve the narrowing of the openings of the valves of the heart. By 1958 some progress also had been made in correcting by surgical means the defect in closure of valves that occurs in rheumatic heart disease. *See* also HEART AND LUNG, SURGERY OF.

Public Health Aspects. — Rheumatic fever frequently occurs in more than one member of a family. apparently due to a hereditary susceptibility to the disease. It has been found in many parts of the world in representatives of all races. In the United States (as measured by mortality statistics) it is commoner in the northern half of the country. the highest rates occurring in the middle Atlantic and mountain states. The observed rates cannot be correlated simply with latitude, average temperature, altitude or rainfall. The disease is not confined to any socioeconomic group, but studies indicate high mortality in low-income groups.

Rheumatic fever became one of the leading causes of death of children in the U.S. as death rates from infectious diseases declined with improved measures for prevention and treatment. It is difficult to estimate the true incidence because of difficulties in diagnosis and poor reporting. but there was evidence of a decline in the death rate of children from rheumatic fever and rheumatic heart disease between 1920 and 1955.

Because of the frequently long duration of rheumatic fever, few families are able to meet the financial burden; the disease thus became an important public problem. In some large cities special hospitals are maintained for the care of children with rheumatic fever and rheumatic heart disease.

One of the earliest community attempts to meet the problem was the London County council's Rheumatism scheme, which provided for both hospital care and a follow-up program for all children with rheumatic fever. The financial difficulties in the care of rheumatic fever in Great Britain were overcome by the National Health Insurance scheme.

In the United States special programs for the care of children with rheumatic fever were developed after 1939 under the Social Security act. These programs were operated on a state basis with funds provided jointly by the states and the children's bureau of the department of health. education and welfare. By 1951, 23 states. Alaska. the District of Columbia and Hawaii had such programs. The nature of the services and of their administration varied from state to state. The American Council on Rheumatic Fever, organized in 1944 under the American Heart association, promoted public and private programs for care, research and edu-

cation. Under the National Heart act of 1948 the National Heart institute of the United States public health service began to conduct research on heart disease, including rheumatic fever. Through a program of grants-in-aid the Heart institute also supported research, training, demonstration programs and community programs for the control of rheumatic fever. Many local communities also developed programs for the control of this disease. (A. DOR.)

RHEUMATISM, a general descriptive term meaning discomfort, pain and stiffness in or around muscles and joints. It may be the result of injury, such as strain, or of the inflammatory or degenerative processes affecting the joints or ligaments, the muscles or nerves. More specifically it may refer to rheumatic fever, forms of arthritis and a variety of conditions designated by a descriptive adjective such as articular rheumatism, muscular rheumatism. etc. *See* ARTHRITIS; RHEUMATIC FEVER. (F. L. A.)

RHEUMATOID ARTHRITIS: *see* ARTHRITIS.

RHEYDT, a town in North Rhine-Westphalia, German Federal Republic, situated on the Niers, 19 mi. W. of Diisseldorf, on the main line of railway to Aachen, and at the junction of lines to Crefeld and Stolberg. Pop. (1959 est.) 94,610. Rheydt is an ancient place, but its industrial importance is of recent growth, and it only received municipal rights in 1856.

The principal products of Rheydt's numerous factories are silk, cotton, woollen and mixed fabrics, velvet, iron goods, machinery, shoes, cables, soap and cigars. It was frequently bombed in World War II.

RHIANUS, Greek poet and grammarian, a native of Crete, friend and contemporary of Eratosthenes (275–195 B.c.). Suidas says he was at first a slave and overseer of a palaestra but obtained a good education later in life and devoted himself to grammatical studies, probably in Alexandria. Of his works none has been preserved except 11 epigrams. But he was chiefly known as a writer of epics, the most celebrated of which was the *Messeniaca* in six books, dealing with the second Messenian war and the exploits of Aristomenes.

Other similar poems were the *Achaica, Eliaca, Thessalica* and *Heracleia.*

Fragments in *A.* Meineke, *Analecta Alexandrina* (1843); for Rhianus' work in connection with Homer, *see* C. Mayhoff, *De Rhiani Studiis Homericis* (Dresden, **1870);** also W. Christ, *Geschichte der griechischen Literatur* (1898).

RHIGAS, CONSTANTINE, known as Rhigas of Velestinos (Pherae), or Rhigas Pheraios (1760–1798), Greek patriot and poet. was born at Velestinos. and was educated at Zagora and at Constantinople, where he became secretary to Alexander Ypsilanti. In 1786 he entered the service of Nicholas Mavrogenes. hospodar of Wallachia, at Bucharest, and when war broke out between Turkey and Russia in 1787 he was inspector of the troops at Craiova. Rhigas later became interpreter at the French consulate at Bucharest, where he wrote the famous Greek version of the *Marseillaise,* well known in Lord Byron's paraphrase as "sons of the Greeks, arise." He founded the Hetairia, a society formed to organize Greek patriotic sentiment and to provide the Greeks with arms and money. Believing that the influence of the French Revolution would spread to the near east, he went to Vienna to organize a revolutionary movement among the exiled Greeks and their foreign supporters in 1793, or possibly earlier. There he founded a Greek press, but his chief contribution was the Collection of national songs which, passed from hand to hand in manuscript, roused patriotic sentiment throughout Greece. They were printed posthumously in 1814.

While at Vienna Rhigas communicated with Napoleon Bonaparte. to whom he sent a snuffbox made of the root of a laurel tree taken from the temple of Apollo, and eventually he set out with a view to meeting the general of the army of Italy in Venice. But before leaving Vienna he forwarded papers, among which is said to have been his correspondence with Napoleon, to a compatriot at Istria. The papers fell into the hands of the Austrian government, and Rhigas was arrested at Trieste and handed over with his accomplices to the Turkish authorities at Belgrade. Immediately on arrest he attempted suicide. His five companions were secretly drowned, but Rhigas himself offered such violent resistance that he was shot by two Turkish soldiers. Rhigas, who wrote in the popular dialect instead of in classical Greek, has been credited with arousing the patriotic fervour of his contemporaries, and his poems were a serious factor in the awakening of modem Greece.

See Rizos Néroñlos, *Histoire de* la *révolution grecque* (Paris, **1829);** I. C. Bolanachi, *Hommes illustres de la Grèce moderne* (Paris, **1875);** and Mrs. E. M. Edmonds, *Rhigas Pheraios* (London, **1890).**

RHINE, the most important river in Europe, both historically and commercially, has a course more than 820 mi. in length and drains an area of 76,000 sq.mi. It rises in Switzerland and later follows the Swiss-Austrian. Swiss-German and Franco-German frontiers before crossing. first northwestern Germany and then the Netherlands, to reach the North sea. Its valley has long formed part of the main highways from the North sea to the Mediterranean, across the Alps, and to the Black sea, by way of the Danube. It has always been a zone of contact between central and western Europe.

Course.—From their sources in the Glarus and Adula Alps the two main headstreams, the Vorder Rhein and Hinter Rhein, flow northeastward and unite near Chur (Coire). The river here is a typical alpine torrent, flowing rapidly in a deep, narrow valley and fed mainly by melting snow and ice on the mountains. From Lake Constance to Basle the High Rhine flows westward but still keeps its alpine character, dropping from 1,200 ft. to 800 ft. above sea level. The falls or rapids at Schaffhausen are used to develop electrical power. Midway in this section of its course it is joined by the Aar, bringing the drainage of the northern Alps and the Swiss plateau.

At Basle the river turns abruptly north again and enters the Upper Rhine valley, a tectonic depression formed in late Tertiary times and usually referred to as the Rhine rift valley or *Graben.* This depression is 25 mi. wide and extends northward for 180 mi. between the Vosges and Hardt mountains on the west and the Black Forest and Odenwald on the east. The level of the river falls about 550 ft. between Basle and Bingen. For much of the way it shares the wide valley floor with its left bank tributary, the Ill. Some of the many meanders in this part of its course have been cut across to ease navigation to Strasbourg. For 120 mi.. to near Lauterbourg, the main stream forms the boundary between France and Germany. The Neckar and the Main, both right bank tributaries. join the Rhine at Mannheim and Mainz respectively.

The Rift valley is blocked at its northern end by the Taunus range causing the river to turn westward to Bingen and enter the 80 mi. gorge characteristic of the Middle Rhine as it crosses the Rhenish plateaus. From Bingen to Bonn the river is deep and narrow, sometimes occupying the whole width of the valley, and is dominated by many castles. Channels were blasted through the rapids at Bingen to facilitate navigation. Near Coblenz the valley widens for a short distance where the Moselle and Lahn enter, the former with its tributary the Saar draining the area between the Vosges and the Xrdennes.

The Lower Rhine begins at Bonn where it enters the Cologne "gulf" and starts its course over the deltaic deposits laid down by the ancient Rhine and Maas (Meuse). Wide terraces cut in the sands and gravels mark former river levels before the marshy flood plain of the modern river is reached at Emmerich and diking becomes necessary. Throughout this section it is a wide sluggish stream. Below Cologne it receives as right bank tributaries the Ruhr and the Lippe flowing across the great industrial region of Westphalia. After the river turns west into the Netherlands it soon breaks up into two main arms of which the Waal carries about two-thirds and the Lek about one-third of its volume. The Maas (Meuse) and Waal waters mingle in the many deltaic channels and finally reach the sea by the Hollandschdiep.

The Regime.—The flow of the Rhine is remarkably regular throughout much of its course. As far downstream as Strasbourg it carries only alpine waters and the range of levels is very high. Both the alpine Rhine and the Aar are fed mainly from the snows and glaciers. Their flow is therefore at a minimum in January but reaches flood heights in June and July when the vigorous melting

is often supplemented by heavy rainstorms. At Basle the mean flow of 35,000 cusec. in January may reach 160,000 cusec. in July. The change is very apparent in the Rift valley uhere the river in winter shrinks to shallow channels through gravel banks all covered in summer. With the entry of the Neckar the regime changes. Melted snow still provides a large proportion of the river waters but, as altitudes are lower and generally continue to decrease northward, this supply is received much earlier in the year. On the Neckar and Main levels are highest in March and lowest from June to September, on the Moselle highest in January and lowest in August. All the middle and lower basins receive more rain than snow water. In this way the unbalance upstream is corrected in the middle course and the lower river has a regular flow. Minor difficulties for navigation are created for short periods from time to time in exceptional seasons. Thus a dry summer may lead to abnormally low levels in autumn and persistent heavy rains on the Rhenish plateaus may cause flooding in the diked country. Freezing occurs on slack water in most winters (at Cologne for an average period of 20 days per year) and may halt river traffic. If the frost has been long and severe, blocking of the river bridges by ice cakes may occur in the thaw period.

Navigation.—Trade from the Netherlands to the Alps has followed the Rhine since prehistoric times. By the early middle ages it mas already the scene of a flourishing civilization based on trade. mineral wealth and agriculture. In the 15th century its valley was the most important route in all western Europe. Besides draining nearly a quarter of the area of Germany it also serves Austria, Switzerland, eastern France and the Netherlands as an outlet to the North sea. Before 1939 Rotterdam handled one-fifth of Germany's overseas trade and practically all these imports and exports arrived at or left the port along the Rhine waterway.

Between the Sniss and Dutch frontiers the main river alone provides 440 mi. of navigable waterway and another 110 mi in Netherlands territory. Its tributaries, the Lippe. Ruhr, Lahn, Moselle. Main and Neckar, all have navigable stretches, some of them of considerable length and capable of carrying barge loads of about 1,000 tons. Seagoing ships pass regularly to Cologne and barge trains of 5,000 tons reach Mannheim. Strasbourg, the real head of navigation, receives barges of up to 2.000 tons. By an artificial channel 600-ton barges can reach Basle at certain times of the year.

The area from which river cargoes are drawn has been considerably extended by the construction of canals linking the Rhine with neighbouring river systems. Thus the Marne-Rhine canal makes possible aater transport from Paris and. by branch canals, from the Lorraine ore fields and the Saar basin. The Rhône-Rhine canal gives connection to southern France and Marseilles through the Belfort gap. Through traffic to the Danube is not possible as the Ludwigskanal became obsolete A new canal route up the Main and then to Regensburg was under construction in the mid-1950s. The Dortmund-Ems canal. though not suitable for the modern large barges gives an alternative route from the Ruhr to the North sea and links with the Mittelland canal, thereby giving a waterway to the Elbe and the east German rivers.

All the Rhine lands thus form a single economic unit with interdependent parts—western Germany. eastern France and the Low Countries. The Rhine with its navigable tributaries, the connecting canals and the railways folloning their valleys, provides the links which bind them together. On the east and nest flanks of the river are the greatest industrial areas of Europe based on Lorraine iron ore and Ruhr coal respectively. Before 1939 over 40,000,000 tons of shipping crossed the Dutch frontier each year. To serve this heavy traffic harbour accommodation was provided at several points and these are all rapidly recovering their former importance. The river is of course especially suitable for the carriage of bulky cargoes. Duisburg handles one-third of all the water-borne traffic of Germany, importing ore, grain and oil products and dispatching coal both up and down stream. It has separate basins equipped to handle each of these types of cargo. Mannheim-Ludwigshafen ranks second among Rhine ports, dealing aith coal for southwestern Germany as well as for its onn chemical and other industries With Strasbourg, which mainly serves the French side of the river, it shares in the landing of coal and grain for Switzerland. Mainz deals with traffic along the Main to Frankfurt-on-Main and Bamberg, while Basle collects and distributes Swiss cargoes. Down-river cargoes are relatively light—mainly timber, potash and iron ore.

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RHINELAND, THE. Before Prussia's dissolution the word "Rhineland" was used to designate the Prussian province of *Rheinprovinz* as well as parts of the Prussian province of Hesse-Nassau, parts of Hesse, the Bavarian Palatinate and most of Baden.

The old Rhenish territory north of Lorraine had been annexed by France in 1801, but after the fall of Napoleon the Congress of Vienna transferred it to Prussia and Bavaria. In 1866 Napoleon III vainly tried to recover the Rhineland by diplomatic bargaining with Bismarck. After the defeat of Germany in 1918, French policy aimed at detaching the left bank of the Rhine from Germany, with the object of protecting itself against a new German attack; but since the region is German in nationality and tradition this was opposed by Great Britain and the United States, and France had to accept a compromise: (1) the left bank remained German; (2) it was to be occupied, together with the bridgeheads, by Allied troops in three zones, the northern zone (Cologne) to be evacuated after 5 years, the middle (Coblenz) after 10, the southern (Mainz) after 15 years, if Germany faithfully carried out the conditions of the peace (Art. 428–29 of the Treaty of Versailles); (3) the left bank of the Rhine and a strip of 50 km. on the right bank was to be completely and permanently demilitarized (Art. 42–44). The occupation was intended to provide both guarantees for the execution of the treaty and security to France against military aggression.

By a separate Rhineland agreement an interallied commission was established, composed of representatives of Belgium, France, Great Britain and the United States, with the right to issue ordinances for the security of the Allied forces. It was not to interfere with the German civil administration, but to erect a customs barrier in order to safeguard the economic interests of the population (Art. 270). Considerable friction developed between the commission, presided over by Paul Tirard. a Frenchman. and the Germans, particularly over the use of Negro soldiers by the French as part of their occupying troops. After the United States failed to ratify the Treaty of Versailles and made a separate peace with Germany (1921), the American troops were withdrawn from Coblenz, and that area was taken over by the French.

France accepted the compromise about the Rhineland because both Great Britain and the United States, simultaneously with the Treaty of Versailles, signed treaties of alliance with France, by which they bound themselves to come to the aid of France "in the event of any unprovoked movement of aggression against her being made by Germany." When these treaties were not ratified by the British and U.S. governments, France felt that she had been victimized, that she had lost the real fruits of victory; subsequent events were to prove the correctness of this view.

As soon as it became clear that the left bank of the Rhine would not be separated from Germany, the French military authorities began to foster separatist movements in the region An old-established anti-Prussian prejudice of the Catholic population of the Rhine province had been intensified by a fear of the spread of bolshevism, and a genuine movement for decentralization arose, which demanded the creation of a Rhineland state within the German republic. The head of this movement, Dr. Hans Dorten, entered into negotiations with General Charles-Marie Mangin, which killed the movement so far as the Germans were concerned, and since the American authorities would not cooperate, the plan collapsed.

The occupation of the Ruhr (*q.v.*) in 1923 by France and Belgium gave new life to the separatist movement. The first

manifestation was a rising in Diisseldorf on Sept. 30, which was suppressed by local authorities. Then came the proclamation on Oct. 21 of a "Rhineland republic" at Aachen (Aix-la-Chapelle). in the Belgian zone; this lasted until Nov. 2, when the Belgian government, under British pressure, disavowed the enterprise. Simultaneously, Dorten and one Matthes organized a *Putsch* at Bonn, Coblenz, Wiesbaden and Mainz, their followers being transported by the Franco-Belgian railway administration. When the two leaders quarreled, their regime collapsed, early in 1924.

More serious was the movement in the Bavarian Palatinate, where it was fathered by General de Metz. On Oct. 25, he declared that the Palatinate had ceased to be part of Bavaria, and the separatists seized the government and ejected about 19,000 German officials. The population retaliated and there was a kind of civil war. in which the separatists fared badly, 15 of them being massacred at Pirmasens.

In 1924 the new French government, under Edouard Herriot, agreed to the Dawes plan *(see* REPARATIONS) for the settlement of the reparation question and to the evacuation of the Ruhr. Germany thereupon looked forward to the evacuation of the northern zone of the Rhineland on Jan. 10. 1925. The Allied governments, however, were convinced that Germany had not carried out her obligations to disarm and postponed the evacuation until the terms of the treaty had been complied with. In order to facilitate the negotiations for evacuation and to prevent another occupation of the Ruhr, the German foreign minister, Gustav Stresemann, on Feb. 9, 1925, suggested to France a pact between the powers interested in the Rhineland which should provide a mutual guarantee of existing frontiers. The French government accepted the proposals, which were extended to include eastern Europe as well as the Rhineland, and after long negotiations between Germany, Great Britain, France, Italy, Belgium, Poland and Czechoslovakia, the Treaty of Locarno *(see* LOCARNO, PACT OF) was concluded on Oct. 16 and signed in London on Dec. 1, 1925. Reassured by the feeling of security thus created and mollified by Germany's willingness to carry out her disarmament as prescribed by the interallied commission, France now agreed to the evacuation of the northern zone.

For the next few years, Germany continually pressed for complete evacuation of the Rhineland on the ground that she was a member of the League of Nations and had fulfilled her obligations, except as regards reparation, which was the subject of another agreement (the Dawes plan); or at least for a reduction of the Allied garrisons (for the upkeep of which Germany had to pay). Shortly after Germany entered the league. Stresemann and Aristide Briand. the French foreign minister, tried, at Thoiry, to reach an understanding about reparation and the whole economic relationship between France and Germany; but nothing practical resulted, partly because Stresemann shortly afterward raised the question of "war guilt" and aroused fears in France that Germany intended to repudiate the Versailles treaty. By the time, however, that the Young committee met to revise the Dawes plan, it was generally understood that if a satisfactory financial agreement could be reached, evacuation of the Rhineland would be conceded as part of a general settlement with Germany. At the Hague conference in Aug.–Sept. 1929, the French delegates endeavoured to postpone evacuation until Germany had accepted the Young plan and to establish some kind of control in the Rhineland for making sure that the region remained demilitarized; but the new Labour government in England and the Belgian government announced their intentions to withdraw their troops before the end of the year, and France was again compelled to compromise. The British and Belgian troops were withdrawn before the end of 1929, the Young plan became effective on May 17, 1930, and on June 30 the last Allied troops left the Rhineland. The president of the Rhineland high commission, Tirard, prophetically declared: "All that remains on the Rhine is the word which Germany has given. The future depends on how that word is kept." It was significant of the future that in the November elections for the *Reichstag,* 113 Nazis were chosen, whereas they had secured only seven seats in the previous election, for the Allies had surrendered all means of pressure.

Whatever trust France may have had in Germany was shattered by the abortive attempt in 1931 to establish an Austro-German customs union. After the true character of the Nazi revolution of 1933 had begun to manifest itself, France in 1935 concluded a five-year pact of mutual guarantee with the Soviet Union. The German government protested against this pact, declaring that it was inconsistent with the Treaty of Locarno (but refusing to submit the question to arbitration, as proposed by France). Inasmuch, however, as the German foreign minister assured the British government that Germany continued to recognize the Locarno agreements the French government decided to ratify the treaty with the Soviet Union. The chamber of deputies acted on Feb. 27, 1936, but on March 7 the senate was still considering the matter.

On that day Hitler, in a speech to the *Reichstag,* repudiated the Rhineland clauses of the Treaty of Versailles and the whole of the Locarno settlement and announced the entry of German troops into the demilitarized zone, where they were uproariously received. At the same time, he declared that Germany was ready to conclude a 25-year pact of nonaggression with France and Belgium, re-enter the League of Nations, negotiate an agreement concerning disarmament and undertake a project for a Franco-German demilitarized frontier zone to be guaranteed by Great Britain and Italy.

The German action was a flagrant violation of both Versailles and Locarno, and a few years before France would certainly have sent its troops into the Rhineland. In March 1936 the French general staff, overestimating the number of German troops (35,000) and not knowing (so it is said) that Hitler had ordered his troops to withdraw if the French marched in, refused to take action unless there was a partial mobilization of the French army; the cabinet refused to sanction this, perhaps because of the cost, and only a few specialized units were moved up to the Maginot line. The French government merely asked the League of Nations and the Locarno powers to take cognizance of the situation.

The British government made clear that it would not take positive action; British public opinion regarded the Rhineland as German territory which German troops might properly enter and refused to comprehend the political or military consequences of Hitler's action. Belgium was weak and helpless. Italy was at war in Africa and secretly approved the German course. Only Poland and Czechoslovakia, among the Locarno powers, were ready to stand by France. The council of the League of Nations and the Locarno powers recorded Germany's violations of its agreements, but. since Hitler offered to make a new agreement, tried to set up a "second Locarno." Negotiations went on for several months but led to nothing.

Germany re-established its position in the Rhineland without assuming any new obligations, and soon recovered military ascendancy on the continent. The failure of Britain and France to use force against Germany on this issue proved to be a turning point, for in 1938, at the time of the Sudeten crisis, the western powers did not feel strong enough to challenge Germany on the Rhine and had to accept Hitler's terms at Munich.

The Rhineland was heavily damaged during World War II. After the conclusion of hostilities, it was occupied by British, French and U.S. troops. Thus for a second time the Rhineland was divided among three political jurisdictions until the establishment of the west German government in 1949.

After the war the northern part of the region was incorporated in the *Land* of North Rhine-Westphalia and the southern part in that of Rhineland-Palatinate (*q.v.*).

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RHINELAND-PALATINATE (RHEINLAND-PFALZ), a

Land of the German Federal Republic, constituted in 1946 from the southern part of the Prussian Rhine province, the Bavarian Palatinate and part of Rhine-Hesse and of Hesse-Nassau. It is bounded north and northeast by North Rhine-Westphalia, east by Hesse and Baden-Württemberg and west and south by the Saarland and France. Area 7,656 sq.mi. Pop. (1950) 3,004,752; (1960 est.) 3,393,100. The country forms part of the Rhine massif, which here rises to the ridges of the Taunus and Westerwald. east of the Rhine, and west of the river to the Hunsriick and the bare and harsh Eifel plateau. These highlands are separated by the gorges of the Rhine, Mosel and Lahn. The Rhine constitutes the eastern border of the country for much of the way. The Mosel cuts across from west to northeast. Except for Hesse, Rhineland-Palatinate is the most wooded of all the Lander.

History. — Because it first became a political unit after World War II, Rhineland-Palatinate has no historical coherence, except in so far as this is contributed by the Rhine. The earlier history of the south and east may be followed in HESSE and PALATINATE. The largest component of the country was formerly part of the Prussian Rhine province, which stretched from the Hunsriick in the south to the Dutch frontier in the north and had an area (excluding the Saarland) of 9,451 sq.mi. Its capital was Koblenz.

The Rhinelands were of great importance from earliest times. and the valley was a land route before the river was used. The Rhine was, broadly speaking, the frontier of the Roman empire. After its decline the Franks settled on both sides of the river in the north and the Alemanni in the south, the dividing line being near Mainz. The later Rhine province was, in fact, an area of Frankish settlement. When the Carolingian empire was divided in 843 between Louis the German and Lothair, the Rhinelands were divided also, but almost all of those which were later to come to the Rhine province fell to the kingdom of Lothair. Further 9th-century agreements (see GERMANY) united the Rhinelands in the German kingdom. The Rhine was the centre of medieval German culture: some of the great universities were there and at Mainz Johann Gutenberg printed his first books. From the early middle ages the three archbishops of Cologne, Trier and Mainz possessed great strips of territory along the river and their power only ended with the secularization of the archbishoprics under Napoleon.

To make the Rhine the French frontier was traditional French policy at least from the time of Cardinal Richelieu, and the Rhinelands were a constant field of conflict in the 17th and 18th centuries. France's acquisitions on the left bank of the Rhine (treaty of Campo Formio, 1797) and the Confederation of the Rhine, which Napoleon set up east of the river, only lasted until 1815. At the Congress of Vienna Prussia mas given the whole of the Rhinelands on both sides of the river from the Dutch frontier to the Mosel, and west of the river beyond the Mosel to the Nahe. Out of these territories — the duchies of Gelderland, Jiilich. Cleves. Berg. the ecclesiastical principalities of Trier and Cologne, the free cities of Aachen and Cologne and nearly roo small lordships and abbeys — were formed the two provinces of Cleves-Berg and Lower Rhine. These were united in gne Rhine province in 1824. In 1834 the principality of Lichtenberg and in 1866 Meisenheim, both on the border of the Bavarian Palatinate, were added.

The Rhinelands mere occupied territory after World War I (see RHINELAND. THE). When at the end of World War II Prussia was abolished, the Rhineland province was divided between the new *Länder* of North Rhine-Westphalia and Rhineland-Palatinate.

Administration and Population. — The *Land* is divided into five administrative divisions. Koblenz. Trier, Montabaur, Rhinehesse and Palatinate. There were in 1960 seven towns with a population of over 50,000: Ludwigshafen (161,922); Mainz, the capital (130,915); Kaiserslautern (88,162); Trier (85,192); Koblenz (97,493); Worms (59,646); and Pirmasens (53,422). In 1955 11.6% of the population came either from the German lands east of the Oder-Neisse line or from eastern Germany and east Berlin, a proportion considerably lower than that for the Federal Republic as a whole (22.2%). In 1950 57.7% of the people were Roman Catholic and 40.8% Protestant. According to the constitution primary schools in Rhineland-Palatinate are confessional (or at least have confessional religious instruction) as are the five teachers' training colleges. Establishments for higher education include the Johann Gutenberg university at Mainz and a technical college for administration in Speyer.

Agriculture and Industry. — Forestry and farming are the staple occupations of the people. Much of the farming is arable, grain crops in particular (wheat, rye and oats) being grown, as well as potatoes, sugar beets, etc. The warmth of the river valleys allows tobacco to be grown; but far more important are the vineyards along the Rhine, and its west-bank tributaries Mosel, Nahe and the smaller rivers. In 1955 Rhineland-Palatinate had 69% of the whole area devoted to vines in the Federal Republic, and by far the greatest wine production per acre. Although it is primarily agricultural, industry plays no inconsiderable part in the economy. Ludwigshafen is a large internal port, and is especially important for chemical manufacture, as well as for metals, paper, etc. Among other industries are Pirmasens' boots and shoes and Kaiserslautern's sewing machines and bicycles. Tourists also bring in much revenue.

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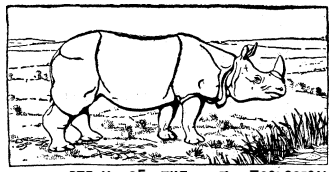
RHINE PROVINCE or RHINELAND: see RHINELAND-PALATINATE.

RHINOCEROS, the name for such perissodactyle mammals (see PERISSODACTYLA) as bear one or two median horns on the head, and for their extinct relatives. Rhinoceroses are large, massively built animals, with little intelligence and a bad temper. The horns, which are composed of modified hairs, are borne on the nose and are used as weapons. The animals are dull of sight, but their hearing and scent are very acute. They are vegetarian in diet and largely nocturnal. The skin is very thick and tough. In the Miocene and Pliocene, rhinoceroses inhabited both eastern and western hemispheres, but they are now restricted to tropical Africa and Asia. An interesting feature is that the horn appears to have been independently evolved in several separate groups of rhinoceroses. Living forms fall into four genera: (1) With a single nasal horn and the thick skin raised into folds on the shoulders and thighs. There are two species. The Indian rhinoceros (*Rhinoceros unicornis*), standing 5–5¾ ft. high at the shoulder, with a horn 1 ft. in length, is now confined to the Assam plain. The Javan rhinoceros (R. sondaicus) is smaller and in the female the horn is often absent. It inhabits Bengal, Burma, the Malay peninsula, Java, Sumatra and Borneo. It prefers hilly forests. (2) With a large nasal and a small frontal horn and the skin not thrown into folds. The only species is the Sumatran rhinoceros (Rhinoceros or Dicerorhinus *sumatrensis*), range as in the Javan species, except it does not extend into Java. It reaches a height of 4½ ft. and inhabits hilly forests. A form with hairy ears and skin is regarded as a local race. (3) With two horns, no skin folds and no lower incisors. This group is confined to Africa and comprises two species. The black rhinoceros (*Diceros bicornis*) is the smaller, weighing just over a ton, with a pointed, prehensile upper lip. It inhabits Africa south of Abyssinia, though in reduced and diminishing numbers, dwelling in the wooded, watered districts. (4) The white rhinoceros (*Ceratotherium simus*) is the largest living land mammal except the elephant and feeds largely on grass. It now inhabits only a reserve in Zululand and the Lado enclave on the Upper Nile. It may stand 5 ft. 8 in. at the shoulder and measure 15 ft. in length, but is very swift of foot. The flesh is said to be excellent to eat, especially in the autumn and winter.



BY COURTESY OF THE N.Y. ZOOLOGICAL SOCIETY

GREAT INDIAN RHINOCEROS (RHINOCEROS UNICORNIS)

The woolly rhinoceros (R. *antiquitatis*), which inhabited Europe, became extinct during the glacial epoch.

RHINTHON (c. 323–285 B.C.), Greek dramatist, son of a potter. He was probably a native of Syracuse and afterward settled at Tarentum. He invented the hilarotragoedia, a bur-

lesque of tragic subjects. He was the author of 38 plays, of which only a few titles (Amphitryon, Heracles, Orestes) and lines have been preserved chiefly by the grammarians, as illustrating dialectic Tarentine forms. The metre is iambic, in which the greatest licence is allowed. The *Amphitruo* of Plautus, although probably imitated from a different writer (Archippus of the Middle Comedy), may be taken as a specimen of the manner in which such subjects were treated. There is no doubt that the hilarotragoedia exercised considerable influence on Latin comedy, the *Rhinthonica* (*i.e.*, fabula) being mentioned by various authorities among other kinds of drama known to the Romans. Scenes from these travesties are probably represented in certain vase paintings from lower Italy, for which see H. Heydemann, "Die Phlyakendarstellungen auf bemalten Vasen," in Jahrbuch des *archäo*logischen *Instituts*, i (1886).

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RHIZOPODA, the name given by Felix Dujardin (pro *parte*, 1838) to a group of Sarcodine Protozoa. They are distinguished by their pseudopods, simple or branched, passing by nide bases into the general surface, never fine radial nor fusing into complex networks; skeleton absent or a simple shell ("test," "theca"), never (?) a calcareous shell, nor represented by a siliceous network, nor spicules. Reproduction is by binary fission; by division or abstriction of buds after the body has become multinucleate; or by the resolution of the body into numerous uninucleate zoospores (amoebulae or flagellulae) which may conjugate as gametes; plasmodium formation unknown; encystment (in "resting cysts" or "hypnocysts") common. Without a knowledge of the history it is impossible to distinguish a naked Lobose from the Amoebula (pseudopodiospore) of a Myxomycete or Proteomyxan. As to the name, Dujardin included the thecate Lobosa, the Filosa and the Reticularia or Foraminifera. For further particulars see PROTOZOA.

RHODE ISLAND, popularly known as "Little Rhody." is a North Atlantic state of the United States, belonging to the New England group. It is bounded north and east by Massachusetts, south by the Atlantic ocean and west by Connecticut. Rhode Island, official name "the State of Rhode Island and Providence Plantations" (see History, below), is the smallest state in the union, having an extreme length. north and south, of 44 mi.. an extreme width, east and west, of 35 mi. and a total area of 1.214 sq.mi., of which 156 sq.mi. are inland water area. The capital is at Providence (*q.v.*). Rhode Island was one of the original 13 states. Its state song is "Rhode Island" and the official state bird is the Rhode Island Red. The origin of the name has been variously traced to a corruption of the Dutch words for "red island," a name supposedly given to the island in Narragansett bay by the Dutch navigator Adriaen Block, and to the Florentine Giovanni da Verrazano, who is said to have called it after the Island of Rhodes.

PHYSICAL GEOGRAPHY

Physical Features. — Rhode Island lies between approximately 41° 9' and 42° 3' N. and 71° 8' and 71° 53' W. The region of which it is a part was at one time worn down to a gently rolling plain near sea level, but has since been uplifted and somewhat dissected by stream action. As a result the topography is characterized by low rounded hills but is nowhere mountainous. Since the uplift and stream dissection a slight depression has allowed the sea to invade the lower portions of the river valleys, forming bays such as Narragansett bay, Providence "river" and Sakonnet "river." Glaciation has disturbed the river systems.

The mean elevation for the entire state is 200 ft., the lowest portions occurring along the ocean and the shore of Narragansett bay. The upper bay region is composed of gently rolling lands, but about two-thirds of the state consists of higher ground nhich begins abruptly just west of Providence and rises toward the northwest where Jerimoth hill, 812 ft., is the highest point within the state. The coast line, including the shores of the bays and islands, is extensive; its western portion is only slightly indented, but its eastern portion is deeply indented by Narragansett bay, a body of water varying in width from 3 to 12 mi. and extending inland for about 28 mi. Within Narragansett bay are numerous islands characteristic of an area that has suffered comparatively recent depression, the largest being Rhode Island (or Aquidneck), Conanicut Island and Prudence Island. Of these the most important is Rhode Island, 15 mi. long and 3 mi. wide. Lying about 10 mi. off the coast and south of the central part of the state is Block Island.

The rivers are short and of no great volume, but they flow swiftly and are useful in supplying water for industry. The Providence river is really an arm of Narragansett bay, into which flow the waters of the Pawtuxet and Blackstone rivers. The latter stream has a fall of about 50 ft. at Pawtucket, and the Pawtuxet also has a number of falls along its course. Mount Hope bay is a northeastern arm of Narragansett bay and is also the estuary of the Taunton river. The Sakonnet river is a long bay separating Aquidneck or Rhode Island from the mainland on the east. The Pawcatuck river forms part of the boundary between Rhode Island and Connecticut.

Climate. — Rhode Island has a more moderate climate than that of the northern sections of New England. There are no great extremes of either heat or cold. Narragansett Pier has a mean annual temperature of 50° F., a mean summer temperature (for June, July and August) of 68° and a mean winter temperature (for December, January and February) of 30°. The mean annual temperature at Providence is 50.5°; the mean for the summer, 70.1°; and for the winter, 30.2' ; while the highest and lowest temperatures ever recorded are respectively 102° and −17°. The mean annual precipitation is about 38.68 in.

Soil.—As in most of New England, the soil in Rhode Island is for the most part sterile. Its quality improves, generally, from west to east. Almost half of the state is covered by an acidic sandy loam derived from the weathering of the underground rocks. Because of its rocky subsoil it drains very thoroughly, and in times of drought may become too dry even for pasturage. Very little of it has been cultivated and for the most part it supports a growth of stunted woodland. The best soil is found farther east on the rolling hills of the Narragansett basin: a firm, brown glacial type. Near Warwick and across the bay in East Providence a sandy loam, while loose and porous, occurs for the most part at low enough elevations to ensure sufficient moisture, and it has proved well suited to market gardening. About 8% of the state is covered by either a thin, coarse sandy soil supporting scrubby pine and grass or by swamp.

Vegetation. — The flora is surprisingly rich. About 60 species of trees are native to the state, among them ash, oak, birch, hickory, poplar, pine and maple. Where the long inlet of Narragansett bay moderates the climate more southerly species such as the tulip tree flourish, while northern types such as the paper birch and sugar maple are found in the northwest. The sand plains, rocks and tidal pools along the coast support a wide variety of seaweeds, ferns and mosses. The swamps have a particularly interesting flora, which includes the insectivorous sundew and pitcher plant and several kinds of orchids. Some of the most beautiful wildflowers occur in the wooded areas — among them violet, trillium, columbine, rhododendron and mountain laurel — and the meadows are often covered with daisies and wild carrots and, in the autumn, goldenrods and asters. Wild blackberries are abundant on the sandy soil in the western part of the state.

Animal **Life.--A** maritime state with a long and, for much of its length, protected coast line, Rhode Island boasts an extensive representation of marine invertebrates, among them the sea anemone, sea cucumber, jellyfish, several types of marine worms, crustaceans such as the barnacle, lobster and crab, and the squid, clam and oyster. The quahog, a highly-prized hard-shelled clam, is protected by law. Both the coastal waters and the inland ponds and streams contain a variety of fish. Cod, perch and alewives are common and sea bass, bluefish and swordfish are often caught off Block Island. Inland species include perch, bass, pickerel and trout. There are many types of turtles, salamanders and frogs and nearly 20 species of snakes. Rhode Island lies at the edge of the

migration route for a number of types of shore birds. In the uncultivated western portions of the state the blue jay, ruffed grouse, barred and screech owls live the year around, while the catbird, flicker and robin are common during the summer. The osprey is frequently seen in the vicinity of Touisset, and pheasants are abundant. especially in Newport county. A number of small mammals inhabit the woodlands, including foxes, rabbits, woodchucks and skunks.

State Parks and Historic Sites.—Approximately 17 state parks and beaches and 28 roadside groves are maintained by the division of parks and recreation of the state department of public works. Recreation facilities, both public and private, are liberally provided in the state, and Newport and Narragansett Pier in particular have long been noted as summer resorts.

Rhode Island's long and colourful history has left its cities and towns dotted mith monuments, buildings, ancient graveyards and other points of interest which vividly recall the past. The home of Gen. Nathanael Greene of American Revolution fame is located in Coventry and the birthplace of the painter Gilbert Stuart in North Kingstown. Bishop George Berkeley, the philosopher, lived at Whitehall in Middletown during his stay in the colony. The village of Wickford contains a number of well-preserved 18th-century houses, among them the Stephen Cooper house (1728) and the John Updike house(1 745). Other historic sites include the grave of Elizabeth Alden, daughter of John Alden and Priscilla Mullins, in Little Compton and Acote's hill in Gloucester which figured in Dorr's rebellion. *See* also NEWPORT; PROVIDENCE: *Historic Sites.*

HISTORY

Rhode Island was founded by refugees from Massachusetts who went there in search of religious and political freedom. The first settlements were made at Providence by Roger Williams (*q.v.*) in June 1636 and at Portsmouth on the island of Aquidneck by the Antinomians William Coddington (1601–78), John Clarke (1609–76) and Anne Hutchinson (1591-1643) in March–April 1638. Becoming dissatisfied with conditions at Portsmouth, Coddington and Clarke moved a few miles farther south in April 1639 and established a settlement at Newport. In a similar manner Warwick was founded in Jan. 1643 by seceders from Providence under the leadership of Samuel Gorton. The union of Portsmouth and Newport, March 12, 1640, mas followed by the consolidation of all four settlements, May 19, 1647, under a patent of March 14, 1644, issued by tht parliamentary board of commissioners for plantations. The particularistic sentiment was still strong, however, and in 1651 the union split into two confederations: one including the mainland towns, Providence and Warwick; and the other the island towns, Portsmouth and Newport. A reunion was effected in 1654 by Roger Williams and a charter secured from Charles II on July 8, 1663.

In the patent of 1644 the entire colony was called Providence Plantations. On March 13, 1644, the Portsmouth-Newport general court changed the name of the island from Aquidneck to the Isle of Rhodes or Rhode Island. The official designation for the province as a whole in the charter of 1663, therefore, was Rhode Island and Providence Plantations. The charter was suspended at the beginning of Sir Edmund Andros' regime in 1686, but was restored again after the revolution of 1689. The closing years of the 17th century were characterized by a gradual transition from agricultural to commercial activities. Newport became a centre of piracy, privateering and smuggling as well as legitimate commerce.

The passage of the Sugar act, April 5, 1764, and the steps taken by the British government to enforce the Navigation acts seriously affected Rhode Island's trade. On June 9, 1772, the "Gaspee," a British vessel sent to enforce the acts of trade and navigation, ran aground in Narragansett bay and was burned to the water's edge by a party of men from Providence. In 1776 Gen. William Howe sent a detachment of his army under Gen. Henry Clinton to seize Newport as a base of operations for reducing New England, and the city was occupied by the British on Dec. 8. To capture this British garrison, later increased to 6,000 men, a combined operation of about 10,000 men (mostly New England militia) under Maj. Gen. John Sullivan and a French fleet carrying 4,000 French regulars under Count d'Estaing, was planned in the summer of 1778. On Aug. 9 Sullivan crossed to the north end of the island of Rhode Island, but as the French were disembarking on Conanicut Island, Lord Howe arrived with the British fleet. D'Estaing hastily re-embarked his troops and sailed out to meet Howe. After two days of maneuvering the hostile fleets were dispersed by a severe storm. On the 20th D'Estaing returned to the port mith his fleet badly crippled, only to announce that he should sail to Boston to refit. The American officers protested in vain, and on the 30th the Americans, learning of the approach of Lord Howe's fleet with 5,000 troops under Clinton, decided to abandon the island. The British evacuated Newport, Oct. 25, 1779, and the French fleet was stationed there in 1780-81.

Rhode Island's association with the other colonies, particularly its New England neighbours, was characterized by individualistic tendencies. It had been one of the first colonies to advocate and to put into practice religious freedom. Throughout its early history, not only did it refuse to give up its independence by joining Massachusetts but, as noted, there was even some difficulty in keeping the colony itself united. Under the Articles of Confederation it was principally Rhode Island that defeated the proposal to authorize congress to levy an import duty of 5% to meet the debts of the central government. When the Constitutional Convention met in Philadelphia in 1787 the Rhode Island farmers and merchants, fearing that a more centralized system of government would interfere with their local privileges, 'refused to send delegates. Not until the federal government threatened to sever commercial relations between the United States and Rhode Island did the latter, in May 1790, ratify the new constitution, and then by only two votes.

At the end of the American Revolution, instead of providing itself with a new state constitution, Rhode Island continued to be governed under the charter of 1663. This charter and the franchise law of 1724 had established substantial equality of representation among the towns and also restricted the suffrage to freeholders and their eldest male heirs. Drastic changes were beginning to take place in the state's economy and population, however. Agriculture and commerce declined in relative importance as Rhode Island became one of the most completely industrialized among the states. The population, which had been increasing since 1800, began an accelerated expansion about 1840 and quadrupled between then and 1900. The bulk of this increase, which continued into the 20th century, was accounted for by successive waves of immigration, beginning with the Irish in the second quarter of the 19th century. The French Canadians arrived shortly after the Irish; the Italians around 1900; and numerous other national groups in the next two decades. In addition, the population shifted from approximately 20% urban and 80% rural in 1800 to nearly 90% urban in 1900.

Demands for a more equitable representation of the urban communities in the legislature and for an extension of the suffrage to nonproperty owners precipitated the first of a long series of struggles for constitutional reform, Dorr's rebellion of 1841–42. About 1840 Thomas W. Dorr (1805–54), a young Providence lawyer, began a systematic campaign for reform. A convention summoned without any authority from the legislature and elected on the principle of universal manhood suffrage met at Providence from Oct. 4 to Nov. 18, 1841, and drafted a document which came to be known as the People's constitution. A second convention met on the call of the legislature in Feb. 1842 and adopted the Freeman's constitution. On being submitted to popular vote (Dec. 27, 28 and 29, 1841) the former was ratified by a large majority; the latter was rejected (March 21, 22 and 23, 1842) by 676 votes. At an election held on April 18, 1842, Dorr was chosen governor. The supreme court of the state and Pres. John Tyler both refused to recognize the validity of the People's constitution, whereupon Dorr and a few of his more zealous adherents decided to organize a rebellion. They were easily repulsed in an attack upon the Providence town arsenal. Dorr, after a brief period of exile in Connecticut, was convicted of high treason, April 26, 1844, and sentenced to life imprisonment. He was released by act of the assembly in June 1845 and restored to the rights and privileges of citizenship in May 1851.

The Freeman's constitution, modified by another convention held at Newport and East Greenwich from Sept. 12 to Nov. 5, 1842, was finally adopted by popular vote, Nov. 21–23, 1842. Only a partial concession was made to the demand for reform. The suffrage was extended to nonfreeholders, but only to those of American birth, so that naturalized citizens could vote only if they held property. The charter legislature was replaced by one comprising a senate, to which each town was to send one representative, and a house of representatives of 72 members, apportioned by population. In the lower house, however, each town was to have at least one representative and no city or town more than one-sixth of the total, and the small towns were left in a dominant position.

After the American Civil War agitation for further reform was renewed. Under the leadership of Charles E. Gorman, himself naturalized, a prolonged campaign was waged to secure the same voting rights for naturalized as for native-born citizens. The constitution was finally amended in 1888 to eliminate all property restrictions but one: only property owners were allowed to vote for members of city councils. This limitation was finally removed in 1928.

It was not until 1909 that further change was made in the apportionment of legislative seats. In that year an amendment to the constitution increased the number of seats in the lower house to 100 and raised the allowable limit for any one city or town to one-quarter. The status of the senate was unchanged. Providence illustrates the inequities that remained in representation. With well over one-third of the state's population in 1910 and 1920, the city was entitled to only one-quarter of the house seats and to one seat in the senate. In 1928 a further change in legislative apportionment was made as a result of which Providence was able to return five senators and Pawtucket two, with the other cities and towns continuing to send one each.

Throughout most of its history Rhode Island has tended to cast its presidential vote for the more conservative party—the Federalists, then the Whigs and, folloning the American Civil War, the Republicans, until Alfred E. Smith carried the state in 1928. The Democrats continued to receive the state's electoral votes from 1932 through 1948. Rhode Island returned temporarily to the Republican fold in the presidential elections of 1952 and 1956, but voted Democratic again in 1960. National Republican allegiance was matched in its congressional representation as well as on the state level from the post-Civil War period until 1932 when it became predominantly Democratic.

An important result of Rhode Island's adherence first to the Republican party and then to the Democratic during their periods of national ascendancy was the prominence thus given to Rhode Island's representation in the councils of the nation—a prominence at times far out of proportion to its size and population. These long periods of one-party dominance made possible the building up of seniority in congress toward positions of national leadership. U.S. Sen. Nelson W. Aldrich (served 1881–1911), backed by a highly-disciplined Republican state organization under his lieutenant, the "blind boss" Gen. Charles R. Brayton, was one of the foremost architects of American tariff policy. Aldrich was so influential nationally that he came to be referred to as the "general manager of the United States." Democratic U.S. Sen. Theodore Francis Green. who was first elected in 1936 and served continuously until his retirement in 1960, rose to the chairmanship of the powerful senate foreign relations committee.

GOVERNMENT

The Freeman's constitution of 1842, frequently amended, remains the basic law of Rhode Island. Amendments must be passed by a majority of the legislature at two sessions and ratified by three-fifths of the voters.

Throughout much of the state's history the legislature possessed most of the governmental power. The governor did not even have the veto until 1909, and until 1935 he had little control over the administrative agencies of the state government or over appointments to these agencies. The members of the state supreme court were (and remained) removable by vote of the legislature. In 1935 Democratic Governor Green, acting with the first Democratic majority in both houses of the legislature in many years, brought about a complete reorganization of the state administration. Administrative control was centralized in the hands of the governor through the consolidation of approximately 80 independent boards and commissions into 11 departments whose heads were appointed by him. This reform, for the first time, made the governorship a full-time position and gave the governor, in effect, the major responsibility for state policy.

The executive officers of the state government are the governor, lieutenant governor, secretary of state, attorney general and general treasurer, each elected for two-year terms in even-numbered years. Each of the latter three is in charge of the department of state government corresponding to his title. Ten additional departments are responsible to the governor: executive, administration, education, social welfare, labour, public works, agriculture and conservation, health, business regulation and employment security. Two of the original 11 set up in 1935, finance and civil service, were combined in 1951 into the department of administration. The object of this merger was to bring together in one agency all the services needed to operate the other agencies of government, while at the same time keeping the total structure under the close control of the governor.

The legislative branch consists of a two-house general assembly made up of a 44-member senate, presided over by the lieutenant governor, and a 100-member house of representatives. The judicial branch is headed by a supreme court consisting of a chief justice and four associate justices, all elected by the legislature; a superior court with appellate jurisdiction and original jurisdiction in certain cases, consisting of a presiding justice and ten associate justices appointed by the governor with the consent of the senate; and 12 district courts.

Government at the local level is carried on by the 8 cities—Providence, Pawtucket, Cranston, Warwick, Woonsocket, East Providence. Newport and Central Falls (*qq.v.*)—and 31 towns into which the state is divided. The state is also divided into five counties, but the Rhode Island county is not a governmental unit as such, and it is the cities and towns which provide the usual services that are the normal responsibility of local government.

Finance.— Property taxes represent the primary source of revenue for the cities and towns. The major sources of income to the state government, in addition to federal grants, are a state sales tax and taxes on motor fuel, cigarettes and corporations. The post-World War II period saw rapidly increasing state expenditures and, hence, corresponding demands for more revenue. State expenditures almost trebled in the post-mid-century decade.

POPULATION

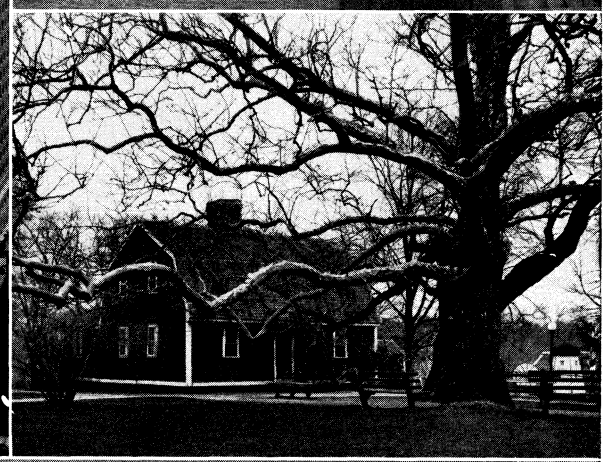
The population of Rhode Island in 1790 was 68,825; in 1840, 108,830; in 1880, 276,531; in 1910, 542,610; in 1950, 791,896; and in 1960, 859,488. The population per square mile in 1960 was 708 as compared with 652.3 in 1950 and with 49.6 for the U.S. in 1960.

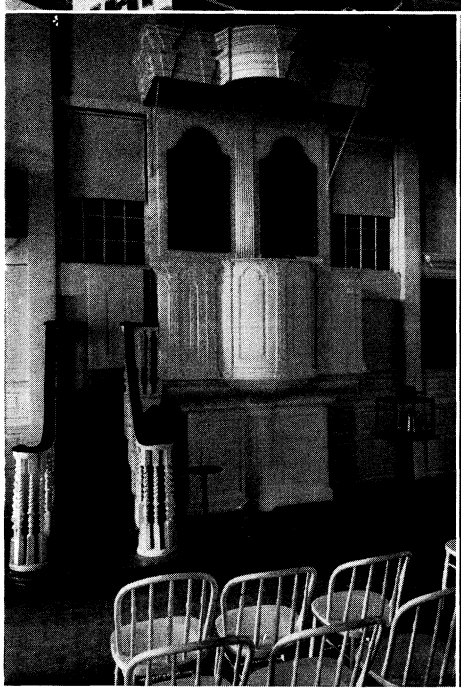
*Rhode Island: Places of 5,000 or More Population (1960 census)**

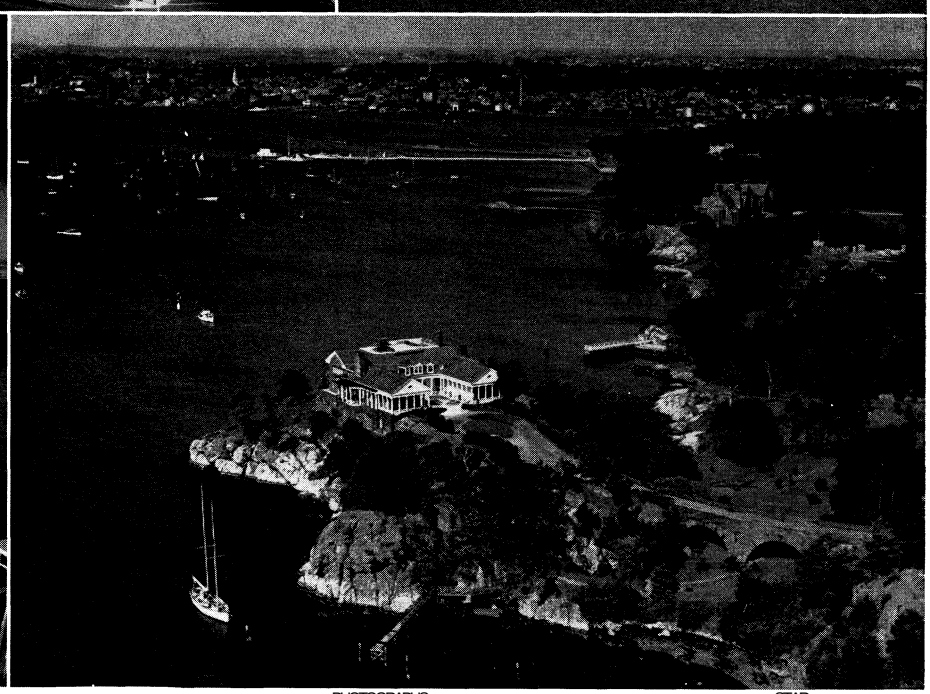
Place	Population				
	1960	1950	1940	1920	1900
Total state	859,488	791,896	713,346	607,397	428,556
Barrington†	13,826	8,246	6,231	3,897	1,135
Bristol†	14,570	12,320	11,159	11,375	6,901
Central Falls	19,858	23,550	25,248	24,174	18,167
Cranston	66,766	55,060	47,085	29,407	13,343
East Providence	41,955	35,871	32,165	21,793	12,138
Middletown†	12,675	7,382	3,379	2,094	1,457
Newport	47,049	37,564	30,532	30,255	22,034
North Providence†	18,220	13,927	12,156	7,697	3,016
Pawtucket	81,001	81,436	75,797	64,248	39,231
Providence	207,498	248,674	253,504	237,595	175,597
Wakefield-Peacedale	5,569	5,224	7,282‡	5,181‡	4,972‡
Warwick	68,504	43,028	28,757	13,481	21,316
Westerly	9,698	8,415	11,199	9,952	7,541
West Warwick†	21,414	19,096	18,188	15,461	—
Woonsocket	47,080	50,211	49,303	43,496	28,204

*Populations are reported as constituted at date of each census. †Town (township) population. ‡Population of South Kingston township in which Wakefield-Peacedale is located.

Note: Dash indicates place did not exist during reported census, or data not available.







BY COURTESY OF (TOP LEFT, CENTRE RIGHT, BOTTOM LEFT) RHODE ISLAND DEVELOPMENT COUNCIL: PHOTOGRAPHS, (TOP RIGHT) HERBERT LANKS FROM BLACK STAR, (BOTTOM RIGHT) JOHN T. HOPF

SCENES OF PROVIDENCE AND NEWPORT

Top left: The business section of Providence, dominated by the 26-story industrial Trust building

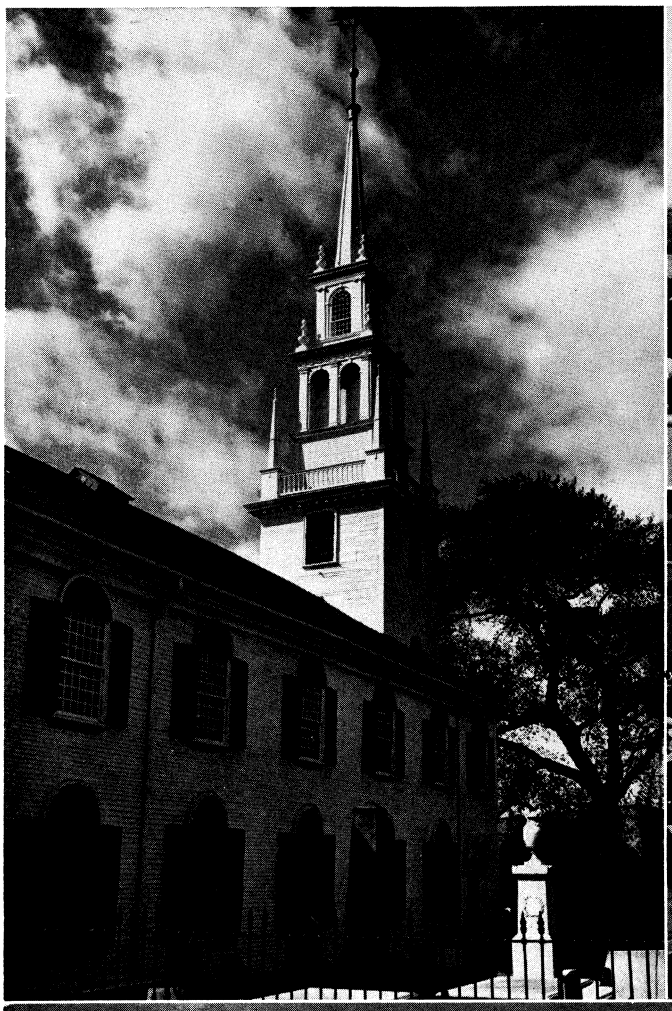
Top right: A monument to Count de Rochambeau overlooking Newport harbour. Rochambeau commanded the first French troops that arrived to aid the colonists in 1780

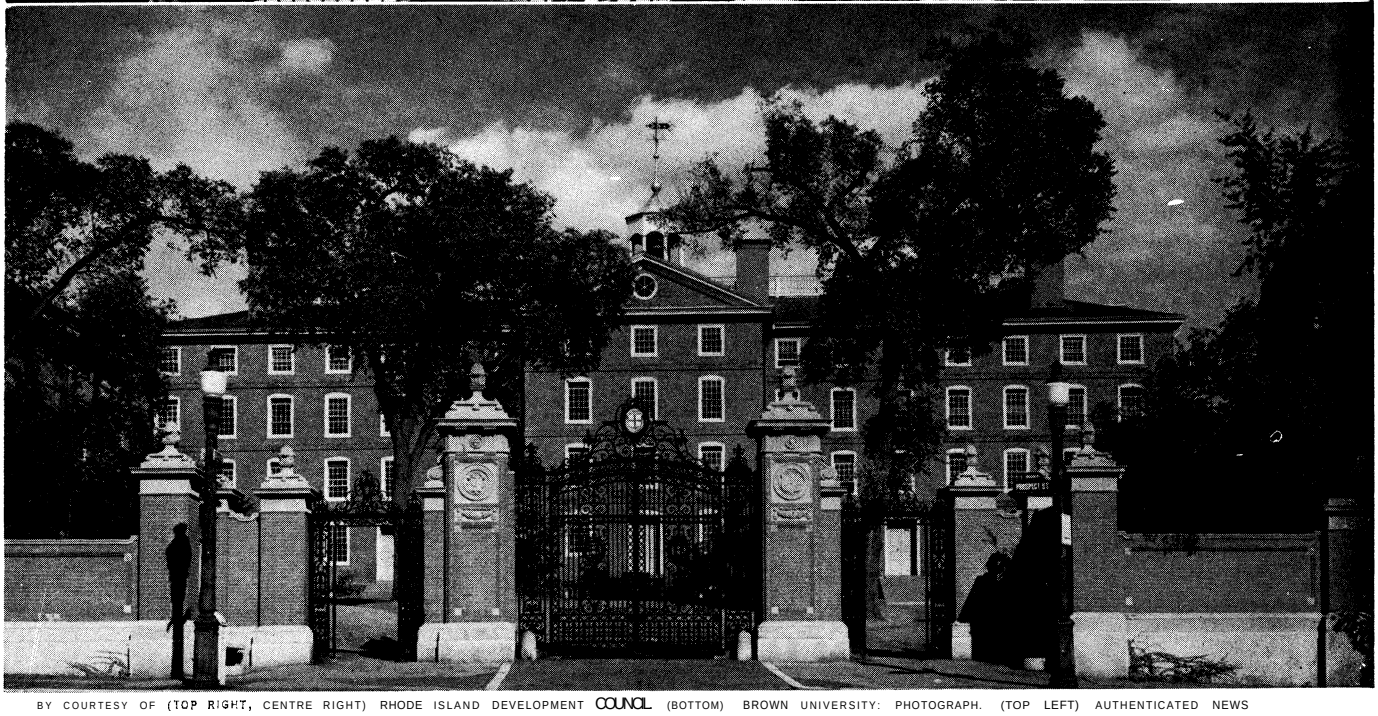
Centre right: Betsy Williams cottage, built in 1775, a museum in Roger Wiliiams oark, Providence

Bottom left: Seventh Day Baptist church, Newport, the oldest meeting-house of the sect in the world. It was built in 1729, and later was incorporated into the Newport Historical Society museum

Bottom right: Aerial view of Newuort harbour. In the foreground are summer mansions built in the late 19th century when Newport was a popular resort for wealthy Bostonians and New Yorkers

RHODE ISLAND





BY COURTESY OF (TOP RIGHT, CENTRE RIGHT) RHODE ISLAND DEVELOPMENT COUNCIL (BOTTOM) BROWN UNIVERSITY: PHOTOGRAPH. (TOP LEFT) AUTHENTICATED NEWS

SCENES IN RHODE ISLAND

Top left: Trinity church, built in 1725, is one of the earliest buildings of importance in Newport. It resembles the Old North church in Boston

Top right: Fishing boat unloading at the Municipal wharf. From a single wharf built in 1680, the port of Providence became the largest on the southern coast of New England

Centre right: Wickford's modern yacht basin with accommodations for more than 100 pleasure yachts

Bottom: University hall, the original college edifice of Brown university, Providence, erected in 1770

The two most important long-term trends in the state's population have been rapid urbanization and the great impact of immigration. The urban area of the state dropped from 91.6% in 1940 to 84.3% in 1950, partly because the census definition was changed to include the suburban fringe but excluded the outlying portions of several towns formerly classed as urban under a special rule. In 1960 the urban population was 752,054, or 87.5% of the total. The state contains a portion of the Providence-Pawtucket standard metropolitan statistical area. The area within Rhode Island had a population of 733,455 or 85.3% of the total population of the state in 1960.

As elsewhere in the United States, the post-World War II years in Rhode Island brought a movement to the suburbs. This meant a flow of population out of densely settled cities such as Providence and Central Falls to residential cities and towns nearer the fringe of the urbanized areas such as Cranston, Warwick and Barrington. For example, the population of Providence fell from 253,504 in 1940 to 248,674 in 1950 and 207,498 in 1960. Warwick, on the other hand, went from 28,757 in 1940 to 43,028 in 1950 and 68,504 in 1960.

The foreign-born white population in 1880 was 73,831, or 26.7% of the total. The number of foreign born in the population reached its peak in 1910 when 178,025, or 32.8% of the total, were listed in this category. Both the number and percentage decreased from then on. In 1950, out of a total population of 791,896 the state had 538.124 inhabitants 21 years of age and older. Of these latter 425,657 were native-born citizens, 88,352 naturalized citizens and 17,810 were aliens (leaving 6,305 unaccounted for). The total population in 1950 comprised 663,751 native white, 113,264 foreign-born white and 14,881 nonwhite, practically all Negro. Of the foreign-born white population, 24,380 were born in Italy, 19,163 were French Canadian and 14.273 were born in England or Wales, with smaller groups of Irish, non-French Canadian, Portuguese, Russian, Polish and other backgrounds.

There were 97.3 males per 100 females in 1950; 8.9% of the population was 65 years of age and older; and 56% of the population 14 years of age and older was in the labour force. Of the total number of employed males, 2.1% was engaged in agriculture, 8.2% in construction, 41.3% in manufacturing and 25.8% in transportation and trade.

EDUCATION

The public-school system was established in 1800, abolished in 1803 and re-established in 1828. A state board of education (provided for in a 1951 act of the general assembly) exercises policy-making power over educational programs in the state and controls the state department of education. A commissioner of education is responsible for the administration of the department's functions under the jurisdiction of the board. Each city and town has a school committee elected by the people and independent of the town or city council.. State contributions to the support of public education in the various cities and towns reached about $8,500,000 annually in the early 1960s.

School attendance is compulsory between the ages of 7 and 16. The total public-school enrollment was approximately 125,000 in the early 1960s; about 46,000 were enrolled in private schools.

The institutions of higher education supported by the state are the University of Rhode Island at Kingston and Rhode Island College at Providence. The University of Rhode Island. a land-grant institution, was chartered in 1892 as Rhode Island College of Agriculture and Mechanic Arts. The name was changed to Rhode Island State college in 1909 and the institution became a university in 1951. It includes colleges of arts and sciences, agriculture, business administration, engineering, home economics and pharmacy and a school of nursing. The division of university extension is located at Providence. The university maintains a computation laboratory and the Narragansett marine laboratory. There is a student-operated radio station which broadcasts to the campus. A number of institutes and workshops are offered during the summer. including, among other subjects, reading and language arts, church music and elementary-school science. Also a part of the summer program is a high-school music camp. In the early 1960s the enrollment totaled approximately 2,800 full- and part-time students and there were almost 300 faculty members.

The Rhode Island College of Education mas established in 1920 as the successor of the Rhode Island Normal school which opened in 1854; the name was changed to Rhode Island college in 1960. The oldest institution of higher learning in the state is Brown university at Providence, chartered in 1764 as Rhode Island college (see also PROVIDENCE). Other colleges in the state are the Rhode Island School of Design (founded 1877; nonsectarian) and Providence college (1917; Roman Catholic), both at Providence, and Salve Regina college (1947, Roman Catholic) at Newport.

HEALTH AND WELFARE

As in most states, these functions are shared by the state and local governments in Rhode Island. Two state administrative departments are involved: the department of health and the department of social welfare. The functions of the former have been grouped under four general headings: (1) the recording of vital statistics, regulation of professions active in the health area, etc.; (2) personal health services, including chronic disease control, maternal and child care and programs for crippled children; (3) local health services, involving co-operation with the communities of the state on health problems; and (4) environmental health services, such as food and drug control and the state laboratories.

The small size of Rhode Island has made possible a high degree of centralization of the institutions relating to welfare services. The department of social welfare's division of curative services operates a state infirmary with about 700–800 beds, a state hospital for mental diseases, the Ladd school for mentally-retarded children, the Zambarano memorial hospital for tuberculosis and other related health and welfare services. The division of correctional services maintains the male and female correctional institutions, a training school for boys and one for girls. The division of community services administers programs for old-age assistance and aid to the disabled, to dependent children and the blind and general public assistance, which is handled co-operatively with local governments. The combined health and welfare services of the two departments discussed above account for one-quarter to one-third of the state's total annual expenditures.

THE ECONOMY

Agriculture. — Rhode Island ranks low in the list of agricultural states, chiefly because of its small area, density of population and the nature of its soil. As has been generally true throughout the United States, there has been a decline in farm acreage and number of farms in the state. From 1935 to 1954 acreage declined from 380,000 to 154.674, and number of farms from 4,327 to 2,004. All but a negligible number of farms are owner-operated. Nearly three-quarters of farm income represents the value of livestock and related products — dairy products, eggs, chickens and turkeys—while the remainder represents crop value. The most important crops zre hay, corn, potatoes, five principal commercial vegetables, apples and peaches.

Industry. — Throughoutits history Rhode Island has had to depend on sources of income other than agriculture. Before the gronth of manufacturing this meant reliance chiefly on the activities of merchants and shipowners. In the period preceding the American Revolution molasses was virtually the cornerstone of the colony's economy. Rhode Island ships carried cargoes of locally produced cheese, fish, lumber and similar products to ports in the West Indies and returned laden with molasses which was exchanged for English-manufactured goods or distilled into rum, a valuable item of commerce. Some idea of the significance of rum in the prerevolutionary economy of Rhode Island can be gained from the fact that in 1764 there were more than 30 distilleries in the colony. Some of the product of this early manufacturing enterprise was bartered for slaves in Africa. The acute concern felt in Rhode Island over regulation of colonial commerce by the British government and the state's later reluctance to join the newly established government under the constitution are closely related to this early growth of a commercial and mercantile economy.

The beginnings of manufacturing activity other than shipbuild-

ing and the production of rum may be said to date from the formation of a company at Providence in 1786 to spin cotton. A factory containing a spinning jenny of 28 spindles (the first machine of its kind to be used in the United States) was put into operation the following year. This factory also included a carding machine, and the fly shuttle was first introduced at Providence in 1788. In 1790 a factory was established at Pawtucket equipped with Arkwright machines constructed by Samuel Slater, an immigrant from England. These machines were operated by water power and they marked the beginning of the factory system in Rhode Island. The first power loom used in the United States was set up at Peacedale in 1814. During the rest of the 19th century and into the early 20th century textile manufacturing grew to become the major employer of labour in the state. Another industry which came to occupy an important place in the state's economy was jewelry manufacture, begun in Providence in 1784 and greatly promoted ten years later by Nehemiah Dodge's invention of the process of gold filling. Rhode Island's water power was the only natural resource in the state which contributed to this growth of manufacturing enterprise.

The most important industries in the early 1960s were textiles (including cotton and woolen worsted), metals and machinery, jewelry, rubber, apparel, food and beverage products and optical instruments. Textiles. however, had declined in both absolute and relative importance. For example, just before World War II there were 907,000 cotton spindles in the state; 15 years later this number had fallen to 475.000.

Trends at mid-20th century showed that manufacturing employment had declined steadily while government, construction, trade, finance and services increased. In the face of this trend, the Rhode Island Development council was created by law in 1953 to encourage industrial expansion and a number of financial inducements to new industry were provided.

Mining. — The only minerals of value produced in significant quantities in the state are sand and gravel, stone and graphite. Sand and gravel accounted for almost three-fourths of the value of mineral products.

Fisheries. — Whaling was early an established industry in Rhode Island. As late as 1846 about 50 whaling vessels sailed annually from Rhode Island ports; but by the close of the century the industry had become practically extinct. In the second half of the 20th century Rhode Island ranked third among the New England states in number of persons engaged, investment and yield of its fisheries. Almost half of the total value of fishery products was accounted for by shellfish.

Trade and Finance. — As already indicated, prior to the growth of industry, Rhode Island's economy was heavily dependent on trade and commerce with neighbouring states and overseas. Until the American Revolution, Newport was the primary centre of this activity. The British occupation of the city during the war, however. spelled the end of Newport's supremacy and Providence, at the head of Narragansett bay, rapidly overtook the former and has remained the commercial centre of the state and adjacent areas. During the early 19th century patterns of commerce changed. Instead of being carried on for its own sake, shipping and commercial activity became adjuncts to the burgeoning factory economy of the state. Cargoes landed at Providence were now mainly coal, cotton, lumber, cobblestones and other materials consumed directly or indirectly in manufacturing. Coal is an example: as steam supplanted water power in the mills, coal imports grew rapidly. Some 200,000 tons were landed at Providence in 1856, and by 1878 the total approached 1,000,000 tons. In the 20th century petroleum products replaced coal as a major item of seaborne commerce.

Trade in the more localized sense grew along with the population and wealth of the state. By the beginning of the 19th century wholesale and retail enterprise had become differentiated in Providence, whereas in an earlier and simpler era no such distinction was made. Retail establishments became more elaborate and numerous. The Arcade in Providence, built in 1828 to house shops fronting on a common covered thoroughfare typified this development, and is still in use by Providence merchants. In the 20th century, in Rhode Island as elsewhere, the small shop was replaced by the chain store, the department store and the suburban shopping centre, all of which owe their existence in large part to the development of more elaborate modes of organization and to new merchandising and packaging techniques.

The year 1791, which saw the chartering of the Providence bank, was a major landmark in the history of banking in the state. Until that date the state had no such institutions largely because the state government itself, through its issue of paper currency, performed many of the functions of a private banking system. Once the federal constitution, which prohibited the states from issuing paper money, had been ratified banks became essential. About 12 or more additional banks had been chartered by 1810, and 43 filed reports in 1825. In 1856–57, 98 reported, the largest number in Rhode Island history. Bank services during the 19th century were provided by numerous small local banks and failures were not uncommon. The first savings banks in the state came into existence in 1819. Around the turn of the 20th century a trend toward consolidation of many of the small banks into fewer large institutions became pronounced. This trend had progressed to the point, by mid-20th century, that the state had less than ten savings banks and only a slightly larger number of commercial banks. The latter in particular developed an ever-expanding system of branches which take the place, as it were. of the numerous independent local institutions.

Transportation. — Because of its small size and the general decline of rail transportation in relative importance by mid-20th century. Rhode Island's highway network represents by far the most important part of its transportation system. While rail mileage in the state declined from 211 in 1920 to 181 at mid-century, total highway mileage exceeded 4,000. Of this total about 1,000 mi. were unimproved and gravel-surfaced, and the remainder hard-surfaced. Approximately 20% of the over-all total comprises the state highway system, the remainder being under the jurisdiction of the cities and towns. State expenditures for highway construction and reconstruction, including federal grants, more than doubled between 1955–57 and continued to rise thereafter. Included in the highway-building program is a system of limited-access divided highways linking with similar road systems in neighbouring Connecticut and Massachusetts, plus expressways to route traffic through the congested Providence metropolitan area.

Most of the state's water-borne commerce passes through the port of Providence. By far the largest proportion of the tonnage handled there is accounted for by petroleum products. Foreign commerce amounted to more than one-sixth of the total, the remainder comprising coastwise and internal shipments.

Communications. — The first printing press was set up in Rhode Island in 1727 by James Franklin, brother of Benjamin Franklin. He published the first newspaper in the colony, the *Rhode Island Gazette,* in 1732. Other newspapers were started in the 18th century, including the *Newport Mercury* by James Franklin, Jr., and the first foreign-language paper printed in the state, which appeared in 1780, issued by the French who were in Newport with Count Jean Baptiste Rochambeau. The most famous and influential newspaper has long been the *Providence Journal,* which was started as a semiweekly in 1820 and appeared daily from 1829. The owners of the *Journal* began publishing the *Evening Bulletin* in 1863 in response to the demand for news of the American Civil War, and started the *Sunday Journal* in 1885. In the second half of the 20th century there were about two dozen newspapers published in the state: the *Journal* and *Bulletin,* which have a state-wide readership; one-half dozen other dailies in various local communities; two semiweeklies; and the rest weeklies.

Among the radio stations in operation, the oldest began broadcasting in June 1922, two others were established in the 1920s and the remaining dozen or so date from after World War II. This total includes both AM and FM outlets, with some stations combining both. A television channel began transmitting programs from Providence in 1949 and a second in 1955.

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RHODES, CECIL JOHN (1853–1902), British-born South African statesman and financier, was one of the great empire builders of the late 19th century. It was from Rhodes that the territories of Rhodesia took their name, and it was mainly because of his efforts that Bechuanaland and the area of the present Federation of Rhodesia and Nyasaland came under British dominion.

Rhodes was born at Bishop's Stortford. Hertfordshire, Eng., on July 5. 1853, the fifth son of the vicar there. Rev. F. W. Rhodes, and was educated at the parish school, where he showed little promise of distinction beyond winning an elocution prize.

In 1869, threatened with tuberculosis, he went to Natal to join his brother Herbert. who was attempting to grow cotton in the Umkomanzi valley. Cecil landed at Durban in Sept. 1870. Their first crop failed, but they made a profit on the second and won a prize at a local agricultural show. In 1871 Cecil was left in charge while Herbert went to prospect at the newly discovered diamond fields in Griqualand West. Cecil joined Herbert at the diggings that year. and they abandoned cotton farming in 1872.

On arriving at Kimberley, Cecil managed Herbert's three claims alone, nhile his brother settled affairs in Natal. He became seriously ill, and nhen Herbert returned they took a long journey to the Transvaal interior. This helped to restore Cecil's health and made a lasting impression on him, giving him his first experience of the interior and helping to mold the future pattern of his life. After their return, Herbert Rhodes left Kimberley (1873).

Oxford.—Cecil Rhodes stayed on to gain a rapid success in the diamond mines, but in spite of his growing influence he spent much of the next few years as an undergraduate at Oxford. He matriculated in 1873, and went to Oriel college. In 1874, however, a severe chill affected his heart and lungs. Given six months to live. he went back to Kimberley. He recovered and returned to Oxford in 1876. keeping terms until 1878 and visiting Kimberley in the long vacation. He took his B.A degree in 1881.

Rhodes always retained an affectionate respect for Oxford, which he showed by founding the Rhodes scholarships in his final will. Although he was not a conventional hard-working student, what he read he thought over deeply. He became convinced that the Anglo-Saxon race was the highest point of evolution in fulfillment of a divine plan and that his aim must be to help secure its predominance. Hence his preoccupation with British expansion, particularly in Africa and with making money, not for his own comfort or security, but for power, since he felt big ideas mere useless without money to carry them out.

He wrote his first will in 1877, making the colonial secretary a trustee, and ieaving his fortune (yet unmade) to form a society to extend the British empire throughout the world, to recover the United States, to inaugurate colonial representation in the imperial parliament at Westminster and to found a power great enough to make wars impossible. These ideas, modified in his five later wills (the last made in 1899); remained the driving forces of his life.

Kimberley and Diamonds.—Even during his Oxford career, Rhodes had been building his fortune at the diamond mines. He had formed a partnership with C. D. Rudd in 1873. and they had secured a lucrative contract to pump out the flooded Kimberley, Dutoitspan and De Beers mines in 1874. Assisted by Alfred Beit (*q.v.*), a brilliant financier, they began accumulating claims, particularly in De Beers Old Rush, by purchase or amalgamation with other claim holders. In 1880 Rhodes, by then the biggest claim holder in De Beers Old Rush, floated the De Beers Mining company. By 1887 the company was sole owner of the De Beers mines, and his only significant rival for control of the diamond industry was Barney Barnato, the main owner in the Kimberley mine. Rhodes, given a £1,000,000 guarantee by Rothschilds, was victorious in the ensuing race to increase production and buy up shares. Finally Barnato acknowledged defeat in 1888 and sold his Kimberley mine for £5,338,650 to Rhodes, who formed the new De Beers Consolidated Mines, Ltd. Rhodes also acquired the Dutoitspan and Bultfontein mines in 1888 and the newly discovered Wesselton mine in 1891, thus securing control of all South African diamond production—90% of the world total. He had also invested in the newly discovered gold mines of the Transvaal after 1886 and had formed the powerful Gold Fields of South Africa company in 1887. On his insistence the terms of incorporation of both the De Beers and Consolidated Gold Fields companies were framed to allow them to finance northward expansion.

Politics and Northward Expansion.—Meanwhile, Rhodes was advancing his political career. He entered the Cape parliament in 1881 as member for Barkly West, a rural. predominantly Dutch constituency. which he kept throughout his career. He soon gained influence in parliament, and from the first he mas concerned with the north, already dreaming of British expansion to the great lakes. He urged vainly that the imperial government, not the weak Cape government, should be responsible for Basutoland. where war had broken out in 1880. While on a Basutoland commission he met General Gordon, who tried unsuccessfully to persuade Rhodes to leave South Africa and work with him.

His next concern aas Bechuanaland. of vital importance to his aims because it commanded the route to the Zambezi river via the trading road from the Cape to the interior, known as the "Missionaries' road." The establishment of two small republics, settled from the Transvaal, Stellaland and Goshen, threatened to block this route, which had been placed outside the Transvaal boundary by the Pretoria convention (1881). Rhodes succeeded in having a boundary commission to Bechuanaland set up in 1882, and he himself became a member. In Stellaland in 1882 he obtained an offer from a local chief to cede his territory to the Cape colony, and also a petition from Stellalanders for Cape annexation. But he could not persuade the Cape government to take action. despite rumours that the republics might be incorporated with the Transvaal. However, both the imperial and Cape governments saw the force of Rhodes's arguments when Germany estabiished a protectorate over Namaqualand-Damaraland (1883–84), making possible an east-west link betneen the Germans and the Transvaal which could block British expansion from the Cape. The London convention (Feb. 1884) finally excluded Stellaland and Goshen from the Transvaal, and the Cape government promised to help finance a protectorate over Bechuanaland. The imperial government sent a deputy commissioner to the area, the Rev. John Mackenzie who tactlessly offended the Boers in Stellaland and Goshen and ignored their interests Rhodes demanded that the Cape government, not the "imperial factor." should annex southern Bechuanaland and was sent to replace Mackenzie in July 1884. He successfully conciliated the Stellalanders. mainly by guaranteeing their land titles. But he was unable to prevent the Transvaal president, Paul Kruger, from declaring a protectorate over Goshen, enlarged by

systematic raiding. Rhodes could do nothing and returned to the Cape demanding imperial intervention. Both the Cape and the imperial governments protested, Sir Charles Warren was dispatched with an expeditionary force to restore order, and Kruger withdrew. At the conference at Fourteen Streams in Feb. 1885 Rhodes met Kruger for the first time but failed to establish a friendly contact, because the president distrusted Rhodes's aims. Kruger remained the greatest obstacle to Rhodes's dream of federation of south African states within the British empire.

Rhodes soon quarreled with Warren and resigned his post of deputy commissioner in March 1885. But the high commissioner, Sir Hercules Robinson, sympathized with his aims, and in Sept. 1885 southern Bechuanaland became a crown colony, and the north, up to the 22nd parallel, was declared a protectorate. It was not until 1895 that British Bechuanaland was annexed to the Cape, as Rhodes had always wished, and part of the protectorate was handed over to Rhodes's British South Africa company.

In 1887 it seemed that Rhodes's plan for northward expansion might again be jeopardized by the Transvaal, which was negotiating with Lobengula, chief of the Matabele, who controlled Mashonaland and Matabeleland. To secure British influence there, Rhodes persuaded the high commissioner to make a treaty of friendship with Lobengula, who agreed to make treaties with other powers only with British consent (Feb. 1888). But since neither the Cape nor the imperial government was prepared to take over the territory, Rhodes determined to do so himself. His agents obtained the Rudd concession from Lobengula, which gave Rhodes a prospecting monopoly in Mashonaland, rumoured to be rich in gold. This was the basis of the British South Africa company's charter, granted in 1889, after Rhodes had amalgamated with rival concessionaries and had gained widespread support in England.

The company secured control of the area of present-day Southern Rhodesia by 1893, but Rhodes's dream extended beyond the Zambezi. In 1891 he made an agreement with the imperial government whereby a British protectorate was established over Nyasaland (the company contributing £10,000 annually for its upkeep, and Rhodes privately giving a further £10,000), while the rest of central Africa north of the Zambezi to Lake Tanganyika was administered by the company. A foreign office official and friend of Rhodes, Sir Harry Johnston, was both imperial commissioner and the company's administrator in Nyasaland until 1895, when the company assumed direct administration of the area of Northern Rhodesia. Despite Rhodes's efforts to secure Nyasaland also for the company—his strong pressure on Johnston amounted almost to blackmail—the British treasury took full responsibility for Nyasaland after 1894.

Prime Minister.—Rhodes became prime minister of the Cape in 1890. His main support came from J. H. Hofmeyr (*q.v.*) and the Afrikander Bond, which had been won over to Rhodes's schemes of northward expansion under the British flag partly by the Transvaal's refusal to allow a rail link with Johannesburg until 1892, and its high duties on Cape products, partly by Rhodes's express policy of conciliating Afrikaans opinion. Rhodes's frank aim was to unite English and Dutch interests. His premiership was important in the development of local politics and education, the advancement of agriculture and the steps taken in native policy. The Franchise and Ballot act of 1892 restricted the vote to men who could write and earn a labourer's wage, removing the abuses of the tribal African "blanket" vote. In native policy Rhodes wanted to introduce measures of local self-government and education and to replace tribal land tenure by individual tenure. His policy was applied in the controversial Glen Grey act of 1894. He took a personal interest in agriculture, encouraging scientific methods of farming, and developing the railways to link the rural districts to the large towns. Rhodes also increased the Cape Colony's territory by his annexation of Pondoland in 1894.

Until 1895 Rhodes waited patiently for economic pressure and encirclement to force the Transvaal into a South African federation, led from the Cape, but President Kruger was intransigent. In Jan. 1895 he trebled the rates on the Transvaal section of the Cape-Johannesburg railway, and when Cape traders attempted to transport goods by ox wagon instead, he closed the Vaal drifts (fords). This clear infringement of the London convention stimulated protests from Rhodes and the high commissioner, and Kruger climbed down (Oct. 1895). Kruger had also infuriated Rhodes by a speech of Jan. 1895, when he had made very friendly references to Germany. Rhodes was at the height of his power. He was unopposed in the Cape and controlled the De Beers and Consolidated Gold Fields companies, with their huge resources, and the British South Africa company. Frustrated by Kruger, he decided to take a short cut to federation via revolution.

Early in 1895 he became the directing spirit in a conspiracy to overthrow the Transvaal government by an *Uitlander* rising in Johannesburg supported by a force of the British South Africa company led by his friend Dr. L. S. Jameson (*q.v.*). Rhodes arranged that his friend Sir Hercules Robinson should again be sent to South Africa as high commissioner early in 1895. He secured a strip of the Bechuanaland protectorate, ostensibly as a railway, but actually as a base for Jameson's incursion into the Transvaal. On Dec. 29, 1895, Jameson made his famous raid, despite frantic messages urging postponement and assurances that the Johannesburg rising would not take place. The fiasco of the raid was disastrous for Rhodes. Openly implicated in the scheme, he resigned the premiership in Jan. 1896. He lost the support of the Bond, which was horrified that Rhodes had conspired against a friendly neighbour while prime minister. He was censured by the committees of inquiry into the raid held by the Cape parliament (1896) and the British house of commons (1897).

The Matabele rising of March 1896 kept Rhodes from brooding on his downfall. He had temporarily lost his seat on the board of the British South Africa company, but he went to Rhodesia as a private individual and negotiated the peace terms with the Matabele (Aug.–Oct. 1896). He supervised the extension of railways in Rhodesia and arranged for a rail link from Salisbury to Lake Tanganyika to further his scheme for a Cape to Cairo railway. He also concluded arrangements for a Trans-African telegraph to pass through German East Africa to Egypt. He died at Muizenberg, Cape Colony, on March 26, 1902, and was buried in the Matopo hills, near Bulawayo, Southern Rhodesia.

Rhodes was not a great orator, but he was able to express his large ideas in popular phrases, and many of his expressions—"British dominion from the Cape to Cairo," "painting the map red," "the imperial factor," "philanthropy plus 5%"—gained common usage. He combined an almost visionary zeal for British expansion with a frank belief that money was power and that one could always deal rather than quarrel with an opponent. He gained the fervent loyalty and friendship of some of his most outstanding contemporaries, but toward the end of his career he became autocratic, imperious and surrounded by sycophants.

In his will Rhodes founded scholarships to Oxford of £250 per annum (later £300) for students of good literary attainments, a taste for outdoor sports and qualities of leadership from every self-governing British colony, the United States and Germany, so that they might appreciate the advantage of imperial unity and the union of English-speaking peoples.

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(M. F. K.)

RHODES, JAMES FORD (1848–1927), U.S. historian, was born in Cleveland, O., on May 1, 1848. He studied at New York university, at The University of Chicago, and at the Collbge de France in 1867–68, and in 1868 served as occasional Paris correspondent to the Chicago Times. He then took a course in metallurgy in the School of Mines, at Berlin, Germany; subsequently he inspected iron and steel works in western Germany and in Great Britain; and in 1870 he joined his father in the iron, steel and coal business in Cleveland, becoming a member of the firm in

1874. He retired from business with an ample fortune in 1885, and after two years devoted to general reading and travel he began his *History of the United States From the Compromise of 1850,* which was published in eight volumes in 1893–1917 (rev. ed., 1920).

In 1909 he published a volume of *Historical Essays;* in 1913, *Lectures on the American Civil War;* in 1917, *History of the Civil War;* and in 1922, *The McKinley and Roosevelt Administration 1897–1909.*

The merit of his work earned him numerous honorary degrees in England and America. He died in Brookline, Mass., on Jan. 22, 1927.

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RHODES (RODI), the most easterly island of the Aegean sea, about 10 mi. S. of Cape Alypo in Asia Minor (length about 45 mi. from northeast to, southwest, greatest breadth 22 mi., area 538 sq.mi.).

Rhodes was taken by Italy from the Turks in 1912 and became capital of the administration of the Dodecanese (*q.v.*). Under the Allies' peace treaty with Italy in 1947, the island of Rhodes and the other Dodecanese Islands were awarded to Greece. During World War II representatives of the people of the Dodecanese had formallv declared their union with Greece.

In 1951 the population of the island was 58,946, the population of the town was 23,599.

The island is diversified in its surface and is traversed from north to south by an elevated mountain range, the highest point of which is called Attavyros (It. Attairo; anc. Atabyris or Atabyrium) (3,986 ft.). It commands a view of the elevated coast of Asia Minor toward the north, and of the archipelago, studded with its numerous islands, on the northwest; on the southwest is seen Mt. Ida in Crete, often veiled in clouds, and on the south and southeast the vast expanse of waters which wash the African shore. The rest of the island is occupied in great part by ranges of moderately elevated hills, on which are found extensive woods of ancient pines, planted by the hand of nature. These forests were formerly very thick, but they were subsequently greatly thinned by the Turks, who cut them down and took no care to plant others in their place.

Beneath these hills the surface of the island falls lower, and several hills in the form of amphitheatres extend their bases as far as the sea. forming a series of beautiful pictures.

Rhodes has been famed at all times for its delightful climate. The wind blows from the west, often with violence, for nine months in the year; at other times it blows from the north, moderating the summer heat, except during July and August when hot winds blow from the mainland.

Rhodes, in addition to its fine climate, is blessed with a fertile soil and produces a variety of the finest fruits and vegetables. Around the villages are extensive cultivated fields and orchards containing fig, pomegranate and orange trees. On the sloping hills, carob trees and others, both useful and agreeable. grow abundantly; the vine also holds its place and produces a species of wine which was highly valued by the ancients, though it seems to have degenerated greatly in modern times; a strong red wine is still exported. The valleys afford rich pastures, and the plains produce a wide variety of grain.

Under Turkish rule Rhodes was a distributing centre for European manufactures to the neighbouring islands and mainland, receiving cattle, foodstuffs and other produce in return. Under Italian rule its commercial position changed and became uncertain. Italian, French and Greek steamships call frequently, and tourists became more numerous.

The only large town is the capital, Rhodes, at the northeast extremity, rising from the sea in the form of an amphitheatre, surrounded with walls and towers and defended by a moated castle. These are the work of the Knights of St. John, almost unimpaired. But few traces remain of the splendour of the ancient city, with its regular streets, well-ordered plan and numerous public buildings.

The modern city of Rhodes is in general the work of the Knights of St. John and has a mediaeval aspect. The picturesque fortifications by which the city is surrounded remain as they were in the 15th century, almost without alteration. Principal buildings are the church of St. John, which became the principal mosque; the hospital, transformed into a museum; the palace of the grand master; and the senate house. The picturesque Street of the Knights is perfectly straight, lined by old houses on which remain armorial bearings of members of the order, including those of royal and noble houses of Europe.

Relics of classical antiquity, inscribed altars, bases of statues and architectural fragments are found in courtyards and gardens in the suburbs, the whole of which were within the limit of the ancient city.

The foundations of the moles between the harbours are also of Hellenic works, though the superstructures were erected by the knights.

Rhodes has two harbours. The lesser lies toward the east, and admits cargo steamers, which can also anchor outside in fair weather. The larger is silted and only admits small craft. The two harbours are separated by a mole and at the eastern entrance is the fort of St. Elmo, with a lighthouse.

HISTORY

Archaeological remains of the Late Minoan age show that the early Aegean culture maintained itself in Rhodes comparatively unimpaired until the historic period. Legend also peopled primitive Rhodes with skilful workers in metal, the "Telchines," and with bold navigators, "Children of the Sun." In Homeric legend there was already a Heracleid settlement, and in historic times Rhodes was occupied by a Dorian population, mainly from Argos and subsequent to the Dorian invasion of Greece. The three Homeric cities refounded by these settlers — Lindus, Ialysus and Camirus — belonged to the League of Six Cities, by which Dorian colonists in Asia Minor protected themselves against the neighbouring mainland.

The early history of these towns records brisk commercial expansion and active colonization, illustrated by the rich tombs of Camirus. Rhodian colonies extended not only eastward along the southern coast of Asia Minor, but also to the westernmost parts of the Greek world. Examples are Phaselis in Lycia, Soli in Cilicia, Salapia on the east Italian coast, Gela in Sicily, the Lipari Islands, and Rhoda in northeast Spain. In home waters the Rhodians dominated Karpathos and other islands.

The history of Rhodes during the Persian Wars is obscure. In the 5th century B.C. the three cities were enrolled in the Delian league and were democracies. In 412 the island revolted from Athens and became the headquarters of the Peloponnesian fleet. Four years later the'inhabitants concentrated in the newly founded city of Rhodes laid out on an exceptionally fine site according to a scientific plan by the architect Hippodamus of Miletus. This town soon rose to considerable importance and attracted much Aegean and Levantine commerce which had hitherto been in Athenian hands.

In the 4th century B.C. political development was arrested by constant struggles between oligarchs and democrats, who in turn brought the city under the control of Sparta (412–395, 391–378), of Athens (395–391, 378–357) and of the Carian dynasty of Mausolus (357–340).

About 340 it was conquered for the Persian king by his Rhodian admiral, Mentor. In 332 it submitted to Alexander the Great, but on his death the people expelled the Macedonian garrison and henceforth not only maintained their independence but acquired great political influence. The expansion of Levantine trade in the Hellenistic age brought especial profit to Rhodes, whose standard of coinage and code of maritime law became widely accepted in the Mediterranean. Under modified democracy, in which the six πρυτάνεις found a powerful executive, the city long enjoyed a good administration. In foreign politics it prudently avoided the ambitious schemes of Hellenistic monarchs, but gained prestige by energetic interference against all who threatened the balance of

power or the security of the seas. Chief incidents were a memorable siege by Demetrius Poliorcetes in 304, who sought in vain to force the city into active alliance with Ring Antigonus; a severe earthquake in 227, the damages of which all Hellenistic states contributed to repair because they could not afford to see the island ruined: some vigorous campaigns against Byzantine, Pergamene and Pontic kings. who threatened the Black sea trade route (220 sqq). and against the pirates of Crete.

In accordance with their settled policy the Rhodians supported the Romans when they made war on Philip V of Macedon and Antiochus III of Syria on behalf of the minor Greek states. During the Third Macedonian War a false step deprived them of possessions in Lycia and partially diverted their trade to Delos (167). Nevertheless, during the two Mithridatic Wars they remained loyal to Rome and in 88 successfully stood a siege. The Rhodian navy did further good service for Pompey in his campaigns against the pirates and against Julius Caesar. But in 43 G. Cassius besieged and ruthlessly plundered the people for refusing to submit to his exactions and, though Rhodes continued a free town for another century. its commercial prosperity was crippled, and extensive earthquakes after A.D. 155 completed its ruin.

In the days of its greatest po er Rhodes became famous as a centre of pictorial and plastic art; it had a school of eclectic oratory whose chief representative was Apollonius Molon, the teacher of Cicero; it was the birthplace of the Stoic philosopher Panaetius; the home of the poet Apollonius Rhodius and the historian Poseidonius.

Protogenes embellished the city with his paintings. and Chares of Lindus with the celebrated colossal statue of the sun-god, which was 105 ft. high. The colossus stood for 56 years, until an earthquake prostrated it in 224 B.C. Its enormous fragments continued to excite wonder in the time of Pliny, and were not removed until AD. 653, when Rhodes was conquered by the Saracens, who sold the remains for old metal to a dealer, who employed 900 camels to carry them away. The notion that the colossus once stood astride over the entrance to the harbour is a mediaeval fiction. During the later Roman empire Rhodes was the capital of the "province of the islands."

The history of Rhodes under the Byzantine rule is uneventful except for some temporary occupations by the Saracens (6j3–658, 717–718) and the gradual encroachment of Venetian traders after 1082. In the 13th century the island stood as a rule under the control of Italian adventurers, who uere. however. at times compelled to acknowledge the overlordship of the emperors of Nicaea, and who failed to protect it against the depredations of Turkish corsairs.

In 1309 it was conquered by the Knights Hospitallers of St. John of Jerusalem at the instigation of the pope and the Genoese, and converted into a great fortress for the protection of the southern seas against the Turks. Under their mild and just rule both the native Greeks and the Italian residents were able to carry on a brisk trade. But the piratical acts of these traders, in which the knights themselves sometimes joined. and the strategic position of the island between Constantinople and the Levant necessitated its reduction by the Ottoman sultans. A siege in 1480 by Mohammed II led to the repulse of the Turks with severe losses; after a second investment. during which Sultan Suleiman (Soliman) I is said to have lost 90,000 men out of a force of 200,000, the knights evacuated Rhodes under an honourable capitulation (1522). The population henceforth dwindled in consequence of pestilence and emigration, and although the island recovered somewhat in the 18th century under a comparatively lenient rule, it was brought to a very low ebb as a result of the severity of its governor during the Greek revolution.

The sites of Lindus, Ialysus and Camirus, which in the most ancient times were the principal towns of the island, are clearly marked, and the first of the three is still occupied by a small town with a mediaeval castle, both of them dating from the time of the knights, though the castle occupies the site of the ancient acropolis. of which considerable remains were still visible. There are no ruins of any importance on the site of either Ialysus or Camirus, but excavations at both places produced valuable and interesting results in the way of ancient vases and other antiquities, which were placed in the British Museum and in the local collection at Rhodes.

In mediaeval times Rhodes's pottery, a lustreware at first imitated from Persian, developed into an independent style of fine colouring and rich variety of design. After the Italian occupation in 1912 a considerable modern quarter on European lines grew up west of the city of the knights; carriage roads were constructed and the harbours improved.

BIBLIOGRAPHY.—*See* Pindar, *7th Olympian Ode;* Diodorus, v, 55–59, xiii–xx *passim;* Polybius, iv, 46–52, v, 88–90, xvi, 2–9, xxvii–xxix *passim;* A. Berg, *Die Insel Rhodos* (1862): C. Torr. *Rhodes in Ancient Times* (Cambridge, 1885), *Rhodes in Modern Times* (Cambridge, 1887); C. Schumacher, *De republica Rhodiorum commentatio* (Heidelberg, 1886); H. van Gelder, *Geschichte der alten Rhodier* (Hague, 1900); *B.* V. Head, *Historia Numorum,* pp. 539–542 (Oxford, 1887); Baron de Balabre, *Rhodes of the Knights* (1909): K. F. Kinch, *Fouilles de Vroulia* (1914); *A.* Gabriel, La *Cite' de Rhodes* (1921).

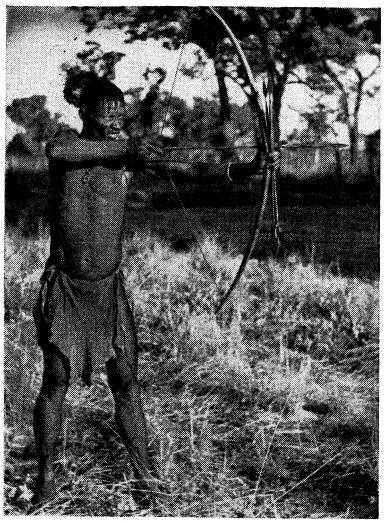
RHODESIA AND NYASALAND, FEDERATION OF. The federation consists of three British central African countries: Northern Rhodesia, a protectorate lying north of the Zambezi river; Nyasaland, also a protectorate. east of Northern Rhodesia; and Southern Rhodesia, a self-governing colony to the south of the Zambezi. It is bounded north by Tanganyika and the Republic of the Congo, south by Bechuanaland and South Africa, west by Angola and east by Mozambique (the latter two Portuguese possessions), and has an area of 477,798 sq.mi. and a population (1956) of 7,488,519. English, tribal dialects and (in Southern Rhodesia) Afrikaans are spoken. The native population is predominantly pagan, and there is a Christian minority. Salisbury. in Southern Rhodesia, is the federal capital. The federation is "exclusive" with limited powers, and those primarily affecting only Europeans, allotted to the federal government; Northern Rhodesia and Nyasaland retain their protectorate status under the aegis of the colonial office so far as African affairs are concerned, and the land rights and political prospects of the Africans are specifically safeguarded. The administration is in the hands of a governor general, a prime minister and an executive council (forming the cabinet); there is a federal assembly with speaker and elected majority, and an African Affairs board, a standing committee of the federal assembly, scrutinizes bills involving African interests before their presentation to the assembly. The three component countries retained their prefederation legislative structure. The political foundation of the federation and embryo dominion was declared to be interracial partnership based on equality of economic and political opportunity. The first governor general and prime minister of the federation were, respectively, Lord Llewellin and Sir Godfrey Huggins. The monetary unit is the Southern Rhodesian pound (= £1 sterling).

In this article the history of Rhodesia is treated first, followed by separate sections on Northern Rhodesia and on Southern Rhodesia. Nyasaland is dealt with in the separate article NYASALAND PROTECTORATE.

HISTORY

The historical records of south-central Africa before the European occupation in the closing years of the 19th century are inevitably scarce, because the African inhabitants built only with poles, grass and mud, could not write and, since they did not have the wheel, made no roads. Yet it is known that the first of them was one of the earliest of men; Rhodesian man, whose skull was discovered at Broken Hill in 1920. was comparable with Neanderthal man uho lived in Europe more than 10,000 years ago; and many palaeolithic implements of the type used by Neanderthal man have also been found. When the first wave of Bantu migrants arrived from the north, probably in the 13th century, they found, and drove before them into the southern deserts, Bushmen. These people, who still exist on the upper Zambezi and in the Kalahari desert in considerable numbers, were cave dwellers, hunters and artists. More than 400 of their lively paintings of men and animals have been discovered in the caves and on the rocks of the two Rhodesias. Of non-African culture evidence is provided by the ruins in Southern Rhodesia of at least 400 stone buildings of which Zimbabwe is the largest and most famous. Nobody really knows

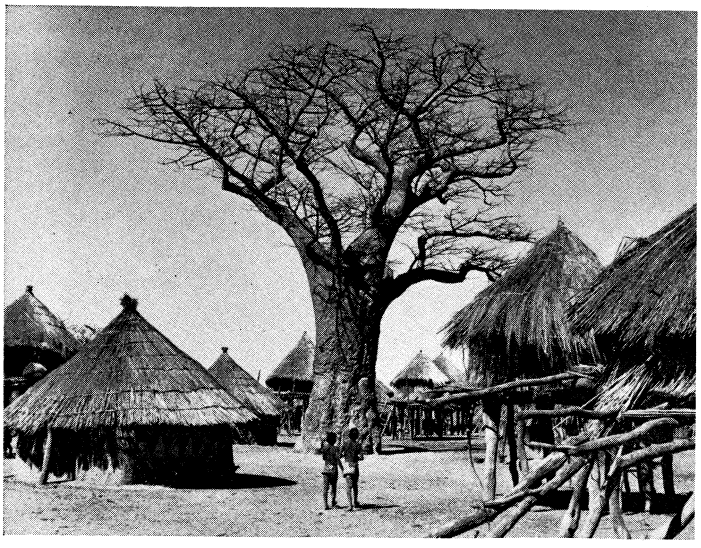
RHODESIA AND NYASALAND, FEDERATION OF



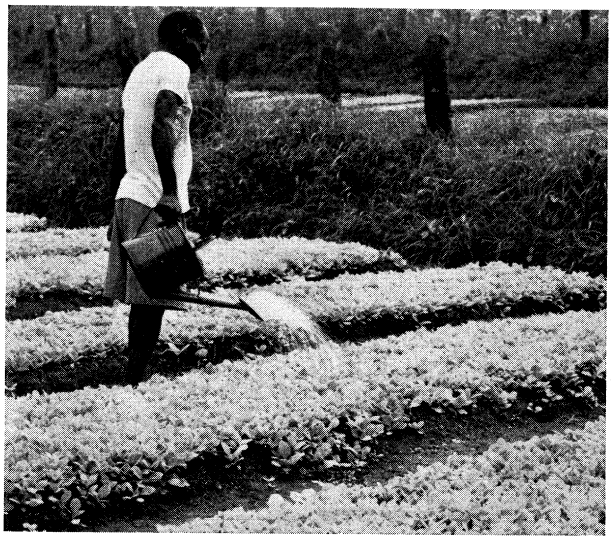
Bushman hunter from the Sesheke township in Barotseland, Norihern Rhodesia

View of Deep bay, Lake Nyasa, seen from Livingstonia escarpment on the edge of the Nyika plateau, Nyasaland

Aerial view of Salisbury, Southern Rhodesia, capital of the Federation and centre of the tobacco industry



Village of the Tonga tribe, Gwembe valley, Northern Rhodesia. The huts are made of poles and dagga (clay) with grass-thatched roofs. A baobab tree (*Adansonia digitata*) stands in the centre



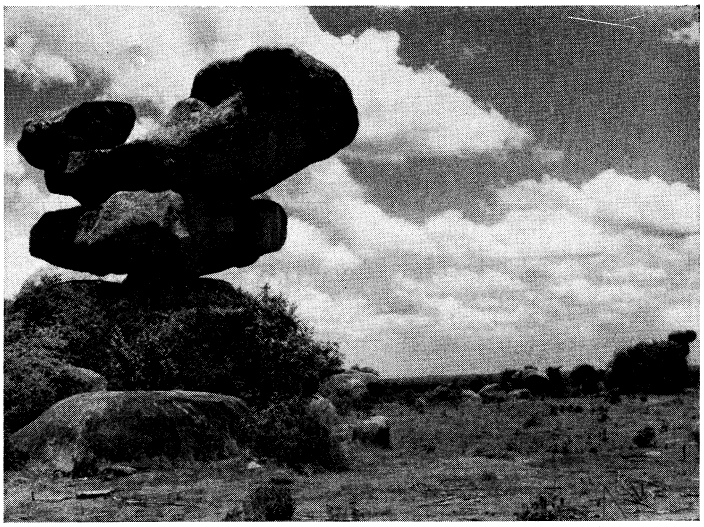
African farmer watering tobacco seedlings. Easily cultivated, tobacco is commercially one of the most important cash crops grown in the Federation

VIEWS OF THE FEDERATION OF RHODESIA AND NYASALAND

BY COURTESY OF (TOP LEFT) THE NORTHERN RHODESIA GOVERNMENT INFORMATION DEPARTMENT, (TOP RIGHT) FEDERAL INFORMATION DEPARTMENT, (CENTRE, BOTTOM LEFT AND RIGHT) RHODESIA HOUSE, LONDON

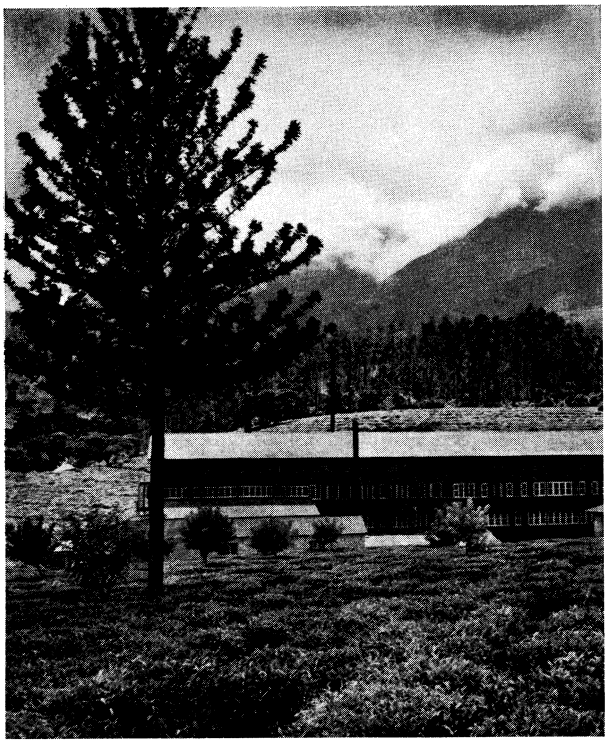
RHODESIA AND NYASALAND, FEDERATION OF

Victoria falls on the Zambezi river between Northern and Southern Rhodesia



Granite rock formation, Salisbury district. Composed of some of the most ancient rocks known, formations like this one are numerous in Southern Rhodesia

Ngoni tribesman in warrior's garb. The Ngoni belong to the Nguni branch of the Bantu and live in settlements throughout the Federation



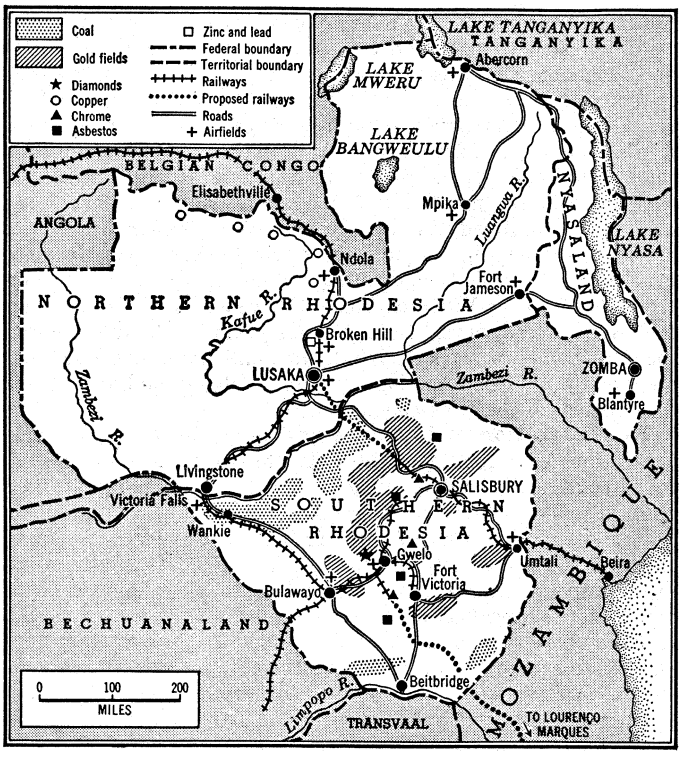
Tea estate in Nyasaland. Grown primarily in the Mlanje plateau, tea is one of the chief exports of Nyasaland

Conical tower of the elliptical temple of the Zimbabwe ruins, southeast of Fort Victoria, Southern Rhodesia. The origin and date of the ruins are unknown

SCENES IN THE FEDERATION OF RHODESIA AND NYASALAND

BY COURTESY OF (TOP RIGHT. BOTTOM LEFT AND RIGHT) FEDERAL INFORMATION DEPARTMENT; PHOTOGRAPHS, (TOP LEFT) MARILYN SILVERSTONE— NANCY PALMER AGENCY, (CENTRE RIGHT) LEN TITCHENER, NORTHERN RHODESIA INFORMATION DEPARTMENT

their date or origin, though theories and legends take the story back to the Sabaeo-Phoenicians and King Solomon's mines ("Ophir" was a generic term meaning any conspicuous source of natural products or merchandise, and most of the gold of those days came from southwestern Arabia), but it seems most probable that they date from the 1st millennium A.D. and that their builders either came from or at least traded with the east. In any case, by the time the Portuguese captured the east coast ports from the Arabs between 1500 and 1520, they found that this civilization had already vanished. There mas a gold industry of great size and antiquity but it was already in decay. Before this date, it is now estimated, gold to the present value of about £75,000,000 had been mined from the rocks of the Southern Rhodesian plateau, but the Portuguese bought gold only from alluvial workings, brought down to the coast in porcupine quills by the people of Monomotapa. This was the dynastic name of a series of Bantu chiefs who seem to have ruled a very considerable "kingdom" on the plateau until well into the 17th century.



COMMUNICATIONS AND MINERAL RESOURCES OF RHODESIA AND NYASALAND FEDERATION

The curtain of history lifts again in 1798 with the explorations into central Africa of Francisco de Lacerda in search of the *viagem a contracosta,* and the actual crossing of the continent from west to east by two half-castes called Pedro Baptista and A. José in 1802–11; and soon after this began the return to the north of Bantu warrior tribes from south Africa under the impact of Shaka's (Chaka's) tyranny. For one reason or another, but chiefly fear, three of these tribes fled northward during the first half of the century and themselves brought terror and conquest to much of central Africa. The Matabele conquered for themselves a kingdom south of the Zambezi, the Makololo under Sebitoane crossed that river and became the overlords of the Barotse on its upper reaches, and the Angoni went even farther north, to wander and raid and plunder as far afield as the east African hinterland. One branch of them eventually settled on the Luangwa-Lake Nyasa watershed, partly in what was later to become northeastern Rhodesia.

Meanwhile it is probable that a later wave of industrial Bantu discovered and began to mine the other great mineral belt of central Africa, the enormous copper deposits of the Congo-Zambezi watershed. It is not known when they started, but they were still mining the outcrops in the early years of the 20th century.

At about the same time, or perhaps a little later, the for the most part quite unmartial tribes north of the Zambezi began to be further afflicted by the inroads of the Arab slave trade. The slavers allied themselves with the Babemba and other warrior tribes and between them for more than a generation they decimated the population.

David Livingstone reached the upper Zambezi in 1851 and discovered the Victoria falls on Nov. 17, 1855 He died at Chitambo's village near Lake Bangweulu on May 1. 1873, during his famous last journey in fruitless quest of the source of the Nile. In the years between he discovered the whole of the Zambezi basin, Nyasaland and the plateau to the south of Lake Tanganyika. He also called the attention of the Christian world to the "open sore" of the east African slave trade, and so started the great missionary developments of the closing years of the century and, indirectly, the occupation and liberation of central Africa from 50 years of war and slavery.

This occupation came from the south. Cecil Rhodes first discussed the possibility of opening up central Africa in a conversation with (later Sir) Sidney Shippard, afterward commissioner in Bechuanaland, in 1878, but it mas not until ten years later that he was in a position to act. In 1887 Portugal laid claim to all the interior between Angola and Mozambique (to secure the *viagem* a *contracosta* which De Lacerda had tried so hard to find 100 years before). This spurred Rhodes, then in Bechuanaland, to action. J. S. Moffat was sent to make a treaty, on Feb. 11, 1888, with Lobengula, chief of the Matabele, binding him to have no dealings with any foreign power; and on Oct. 30 James Rochford Maguire and two other emissaries of Rhndes acquired from the chief a mineral concession covering the whole of the country sodth of the Zambezi. Rhodes went to London and persuaded Lord Salisbury to entrust him and his associates with the occupation of the whole of central Africa. After some negotiation the British South Africa company received its charter on Oct. 29, 1889. The stated objects of the company were: (1) to extend the railway from Kimberley northward toward the Zambezi; (2) to encourage emigration and colonization; (3) to promote trade and commerce; (4) to secure all mineral rights in return for guarantees of protection and security of rights to the tribal chiefs. Nine months later a pioneer column. led by Lieut. Col. E. G. Pennefather, guided by the great hunter F. C. Selous and consisting of about 200 settlers and 500 police, reached the site of the future capital of Southern Rhodesia and built Fort Salisbury. There was a brush with the Portuguese on the eastern border but in 1891 a treaty was concluded which was still in force in the 1950s; it delineated the frontier and included provision for the building of a railway from Beira and the recognition of the Shiré and Zambezi rivers as international waterways. By 1892 there were 1.500 settlers prospecting in Matabeleland, mostly on the ancient gold workings, and beginning to take up land, but for the next few years they were beset by trouble. In 1893 the Matabele attacked and were only defeated after severe fighting. In 1895 many of the settlers took part in the Jameson raid and were subsequently sent to England for trial; and a few months later the Matabele rose again, 10,000 of them forcing the settlers at Bulawayo to go into laager. Rhodes came out from London by way of Beira and held his famous indaba with the Matabele chiefs at the place in the Matopo hills where his grave now lies.

Meanwhile Rhodes had been energetically trying to secure the hinterland north of the Zambezi for Britain before the Germans, the Belgians or the Portuguese should forestall him. The "scramble for Africa" was on. In 1887 Chief Lewanika of the Barotse on the upper Zambezi had, under the influence of the great missionary, François Coillard, sought Queen Victoria's protection, and after much tortuous negotiation an agreement was arranged by Frank Lochner in 1890. It was followed by a treaty in 1900. This secured for the company rights which were later extended to cover the whole of what was to become northwestern Rhodesia. In the northeast Rhodes's emissaries were Alfred Sharpe and Joseph Thomson who between them, in 1890, made treaties with most of the chiefs in the country. Sharpe tried to secure also a concession from the powerful Chief Msiri in the Katanga hills, but, because of a misunderstanding, he did not succeed and in 1891 the Belgians

annexed Msiri's country and so secured the "Congo Pedicle" which contains some of the richest copper mines in the world. The warlike Babemba, south of Lake Tanganyika, refused to parley and continued. in alliance with the Arabs, to raid their weaker neighbours for slaves and ivory. The first European to penetrate their country was a missionary called Père van Oost of the White Fathers but it took several years of intermittent fighting to drive the Arabs from the plateau and to pacify the area. In the east, too, the Angoni, who had given a concession to a German which he in turn sold to the North Charterland Exploration company, rebelled. None of this fighting was very serious, but it was not until 1900 that the ***Pax Britannica*** was finally secured throughout the chartered company's vast new territories.

In 1899 the Barotseland-Northwestern Rhodesia order in council established a separate protectorate over northwestern Rhodesia with its capital at Kalomo and with Robert Coryndon as its first administrator; and two years later a similar order was made establishing the protectorate of North-Eastern Rhodesia with its capital at Fort Jameson. Robert Codrington, its administrator, and Coryndon in the west were both very remarkable men and were both under 30 years of age when given these high commands.

For the next 14 years the story of all these territories was one of peaceful progress and economic development. The railway had reached Bulawayo five months after the end of the Matabele rebellion and eight years later (two years after Rhodes's death) the Victoria falls. It halted for a while at Broken Hill and finally linked up with the Belgian system on the Katanga border in 1909. In Southern Rhodesia there were 12,506 settlers by 1904. In 1905 gold exports rose to £1,500,000 and by 1909 to £2,623,708. Agricultural development, however, got off to a slower start and it was not until 1907 that steps were taken to make the acquisition of land easier and give help and advice to the farmers. After that, progress improved and £34,810 worth of tobacco was exported in 1911. By then the white population (mainly of British stock) had risen to 23,606.

In the north settlement followed the railway and, because of the remoteness of the country, it was slow to develop. The lead-zinc-vanadium mine at Broken Hill was discovered in 1902 and by 1911 both this and the Bwana Mkubwa copper mine, the forerunner of the Northern Rhodesia copper belt, were in operation. But the prospecters had been active. The outcrops of most of the great copper mines had been discovered, including the Roan Antelope and Nkana, though they attracted little attention. The surface ores were copper oxides which were very expensive to work and the attention of the mining world was fully concentrated on the fabulous discoveries in the Katanga. In 1911 there were still only 1,500 Europeans, including officials and missionaries, in both the northern territories. In that year the two were united into the single protectorate of Northern Rhodesia, with its capital at Livingstone, near the Victoria falls.

In 1914. when the a;-year term of the company's charter was due to expire, the electors in Southern Rhodesia had the choice of either joining the Union of South Africa, supporting the continuation of the charter or pressing for self-government. They chose the middle course and the British government renewed the charter for ten years, provided that self-government should be granted earlier if the settlers showed themselves capable of administering the colony. During World War I all three territories contributed liberally of their manpower to the armed services, and local units played a prominent part in the campaign in East Africa against Gen. Paul von Lettow-Vorbeck. The armistice came at a very timely moment, when the German column, hotly pursued by Northern Rhodesian troops, was moving southward through the Bemba country in the direction of Broken Hill. The formal surrender took place at Abercorn. The Rhodesias, like most other countries, suffered severely from the influenza epidemic in 1918–19 and tens of thousands of Africans died. Meanwhile discussion about the political future of the territories had been going on and a privy council judgment was needed in 1918 to settle a dispute between the legislative council of Southern Rhodesia and the company about the ownership of unalienated land. After the war a royal commission under Lord Buxton was appointed to consider the political problem, as a result of which a referendum was held in 1922 on the choice between entry into the Union of South Africa and self-government. In spite of the offer of generous terms by Gen. Jan Christiaan Smuts 8,774 electors voted for self-government as against 5,989 for joining the Union, and on Sept. 12, 1923, on the 32nd anniversary of the arrival of the pioneers at Fort Salisbury, Southern Rhodesia was annexed to the crown and became a self-governing colony. Northern Rhodesia became a protectorate of the crown under colonial office rule in 1924. The company, which had never yet paid a dividend and had spent great sums on administration and development, received £3,750,000 in cash, retained its land rights in the north for 40 years, and all its mineral rights in both territories, from which. later, it was to reap a rich reward. At the time of the annexation there were about 34,000 whites in Southern Rhodesia and still only 4.000 in the north, but the dawn of Northern Rhodesia's prosperity was already in the sky. In 1921 Chester Beatty had become interested in the mineral possibilities of the Northern Rhodesian side of the Congo border and had formed a small syndicate called Copper Ventures Ltd. The ventures which it undertook were to lead, during the next four years, to the discovery of the great bodies of copper-sulphide ores underlying the oxide outcrops on the old Roan Antelope and Nkana claims, and to the rapid development of the great copper belt.

The Federation of Rhodesia and **Nyasaland.**—After 1924 the obvious geographical unity of the three central African territories continually bred discussion about the possibility of their political union. Royal commissions reported on the question in 1927 and 1939 but both of them recommended postponement of any such project, mainly because Southern Rhodesia. as a much more prosperous and self-governing colony, would be too weighty a partner for the two backward protectorates. Northern Rhodesia's revenues, however, leaped from £3,000,000 to £30,000,000 a year between 1945 and 1953 and, in this respect, to equality with the south. In consequence the northern settlers stepped up their agitation for closer union and in 1951 an impartial committee of civil servants from the three territories and the United Kingdom strongly recommended a federation. They rejected outright amalgamation because of the long-expressed opposition of the northern Africans to such a project. Two years of discussion and negotiation followed, marked by considerable opposition from the vocal elements of the African populations of Northern Rhodesia and Nyasaland and sharp party controversy in the British parliament; but a referendum in Southern Rhodesia supported federation; the colonial office remained convinced that it was both essential and urgent, and the necessary legislation was passed in July 1953. The federal assembly met for the first time on Feb. 2, 1954, and by the following July the government had assumed most of the responsibilities allotted to it. Oct. 23 was chosen as "Federation day."

NORTHERN RHODESIA

Northern Rhodesia is a British central African protectorate administered by the colonial office. It is 288,130 sq.mi. in area and is bounded on the north by the Belgian Congo, Lake Tanganyika and Tanganyika, on the east by Nyasaland, on the south by Portuguese East Africa and Southern Rhodesia and on the west by Angola.

Physical Features.—Most of the country consists of undulating plateaus between 3.000 and 4,500 ft. high, rising to more than 5,000 ft. on the Congo-Zambezi watershed along the Congo border, in the hills along the eastern border and in. the Muchinga escarpment southeast of Lake Bangweulu (*q.v.*). Most of it is drained by the Zambezi and its two great tributaries, the Luangwa and the Kafue. In the northeast the Chambezi river runs into Lake Bangweulu and this in turn drains into Lake Mweru (q v.) through the Luapula river. The Luangwa and lower Zambezi, below the Victoria falls, run in deep, hot valleys through broken, arid country.

The climate is tropical, with three distinct seasons: hot, August to October; wet, November to April; cool, May to July. Annual rainfall amounts vary, according to altitude, from 25 in. to 50 in.

The plateau country is of the wooded savanna type, though the

woodland is heavier along the Congo-Zambezi watershed and in the teak forests on the central Zambezi. Most of the country north of Broken Hill is infested with tsetse fly. For 100 mi. W. of Kafue township the Kafue is bordered by grassy plains about 40 mi. wide, flooded in the rains, the home of thousands of antelope and buffalo. Similar plains occur on the middle Zambezi and near Lake Bangweulu. The westward bend of the Kafue (the "Hook") was made a national park (c. 8,650 sq.mi.) in 1950 and is particularly well stocked with game. Game is fairly plentiful in most of the more thinly inhabited areas, and almost all varieties of south-central African fauna are to be found, including sitatunga, koodoo, sable and roan antelope, wildebeest, rhinoceros, hippopotamus and a few giraffe. Lions are not uncommon and elephant and buffalo abound in certain areas.

Population and Chief Towns. — There were, in 1951, 37,221 Europeans in the country, 2,529 Asiatics, 1,092 coloured people and about 1,700,577 Africans. In 1942 there were estimated to be only about 15,000 Europeens and 1,366,641 Africans. More than 20,000 Europeans are concentrated on the copper belt and most of the remainder live near the railway, with isolated planting communities at Fort Jameson and Abercorn. There are about 60 distinguishable tribes of Africans, among the largest being the Babemba, Xchewa, Barotse and Angoni.

The chief towns are Lusaka (cap.), 62,000 (1953 est., 6,000 Europeans); Kitwe 60,926 (6,300 Europeans); Luanshya, 54,127 (4,727); Ndola, 44,120 (5,120); Mufulira, 41,668 (4,247); Chingola, 34,484 (3,384); and Broken Hill 32,810 (4,050).

Education and Health. — For European children there are 22 government and 9 other schools. Seven of them offer secondary education. Education is free. In 1951 approximately 146,000 Africans were attending 1,380 schools, administered either by the government or the missions or the native authorities with government grants. Teacher training and secondary and technical education for Africans are being developed as rapidly as the output of the primary schools permits. The climate is good and, if normal precautions against tropical disease are taken, healthful. Malaria, hookworm, dysentery and similar illnesses are prevalent in rural areas only and there is much malnutrition in the villages. Sleeping sickness occurs in certain, well-defined areas. Hospitals and dispensaries serve all but the remotest districts.

Administration. — Northern Rhodesia is administered by a governor and commander in chief assisted by an executive council of seven official and four unofficial members, one of whom represents African interests. These councillors, including the unofficial members, share between them most of the administrative portfolios and answer for the departments in the legislative council. This consisted in 1953 of a speaker, nine official members, nine (European) elected members and four members nominated to represent African interests, of whom two were Africans. The latter were members of the African representative council which advises on all bills affecting African interests and which stands at the apex of a system of provincial councils and tribal local government. The franchise for the legislative council was limited to British subjects, which virtually means the European population.

Agriculture and Industries. — Copper mining employs about 6,000 European males out of a total labour force of 16,000 and about 40,000 Africans. Apart from civil servants, missionaries, traders and railway workers, most other Europeans are engaged in farming. Along the railway they produce cattle, maize, some wheat and tobacco (which is also grown around Fort Jameson in the east). Coffee is produced on the highlands south of Lake Tanganyika. Except for tobacco, which is exported, the chief market for produce is the copper belt, and after World War II many secondary industries developed, including a big, publicly owned cement factory at Chilanga near Lusaka. Lead, zinc and vanadium are mined at Broken Hill, and there is a considerable output of timber from the Zambezi teak forests. After the war production and trade expanded remarkably. Exports in 1938 were worth £5,114,428; by 1951 the figure had risen to more than £67,000,000. This prosperity was almost entirely the result of the rise in the price of copper of which 309,142 tons were exported in 1951, worth 83% of the total value of the export trade. The African population is mainly engaged in subsistence farming though maize is grown as a cash crop. mainly in the Southern province, and tobacco and cotton in the Eastern province. There is a big fishing industry on the Luapula river. About 46,000 adult males are usually away working in Southern Rhodesia and many others in South Africa, in addition to those employed on the copper belt and in the farming areas. In many tribal areas less than 30% of the men are to be found in their villages.

Communications. — The Cape to Congo railway runs northward (507 mi.) from the Victoria falls to the Katanga border with a branch-line system serving the copper belt. It provides access to the ports of Lobito Bay in Angola, Beira in Mozambique and all South African ports. Some barges operate on the upper Zambezi but otherwise the rivers are only used for local canoe transport. Mpulungu on Lake Tanganyika is served by a lake steamer operating from East Africa. Main roads (only 300 mi. with a bitumen surface) run northward from Livingstone to the copper belt and northeast to Abercorn (1,100 mi.); eastward from Lusaka, to Fort Jameson (392 mi.); westward from Lusaka and Nchanga to Mwinilunga, and from Lusaka to Mongu. and southeastward from Kafue to Chirundu and onward to Salisbury. These are all-weather roads of varying quality. District roads serve all the settled areas and the more densely populated African areas. There are 42 airfields, those at Lusaka and Livingstone being of international standard. Internal and regional air services are provided by Central African airways.

Finance. — Revenue rose from less than £3,000,000 in 1942 to £15,000,000 in 1951 and more than £23,000,000 in 1952, more than half of it being paid in income tax by the mining companies. Expenditure followed suit. A ten-year development plan was expected to cost £36,000,000 and was to be financed by £20,500,000 from revenues, £13,000,000 from loans and £2,500,000 from colonial development and welfare funds.

Customs. — The northern third of the country is in the "Congo basin" where, by international convention, no preferences can be given. Ad valorem duties do not exceed 10%. The rest of the country is covered by customs agreements with Southern Rhodesia and South Africa under which these countries admit their products. except spirits and tobacco, duty free. Goods from overseas may be consigned through to Northern Rhodesia in bond, thus, in some cases, saving the higher duties payable in South Africa.

(K. G. B.)

SOUTHERN RHODESIA

Southern Rhodesia, separated from Northern Rhodesia by the Zambezi river, is bounded on the northeast and east by Portuguese East Africa, on the south by the Transvaal and on the southwest and west by the Bechuanaland protectorate. It consists of Matabeleland and Mashonaland, covering 150,333 sq.mi. The country lies between 15° 36' and 22° 25' S. and 25° 14' and 33° 4' E.

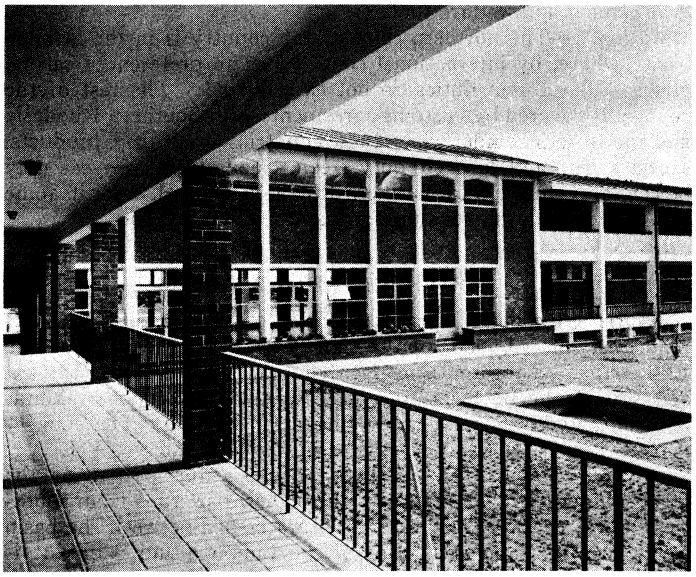
Physical Features. — Southern Rhodesia forms part of the great southern African plateau. The highest part runs from southwest to northeast and forms a broad watershed between the basin of the Zambezi and the basins of the Limpopo and Sabi. It is along this central axis that the railway runs from Plumtree through Bulawayo to Salisbury. In this central area the elevation ranges from more than 4,000 ft. to more than 5,000 ft. On each side the elevation decreases, falling to less than 2,000 ft. about the Zambezi and to less than 1,000 ft. in the southeast. About 24% of the total area lies above 4,000 ft. The surface consists for the most part of gently undulating plains, diversified by steep-sided hill ranges and isolated *kopjes*. The highest point occurs 48 mi. N. of Umtali in Mt. Inyangani, 8,251 ft. There a definite mountain range runs north and south and forms the eastern border of the country.

On the whole the considerable altitude partly compensates for the low latitude. The days are mostly hot throughout the year, the nights frequently cool, and frost is likely to occur during June, July and August. From the middle of August the temperature increases to its maximum in October, when the mean maximum is 85.2" F., taking the country as a whole. Rains and clouds usually appear about October and bring a little coolness. Sometimes the rains are

late and the high temperatures continue to be rather trying during November and December. The thermometer may rise to more than 100° F. even on the high veld. Humidity averages 65% over the year, falling to 48% in October and remaining at about 75% from December to March. The rainy season may be said to last from October to March. The annual average rainfall is 28 in.

About two-thirds of the country is covered with trees and shrubs. There are comparatively few open stretches. The prevailing plant association is savanna, forming parklike territory. At favourable spots on the mountainous eastern border, close evergreen forests occur in patches, some of the trees attaining a height of 200 ft. On the upper slopes Lussonia *umbellifera* and Eugenia species are dominant, and there they grow to heights up to 80 ft. The so-called Rhodesian teak (native igusi; Baikiaea *plurijuga*) is about 50% harder than real teak. From the bark of the baobab the natives obtain a fine fibre which they use for making nets.

The country is rich in antelopes, the most common species being the duiker, the steinbok and the reitbok. Other herbivorous animals are the buffalo, giraffe, zebra. elephant, rhinoceros and hippopotamus. The Carnivora include the lion, leopard, cheeta and various wildcats. There are crocodiles in the rivers. Beetles, butterflies and moths abound. White ants (termites) and locusts can be troublesome. Among the largest of the birds are ostriches, secretary birds, paauws, knorhaans, cranes, storks, vultures and eagles. Guinea fowl, partridge, duck, geese and teal are shot. Good shooting is to be had. but the following are royal game, and so are protected: eland, elephant, giraffe, gemsbok, hippopotamus, inyala, ostrich and rhinoceros. Animals and plants are protected in eight national parks. (See also SOUTH AFRICA, UNION OF.)



AUTHENTICATED NEWS

UNIVERSITY COLLEGE OF RHODESIA AND NYASALAND. LOCATED IN SALISBURY. SOUTHERN RHODESIA. THE COLLEGE WAS OPENED FOR CLASSES IN 1957

Population and Chief Towns. — In 1956 the population consisted of 176,000 Europeans, 2,290,000 Africans and about 13,000 Asian and coloured people. One of the first concerns of the colonial government was to augment the European element. In the first nine months of 1927, 3,574 immigrants were received. In the following year the European population was estimated to be 50,000. After World War II immigration averaged 15,000 a year. The Africans include Amandebele, Amatshangana, Basuto and numerous tribes often grouped together as "Mashona." English is the official language. A certain amount of Afrikaans, however, is spoken in the country districts.

Salisbury (cap.) and Bulawayo are described in separate articles. Umtali, the centre of a gold-mining area, has a non-African and employed African population of 21, 500 (1956). Other municipalities are Gwelo, Fort Victoria, Que Que and Gatooma.

Education. — In 1954 there were 116 European government schools and 24 private, 9 European-aided farm schools, 14 Asian and coloured government schools and more than 2,300 mission and government schools for Africans.

Administration. — In the constitution under the letters patent of 1923 legislation affecting the African population, the unalienated land. the railways and the mineral rights of the British South Africa company were subject to disallowance by the crown (there mere several important changes later), but in other respects Southern Rhodesia was endowed with the institutions of a self-governing overseas British state. Legislative power is vested in the sovereign, represented by the governor, and an executive council composed of the ministry under the presidency of the governor and responsible to the legislative assembly of 30 members. The first general election was held on April 29. 1924, and the first ministry was then formed by Sir Charles Coghlan. The franchise is extended to all British subjects. including Africans, over 21 years of age and possessing premises to the value of £500 or receiving an income of not less than £240 a year.

Agriculture and Industries. — Farming exists in several forms. from ranching to tobacco growing. Mixed farming is common and dairying is practised on the smaller farms near the towns and mines. The three major agricultural products are tobacco, cattle and maize. The acreage under crops (1953) was: maize 374,500; tobacco 178,200; green manures, legumes and fodders 240,000. Irrigation is rapidly developing. Citrus orchards are extending.

Ranching is favoured by the climate. which allows the cattle to run on the veld throughout the winter. In 1953 there were more than 3,000,000 head of cattle, generally in herds of from 600 to 1,000 African-owned cattle totalled 1,831,735. They are grass-fattened for market or are sent on to agricultural farms for final preparation.

Minerals being mined in the 1950s were gold, chrome. lead, asbestos. mica, tungsten, coal. silver, etc. In 1954 the output of gold was valued at £6,651,000. The total output of minerals was valued at £18,776,000.

The gross output of industries in 1952 was valued at £60,000,000. Exports (1952) were valued at £44,486,182, in the form of produce and manufactures. Tobacco exports were valued at £18,838.300. Imports of general merchandise totalled £88.377,915, chiefly textiles and iron and steel goods. Exports to the U.K. were £19,362,000 (1952); to the U.S.. £2,596,484.

Communications. — The railways, with a mileage of nearly 3,000, are operated by a railway commission acting for the two Rhodesias and Bechuanaland (Railaay act, 1926). The colony is well served. and is connected with Beira, the nearest port. Lourenço Marques, the Belgian Congo and the Union of South Africa. There is through communication by the Rhodesian system from Cape Town to the Congo border and, via Bulawayo and Salisbury, to Beira on the Indian ocean. The lines, as far as possible, follow the watersheds. The standard gauge is 3 ft. 6 in. More than 2,500 mi. of all-weather roads of full tarmac or on the strip principle reach in all directions from end to end of the country. The approximate mileage of existing motor roads is 15,600.

Finance. — In the budget for Southern Rhodesia for 1954–55 revenue was estimated at £12,346,000 and expenditure at £12,900,000. The national income for 1954 was estimated at £127,600,000. (See also NYASALAND PROTECTORATE.) (C. L. BK.)

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RHODES SCHOLARSHIPS, founded in 1902 under the

will of Cecil Rhodes. Rhodes provided for the maintenance at Oxford university of men from specified areas overseas. The value of each scholarship eventually rose to £600 a year, for two years in the first instance, and for a third year should the trustees so decide in individual cases. The annual awards in the 1950s were distributed as follows: from Australia, 6 (1 from each state); from Canada 11 (Ontario and Quebec, 2 each; the other provinces. including Newfoundland, 1 each); from New Zealand, 2; from Rhodesia, 3; from South Africa, 8 (including boys from 4 specified schools); and from Bermuda, India, Jamaica, Malta and Pakistan, 1 each. From the United States 32 scholars are elected annually. Five annual scholarships were originally allotted to Germany (because "an understanding between the three great powers will render war impossible and educational relations make the strongest tie") but these were annulled by act of parliament in 1916. The renewed German scholarships were discontinued in 1939.

In his will Rhodes mentions the objects he had in view in founding the different scholarships.

1. *Colonial.* "I consider that the education of young colonists at one of the universities in the United Kingdom is of great advantage to them for giving breadth to their views, for their instruction in life and manners, and for instilling into their minds the advantage to the colonies as well as to the United Kingdom of the retention of the unity of the empire."

2. *United States.* "I also desire to encourage and foster an appreciation of the advantages which I implicitly believe will result from the union of the English-speaking people throughout the world, and to encourage in the students from the United States an attachment to the country from which they have sprung, but without, I hope, withdrawing them or their sympathies from the land of their adoption or birth."

He defines as follows the principles on which he wished his scholars to be selected: "My desire being that the students who shall be elected to the scholarships shall not be merely bookworms, I direct that in the election of a student to a scholarship regard shall be had to (1) his literary and scholastic attainments; (2) his fondness for and success in manly outdoor sports such as cricket, football and the like; (3) his qualities of manhood, truth, courage, devotion to duty, sympathy for and protection of the weak, kindliness, unselfishness and fellowship; and (4) his exhibition during school days of moral force of character and of instincts to lead and to take an interest in his schoolmates, for those latter attributes will be likely in after life to guide him to esteem the performance of public duties as his highest aim."

Method of Selection. — Subject to ratification by the eight trustees, the nomination of scholars is in the hands of local committees, which are appointed by the trustees, and on which former Rhodes scholars sit, but never preside. Candidates must be citizens of the country which they are to represent, with at least five years' domicile, and unmarried; and they must have passed their 19th and not have passed their 25th birthday by Oct. 1 of the year for which they are elected. Candidates are judged on their records and after a personal interview with the election committee. Save in certain exceptional cases. candidates are obliged to have attended a recognized degree-granting college or university for two years at least.

At Oxford the scholars are distributed, as Rhodes desired, among all the colleges of the university, as far as possible in accordance with their own wishes; but acceptance of any scholar is determined by the colleges themselves. More than 3,000 scholars had been elected by 1955.

The 50th anniversary of the first elections (all of which were from South African schools) and the centenary of the founder's birth were celebrated in Rhodes house, Oxford, in 1953.

(P. K.; E. T. Ws.)

RHODIUM is a chemical element which is a precious silver-white metal, one of the six platinum metals (*q.v.*). The metal has a specific gravity of 12.4 and melts at 1,980° C.; thus it is difficult to fuse or cast.

Rhodium (symbol Rh, atomic number 45, atomic weight 102.91) is fairly hard and cannot be easily worked at room temperature; but it can be forged above 800° C., a red heat. Its boiling point must be above 2,500° C.

The surface of the metal has a high reflectivity for light and is not corroded or tarnished by the atmosphere at room temperature. It is frequently electroplated onto metal objects and polished to give permanent attractive surfaces for jewelry and other decorative purposes. In particular, the black tarnish of silver is avoided by the use of rhodium plate. Rhodium also serves for the preparation of "silvered" surfaces for reflectors of searchlights and motion-picture projectors.

Rhodium added to platinum in small amounts yields alloys which are harder and lose weight at high temperatures even more slowly than does pure platinum. Therefore crucibles for heating materials in the chemical laboratory are commonly made from these alloys. In the industrial manufacture of nitric acid, gauze catalysts of the rhodium-platinum alloys are used because of their ability to withstand the flame temperature as ammonia is burned to nitric oxide.

A wire of the alloy 10% rhodium-90% platinum joined to a wire of pure platinum forms an excellent thermocouple for measuring high temperatures in an oxidizing atmosphere. The international temperature scale is defined over the region from 660° to 1,063° C. by the electromotive force of this thermocouple.

The only stable isotope for rhodium has a mass number of 103, *i.e.*, Rh^{103}. Its nuclei possess a high cross section or probability for the capture of neutrons with thermal energies. The Rh^{104} formed by neutron capture is radioactive, and consists of two nuclear isomers (half lives of 44 sec. and 4.3 min.). In nuclear physics experiments, a flux of neutrons can be conveniently and quickly measured by the determination of the amount of radioactivity induced in a thin rhodium foil, exposed for a few minutes to the neutrons.

Rhodium always accompanies platinum in minerals, but only to a minor extent. It was first isolated from crude platinum by William Wollaston. who announced its discovery in 1804. He gave it the name rhodium in consequence of the red colour of a number of its compounds.

Rhodium is almost as resistant as iridium to chemical attack by acids. The massive metal is not dissolved by hot concentrated nitric or hydrochloric acid or even by aqua regia which dissolves gold and platinum. The element dissolves in fused potassium hydrogen sulfate to yield a complex sulfate, soluble in water.

Rhodium, in all well-characterized compounds, possesses the +3 oxidation state. Possibly some compounds of lower oxidation state can form. and strong oxidizing agents yield higher oxidation states of transient stability, probably +4 and +6. All its compounds are readily reduced or decomposed by heating to yield the powdered or sponge metal.

Many rhodium compounds contain co-ordination complexes in which ammonia, water, chloride or other groups are bonded covalently to a central rhodium ion. Characteristically, the groups in these complexes are replaced slowly. A series of substituted ammine compounds is analogous to familiar compounds of cobalt (III) (see COBALT). A yellow hydrous rhodium hydroxide, soluble in acid or alkaline solutions, can be precipitated, but some conditions will cause a black precipitate to form. Rh_2O_3 is a gray compound, insoluble in acids. $RhCl_3$ can be prepared in a form which does not dissolve in water or acids. Other forms dissolve readily to give solutions whose colour may range from brown to yellow and in which some or all of the chloride is not precipitated by silver nitrate.

(D. S. MN.)

RHODOCHROSITE, one of the calcite group of carbonate minerals, consisting of manganese carbonate. It is used as a source of manganese for the ferromanganese alloys consumed in steelmaking and in the preparation of other manganese chemicals. Named from the Greek meaning "rose coloured," it sometimes is known as manganese spar.

The formula for rhodochrosite is $MnCO_3$. Extensive substitution of iron and calcium, as well as lesser amounts of magnesium, may occur in place of the manganese. It crystallizes in the rhombohedral system, and occurs commonly as compact crystalline masses and incrustations rather than as single crystals. When

pure it is usually some shade of pink or rose-red, with a specific gravity of 3.7 and a hardness of 3.5–4.

Rhodochrosite is found in sedimentary deposits, in mineral veins of silver, lead, copper and zinc minerals formed at moderate temperatures and in high-temperature metamorphic deposits. It is found in England, at a number of localities in Europe, in Siberia and in Argentina. Brazil and Peru.

In the United States it occurs abundantly at Butte, Mont.. and is found in California, Colorado, Nevada, Ctah, Arkansas. Tennessee and Maine. (D. L. G.; X.)

RHODODENDRON, of the heath family (Ericaceae), is one of the largest genera of woody plants. It comprises 800–900 species including about 70 azaleas. Azaleas, together with rhodora, were once considered as constituting a distinct genus, but are now treated as species of *Rhododendron.*

The true rhododendrons are mostly evergreen and with campanulate corollas while the azaleas are usually deciduous and with funnelform corollas. They are commonly kept distinct by gardeners but botanical characters distinguishing the two are not constant. Some azaleas are evergreen while some true rhododendrons are deciduous.

Rhododendrons are among the most popular garden plants, much planted for their beautiful showy flowers and for their

ROCHE

RHODORA (RHODODENDRON CANADENSE) **BLOSSOMS**

ornamental foliage in the evergreen species. The species are distributed throughout the colder regions of the northern hemisphere, and also on the high mountains of southern Asia, Malaysia and New Guinea. with one in northern Australia, but none in Africa and South America. The greatest development is found in the Himalayas eastuard to western and central China, in the wet monsoon zone of Asia. There are about 26 species in North America, but none extending into Mexico.

There is no wild species in Britain. although *R. ponticum* is practically naturalized in the south. but the genus is exceedingly popular for gardens and most species do extremely well there. In North America they are best cultivated along the Atlantic seaboard, in the Alleghenies and on the Pacific coast.

The rhododendrons are shrubs. rarely small trees. Some species are epiphytic. The leaves are alternately arranged, stalked and, generally, with entire margins. The flowers are large and showy, on stalks, generally several to many grouped together in terminal umbellike clusters. There is a small calyx. generally five-parted. The corolla is red blue. yellow or white, or of intermediate shades, rotate to campanulate or funnelform, usually slightly irregular, and five or rarely six to ten lobed, occasionally divided to the base. There are five to ten stamens with anthers opening with apical pores. The ovary is five to 20 celled. each cell many ovuled. There is a slender style ending in an enlarged stigma. The fruit is an ovoid or elongate capsule, splitting from top into 5 to 20 valves when mature, liberating numerous minute seeds.

The species grow only in acid soils rich in humus. They thrive best in a cool, damp atmosphere and prefer "high shade." To prepare ground for cultivation, peat moss or acid leafmold, especially from oaks, or sawdust can be used to mix with loamy soil. The roots are shallow and are without root hairs but are associated with a mycorrhizal fungus. It is important to mulch the soil to keep the roots from drying out in summer as well as in winter. The evergreen rhododendrons are generally propagated by seeds or layering. Grafting is resorted to in only the rarer and more tender kinds.

A number of American species are highly ornamental and much planted. Among these are the coast rhododendron, R. *macrophyllum,* the state flower of Washington; the catawba rhododendron, *R. catawbiense,* of the southern Alleghenies; and the rose bay rhododendron, *R. maximum,* of eastern North America. The latter two, together with the less hardy *R. arboreum* and *R. campanulatum* from the Himalayas, *R. caucasicum* from the Caucasus, R, *ponticum* from the Mediterranean region and other species have given rise by hybridization to numerous horticultural varieties now in general cultivation. (H. L. L.)

RHODONITE, a member of the silicate group of minerals, consisting of manganese metasilicate. It commonly occurs as cleavable to compact masses with a rose-red colour; hence the name, from the Greek word meaning a rose. The formula is $MnSiO_3$. It crystallizes in the triclinic system and crystals often have a thick tabular habit; there are perfect cleavages parallel to the prism faces. The hardness is 5.j–6.5, and the specific gravity 3.4–3.68.

Rhodonite is liable to alteration, and in certain cases forms the primary source of very important deposits of ores of manganese, mainly in the form of oxides, such as pyrolusite (*q.v.*); such are a considerable part of the manganese ores of India.

Rhodonite occurs as large rough crystals with franklinite and zinc ores at Franklin, N.J. Fine-grained rhodonite of clean colour is a desirable gem and ornamental stone. The finest quality is mined near Sverdlovsk, U.S.S.R., in the Urals. Good stone occurs in Siskiyou and Plumas counties in California. It has been used for beads, pendants and other ornaments.

See JADE AND OTHER HARD STONE CARVINGS: *Other* Hard *Stones.* (W. F. FG.)

RHODORA, the common name for *Rhododendron canadense* (formerly *Rhodora canadensis),* a small deciduous shrub of bogs and lox\-acid soils of the New England states and adjacent areas. It produces beautiful pale to deep rose-purple flowers in April and May.

The plant is perhaps best known from Emerson's poem concerning it.

(*See* RHODODENDRON.) (*J.* M. BL.)

RHOECUS, a Samian sculptor and architect of the 6th century B.C. He and his partner Theodorus were especially noted for their work in bronze.

Herodotus says that Rhoecus built the temple of Hera at Samos. In the temple of Artemis at Ephesus was a figure of "Night" by Rhoecus, apparently of bronze. The name has been found on a fragment of a vase dedicated to Aphrodite at Naukratis. His sons Theodorus and Telecles made a statue of the Pythian Apollo for the people of Samos.

RHONDDA, DAVID ALFRED THOMAS, 1ST VISCOUNT (1856–1918), British colliery owner and statesman. was born on March 26, 1856, in Aberdare, the son of a grocer, Samuel Thomas, who had enriched himself by colliery speculations. After an education at Clifton college and Caius college. Cambridge university, Thomas joined his father in the coal business, into which he threw himself with great energy and ability. His extraordinary commercial gifts, his insight, his foresight and the sympathy which he brought to bear on conditions of life in the mining industry soon made him a prominent, and eventually the leading, figure in the

industrial world of south Wales. His business combinations brought him great wealth: and culminated in the Cambrian supercombine, which produced about 6,000,000 tons of steam coal a year.

Though he had sat as a Liberal for Merthyr Tydfil for 22 years from 1888, and for Cardiff for a few months in 1910, Thomas achieved no political importance till the outbreak of World War I, when Lloyd George invoked his assistance in mobilizing British industrial resources. He considerably expedited U.S. munitions supplies by personal visits to the United States. on one of which he narrowly escaped with his life from the sinking of the "Lusitania." He was created a baron, as Lord Rhondda. for his services. in Jan. 1916: and took office in Lloyd George's ministry in the following December as president of the local government board. passing to the food controllership in June 1917. There, taking strong steps to put an end to speculation in the necessities of life, he gradually fixed prices and brought supplies under control.

He will be mainly remembered as the author of the system of compulsory food rationing, which was carried out with absolute fairness and impartiality. In April 1918 he tendered his resipnation; but pressure was put upon him to remain. He died on July 3 at Llanwern, Monmouthshire. Just previously he had been created a viscount. His only child. a daughter (who married Sir Humphrey Mackworth in 1908, and obtained a dissolution of their marriage in 1923), succeeded to the viscounty of Rhondda under a special remainder. In 1921 Lady Rhondda published a *Life* of her father.

RHONDDA, a municipal borough (1955) of Glamorgan, south Wales. 12 mi. long by about 4¾ mi. across at its widest part, comprising two main valleys, named after their respective rivers, Rhondda Fawr and Rhondda Fach. Pop. (1961) 100,314. Area 37.3 sq.mi. The valleys are deeply incised in the coal measures of the south Wales geological basin and their lateral boundaries are formed by hills varying from 560 ft. near Trehafod to 1,567 ft. on the northeast of Maerdy in the Rhondda Fach and 1,742 ft. on the southwest of Treherbert in Rhondda Fawr. The upper end of the latter valley rises to the Rhigos plateau where Craig-y-Llyn (1,969 ft.) is the highest point in Glamorgan. The two valleys are separated by the ridge of Cefn-y-Rhondda, which ranges from 600 ft. above Porth to 1,690 ft. There are tributary valleys where it joins the Rhigos plateau of which Cwmparc, Clydach vale and Cymmer are the chief.

Rhondda is the centre of the eastern division of the south Wales coal field. Coal exploitation there started in 180; and so it was later than that of the northern sections of the south Wales area where coal was worked early for iron smelting. It was the realization of the steam-raising properties of the Rhondda coal and the opening of the Treherbert pits in 1855 that made the region famous.

With the great demands made for steam coal by the ever-increasing railway traffic. steamship services and navies of the last half of the 19th century. Rhondda from being a purely pastoral upland region was transformed into a densely populated industrial area. No thought was given then, however, to the development of other industries which could provide alternative employment in the event of a setback in the coal-mining industry. With the rapid growth of each township provision was made for miners' libraries and institutes and numerous places of worship, and around these grew and flourished social, religious and cultural activities, particularly in music and drama, which. in turn: led to the creation of a strong community of interest and civic pride.

In 1801 the population was 542, but by 1871 it had reached 23,950; in 1881 it was jj.632 and in 1901 it was 113,735. The peak population figure was 167,900 in 1924 but during the severe industrial depression of the 1930s it fell to 121,940 by 1938 Further migration during World War II reduced the population seriously and by 1951 the figure stood at 111.389.

With the development of the coal exporting trade a number of small railway companies connected Rhondda with Cardiff, Port Talbot and Swansea but all these lines were eventually merged in the Great Western railway, and in 1947 in the Western region of British railways. The slump in world demand for Welsh coal following World War I undermined the prosperity of the area and led to mass unemployment and migration. In 1934, of Rhondda's 61.460 insured men more than 47% were without work. In an attempt to relieve this critical situation two new factories were opened in the area in 1939. After World War II the policy of redistribution of industry to help depressed areas brought 29 new industries to Rhondda. At mid-century the area had a stable and varied industrial pattern. There are two major schemes of mining reorganization at Maerdy and Treherbert. (J. C. G. J.)

RHÔNE, a *département* of southeastern France, formed in 1793 from the eastern portion of the *département* of Rhône-et-Loire, and comprising the old districts of Beaujolais, Lyonnais, Franc-Lyonnais, Forez and a small portion of Dauphiné. Pop. (1954) 966,782. Area, 1,104 sq.mi. Rhône is bounded north by the *département* of Saône-et-Loire, east by Ain and Isère and south and west by Loire. The Saône and the Rhône form its natural boundary to the east. The *département* belongs almost entirely to the basin of the Rhône, to which it sends its waters by the Saône and its tributary the Azergues, and by the Gier. The mountains which cover the surface of the *département* constitute the watershed between the Rhdne and the Loire, and from north to south form four successive groups—the Beaujolais mts., the highest peak of which is 3,320 ft.; the Tarare group; the Lyonnais mts. (nearly 3,000 ft.); and Mt. Pilat, the highest peak of which belongs to the *département* of Loire.

Good agricultural land is found in the valleys of the Saône and Rhône, but for the most part the soil is stony and only moderately fertile. Wheat, oats, rye and potatoes are widely grown. with colza on the banks of the Saône, but they are less important than the vine, the hills of the Beaujolais on the right bank of the Sadne producing excellent wines. Mines of copper pyrites and coal and quarries of marble (at Bully) are worked. The production of silk fabrics, the chief branch of manufacture of artificial silk goods, of chemicals and machinery, together with most of the other industries of the *de'partement,* are concentrated in Lyons (*q.v.*) and its vicinity. Tarare is a centre for the manufacture of velvet, muslin and embroidery. Oullins has large railway workshops belonging to the P.L.M. railway, and there are important glassworks at Lyons and at Givors. Cotton spinning and weaving are carried on in several localities.

The *de'partement* is served by the P.L.M. railway. The Rhône and the Sadne and in the extreme south the canal of Givors are its navigable waterways. Lyons, the capital. is the seat of an archbishop and of a court of appeal and centre of an educational division *(acaddmie).*

The *de'partement* is in the 14th military region. There are two *arrondissements* (Lyons and Villefranche) with 33 cantons and 269 communes. The principal places besides Lyons are Givors, Tarare and Villefranche (*q.v.*).

RHÔNE, one of the most important rivers in Europe, and the chief of those which flow directly into the Mediterranean. It rises at the eastern. extremity of the Swiss canton of the Valais, flows through Switzerland and France and enters the Mediterranean at the Gulf of Lyons. Its total length is 505 mi.. of which the Lake of Geneva, through which it flows: claims 45 mi.; and its total fall is 5.898 ft. Its course (excluding the Lake of Geneva. *q.v.*) naturally falls into three divisions: (1) from its source to the Lake of Geneva (105½ mi. and fall 4.679 ft.) *(2)* from Geneva to Lyons (124 mi. and fall 689 ft.) and (3) from Lyons to the Mediterranean (230 mi. and fall 530 ft.).

From its Source to the Lake the Rhdne is a purely Alpine river, flowing through a great trench first in a synclinal structure between the Aar and St. Gothard massifs, then along the front of the Pennine nappes. *(See* ALPS.) It issues as a torrent, at the height of 5,909 ft., from the Rhône glacier at the head of the Valais. It is almost immediately joined (left) by the Mutt torrent. coming from a small glacier and then flows past the Gletsch hotel (where the roads from the Grimsel and the Furka pass unite). About half a mile from the glacier the river descends through a wild gorge to the more level valley, to reach the first village, Oberwald. It preserves a south-westerly direction till

Martigny.

The uppermost valley of the Rhbne is named Goms, its chief villages being Miinster and Fiesch, whilst the river is swollen by mountain torrents, descending from the glaciers on either side, by the Geren (left), near Oberwald; by the Eginen (left), near Ulrichen; by the Fiesch (right), from the Fiesch glacier, at Fiesch; by the Binna (left), near Grengiols; by the Massa (right) from the Aletsch glaciers, above Brig. At Brig the RhBne has descended 3,678 ft. from its source in 28 m., and is already a considerable stream when joined (left) by the Saltine. descending from the Simplon Pass. Its course below Brig is less rapid and lies through wastes of alluvial deposits. The valley is wide and marshy, the river frequently overflowing its banks. Further mountain torrents fall into the RhBne: these are the Visp (left) from the Zermatt valley, at Visp; at Gampel, the Lonza (right) from the Lotschen valley; at Leuk, the Dala (right) from the Gemmi Pass; at Sierre, the Navizen (left) from the Einfisch or Anniviers valley; at Sion, the capital of the Valais, the Borgne (left) from the Val d' Hérens; below Sion, by the Morge (right), from the Sansetsch pass; and at Martigny by the Dranse (left) from the Great St. Bernard and the Val de Bagnes. At Martigny, the river bends sharply to the northwest toward the Lake of Geneva. Opposite Dorénaz it receives the Salanfe (left). Immediately below St. Maurice the Rhône rushes through a narrow and striking defile which commands the entrance of the Valais.

Beyond, the river enters the wide alluvial plain, formerly occupied by the south-eastern arm of the Lake of Geneva, but now marshy. It receives at Bex the Avançon (right) flowing from the glaciers of the Diablerets range, at Monthey the Vièze (left) from Champéry and the Val d' Illiez, and at the Aigle the Grande Eau (right), from the valley of Ormonts-dessus. It passes Port Valais, once on the lake, before expanding into the Lake of Geneva, between Villeneuve (right) and St. Gingolph (left). During all this portion of its course the Rhône is not navigable, but its valley forms an artery into the Alps which is followed by the railways and roads.

The Upper RhBne. being fed by glacial streams, is overladen with sediment, much or which is deposited along the course, the remainder settling down in the Lake of Geneva, in the blue waters of which it is possible to follow the whiter course of the stream for some distance before it disappears.

From Geneva to Lyons.—About ½ m. below Geneva the blueness of the water of the RhBne is again disturbed by the Arve (left), from the glaciers of the Mont Blanc range, the two currents for some distance refusing to mix. The RhBne is here forced southward by the sweep of the Jura folds through which it breaks in a number of narrow gorges or *cluses*. It continues southward until joined near Corbelin by the Guier (left), from the Grande Chartreuse mountains and it continues the direction of this tributary thus rounding the southern spur of the Juras.

About 12 m. south of Geneva the RhBne enters France. At Bellegarde the Valserine flows in (right), and then the river resumes its southerly direction, from which a great gorge has deflected it for a while. Some way below Bellegarde, between Le Parc and Pyrimont, the Rhbne becomes officially "navigable" though as far as Lyons the navigation consists almost entirely of flat-bottomed boats. Above Seyssel the Usses (left) joins the RhBne, while just below that village the Fier (left) flows in from the Lake of Annecy. Below the junction of the Fier the hills sink on either side, the channel of the river widens and it leaves the mountains for the plains. The Geneva-Paris railway follows the river as far as Culoz. The Rhône receives the waters from Lake Bourget by a canal (left). The last of the *cluses* is at the Pont du Saut or Sault, a little south of Lagnieu. The river now widens but the neighbouring country is much exposed to inundations.

It receives the Ain (right), which descends from the French slope of the Jura and is navigable for about 60 m., above its junction with the SaBne, just below Lyons. The SaBne (*q.v.*), which has received (left) the Doubs, is the real continuation of the lower RhBne, both from a geographical and a commercial point of view. and it is by the means of canals branching off from the course of the SaBne that the RhBne communicates with the basins of the Loire, the Seine, the Rhine and the Moselle.

Below Lyons, the Rhône becomes one of the great historical rivers of France. It was up its valley that various civilizations penetrated from the Mediterranean to Lyons. From Lyons downward the left bank serves as a great medium of commerce by which central France sends its products to the sea. During this half of its course it flows over an alluvium-filled valley resting on Jurassic and Cretaceous rocks, and it can boast of having on its left bank (the right bank is very poor in this respect) such historical cities as Vienne, Valence, Avignon, Tarascon and Arles, while it receives (left) the Iskre, the Drôme, the Aygues and the Durance rivers, all formed by the union of many streams from the Dauphiné Alps.

The Ardèche is the only considerable affluent from the right. Near Arles, about 25 mi. from the sea, and 175¼ mi from Lyons by rail, the river breaks up into two main branches, the Grand RhBne running southeast and the Petit Rhône southwest; they enclose between them the delta of the Camargue, which is cultivated on the banks of the river only, but elsewhere is simply a great alluvial plain, composed of scanty pasturages and of great salt marshes. Changes in sea level have taken place in the RhBne delta in recent times. R. D. Oldham (*Nature,* vol. cxvi, pp. 16, 52, 100 [1925]), shows that in Pre-Roman times the sea level was 15 ft. higher than in modern times. A rise was followed by a subsidence which occurred in about the 8th century when the river ended far inland in a shallow landlocked inlet uhich it proceeded to fill up with alluvium until in the 17th century it had regained the sea front. Even since that time it has greatly modified its form by changes of channels, etc.

The RhBne river system is dominated by two tectonic features, the Alps and the Central Plateau of France. Below Chalon-sur-Saône, the Saône-Rhône flows along the eastern side of the central plateau and most of the course is determined by a north to south fault. The remainder of the river system is determined by the structure of the Alps (*q.v.*). The greater length of the river and of its Alpine affluents is parallel to the trend of the structures, as above Martigny, between Lake Geneva and Corbelin, the Arve in the Chamonix valley and parts of the Iskre and of the Durance. On the other hand other portions flow radially to the trend, as between Martigny and Lake Geneva, parts of Iskre, the Drôme, the Aygues, the Durance and numerous other tributaries.

RHOXOLANI, a Sarmatian tribe defeated in the Crimea by Diophantus, general of Mithradates, c. 100 B.C., and by the Romans on the lower Danube *c.* A.D. 60, and also under M. Aurelius. They seem to have finally succumbed to the Goths.

RHUBARB. This name is applied both to a drug and to a vegetable.

Drug.—The drug has been used in medicine from very early times, being described in the Chinese herbal Pen-king, which is believed to date from 2700 B.C., and it is still produced in the four northern provinces of China in modern times. In England the culture of rhubarb for medicinal purposes began in 1777 at Banbury in Oxfordshire and continued to be carried on there.

Two varieties of the drug are known, viz., kiln dried and sun dried. So-called Turkey rhubarb was the Chinese drug which reached Europe from Aleppo and Smyrna, having traveled to Asia Minor by way of Persia and the Caspian.

The most important constituent of this drug, giving it its purgative properties and its yellow colour, is chrysarobin, formerly known as rhein or chrysophan. The rhubarb of commerce also contains chrysophanic acid, a dioxymethyl anthraquinone of which chrysarobin is a reduction product.

Nearly 40% of the drug consists of calcium oxalate, which gives it the characteristic grittiness. There is also present rheotannic acid, which is of some practical importance. There are numerous other constituents, such as emodin, mucilage, resins, rheumic acid, aporrhetin. etc.

Vegetable.—The vegetable rhubarb (Rheum *rhaponticum*), also called pieplant (family Polygonaceae), is a hardy Asiatic

perennial grown for its large, succulent leafstalks. The plant produces large clumps of enormous leaves, up to two feet across, on proportionately large petioles or leafstalks—an inch or more in diameter and up to two feet or more in length—that arise from a shortened underground stem. These huge leaves arise early in the spring; later in the season a large central flower stalk may appear and bear numerous small greenish-white flowers and three-angled or winged fruits containing one seed. The plant is best adapted to the cooler parts of the temperate zones; the roots are quite hardy to cold although the tops are killed in autumn.

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RHUBARB (RHEUM RHAPONTICUM) IN FLOWER

Rhubarb seed does not produce plants true to the variety that bears them; therefore it is propagated by dividing the perennial "crown" into pieces each consisting of a root piece and a bud. These are set in the field about four or five feet apart each way. The large crowns are sometimes moved into forcing houses in late winter for producing the leafstalks under artificial heat. and in subdued light. A greenhouse is not necessary. Only the fleshy leafstalks are eaten: they are highly acid and contain considerable amounts of oxalates. The leaves should never be eaten since they are sometimes poisonous.

(J. M. BL.)

RHUS: *see* SMOKETREE; SUMACH.

RHYL, a seaside town and urban district in the West Flintshire parliamentary division of Flintshire, north Wales. 18 mi. W.N.W. of Flint by road. Pop. (1951) 18.868. Area 2.7 sq.mi. It lies on a sandy coast near the mouth of the Clwyd and was originally a fishing village with a little coastal trade. Many people on vacation visit Rhyl in summer.

RHYME, more correctly spelled rime, from Provençal word *rim* (its customary English spelling is the result of a confusion with *rhythm*), a literary ornament or device consisting of an identity of sound in the terminal syllables of two or more words. In the art of versification it signifies the repetition of a sound at the end of tn-o or more lines in a single composition. This artifice was practically unknown to the ancients, and. n-hen it occurs, or seems to occur. in the works of classic Greek and Latin poets, it must be considered to be accidental. Conscious rhyme came later. The name given to lines with an intentional rhyme in the middle is *leonine verse,* the invention being attributed to a probably apocryphal monk Leoninus or Leonius, who is supposed to be the author of a history of the Old Testament preserved in the Bibliothèque Nationale of Paris. This '.history!' is composed in Latin verses, all of which rhyme in the centre. Modern criticism has been inclined to look upon the African church Latin of the age of Tertullian as the starting point of modern rhyme, and it is probable that the ingenuities of priests, invented to aid worshippers in hearing and singing long pieces of Latin verse in the ritual of the Catholic Church. produced the earliest conscious poems in rhyme. It is certain that by the 4th century a school of rhymed sacred poetry had come into existence, classical examples of which we still possess in the "Stabat Mater" and the "Dies Irae." In the course of the middle ages, alliteration, assonance and end-rhyme held the field without a rival in vernacular poetry. After the 14th century. in the north of Europe, and indeed everynhere except in Spain. where assonance held a powerful position. end-rhyme became universal and formed a distinctive indication of metrical construction.

It was not until the invention of blank verse (*q.v.*) that rhyme found a modern rival. Certain forms of poetry are almost inconceivable without rhyme, though efforts have been made to compose even rhymeless sonnets. In the heyday of Elizabethan literature a serious attempt was made in England to reject rhyme altogether, and to return to the quantitative measures of the ancients: The prime mover in this heresy was a pedantic grammarian of Cambridge. Gabriel Harvey (1j45?–1630). For a short time he actually seduced no less melodious a poet than Edmund Spenser to abandon rhyme and adopt a system of accented hexameters and trimeters.

From 1576 to 1579 the genius of Spenser seems to have been obscured by this error of taste. but he shook it off completely when he composed The *Shepherd's Calendar.* Thomas Campion, in a tract published in 1602, advocated the omission of rhyme from lyrical poetry. By dint of a prodigious effort, he produced some unrhymed odes, which were not without charm, but the best critics of the time, such as Daniel, repudiated the innovation.

In Germany a determined attack on rhyme was made early in the 17th century. particularly by a group of aesthetic critics in the Swiss universities. G. Lessing recalled the German poets to a sense of the beauty and value of rhyme, but the popularity of F. Klopstock and his imitators continued to exercise a great influence. Goethe and Schiller. without abandoning rhyme, permitted themselves a great liberty in the employment of unrhymed measures and in imitation of classic metres. This was carried to greater lengths by A. Platen-Hallermund and H. Heine, the rhymeless rhythm of the last of whom was imitated in English verse by Matthew Arnold and others. In France. on the other hand, the empire of rhyme has always been triumphant. and in French literature the idea of rhymeless verse could till recently scarcely be said to exist.

In Italian literature the excessive abundance and facility of rhyme has led to a rebellion against its use. It was the influence of German aesthetics which forced upon the notice of G. Leopardi the possibility of introducing rhymeless lyrical measures into Italian verse. an innovation which he carried out with remarkable hardihood and success. The rhymeless odes of G. Carducci are also worthy of admiration. At the close of the 19th century, particularly in France, where the rules of rhyme had been most rigid, an effort was made to modify and minimize the restraints of rhyme.

The laws of rhyme, like other artificial regulations. may be too severe, but there is no evidence that the natural beauty which pure rhyme introduces into poetry is losing its hold on the human ear or is in any real danger of being superseded by accent, assonance, or rhythm.

See J. B. Schutze, *Versuch einer Theorie des Reimes nach Inhalt und Form* (Magdeburg, 1802); J. Minor. *Neuhochdeutsche Metrik* (Strasbourg, *1893);* J. B. Mayer, *A Handbook of Modern English Metre* (1903); Eaerton Smith, *The Principles of English Metre* (Oxford, 1923); Henry Lanz, *The Physical Basis of Rime* (1931).

RHYMNEY, an urban district in the northwestern corner of Monmouthshire. Eng.. and in the Ebbw Vale parliamentary division. 23 mi. N.N.W. of Cardiff by road. Pop. (1951) 9,137. Area 4.1 sq.mi. It comprises Rhymney and Abertysswg. It was one of the earliest and most prosperous centres of the south Wales iron industrv.

The principal industries are now brewing, light engineering and clothing manufacture. and many of the inhabitants work in nearby collieries

RHYOLITE, the volcanic, mostly effusive, equivalent of granite, takes its name from the Greek word for torrent or stream because of the frequency and variety of its fluxional textures. The term liparite, from the Lipari Islands of Italy, originally proposed for the same rocks, was subsequently restricted to porphyritic varieties and is rarely used.

The glassy rhyolites include obsidian, pitchstone, perlite and pumice, though microscopic examination sometimes shows that pumices are actually ash flows and thus better designated as tuffs.

At atmospheric pressure granitic liquid above its melting point is exceedingly viscous. Cooled rapidly, as when extruded from a volcanic vent. it tends to chill to a glass rather than crystallize, as under plutonic conditions. The glassy or partly glassy rocks so formed are metastable, however, and devitrify into minutely crystalline, frequently spherulitic or felted aggregates, in periods of time that are relatively short by geological standards. Hence pre-Tertiary rhyolites which were originally true glasses almost invariably display one of the vitrophyric, stony or felsitic textures

characteristic of devitrification. The glasses are also especially susceptible to hydrothermal alteration and weathering.

Most rhyolites are porphyritic, indicating that crystallization had begun prior to extrusion. Indeed, intratelluric crystallization may sometimes continue until the rock consists largely of phenocrysts at the time of extrusion, and the amount of microcrystalline matrix in the final product may then be so small as to escape detection except under the microscope. Such rocks (nevadites) are easily taken for granite in hand specimens.

In most rhyolites, however, the period of intratelluric crystallization is relatively short, so that the rock consists largely of a microcrystalline or partly glassy matrix in which are set a few per cent of phenocrysts. The matrix is sometimes micropegmatitic or granophyric.

Composition. — Except for occasional gross enrichment in silica, usually due to hydrothermal alteration, the chemical composition of rhyolite is very like that of granite (*q.v.*). There can be little doubt of the equivalence, and this is perhaps the strongest single reason for supposing that at least some and probably most granites are of magmatic origin.

The phenocrysts of rhyolite may include quartz, alkali-feldspar, oligoclase, biotite, amphibole or pyroxene, and the rules governing the coexistence of the different species are similar to those obtaining in granite. Thus, if an alkali-pyroxene or alkali amphibole is the principal dark mineral, oligoclase will be rare or absent and the feldspar phenocrysts will consist largely or entirely of alkali-feldspar. Rocks of this sort. for which the names comendite and pantellerite have been proposed (the latter has priority), are the volcanic equivalents of the alkali-granites.

If both oligoclase and alkali-feldspar are prominent among the phenocrysts the dominant dark silicate will be biotite, and neither amphibole nor pyroxene, if present, will be an alkaline variety. Such lavas, the quartz porphyries or "true" rhyolites of most classifications, are the volcanic equivalents of the two-feldspar granites.

Certain differences between rhyolite and granite should not be glossed over. Muscovite, a common mineral in granite, occurs very rarely and only as an alteration product in rhyolite. In most granites the alkali-feldspar is a soda-poor microcline or microcline-perthite. In most rhyolites the alkali-feldspar is sanidine, thought to be a high-temperature form, and not infrequently rich in soda.

A great excess of potassium oxide, K_2O, over sodium oxide, Na_2O, is uncommon in granite except as a consequence of hydrothermal alteration; it is not uncommon in rhyolites, and though it sometimes seems to be produced in the same way, this is by no means always the case.

Occurrence.—Rhyolites are known from all parts of the earth and of all geologic ages, though the pre-Tertiary ones are ordinarily so devitrified or otherwise altered as to receive special names, viz., felsite, quartz-keratophyre, quartz-porphyry, etc. Obsidian is well developed in Yellowstone National park, Mont., and Mono craters, Calif. Perlite has been mined in New Mexico for lightweight cement aggregate; it also occurs in Yellowstone but the classic localities for it are in Hungary. Pitchstone, of particular interest as a rock glass containing several per cent of combined water, has been described from Meissen, Saxony; Boggabri, New South Wales, Austr.; Amba Barra, Aby.; Berufjord, Ice.; and numerous other localities, but is perhaps best known from Arran Island, Scot.

Pumice, a frozen emulsion of air and lava of rhyolitic composition, is likewise of world-wide occurrence; Mono lake, Calif., is a well-known North American locality. Porphyritic rhyolites showing every ratio of phenocrysts to matrix abound in Colorado and Nevada.

The pantellerites, essentially volcanic equivalents of the alkali-granites, are spectacularly developed on the island of Pantelleria, southwest of Sicily, but are common throughout the Mediterranean as well as in British East Africa, eastern Siberia, Indonesia and west Texas.

Plagioclase and biotite are rare or lacking as phenocrysts in these rocks and in many of them quartz phenocrysts are not common. Quartz is usually abundant in the groundmass, however, and the silica content is generally appropriate for a granite or quartz syenite. The ferromagnesians are alkali amphiboles and pyroxenes, cossyrite (evidently a titaniferous amphibole) and, occasionally, fayalite.

Fractional Crystallization Hypothesis. — It is known that granites are confined to continental areas and the association can hardly be fortuitous. Rhyolites are for the most part also confined to the continents or their immediate margins, but they are not entirely lacking elsewhere. Small quantities of rhyolite (or quartz trachyte) have been described from the Marquesas, Tonga, Hawaii, Gambier, Eastern Samoa, St. Helena and Ascension, all genuine oceanic islands remote from any continental land-mass. There seems no way to explain such occurrences except as residual liquids from the fractional crystallization of basalt, and they are the clearest kind of evidence that granitic magma may indeed form in this fashion. Furthermore, on the continents proper and on continental islands, there is often a close and quite possibly genetic association between basalt, andesite and rhyolite. Sardinia and the Lipari Islands in the Mediterranean offer excellent examples of this association, as do Steens mountain and Newberry volcano in Oregon.

If the ratio of rhyolite to basalt in the oceanic islands is any criterion of the efficiency of the fractionation process, however, the derivation of the known or reasonably inferred volume of granite in the continents by this means would require an almost unimaginably immense volume of basaltic magma. Granting that this amount of basalt was available, and that it did indeed fractionate during cooling to yield granite magma, it must yet be explained why rhyolites should be so much less abundant than granites.

The derivation of granitic and rhyolitic magma by fractional crystallization of basalt is the most reasonable working hypothesis available; it is nothing more.

For additional information respecting the special characters and the occurrences and uses of the more important rhyolites see OBSIDIAN; PERLITE; PITCHSTONE; PUMICE. More detailed discussion of fractional crystallization will be found in PETROLOGY: Plutonic Complexes. See also GEOCHEMISTRY: Geochemistry of the Lithosphere: Crystallization of Magmas and Its Products.

(F. Cs.)

RHYS, SIR JOHN (1840–1915), Welsh philologist, was born near Ponterwyd, Cardiganshire, on June 21, 1840. After attending local schools, Rhys went to the Normal school at Bangor and then became a schoolteacher at Rhos-y-b61 (Anglesey). But in 1865 he was given a scholarship to attend Oxford, where he read Classics (B.A., 1869) at Jesus college, and was elected a Fellow of Merton college. On his own initiative he studied comparative philology during the summers at the Sorbonne, and at Heidelberg, Leipzig and Gottingen.

After a few years as inspector of schools for the counties of Flint and Denbigh, he became professor of Celtic at Oxford (1877–1915) and subsequently (1895) principal of Jesus college. He played an important part in the establishment of the university colleges at Cardiff and Bangor. His best work is in Welsh antiquities and philology, that on Gaulish inscriptions less satisfactory.

Rhys died on Dec. 17, 1915, at Oxford.

See *Proceedings* of ***the*** *British* ***Academy,*** xi, pp. 187–212 (bibliography) (1924–25). (J. WH.)

RHYTHM, a certain swing or balance in bodily movement, music, verse or prose; often extended by metaphor to apply in other spheres (*e.g.,* "rhythm of life"). The early critic of prosody, Aristoxenus (c. 320 B.c.), distinguished three elements in rhythm — the speech (lexis), the melody (melos) and the bodily motion (*kinesis* somatike); but the later tendency has been to separate these elements, and to emphasize more and more the distinction between them. Precision, however, has hardly yet been reached; and there are few subjects on which opinions, even among experts, differ more widely. In a short article it will be necessary to make controversial statements without defending them by argument.

Rhythm in Verse.—The line between rhythm and metre is hard to draw. Aristotle is very vague on the question: Suidas says that rhythm is the father of metre, and Quintilian that rliythm is male and metre female. Such sayings–merely prove the difficulty of measuring a delicate instinct by rule of three. It would appear, however, that to the Greeks metre was concerned with the measurements of poetic periods, and rhythm with their effective chanting or recitation; it cannot therefore have depended largely on *ictus* or stress, and the word is therefore often applied to prose as well as to verse. It is probable that, in a quantitative language like Greek, this stress (as it is in modern French) was far less strongly marked than (*e.g.*) in English; but it is a mistake to think it entirely absent, as, conversely, it is a mistake to think that in English, though accent is, of course, predominant, quantity is unimportant.

As Schipper says, "in English long and short syllables have no constant length, no constant relation; they depend on the context. They do not *determine* rhythm, but they help to *regulate* it." No rigid laws, therefore, can be laid down as to the proper employment of rhythmic balance. A subtle *feeling* must govern the periodic progress of sounds in harmony with the emotions it is desired to express. When the ear is satisfied, we feel that the rhythm is adequate; and a very brief study will show us that the ear demands different rhythms for an expression of different emotions. The genius of the poet is, on this side, revealed by the unforced skill with which he selects the appropriate rhythm. Ecstasy, *e.g*, takes a quick, eager, rising movement; sadness is full, slow and emphatic; meditation deliberate; mystery and suspense are faint, languorous and throbbing; often, indeed, the rhythm is so intimately linked with human feeling that no analysis can disentangle them.

Pauses, again, are an almost essential element in modern rhythm. In Shakespeare and Milton, *e.g.*, a pause may take the place of a whole beat; and the right use of such pauses often lends a variety which increases the beauty of a passage. Still more important is what has been called the "free musical paragraph," of which Milton, in *Paradise Lost,* is so consummate a master. Here the balance, overstepping the limits of the verse-form, and felt over wide spaces, is perhaps the chief glory of the poet's style; and the skill with which one "paragraph" is set against another forms, so to speak, a larger rhythm containing and holding up the smaller rhythms of the single paragraphs and of the verse-form. In rhymed verse this larger rhythm is represented by the progression of the stanza in itself, and by the linking of the stanzas into harmonious wholes. Thus in the full meaning of the term, rhythm depends at least as much on the orderly arrangement of the thought as on the balance of the words.

Rhythm in Prose.—We perceive then that there is a rhythm in prose no less than in verse; and this appears not only in the balance of the sentence, but in the arrangement of the sentences in paragraphs and in the building up of paragraphs into chapters. Here, as in everything else, the art must be concealed. A mechanical, epigrammatic balance, like that of Johnson, is too obvious, and ere long tends to weary. The truly rhythmic prose-writer satisfies at once the ear and the mind as a skilled dancer satisfies at once the ear and the eye, without drawing attention to the means by which the effect is attained.

On the special laws of rhythm in the poetry of different nations—Greek, Hebrew, Old English, and the like—it is impossible to speak here; the works of scholars should be studied.

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RHYTHM IN MUSIC

Like all artistic categories musical rhythm must be studied historically, to avoid Philistinism towards the rhythms of early periods. But the musical rhythms of the 18th and 19th centuries are so much more familiar to us than any others, and so radically different from speech-rhythms, that we shall do well to analyse them first. Their true relation to speech-rhythms will then become much clearer, and the study of older rhythms will be greatly simplified.

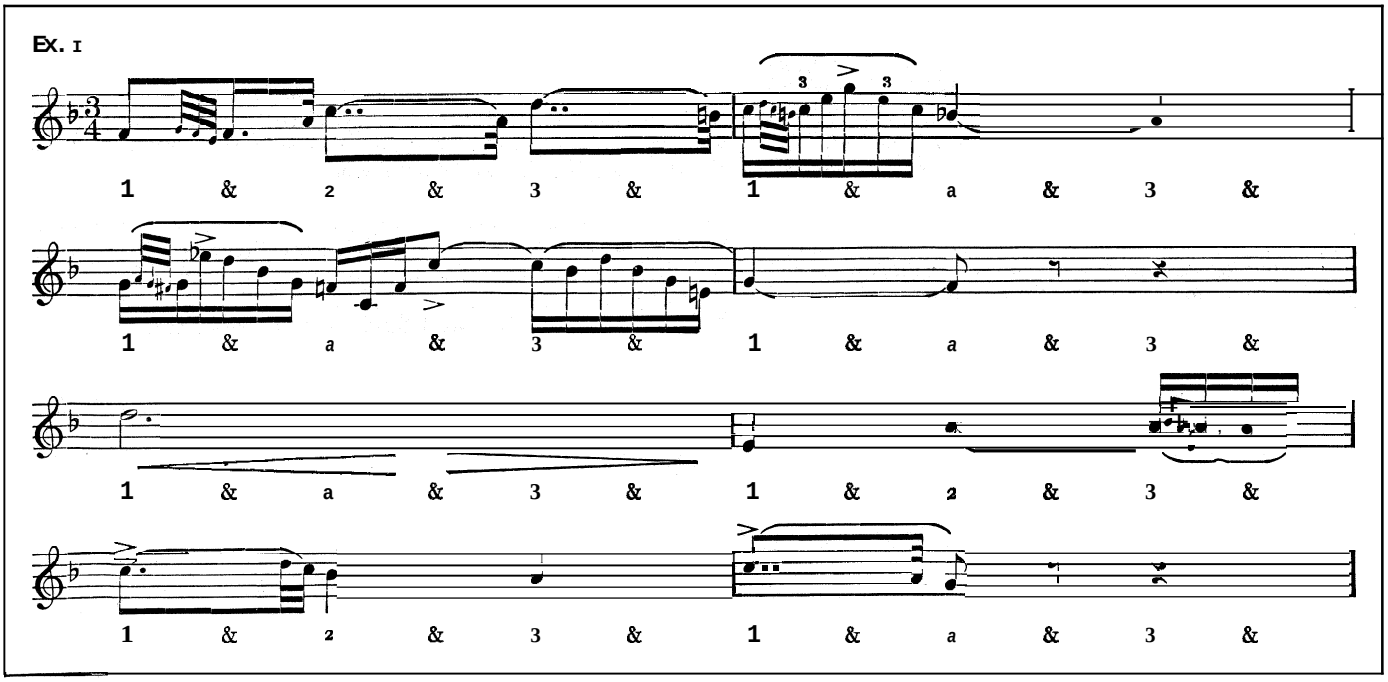
1. Body-rhythm and Speech-rhythm.— These are two prehistoric elements in musical rhythm; and in modern music they are in equipoise, though apart from music they are incompatible. Dance-rhythm is too narrow a term for the one, and speech-rhythm is a satisfactory term for the other. We may coin the term body-rhythm as giving the necessary extension to the notion of dance-rhythm. Musical body-rhythm, even in the slowest paces, is enormously stronger than anything known to prosody. It is no exaggeration to say that it is as strong as the pace of a horse. Not even Browning could have recited "How they brought the good news from Ghent to Aix" with comfort while riding a galloping horse; but Schubert's Characteristic Marches (op. 121) do not merely imitate that pace but go far to stimulate it if played to a body of cavalry. Gentler rhythms may be less immediately understood, but, once grasped, are not more easily changed. The music must brace itself up for any abrupt change of its fundamental rhythm. But that fundamental rhythm may be very slow and lie very deep.

In the example on p. 274 (Ex. 1), Haydn uses an underlying rhythm of thrice two beats. The beat is a quaver, for which one second is not too slow a tempo for this particular composition. Its whole group of six beats is invariably $3 \div 2$ and never $2 \div 3$. In this kind of music change from the one division to the other would be impossible without either violence or vagueness; unless it were a permanent change of metre. So important is the notion of $3 \div 2$ that it is not counted as 6 at all, but as 1 & 2 & 3, etc. Of these beats the first bears the chief stress, the second and third bear less, and there is no rule to give either more stress than the other. We are not, at present, considering the case of three beats quick enough to mark the rhythm without subdivision. Obviously the subdivisions (counted by "&") have no accent, except in relation to their own further subdivisions. Musical rhythms are measured from accent to accent; and of pairs of accents the first is stronger than the second. In larger groups, if the rhythm is binary the third accent will be stronger than the second, but not as strong as the first or fifth. At a very quick pace the difference of strength between the first accent and the fifth may become perceptible, but the rhythm would be inartistically stiff if such distinctions were not soon obliterated.

Triple rhythm, whether slow and subdivided or quick and undivided, also falls readily into larger binary periods with the same relative strengths of accent. There is nothing to prevent it from falling into ternary periods, but the mind ceases to apprehend a high power of three rhythmically, for we cannot know that the third period of a slow group is not the first of a new pair.

On these data it is now possible to analyse the rhythm of Ex. 1. It begins on the main accent, with no anacrusis. Between the first and second quaver beats there is a group of grace-notes. In actual time these should come on the second quaver and reduce the length of the second main note instead of that of the first, but they have no accent, and the second main note has its due stress and is not noticed to have arrived late, even if the grace-notes have been taken with some deliberation. They are like the consonants in the word *three:* it is easy to pronounce the word at a given moment, and nobody thinks of dividing it as thr-ee, though the consonants really take an appreciable time.

During the second bar of six beats the accompaniment (not given here) takes its cue from the melody and divides the quaver-beats by 3 (and the crotchets by 6). This motion thereafter pervades the whole composition, sometimes in the melody, and



always in the accompaniment, except when the whole orchestra pauses. These triplet semiquavers become equivalent to the average length of syllables in speech-rhythm, and the mind automatically measures all pauses by them. Besides the indeterminate grace-notes there are definite shorter values.

No rhythm in poetry or prose ever contemplated giving one syllable seven times the length of another, as we see in the double-dotted quavers with their complementary demisemiquavers. But in the fifth bar we have the whole six beats occupied by one sustained note, eighteen times the length of the average syllable. Yet so cogent is the body-rhythm of these long and complex bars that a deviation from the symmetry of an 8-bar period is permissible only when a change of key introduces new topics, as happens immediately after this quotation. But this will lead us to the separate topic of *phrasing.* Irregularities in the lengths of the bars themselves would be quite impossible, except in the case of a dramatic or final pause. Haydn has one opportunity for a dramatic pause in the course of the movement, yet he does not leave it at that, but expands it to two entire normal bars filled with organized rhythms.

Musical rhythm is not often as ornate as this, nor is this elaboration capable of much contrast or development, but the example at once carries us far away from the rhythms of poetry and includes all the musical principles so far mentioned. From it we can move a step nearer towards considering the simple relations between musical and poetic rhythm.

The technical terms of prosody are of no use here, with the solitary exception of the word anacrusis, which may be generalized to mean anything that happens before the first principal accent. When Rockstro tells us that "the theme of Weber's Rondo brillante in E flat (op. 62) is in Anapaestic Tetrameter Brachycatalectic, very rigidly maintained," this tells us less about the music than Weber's brilliant theme tells us about these solemn terms. A more scientific idea of Weber's theme, and of the prosodic technicalities, may be obtained from the following paradigm, to be recited *prestissimo.* Each dash at the end of the line represents a quarter of a beat.

Prestissimo.

Diddle | dum diddledum diddledurn diddledurn diddle | durn diddledum diddledum:— —
1 & 2 & I & & 2 &

Diddle | dum diddledurn diddledurn diddledurn diddle | durn diddledurn diddledum:— —
1 & 2 & I & & 2 &

After which Weber ceases to maintain his anapaestic-etcetera so rigidly, and proceeds for two lines with:—

Diddle | diddle diddle diddle diddle diddle diddle durn dum | durn durn durn durn Di do
1 & 2 & & 1 & & 2

Such rapid rhythms at once remind us of Aristophanes or Gilbert, though they can move faster than syllables can be pronounced. If they coalesce into uniformity for a long period (e.g., *diddle-diddle* for several bars without a single *durn)* they cease to resemble speech-rhythm and subside into vibration, unless melodic interest sets up larger rhythms by illuminating a peak here and there. A common defect in second-rate music is the composer's failure to know when his quick motion has settled down into mere vibration.

2. Time.—The body-rhythm underlying Weber's Rondo brillante is an unchangeable binary rhythm, counted (as the paradigm shows) in a slow two or a quick four. Classical music uses only binary and ternary times, which, so long as vertebrate anatomy continues to develop with bilateral symmetry, are the only ones that yield a strong body-rhythm naturally, the elements of triple time giving just enough resistance to be overcome by a pleasant compromise.

The kinds of time, *i.e.,* of invariable rhythmic molecules underlying each continuous piece of music, are classed not only as *duple* and *triple* but also as *simple* and *compound.* Compound time is the result of dividing simple time by three. Division by two is ignored: thus the evidently highly compound time of Ex. 1 is reckoned as simple triple time. All beats are reckoned as binary divisions and subdivisions of the modern standard note, the semibreve: the time-signature given at the beginning of a composition is a fraction, with a numerator showing the number of beats in a bar, and a denominator showing the size of the beat. Thus $\frac{3}{4}$ signifies three crotchets (quarters) in a bar. Compound time does not indicate the main beats at all, but counts the smaller beats as normal fractions of the semibreve. The main beats are written as *dotted* notes, in which the dot lengthens the note by one half. Accordingly $\frac{6}{8}$ is the compound time of two dotted crotchets divided by three quavers; $\frac{9}{8}$ is that of three dotted crotchets: $\frac{12}{8}$ of four. When the division by three is only local, *triplets* are used. Triplets are groups of three equal notes crowded into the time of two.

Binary and ternary subdivision answers every ordinary purpose of musical rhythm, being capable of expressing distinctions far more subtle than have ever been regulated in speech. It is impossible to pronounce a syllable in less than a tenth of a second; but it is easy to play 16 notes in a second on the pianoforte. In such rapid notes a single break twice in a second would have an effect directly measured by the ear. If the broken series were

levelled into an even series of fourteen notesasecond, the rhythmic effect would be appreciably different, though the actual difference of pace would be only $\frac{1}{56}$ of a second.

The special sign for triplets is readily adapted to other subdivisions. In most cases such adaptation is not meant to produce abstruse rhythms, but to secure an effect of free declamation. Freedom is as necessary in music as it is in speech; but fine playing, whether in obvious *tempo rubato* or in apparent strictness, bases this freedom on the superlative accuracy of good rhythmic notation.

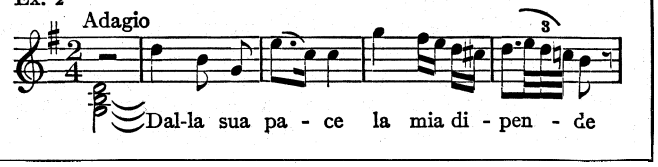
3. Tempo.—The time-signature tells us nothing about the pace of the music, for the choice of the denominator is determined by a tangle of historic associations, so that $ may mean (as in Beethoven's C minor concerto) the slowest movement ever written, and $\frac{3}{4}$ may be a scherzo-tempo in which only one beat in a bar is countable.

The sense of tempo is a larger aspect of the body-rhythm, and in classical music it is very steady. A fundamental law of all musical rhythm is that a hurrying or slackening of tempo has no power to alter the rhythmic organization. If your phrase is too short a *ritardando* will not make it aesthetically any the longer; nor will an *accelerando* get rid of a redundant bar. On the contrary, it is crowded detail that will best profit by slackening, and loose-knit passages that have most to gain by an unobtrusive mending of the pace.

The genuine *tempo rubato* is, as its name implies, a rhythmic robbing of Peter to pay Paul. Chopin said that his left hand conducted in strict time while his right declaimed freely. The truth is that sound is as full of illusions as sight. One such illusion has already been illustrated by the grace-notes of Ex. 1, and other illusions are of much the same kind. The tick of metronome measures average time-intervals; and if it is set to measure a naturally rhythmic performance it will seem to hustle the player in some passages and to drag upon him in others, however carefully we select its pace.

In the classics from Bach to Brahms a movement may give more legitimate scope for *tempo rubato* than some purists care to admit, but it will not drift from one tempo to a radically different tempo, unless towards the end, or as evidence of imminent break-up. The gradual drift from one tempo to another first becomes something better than a weakness when the whole nature of musical movement becomes capable of continuity over hours, as in Wagnerian opera. Then, and not before, can we view one and the same tempo from opposite directions. Thus, in *Tristan und Isolde* the last part of the love-duet in the second act is a quick movement in $\frac{2}{2}$ time. Isolde's *Liebestod* ends the opera with an exact recapitulation of this (differing only in the voice part and absolutely unaltered in the orchestra) in rather slow $\frac{4}{4}$ time. By metronome the two tempi should be identical, though the impulse in the duet is energetic and that of the *Liebestod* reposeful. Wagner merely feels that the broader notation better suits Isolde's dying vision; and the listener, who may know and care nothing about the notation, agrees with Wagner.

Ex. 2



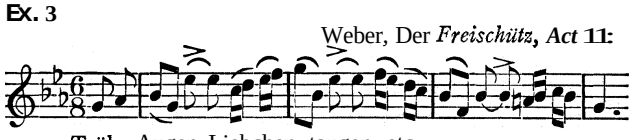
It is partly a question of accent and comes under the heading of phrasing.

4. **The** Rhythm of Classical Music in Relation to Poetry.—We can now return, furnished with new criteria, to the relation between musical and poetic rhythm. Even a simple musical setting of poetry will stretch the words in ways which speech does not normally admit. The naïve poet will unhesitatingly accept this as in the nature of singing. Only the half-baked musical *littérateur* objects, when Mozart makes Ottavio sing *Dalla sua pace la mia dipende* (Ex. 2) five times as slowly as any speaker could naturally utter the words, and then puts the top note and chief accent on the unimportant la. The poet would be glad to sing it that way if he could. It is quite good Italian prosody to give a nearly equal stress to *la* and *mia:* and the climax on *la* is more than counterbalanced by the fact that the important word *mia* falls on a harmonically sensitive note. The grammatical sense might have been clearer if a similar but slighter emphasis had been given to sua. But Ottavio is not giving instructions to a servant, but expressing his inmost feelings in solitude. Language does not base its emotional accents on logical analysis. Dr. Johnson corrected a clergyman for saying "Thou *shalt* not steal" instead of "Thou shalt *not* steal." If Johnson was right, how in the world did "shall not" ever become "shan't"?

The sensitive note on *mia* shows one of the four main degrees of freedom in musical accent. There is first the normal time-accent. Many critics of musical declamation seem to know no other forms of stress; but it can be completely eclipsed by putting the highest note of the melody elsewhere. The highest note can in its turn be eclipsed by the longest note. And in Ex. 2, both together are eclipsed by the most sensitive note. Moreover, and without recourse to anything so drastic as syncopation, the weakest note in the phrase may be given a special accent stronger than a main beat. This is beautifully shown in the third bar of Ex. 1, where the accented E♭, normally quite the weakest note in the bar, could certainly bear the chief syllable in a sentence if words for Haydn's wonderful rhythm could be found at all. Lastly, such a displaced accent may have a double meaning, the note retaining its original lightness in spite of its borrowed stress. Weber has been blamed for his bad declamation in the following famous passage:—

Ex. 3

Weber, Der *Freischütz*, Act 11:

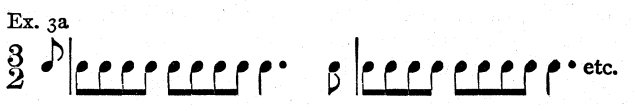


But, by your leave, this is a triumph of musical gesture. The lively Aennchen might even point a playful finger at the anxious Agathe with each false accent that Weber so explicitly marks. Meanwhile the orchestra corrects the declamation in waltz-rhythm.

By the interplay of these varieties of accent the strophic song, with the same tune to several stanzas, condemned as lazy and low by our prose critics of music, becomes, as Brahms always maintained, the highest achievement of a song-writer. The interplay does not annihilate right and wrong in declamation, nor does it prove that the classics are infallible; but it forms a musical technique as disciplined as prosody and as unlike prose. In such ways artistic factors reconcile their conflicts, and without such conflicts there is neither art nor life. Wagner and Wolf are perfect masters of a musical declamation that follows the rules of prose; but when we are told that there are no other rules, and that the classics from Bach to Brahms merely blundered insensitively, it is time to point out that musical rhythm cannot be learnt from a bell-metronome nor poetry from a pronouncing dictionary.

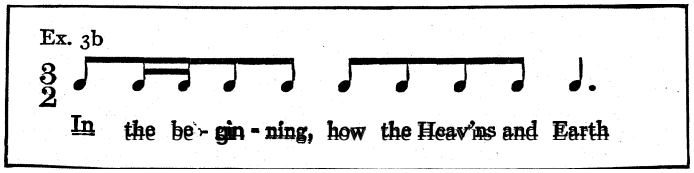
Let us now try a few experiments in setting blank verse to music. The first step will be to find a constant musical rhythm to represent the average line. This average rhythm will horrify the poetic ear if it is put forward as a specimen of blank verse, and probably if a line could be found that fitted it exactly that line would be a very ugly one. Still, the fact remains that the musician's average idea of blank verse is accurately represented by the following scheme, which represents two lines:

Ex. 3a

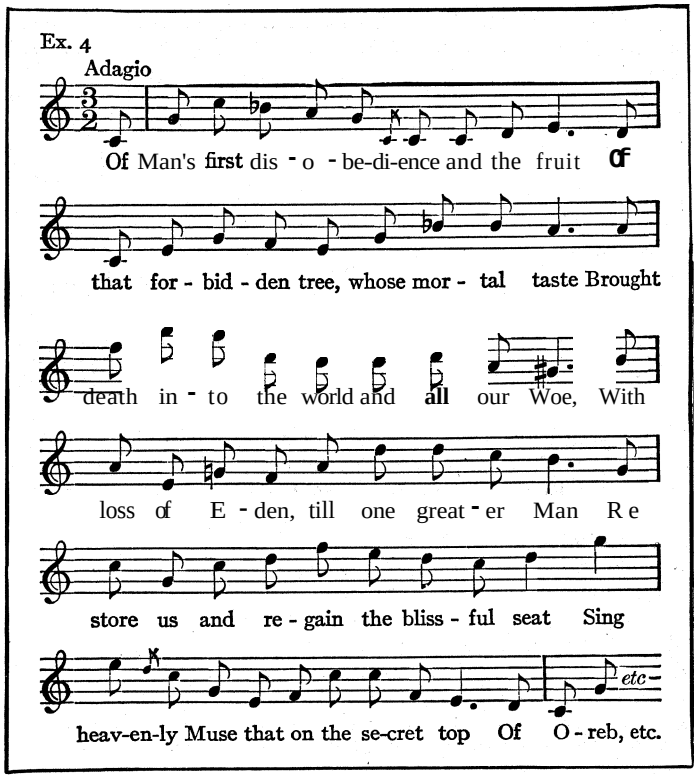


Now read the first paragraph of *Paradise Lost* rigidly to this scheme at the rate of two syllables to a metronome-beat of 80 to the minute. You will not satisfy the poet's ear; but you will find

that the lines accommodate themselves better to this than to any other uniformity; that extra syllables can be managed by grace-notes, and that the interval of two quavers between each line is a natural part of the scheme. We can proceed thus for eight lines, with rheumatic pains but not complete disaster. The imperative "Sing" is a heavy word to put into anacrusis, even of double length, and our three main beats must override many accents in lines that so often have four. Also the interlinear pause of two beats is irksome when the sense runs on. In the ninth line we must alter the scheme, for no anacrusis can digest any part of "In the beginning." So we must "invert" the first foot thus:—



But before we condemn the scheme let us see how far the torture is mitigated by merely adding musical rise and fall:—



Blank verse has been worse recited than this. The rigid musical timing proves uqexpectedly flexible already; and the rubato of a good singer can go far to improve it without becoming vulgar.

Now let us legalize the singer's rubato, and, without altering the two-quaver intervals between the lines, help the *enjambement* by a pianoforte accompaniment that makes the ear expect the resolution of a discord. Sensitive harmonies will further aid the rhythmic sense. The $\frac{3}{2}$ notation is now becoming troublesome; so that bars are divided into three and the lengths of the notes doubled. But the original $\frac{3}{2}$ scheme is nowhere violated. *(See* Ex. j.)

After this point any attempt to continue this literal interpretation of the metre would make the music drag hopelessly. Already the first two lines would be the better for running over the pause and doubling the pace of "that forbidden tree." But this would mean using two time-scales and would take us into free composition. The object of this illustration is not to show how these words ought to be set, nor to prove the very doubtful proposition that they are singable to any kind of music; but simply to bring out the most elementary relations between music and verse.

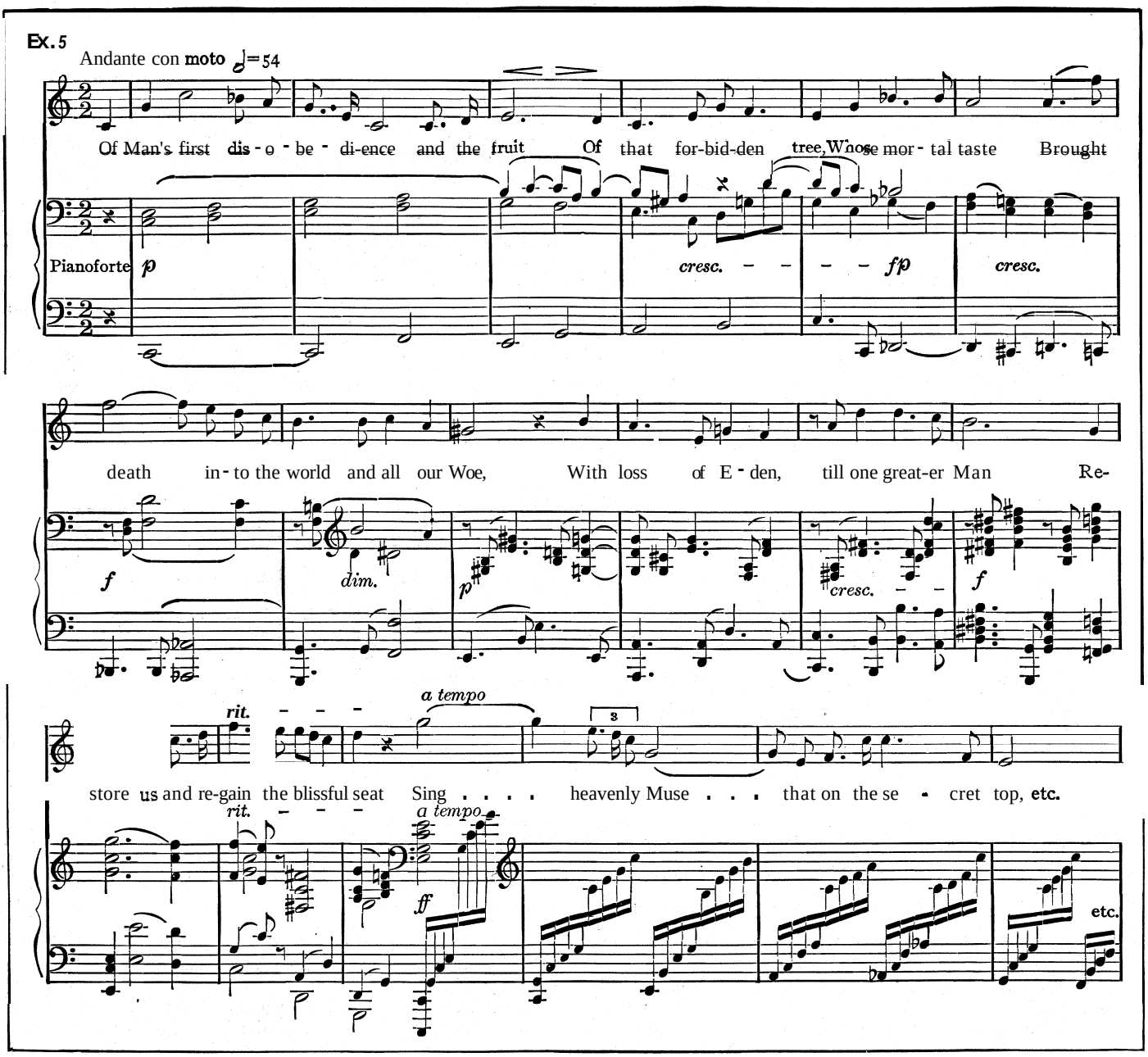
5. Phrasing. — The higher art of phrasing is chiefly observable in groups of very much simpler bars than those of our illustrations so far. Two facts, often ignored, must be realized before we can understand phrasing at all. First, music, being in time and not in space, is never apprehended in a *coup d'oeil,* but always in a momentary present connecting a remembered past with an imperfectly anticipated future. Consequently we miss half the aesthetic values of rhythm if we insist on knowing all about it from the first note. Rhythms have as much right to change their meaning while we listen to them as the cats of Wonderland have to grin; and "they all can and most of them do."

The second point is that the bar represents no fundamental rhythmic fact. It did not come into existence so long as music was printed only in parts. When music began to be printed with all the parts ranged legibly on one page, it was necessary to score the pile of parts with vertical strokes to range them in partitions and guide the eye. Hence the word *score,* and the French *partition* and German *Partitur.* The nascent body-rhythm grew stronger and gradually made it convenient that the bars should coincide with the groups indicated by the time-signature, and this gave rise (but only in recent times) to the delusion that the bar was the permanent unit. It is often obviously not so. When Mozart writes in moderate common time his phrasing is sure to make an odd number of half-bars somewhere so that a theme that originally lay on **1**, 2, 3, 4 now lies on 3, 4, **1**, 2. In such a case it is pedantic to say that the accent has changed and still more pedantic to blame Mozart for not either taking shorter bars throughout or changing to them according to the rhythm. If the half-bar displacement is really awkward Mozart will put it right, as when he rebarred the duet "Bei Männern welche Liebe fühlen" in *Die Zauberflöte.* But long bars imply delicate accents and these accents become no harder when the phrasing contracts.

Beethoven writes his scherzos, and some very powerful other movements, in the shortest possible bars, and it is often difficult to tell whether the first of such bars is a main accent or an anacrusis. In the first movement of the C minor sonata (op. 10, No. 1) when we reach bar 22 it becomes manifest that bar g must have been in anacrusis; but we cannot have noticed that at the time, for when theorists go back to bar 1 and say that that initial bump was in anacrusis we can only smile. In three late works Beethoven helps the players by the words *Ritmo di tre battute* and *Ritmo di quattro battute.* The most famous of these passages is in the scherzo of the ninth symphony. Why did Beethoven not use there $\frac{6}{4}$ or $\frac{12}{4}$ bars so that his *ritmo di tre battute* became self-evident as a change to $? Because if you wish to ride this Pegasus you must please to rise on your stirrups once in Beethoven's bar, and not only once in 3 or 4. The change to 3-bar rhythm is obvious enough; but the return to 4 is not, as Grove said, effected by the drums, but comes where nobody can possibly detect it. And Beethoven, having helped the conductor at this point, is quite content, as in earlier works *passim,* that the listeners should gradually become aware that the 3-bar swing is no longer in being. In the trio, Beethoven wishing to indicate that 2 of its crotchets correspond to 3 of the scherzo, first wrote in $\frac{2}{4}$ time. But this made the lilt as unrecognizable as the true proportions of Iceland at the top of a map on Mercator's projection. So he changed it to alla-breve bars $\frac{2}{2}$.

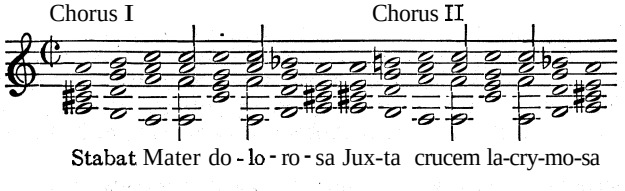
The common sense of the whole matter is that hard accents and soft accents are equally liable in the long run to obliterate the distinction between the first and the third of four beats, and may go far to weaken that between the first and the second. We shall never find that Beethoven's short bars will fit any one interpretation throughout a piece, nor shall we often be able to fix the point at which the rhythmic angle is shifted. And when we have fixed everything some overlap will upset us or some extra bar make us hold our breath. Four-bar rhythm is more important to music than limericks are to literature, but the limerick is hardly more adequate or historically qualified to be taken as the fundamental basis for rhythm. And we must not take a lofty timeless view of rhythmic inequalities and changes. Farmer Giles is mistaken in the idea that the lady he finds sketching in the woods where you can't see round the corner would find a better subject on the top of a hill where you can see six counties.

Ex. 5



6. **Older Musical Rhythms.—In** measuring the distance between the musical rhythms, the most familiar to us and those of the 16th and earlier centuries, the first thing we must dismiss is our strong body-rhythm. Only the lightest ballets and fa-las of our great madrigalists have any such element. The greater part of the 16th century polyphony is held together by a time system which merely counts semibreves and settles whether the semibreve is to be *perfect* and equal to 3 minims or *imperfect* and equal to 2, and also whether three or only two semibreves are to go to a breve. The law of accent holds with pairs of minims about as strongly as in modern music, but it is already very much weakened with pairs of semibreves. Examine the first two lines of Palestrina's *Stabat Mater,* which is as wonderful in rhythm as it is in harmony.

Ex. 6

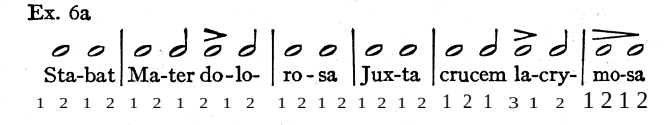


The music of the second line is identical with that of the first, and both lines are an exact quantitative rendering of the verses, with longs twice the size of shorts. The time signature tells us that the breve contains 2 semibreves and the semibreve two minims. Accordingly the modern editor draws bar strokes at regular breve-distances throughout the score. Then comes the modern choir master, warm from a rehearsal of ***Be*** Not *Afraid* in *Elijah,* and beats four in a bar, down, left, right, up, while the dutiful double choir sings

Sta-bat		Ma-ter			do	(sniff)		lo	ro	Sa	jux				
1		**1**	2	3	4	**1**		2	3 4	**1**	2	3	4		
Ta	cru	Cem	la	(sniff)	cry	mo	sa								
1	2 3 4	**1**		2	3	4	**1**	2 3 4							

But now let each singer, at a starting signal from the conductor, merely move one finger regularly up and down in minims, downward for accented beats and upward for unaccented. It will then be found perfectly easy to override these gentle accents whenever the sense dictates, and the choir will find itself declaiming the words beautifully.

Ex. 6a



If bars must be drawn let them come only where there is a normal accent. We must not put a bar line after *mater,* because this would come in the middle of a semibreve, or, as Morley calls it, a stroke.

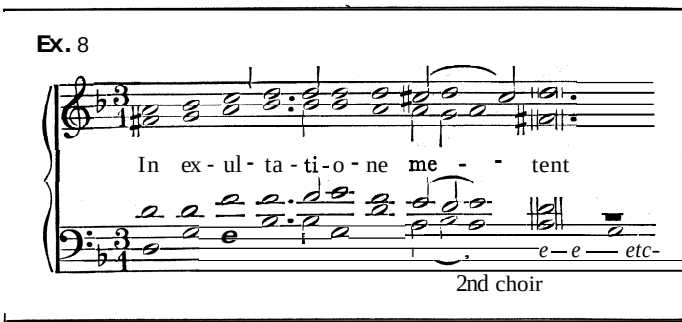
The examples of Victoria and Josquin given in the articles MASS and MUSIC are barred freely by these rules, but no such single scoring is adequate for an elaborate polyphony. Ex. 7 gives a passage from Victoria's *O quam gloriosum.*

From this we can see Victoria's Miltonic art of finishing a big paragraph.

The lower voices enjoy their own rhythms until the slow swing of the soprano draws the bass along with it. Then the alto joins. and the tenor is compelled to regard his own rhythm as a syncopation against this majority.

Little has been said so far about syncopation, and little now remains to be said. Its main point, even in the 16th century, as Ex. 7 shows, is that it requires a strong body-rhythm to contradict. A common fallacy of self-centred composers is to write syncopations that never encounter opposition at all. We must not confuse this with the legitimate case of a rhythm the meaning of which first appears later in the course of the music, nor with the case of an intentional vagueness. Nor, to return to the 16th century, must we put the unanimous speech-rhythm syncopations of Ex. 6 into the same category as those of the tenor at the end of Ex. 7.

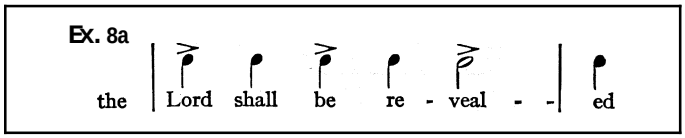
Ex. 8



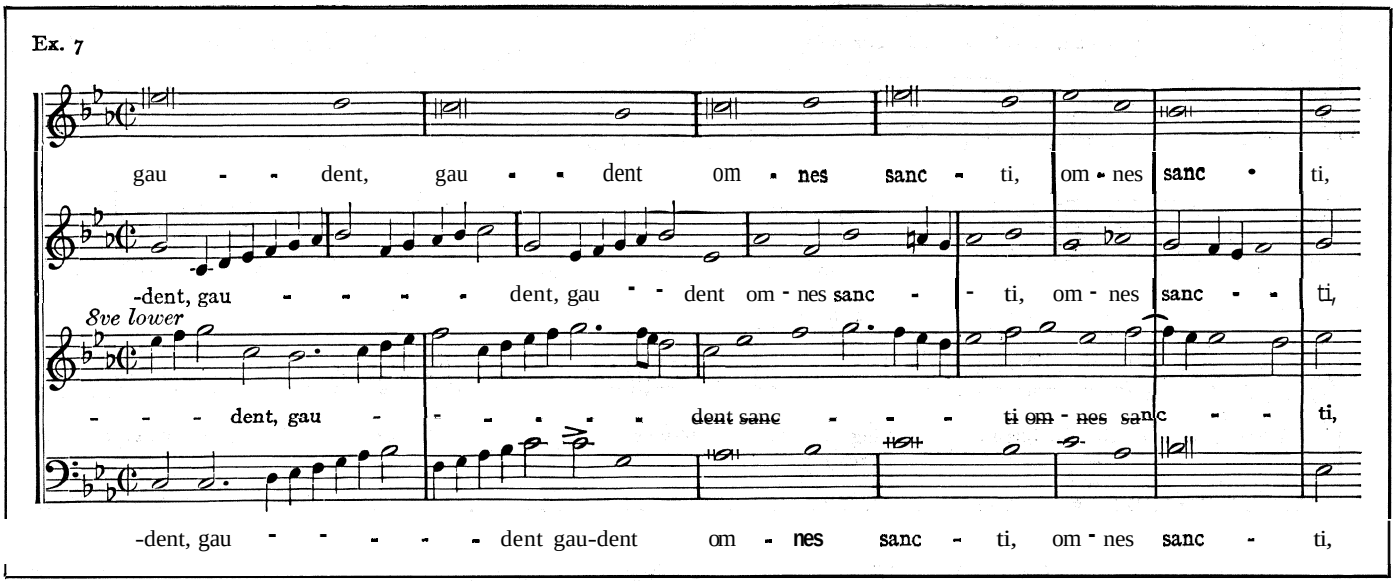
Triple time in the 16th century was very dilferent from what it is in music with a strong body-rhythm. For one thing, it continually obliterates the difference between 2÷3 and 3÷2, as in example 8 by Lasso.

This swing from 3 to a 3 twice as slow is called *hemiole* and survives as late as Bach and Handel. Thus, in the first chorus of The *Messiah* the hemiole which Handel always uses in triple time closes gives the cadential accentuation:

Ex. 8a



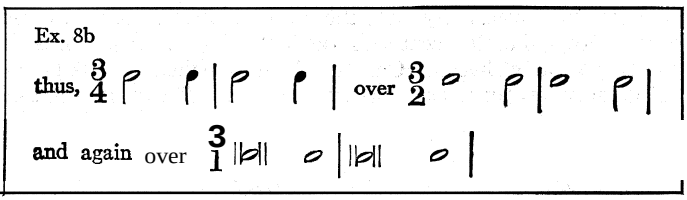
Ex. 7



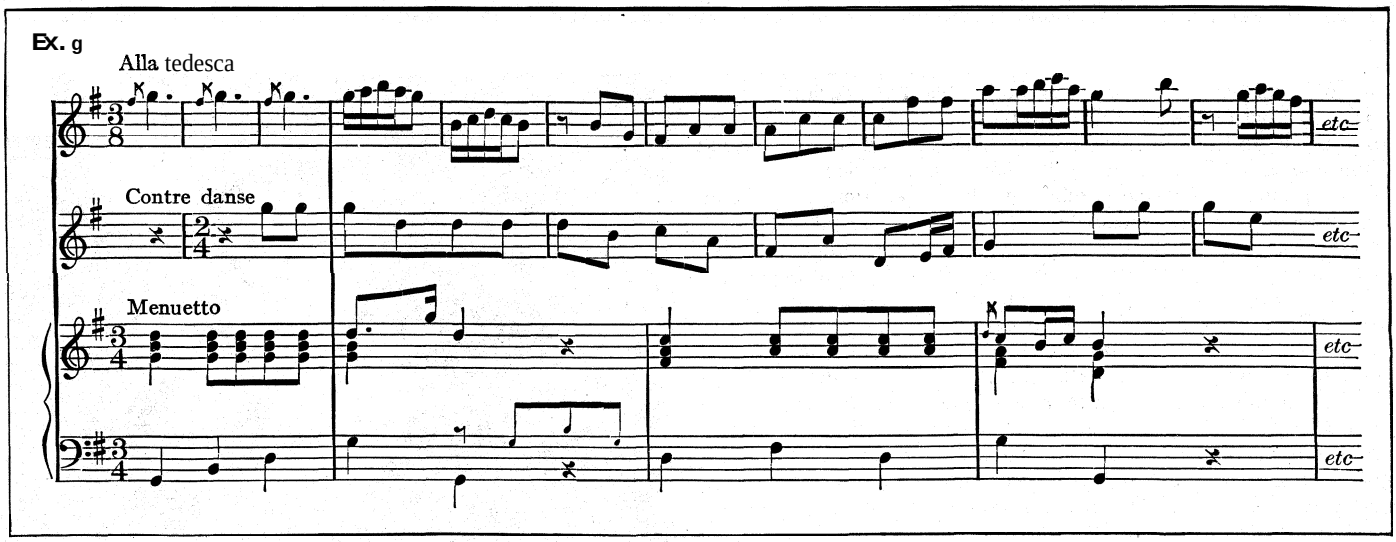
The opposite swing from $ to $ with a curious bump in the last ( ) bar characterizes the French courantes of Couperin and Bach.

Before Palestrina we find in England a fairly steady slow triple time (3 divided by 2 or 4) in Tallis; but a little earlier we find Obrecht writing music which abounded in amazing complexities, such as three depths of triple rhythm:

Ex. 8b



The complexity is illusory, for the ear makes nothing of it, and the same is the case with the capacity of the ancient time system of mode, time and prolation to multiply triple rhythms up to 27 beats. The fact that the process was by multiplication shows at once that no real rhythmic effects are concerned, and that the system is only a device by which the long-suffering tenors may count out the enormous notes of some unrecognizable *canto fermo.* If we want genuine highly compound times we must leave these multiplication tables and study the last movement of Beethoven's sonata Op. 111, where the theme and first variation are in triple time divided by 3 ($\frac{9}{16}$); the second variation divides the half-beat by 3, producing &$ (which Beethoven misnames &); the



third variation divides the quarter-beats, producing $\frac{36}{64}$ (misnamed $\frac{12}{32}$); and the fourth variation returns to $\frac{9}{16}$ time and divides it by a uniform triplet vibration of 27 notes to a bar, afterwards surmounted by the unmeasured vibration of a trill. All this is sublime in its cogent clearness.

Genuine complexity was achieved by Palestrina in the second Kyrie of his *Missa* "L'homme armé," a work as beautiful as it is ingenious. But Mozart achieved something unsurpassed in the ballroom scene in *Don Giovanni,* putting his vigorous body-rhythms to the supreme test of making the characters actually dance and pass remarks in them.

7. **Recent** Rhythmic Developments. — Rhythms other than binary and ternary cannot develop a very strong ictus, though Holst manages in the ballet of *The Perfect Fool* to make some good dance-rhythms of $\frac{7}{8}$. But they tend to flow like speech-rhythms, and they are very reluctant to change their pattern. A rhythm of 5 falls into either 3+2 or 2+3. The famous 5-time movement in Tschaikowsky's *Pathetic* symphony is 2+3 and is in absolutely square 8-bar rhythm throughout. Again g-time will be some form of 4 and 3, or will suggest 8 with a beat clipped. Ravel, in his pianoforte trio, showed that it is possible to divide 8 into 3+2+3 so inveterately that no listener can possibly hear it as 4+4. The effect is excellent, and other versions of it are used in a much quicker tempo and with more variety by Holst in his Fugal Overture. But we must call things by their right names and not say that a thing is complex when it clings like grim death to its one pattern and falls into phrases of 2+2 for pages together.

The *Pantoum* of Ravel's trio blends an impish $\frac{3}{4}$ with a sanctimonious $\frac{4}{2}$ very amusingly. An early pianoforte sonata by Cyril Scott attempts to get away from all regularities. Its 13s and 3s do not always succeed in avoiding straightening out into plain 16=4×4; and when successful are conscientious rather than impulsive. The rhythms of Greek tragedy, interpreted syllabically, are suggestive, and so are many oriental rhythms. But they are not body-rhythms; and it may be doubted whether any great increase in variety of strong body-rhythms is imminent at present.

(D. F. T.)

RHYTINA: see SEA COW.

RIAL. The monetary unit of Persia (Iran), which has a paper currency mainly. There are notes of 5, 10, 20, 50, 100, 500 and 1,000 rials issued by the Bank Melli Iran and subsidiary coins of copper and bronze for 5, 10 and 50 dinars (1 rial= 100 dinars). Authority was given in Dec. 1943 for the minting of 1, 2, 5 and 10 rial coins from an alloy containing 60% silver and 40% copper. Fixed rates of exchange are maintained by virtue of the foreign exchange control law of 1936. The sterling value of the rial in 1944 was slightly under *2d.*, the rate of exchange being fixed at 128–130 in accordance with the currency law of Nov. 19, 1942, which also provided for the retention of a 60% reserve of gold and silver against the first 3,500,000,000 rials in circulation and a reserve of 100% in gold or foreign exchange convertible into gold against any circulation in excess of this figure. The circulation on April 20, 1944, was 6,035,000,000 as compared with approximately 800,000,000 in the years 1936–38. (N. E. C.)

RIAZ PASHA (c. 1835–1911), Egyptian statesman, was born about 1835. He was discovered by Ismail Pasha, who made him one of his ministers. When Ismail's financial straits compelled him to agree to a commission of inquiry, Riaz was vice-president of the commission. He filled this office with distinction, but not to the liking of Ismail.

When Ismail attempted to resume autocratic rule, Riaz fled the country. Upon the deposition of Ismail (June 1879), Riaz was sent for by the British and French controllers, and he formed the first ministry under the khedive Tewfik. His administration was overthrown by the agitation which had for its figurehead Arabi Pasha (*q.v.*).

On Sept. 9, 1881, Riaz was dismissed and went to Europe, remaining until the fall of Arabi. He then accepted office as minister of the interior under Sherif Pasha. He wanted the immediate execution of Arabi and his associates; and when the British insisted on clemency to the leaders of the revolt, he resigned (Dec. 1882).

Riaz took no further part in public affairs until 1888 when, on the dismissal of Nubar Pasha (*q.v.*), he was summoned to form a government, remaining in office until May 1891. In Feb. 1892 he again became prime minister under Abbas II. In April 1894 he finally resigned office.

Riaz died on June 18, 1911.

RIBADENEIRA, PEDRO A. (1527–1611), hagiologist, was born at Toledo on Nov. 1, 1527. In Rome on Sept. 18, 1540, he was admitted by Ignatius Loyola as one of the Society of Jesus.

He pursued his studies at Paris (1542) in philosophy and theology. Loyola, in 1555, sent him on a mission to Belgium; in pursuance of it he visited England in 1558. In 1560 he was made provincial of the Society of Jesus in Tuscany. He was transferred as provincial to Sicily in 1563, was again employed in Flanders and from 1571 served in Spain. In 1574 he settled in Madrid, where he died on Sept. 10, 1611. His most important work is the *Life of Loyola* (1572). That Ribadeneira was, though an able, a very credulous writer, is shown by his lives of Loyola's successors Diego Laynez and St. Francis Borgia; and especially by his *Flos Sanctorum* (1599–1610), a collection of saints' lives, entirely superseded by the labours of the Bollandists.

See his autobiography in his *Bibliotheca Scriptorum Societatis Jesu* (1602 and 1608, supplemented by P. Alegambe and N. Sotwell in 1676); H. F. De Puy, *An Early Account of the Establishment of Jesuit Missions in America* (1921).

RIBAULT or **RIBAUT, JEAN** (*c.* 1520–1565), French navigator, was born at Dieppe, about 1520. Appointed by Admiral

Coligny to take French Protestants to America, Ribault sailed on Feb. 18, 1562, with two vessels, and on May 1 landed at Florida at St. John's river, or. as he called it. Rivière de Mai. Having settled his colonists at Port Royal harbour (now Paris Island, S.C.), and built Fort Charles for their protection, he returned to France. In 1563 he appears to have been in England and to have issued *True and Lust Discoverye of Florida* (Hakluyt Soc., vol. vii.). In April 1564 Coligny despatched another expedition under René de Laudonnière, but meanwhile Ribault's colony. destitute of supplies. revolted against their governor and attempted to make their way back to Europe in a boat which was happily picked up by an English vessel. In 1565 Ribault was again sent out to satisfy Coligny as to Laudonnikre's management of his new settlement, Fort Caroline. on the Rivière de Mai. While he mas still there the Spaniards attacked the French ships at the mouth of the river. Ribault set out to retaliate but his vessels mere wrecked near Matanzas Inlet and he had to return to Fort Caroline by land. The Spaniards by this time had slaughtered all the colonists except a few who got off with two ships under Ribault's son. Induced to surrender by false assurances. Ribault and his men were put to the sword in Oct. 1565.

BIBLIOGRAPHY.—*See* E. and E. Haag, *La France protestante* (1846–59); F. Parkman, *Pioneers of France in the New World* (new ed. 1912); J. Ribault, *The Whole and True Discoverye of Terra Florida*, a reprint of the London ed. of 1563 with notes and biography (Deland, Florida, 1927).

RIBBONFISH: *see* OARFISH.

RIBBONS. By this name are designated narrow webs. commonly of silk or velvet. used primarily for binding and tying in connection with dress. but also applied for innumerable useful, ornamental and symbolical purposes. Along with that of tapes, fringes and other small wares. the manufacture of ribbons forms a special department of the textile industries.

RIBEIRO, BERNARDIM (*c.* 1482–1552), the father of bucolic prose and verse in Portugal. was a native of Torrão and the son of a treasurer in the household of the duke of Viseu. The details of Ribeiro's life are very uncertain. Between 1507 and 1512 he was a student in the faculty of law at the university, which was at that time in Lisbon. He later frequented the court of King Manuel where he won the friendship of the poet Sá de Miranda and perhaps fell in love with one of the court ladies, whose identity is unknown. In 1521 he probably went to Italy; it was there. perhaps. that he wrote his chivalric and pastoral romance. *Menina e Moça,* in which. it is thought. he may have related his own love story. personifying himself under the anagram of "Binmarder" and the lady under that of "Aonia."

On his return he was appointed secretary to Ring John III (1524). About 1540 he seems to have suffered some mental derangement and he died insane in Oct. 1552 in the hospital of Todos os Santos, Lisbon.

The *Menina e Moça* was first printed at Ferrara in 1554, together with six eclogues (including the eclogue *Crisfal* which may not be his) and some minor poems. A second edition appeared in Évora in 1557, containing a much longer version of the story but it is doubtful how much of this is Ribeiro's own work.

Modern editions are *Obras de Bernardim Ribciro e Cristovam Falcão* by A. Braamcamp Freire. 2 vol. (1923); *Obras Completas de Bernardim Ribeiro* by A. Ribeiro and M. Braga, 2 vol. (1949–50); and *Histdria de Menina e Moça* by D. E. Grockenberger (1947).

See A. Salgado Júnior, *A 'Menina e Moça' e o Romance Sentimental* (1940), a valuable critical study. (N. J. L.)

RIBERA, JUSEPE (José) **DE** (Lo SPAGNOLETTO) (1591–1652), Spanish painter and engraver who worked in Naples. Italy, was born at Játiva, near Valencia, but spent most of his life in Italy. where he was known as Lo Spagnoletto. Apart from his certificate of baptism (Feb. 17, 1591), there is no record of his life in Spain, though he is said by A. Palomino to have received his first training there under Francisco Ribalta. It is not known when he went to Italy but there is evidence that he worked as a young man in Parma and Rome. In 1616 he married in Naples, then under Spanish rule. where he was established during the rest of his life. In 1626 he signed as a member of the Roman Academy

ANDERSON

"THE MARTYRDOM OF ST. BARTHOLOMEW" BY RIBERA. IN THE PRADO. MADRID

of St. Luke and in 1631 as a knight of the Papal Order of Christ. He died in Naples on Sept. 2, 1652.

The whole of Ribera's surviving work appears to belong to the period after he settled in Naples. His very large production comprises mainly religious compositions with a number of classical and genre subjects and a few portraits. He did much work for the Spanish viceroys, by whom many of his paintings were sent to Spain. He was also employed by the church and had numerous private patrons of various nationalities. Whether or not he first studied painting in Spain, he became in Italy one of the chief followers of Caravaggio, who formed the Neapolitan school, and he is often referred to as a Neapolitan artist.

Ribera's earliest known painting is probably the "Crucifixion" (Colegiata. Osuna), presumed to have been made for the duke of Osuna. viceroy in 1616–20. From 1621 onward there are numerous signed, dated and documented works; some of the more important are: etchings of "St. Peter" and "St. Jerome" (1621); "St. Jerome" (1626. Hermitage. Leningrad). "Drunken Silenus" (1626, Naples museum), his earliest dated paintings; "Martyrdom of St. Andrew" (1628, Budapest!; "Archimedes" (1630. Prado museum. Madrid); "Portrait of a Bearded Woman" (1631. Lerma collection, Toledo); "Tityus" and "Ixion" (1632, Prado museum); "Immaculate Conception" (1635, Augustinian convent, Salamanca); "Pietà" and "Prophets" (1637–38), first commissions for the monastery of S. Martino. Naples; "Venus and Adonis" (1637, Galleria Nazionale. Rome); "Clubfooted Boy" (1642, Louvre. Paris); and "Holy Family" (1648. Metropolitan museum, New York). In 1651 he completed the "Institution of the Eucharist" (S. Martino, Naples), one of his last and most important works.

The chief elements of Ribera's style, tenebrism and naturalism, derived from Caravaggio, are used to emphasize the mental and physical suffering of penitent or martyred saints or tortured gods. Realistic detail. often horrific. is accentuated by means of coarse brush marks on thick pigment to represent wrinkles, beards, flesh wounds, etc. The influence of Bolognese and Venetian artists and probably of Velázquez, who visited Naples in 1630–31 and 1649–50, contributed to the more spacious settings, lighter tones: richer colours and more pleasing subjects which appear in Ribera's works after 1630; but he never entirely abandoned detailed realism or dramatic lighting. The objective realism of his portraits relates them to the early manner of Velázquez and to the school of Seville; while his figures of ancient philosophers in picaresque

guise are typically Spanish subjects which Ribera popularized in Italy and Spain.

Ribera had many pupils and followers in Naples. In Spain his works were widely copied and imitated and were one of the chief sources of Caravaggesque naturalism. He was one of the few Spanish artists to produce numerous drawings, which were also much imitated. His etchings as well as his paintings contributed to his European fame. Like other Spanish "naturalists" he was admired and studied by 19th-century French painters.

See also PAINTING: *Rise of European Schools: Spain.*

See **A. L.** Mayer, *Ribera,* 2nd ed. (1923); E. du G. Trapier, *Ribera* (1952). (E. Hs.)

RIBES: *see* CURRANT.

RIBOT, ALEXANDRE FELIX JOSEPH (1842–1923), French prime minister, was born at Saint-Omer on Feb. 7, 1842. He practised at the bar and first entered the chamber of deputies in 1878, where he won eminence among the right-wing republicans opposed to the Radicals and followers of Léon Gambetta. He specialized in financial matters, serving as *rapporteur* of the budget in 1882 and opposing the credits sought by Jules Ferry for the Tongking expedition. In 1890 he joined the Charles de Freycinet ministry as minister of foreign affairs and kept that office under Emile Loubet (Feb.–Nov. 1892) and in his own ministry which succeeded Loubet's until its fall in March 1893. In these years he gave a fresh direction to French policy by the *rapprochement* with Russia which ripened into formal alliance by 1895. He formed his second ministry in Jan. 1895, and took also the ministry of finance. but it fell in October. In opposition until 1914, he attacked the anticlericalist policies of Emile Combes and tried to alleviate the severities of the separation of church from state in 1905. His tenures of office in 1914–17 were all at the ministry of finance, but in March 1917 he succeeded Aristide Briand as prime minister and minister of foreign affairs, and kept the latter post under Paul Painlevé until Oct. 1917. He brought to politics undoubted talents and patriotism, but the brevity of his periods in power prevented him from achieving much financial reform. He was a member of the Académie française and of the Académie des Sciences Morales et Politiques. He died in Paris on Jan. 13, 1923.

See **A. Ribot,** *Lettres à un anzi: Souvenirs de ma vie politique,* 5th ed. (1924; Eng trans. by H. Wilson, 1921). (D. TN.)

RIBOT, THÉODULE ARMAND (1839–1916), French psychologist, best known for his studies in the pathology of the brain and mind, was born at Guingamp, Côtes-du-Nord, on Dec. 18, 1839. He studied medicine in Paris and became director of the first French psychological laboratory at the College de France. He was early impressed by the physiological and biological theories of contemporary British associationists (notably Herbert Spencer and Alexander Bain) and by the experimental researches carried out by Wilhelm Wundt at the Leipzig laboratory. He first attracted attention by his work on mental inheritance (*L'Hérédité: étude psychologique,* 1869)—a problem to which English writers had recently drawn attention—and by his survey of British psychology (*La Psyclzologie anglaise contemporaine,* 1870). His studies in psychopathology, like nearly all his later writings, were almost at once translated into English (*Diseases of Memory,* 1881; *Diseases of the Will,* 1884; *Diseases of Personality,* 1891). All such disorders he regarded as the direct outcome of cerebral disturbances, which he interpreted in terms of gross lesions rather than of a disorganization of the minuter structures (nerve cells and their connections); *i.e.,* as organic rather than functional. In later life he turned to the study of normal mental processes (*The Psychology of Attention,* 1890; *The Psyclzology of Emotions,* 1897; *The Evolution of General Ideas,* 1889; *Essay on the Creative Imagination,* 1906). His systematic analyses of emotional states provided much of the material for the theories of "primary emotions" and "sentiments" subsequently developed by such British psychologists as William McDougall and **A.** F. Shand. Ribot died in Paris on Dec. 9, 1916. (CY. B.)

RICARDO, DAVID (1772–1823), English economist who systematized and gave classical form to the rising science of economics, was born in London on April 19, 1772, of Jewish origin. His father, who was of Dutch birth, was a successful member of the stock exchange. In 1786 Ricardo entered his father's office, where he showed much aptitude for business. After 1793, upon abandoning the Jewish faith for the Unitarian and marrying a Quaker, he was separated from his family for about eight years and was thrown upon his own resources. He continued as a member of the stock exchange, however, his talents and character winning him the support of an eminent banking house. He prospered immediately, and by 1815, when he prepared to retire from business, he had accumulated a large fortune. In 1819 he entered parliament as a member for Portarlington. There he made valuable speeches on economic questions and helped bring about a change in opinion respecting freedom of trade which eventuated in the legislation of Sir Robert Peel (*q.v.*) on that subject. Ricardo died on Sept. 11, 1823, at his estate in Gloucestershire.

His first communication on an economic subject appeared in 1809, a decade after a chance reading of Adam Smith's *Wealth of Nations* had diverted his attention largely from geology and mineralogy, which, along with mathematics and chemistry, had begun to interest him about 1797. His tract, *The High Price of Bullion, a Proof of the Depreciation of Bank Notes* (1810), gave a fresh stimulus to the controversy respecting the resumption of cash payments and indirectly led to the appointment of a committee of the house of commons, commonly known as the Bullion committee, to consider the question. The report of the committee confirmed Ricardo's views and recommended the repeal of the Bank Restriction act, but the house of commons declared that paper had undergone no depreciation.

In 1815, when the corn laws were under discussion, Ricardo published his *Essay on the Influence of a Low Price of Corn on the Profits of Stock,* directed against a tract by T. R. Malthus but based upon a theory of rent already stated by Malthus and James Anderson. In this essay are set forth the essential propositions of the Ricardian system. such as that an increase of wages does not raise prices; that profits can be raised only by a fall in wages and diminished only by a rise in wages; and that profits, in the whole progress of society, are determined by the cost of the production of the food which is raised at the greatest expense. These ideas were afterward incorporated in Ricardo's chief work *Principles of Political Economy and Taxation* (1817). In the field of the theory of banking and currency some of Ricardo's best work appears. His main ideas are expressed in three pamphlets: (1) *The High Price of Bullion* (1810), in which he discussed the available means of testing the value of paper money and the power of the Bank of England to regulate the supply; (2) *Proposals for an Economical and Secure Currency* (1816), in which he elucidates the quantity theory and pronounces in favour of a monometallic standard; and (3) the *Plan for a National Bank* (1824), which was, in fact, an indictment of the methods of the existing bank, particularly in connection with its issue of paper money. In an essay on the "Funding System" (1820), written for the 6th edition of the *Encyclopaedia Britannica,* Ricardo urged that nations defray their expenses, whether ordinary or extraordinary, at the time when they are incurred instead of providing for them by loans.

In the *Principles of Political Economy and Taxation,* Ricardo undertook "to determine the laws which regulate" the distribution, under free competition, of the "produce of the earth" among the "three classes of the community," namely, the landlords, the farmers and the agricultural labourers. He applied his findings more widely, however, and elaborated various other economic principles. He found that the relative domestic values of commodities are dominated, but not wholly determined in the longer run, by the quantities of labour required in their production, rent being eliminated from the costs of production. He concluded that profits vary inversely with wages which move with the cost of necessaries; and that rent tends to increase as population grows; rising as the marginal costs of cultivation rise. He supposed, following J. B. Say, that there was little tendency to unemployment. but remained apprehensive lest population grow too rapidly, depress wages to the subsistence level, and, by extending the margin of cultivation, reduce profits and check capital formation.

He concluded that trade between countries was not dominated by relative costs of production, but by differences in internal price structures which reflected the comparative advantages of the trading countries and made exchange desirable. He treated monetary questions and especially tax incidence at length.

In his exposition Ricardo usually made use of apposite hypothetical examples rather than of empirical data. While he built in part upon the work of Smith, he defined the scope of economics more narrowly than had Smith and included little explicit social philosophy. His views early won considerable support in England despite their abstract character and the many criticisms to which they were subjected. For this support Ricardo's two principal disciples were significantly responsible. J. R. M'Culloch, a voluminous writer and skilled propagator, was chosen to fill a lectureship on political economy commemorating Ricardo. James Mill, friend and political and editorial counselor to Ricardo. made of his son, John Stuart Mill, an able expounder and influential improver of the Ricardian system. Ricardo and the theories associated with his name have continued to command the critical attention of economists ever since.

His works and correspondence, in 10 vol., were edited by Piero Straffa for the Royal Economic society (1951–55). *Principles of Political Economy and Taxation* appeared in several editions, including Everyman's Library. Several of the minor works were edited by J. H. Hollander.

See also B. Franklin and G. Legman, *David Ricardo and Ricardian Theory* (1949); *M*. Blaug, Ricardian Economics (1958). (J. J S.)

RICASOLI, BETTINO, BARON (1809–1880), Italian statesman, born at Broglio, March **19, 1809.** In **1847** he founded the journal *La Patria,* and sent to the grand duke of Tuscany a memorial suggesting remedies for the difficulties of the state. In **1848** he was for a short time gonfaloniere of Florence. As Tuscan minister of the interior in **1859** he promoted the union of Tuscany with Piedmont. Elected Italian deputy in **1861,** he succeeded Cavour in the premiership. As premier he admitted the Garibaldian volunteers to the regular army, revoked the decree of exile against Mazzini, and attempted reconciliation with the Vatican; but his efforts were rendered ineffectual by the *non possumus* of the pope. He found himself obliged in **1862** to resign office, but returned to power in **1866.** On this occasion he refused Napoleon III's offer to cede Venetia to Italy, on condition that Italy should abandon the Prussian alliance, and also refused the Prussian decoration of the Black Eagle because Lamarmora, author of the alliance, was not to receive it. After the French troops left Rome in **1866** he attempted to conciliate the Vatican with a convention, in virtue of which Italy would have restored to the Church the property of the suppressed religious orders in return for the gradual payment of **£24,000,000.** He conceded the *exequatur* to **45** bishops inimical to the Italian regime. The Vatican accepted his proposal, but the Italian Chamber proved refractory, and, though dissolved by Ricasoli, returned more hostile than before. Without waiting for a vote, Ricasoli resigned office. He died at Broglio on Oct. **23,** 1880. His private life and public career were marked by a rigid austerity which earned him the name of the "iron baron."

See Tabarrini and Gotti, *Lettere e documenti del barone Bettino Ricasoli,* 10 vol. (Florence, 1886–94); Passerini, *Genealogia e storia della famiglia Ricasoli* (1861); Gotti, *Vita del barone Bettino Ricasoli* (1894).

RICCATI, JACOPO FRANCESCO, COUNT (1676–1754), Italian mathematician, whose authority on all questions of practical science was deferred to by the senate of Venice. Born at Venice on May **28, 1676,** he died at Treviso on April 15, 1754. He studied at the University of Padua, where he graduated in **1696.** He corresponded with many of the European savants of his day. and contributed largely to the *Acta Eruditorum* of Leipzig. He was offered the presidency of the academy of science of St. Petersburg (Leningrad), but declined, preferring the leisure and independence of life in Italy. Riccati's name is best known in connection with his problem called Riccati's equation, published in the *Acta Eruditorum,* Sept. 1724. A very complete account of this equation and its various transformations was given by J. W. L. Glaisher in the *Philosophical Transactions* **(1881).**

His works were collected and published by his sons **(4** vol., 1758).

RICCI, CURBASTRO GREGORIO (1853–1925), Italian mathematician, celebrated for the discovery of the absolute differential, or Ricci calculus, was born at Lugo, Romagna, on Jan. 12, 1853. From **1880** until his death on Aug. **7, 1925,** he was professor at the University of Padua. His earliest work was in the fields of mathematical physics and differential equations. In **1887** appeared his first contribution to the subject, now known as the absolute differential, or Ricci calculus. Its origins are to be found in the differential geometry of G. F. B. Riemann, where it is necessary to study the behaviour of functions of partial derivatives in which the variables undergo transformation. First steps in the development of the appropriate technique of tensors had been taken by E. B. Christoffel, while important concepts had been introduced by E. Beltrami and R. O. S. Lipschitz (*q.v.*). But the systematic theory is due to Ricci (1887–96); significant extensions were later contributed by his pupil T. Levi-Civita. For some time the new calculus found few applications; when, however, Einstein came to formulate his theory of general relativity, Ricci's methods proved to be the natural tool. The impulse given by Einstein has resulted in an intensive study of differential geometry based on the tensor calculus. (L. R.)

RICCI, MATTEO (1552–1610), Italian Jesuit missionary who with Michael Ruggieri opened China to evangelization, was born at Macerata in the march of Ancona on Oct. **6,** 1552. After some education in his native town he went to study law at Rome (1568), where in 1571 he entered the Society of Jesus. He studied mathematics and geography under Clavius at the Roman college between 1572 and 1576, and in 1577, accompanied by others, he left for the Indies via Lisbon. He arrived in **1578** in Goa, where, after finishing his religious training. he taught in the college until **1582;** he was then called to Macao to prepare himself for the task in China.

It was only after Alessandro Valignani became visitor of the Jesuit missions in the far east that the opening of China to Christianity was really taken up, although fruitless efforts had been made since Francis Xavier (*q.v.*). First Michael Ruggieri and then, in **1582,** Ricci were summoned to Macao by Valignani for the undertaking. After various disappointments they established themselves at Ch'ao-ching, Kwangtung province, in Sept. **1583.** Though never forgetting the spiritual purpose of his mission, Ricci proceeded with circumspection and contented himself with exciting the interest of the Chinese, even the more educated, with clocks, maps, European paintings and books and his own vast erudition. When in **1589** the new viceroy of Kwangtung-Kwangsi forced the missionaries to leave, Ricci obtained permission to settle elsewhere in the province in compensation for selling the mission property at a lower price. The church at Shao-chou was constructed in Chinese style and the missionaries themselves, relinquishing the costume of the despised bonzes, adopted that of the litterati.

When after various misfortunes the occasion presented itself in **1595,** Ricci, in the company of a high official, set out to realize his own fondest plan to establish himself in Peking. Upon arrival in Nanking, however, he found that, because of Toyotomi Hideyoshi's invasion of Korea, all foreigners were suspect and that it would be unwise to continue northward; he therefore established a new residence in Nan-ch'ang, Kiangsi province. His second chance to go to Peking came in **1597** when an official of the tribunal of rites, Kuang by name, invited Ricci to accompany him and help him compose the calendar. After waiting for two months before the gates of Peking he had to return south, again because of the Sino-Japanese conflict in Korea. He settled in Nanking until **1600** when, accompanied by two confreres, he traveled north once more. Their entrance into Peking was delayed by the intrigues of the eunuch Ma T'ang, who tried to take possession of the presents brought for the Wan-li emperor. The emperor, however, having already heard about Ricci, granted permission to enter and to offer the presents on Jan. **25, 1601.** This event is recorded in the history of the Ming dynasty (Ming-shih).

They obtained a settlement with an allowance for subsistence in Peking, and from this time on to the end of his life Ricci's esti-

mation among the Chinese increased. Besides the missionary and scientific work, from 1jg6 he was also superior of the mission, which in 1605 numbered 17. Ricci died on May 11, 1610, and was granted a place for burial by imperial order.

Ricci's efforts to attract and convert the Chinese intelligentsia brought him into contact with many outstanding personalities, among them Hsu Kuang-ch'i, Li Chih-tsao and Yang T'ing-yun, who later became known as the "Three Pillars of the Early Catholic Church" in China and who assisted the missionaries. especially in their literary efforts. Ricci's literary efforts include about 20 works, mostly in Chinese, ranging from religious and scientific works to treatises on friendship and local memory. Probably the most famous of his works are the "Mappamondo" and the "True Idea of God."

Ricci's "accommodation method" was the foundation of the subsequent success obtained by the Roman Catholic Church in China. The unhappy rites controversy, however: which erupted shortly afterward brought the mission near ruin. Probably the name of no European of past centuries is so well known in China as that of Li Ma-tou (Ricci Matteo).

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RICCIO (ANDREA BRIOSCO) (*c.* 1470–1532), Italian sculptor, was born at Padua about 1470 and died in 1532. Trained in the workshop of B. Bellano and active principally as a bronze sculptor, he executed the great paschal candlestick for S. Antonio at Padua (1507–1j) and the Girolamo della Torre monument in S. Fermo at Verona (1516–21). The bronze reliefs from the latter are now in the Louvre, Paris. The style and imagery of both works are strongly influenced by Paduan humanism. Riccio was also a prolific maker of bronze statuettes, for the most part of subjects from classical mythology. Unlike the statuettes of his contemporary Antico at Mantua, these are romantic in treatment. with marked individuality and expressive character. Outstanding examples are the "Boy Milking a Goat" in the Museo Nazionale, Florence, the "Warrior on Horseback" in the Victoria and Albert museum, London, and the "Arion" in the Louvre.

See L. Planiscig, *Andrea Riccio* (1927). (J. W. P.-H.)

RICCIO, DOMENICO (called IL BRUSASORCI) (c. 1516–1567), Italian painter of the Veronese school. pupil of Giovanni Francesco Caroto. He was a colourist, characterized by B. Berenson as "the first purely pictorial artist in Italy." His importance in art history is mainly the result of his being the predecessor of Paolo Veronese. There are pictures by him which resemble those of his great follower, both in design and colour; among these are the altarpieces in the churches of Sta. Eufemia and S. Lorenzo, and some single, well-preserved figures in his frescoes in the archbishop's palace at Verona. His principal works are in Verona; there are very few elsewhere. In 1j51 he painted frescoes on the façade of the Casa Garavaglia in Via San Marco at Trent, representing Midas and Apollo, and a battle with Norsemen. His altarpiece at Mantua cathedral is dated 1j52.

See B. Berenson, *North Italian Painters of the Renaissance* (1907); J. P. Richter, *A Descriptive Catalogue* of *Old Masters of Italian School in the Villa Doccia* (1907).

RICCOBONI, MARIE JEANNE, LABORAS DE MÉZIÈRES (1714–1792), French novelist, was born in Paris. She married Antoine François Riccoboni, an actor and dramatist, in 1735 but separated from him soon after. She was also an actress but had no great success on the stage. Her writings are examples of the "novel of sensibility." the nearest English equivalent being the work of Henry Mackenzie. Her works include. *Lettres de Mistriss Fanny Butlerd* (1757); the remarkable *Histoire de* M. *le Marquis de Cressy* (1758); *Lettres de Milady Juliette Catesby* (1759); *Lettres d'Adelaïde de Dammartin, Comtesse de Sancerre,* 2 vol. (1767); *Lettres d'Elisabeth-Sophie de Vallikre,* 2 vol. (1772); *Lettres de Mylord Rivers,* 2 vol. (1777); and *Histoire d'Ernestine* (1783), which J. F. de La Harpe thought her masterpiece. Deprived of her small pension from the crown by the Revolution, she died in great indigence on Dec. 6. 1792.

BIBLIOGRAPHY.—The complete edition of Madame Riccoboni's *Oeuvres,* 9 vol. (1826) gives notices by J. F. de La Harpe, Baron von Grimm and Denis Diderot. *See* also J. M. Querard, *La France littéraire,* vol. vii (1835); Julia Kavanagh. *French Women of Letters,* 2 vol. (1862), which gives an account of her novels; Jean Fleury, *Marivaux et le marivaudage* (1881); and E. A. Crosby, *Cne romancière oubliée* (1924).

RICE, EDMUND IGNATIUS (1762–1844), Irish philanthropist.-founder of the "Irish Christian Brothers." was born at Westcourt, near Callan, Kilkenny, on June 1, 1762. He abandoned his provision merchant business to devote himself to education and in 1808 he and nine others, meeting at Waterford, took religious vows from their bishop, assumed a habit and adopted an additional Christian name, by which, as by the collective title "Christian Brothers," they were thenceforth known. Schools were established in Cork (1811), Dublin (1812), and Thurles and Limerick (1817). In 1820 Pope Pius VII issued a brief sanctioning the order of "Religious Brothers of the Christian Schools (Ireland)," the members of which were to be bound by vows of obedience. chastity, poverty and perseverance, and to give themselves to the free instruction, religious and literary, of male children, especially the poor. Rice held the office of superior general of the order from 1822 to 1838. He died on Aug. 29, 1844.

RICE, a well-known cereal. is the staple food of hundreds of millions of people in Asia. Cultivated rice. *Oryza sativa,* was first mentioned in history in 2800 B.C. when a Chinese emperor proclaimed the establishment of a ceremonial ordinance for the planting of rice. Other authorities have traced the origin of rice to a plant grown in India in 3000 B.C. Rice culture gradually spread westward from southeastern Asia with the passage of time and was introduced to southern Europe in medieval times by the invading Saracens. This article briefly summarizes the botanical characteristics of rice and discusses its cultivation, preparation for the market and production. For additional information *see* TROPICAL AGRICULTURE: GRAIS PRODUCTIOS AND TRADE; FOOD SUPPLY OF THE WORLD; AGRICULTURE: *World Agriculture;* CEREALS. *See* also articles on various rice-growing countries, as CHINA; INDIA; etc.

The cultivated rice plant is an annual grass with numerous varieties that differ markedly in morphological characters and in physiological behaviour. It originated from wild species which are indigenous to Africa. India and Indochina. The rice plant has linear pubescent or glabrous leaves. each provided with a pointed ligule. The spikelets are borne on a loose panicle, which is erect at blooming, but nodding as the grains develop and mature. Each spikelet contains one flower enclosed by the compressed lemma and palea. At the base of each of these organs is a small lance-shaped glume. The flower consists of six stamens and an ovary surmounted by two styles bearing a feathery stigma. The ovary, after fertilization, develops into the fruit or grain, which is enclosed by the lemma and palea, or hull. Most varieties are grown on submerged land. but others, known as upland rice, are grown on land not submerged.

BY COURTESY OF THE BRITISH MUSEUM (NATURAL HISTORY)

RICE (ORYZA SATIVA), SHOWING GENERAL HABIT OF GROWTH

(A) Single flower with part removed to show branched stigma and 6 stamens. (B) Single stamen (Both A and B are enlarged)

Cultivation.— Rice is grown in coastal plains. tidal deltas and river basins in tropical, semi-tropical and temperate regions where fresh water is available to submerge the land. In the orient, where most of the farms are too small for the use of farm machinery. rice is generally grown by hand labour, although animals, when available, are used in preparing the land. The rice is sown broadcast on well-prepared beds. and when the seedlings are 25 to 50 days old they are transplanted to the field, or paddy, by hand. Before transplanting, the fields, which are enclosed by levees, or bunds, are submerged

two to four inches and the surface soil is thoroughly stirred. Two to five seedlings are placed in hills 3 to 6 in. apart in rows 8 to 12 in. apart. The land is submerged during most of the growing season, and the crop is harvested by hand. About 95% of the world's rice is produced in Asia and the Japanese, Philippine, Indonesian and other nearby islands.

Outside of the orient, farm machinery usually is used for preparing the land, seeding and harvesting. The crop is grown in essentially the same manner as wheat, oats and barley, except that the land is submerged during most of the growing season. The principal rice-producing countries outside of the orient are Egypt, Italy, Spain, Brazil and the United States. Rice was introduced to North America in the colony of South Carolina about 1685. By 1839 South Carolina produced 60% of the rice grown in the United States. Other rice-producing states were North Carolina and Georgia. The American Civil War and the reconstruction period adversely affected this crop but rice acreage increased along the Mississippi river in Louisiana, becoming an important crop in this state in 1887 with the introduction of mechanized farming methods. In Texas, upland or nonirrigated rice was grown to a small extent in 1863, becoming of commercial importance on irrigated land in 1899, when 8,500 ac. were grown around the Beaumont district. Commercial production of rice began in Arkansas in 1903 and in California, in the Sacramento valley, in 1912. In the second half of the 20th century, many farmers broadcast seed and fertilizer by airplane on submerged land while others seed and fertilize their fields with a grain drill.

Preparation of Rice.—The kernel of rice as it leaves the thresher is enclosed by the hull, or husk, and is known as paddy or rough rice. Rough rice is used for seed and feed for livestock, but most of it is milled for human consumption. Rice is a good energy food, and is consumed in vast quantities in the orient. In the western hemisphere, however, rice is not the staple cereal food, except in certain Caribbean and South Pacific islands. A diet limited largely to well-milled rice renders eastern people on a restricted diet liable to beriberi (*q.v.*), a deficiency disease caused by a shortage of essential thiamine (vitamin B_1) and minerals. This disease, however, can be avoided by adding legumes, fish, fruits and vegetables to the diet.

Rough rice that is parboiled and dried prior to milling retains more thiamine and minerals than untreated rice, and hence is less apt to cause beriberi. It appears that in parboiling, the thiamine, which is largely in the germ and bran layers of the kernel, diffuses into and is fixed in the starchy endosperm.

Most of the rice is milled in or near the areas in which it is produced. In modern mills, special machines are used for removing the hull from the kernel, for removing the bran layers by attrition, for polishing, for coating and for grading. The object in milling is to remove the hull and the bran layers of the kernel with as little breakage as possible, for the most valuable product is the whole kernel. Milled rice is sometimes coated with glucose and talc to give a high glossy finish. The by-products of milling—bran and rice polish (finely powdered bran and starch resulting from polishing)—are used as feed for livestock, and oil is processed from bran for edible and industrial uses. Broken rice is used in brewing, distilling and manufacturing starch and rice flour. The hulls are used for fuel, packing, poultry litter, manufacturing furfural, industrial grinding and manufacturing fertilizer. Straw is used for feed, bedding livestock, thatching roofs and for mats, garments, packing and broomstraws.

World Production.—In the second half of the 20th century the world rice crop averaged between 360,000,000,000 lb. and 460,000,000,000 lb. annually, from an average of about 250,000,000 ac. The average acre yield for the world was about 1,450 lb.

Principal producing countries included China, India, Japan, Pakistan, Indonesia, Thailand and Burma.

Annual rice production in the United States averaged about 5,000,000,000 lb. from an average of less than 2,000,000 ac. The average acre yield was more than 3,000 lb. Leading producing states were Texas, Louisiana, Arkansas, California and Mississippi.

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RICE, WILD (*Zizania aquatica*), or Indian rice, water oats, also knonn locally by many other names, is an indigenous, coarse, annual grass, the grain of which has long been used as an important food by various Indian tribes and early settlers. It is commonly found on muddy bottom in fresh to brackish water along shores, streams or in lakes and swampy places from the Atlantic coast west to the Mississippi valley and is widely planted as food for waterfowl. A tall, self-sowing grass (4 to 8 ft.), it is highly variable and regionally marked by three varieties: (1) short variety of the St. Lawrence river system; (2) small northern wild rice found along the Canadian border; and (3) the large wild rice of the middle west. The fruiting panicle may be one to two feet long, the lower spreading branches of which bear male flowers whereas the upper erect branches bear female flowers. When well cooked, the slender, round, purplish black, starchy grain (nearly ¾ in. long) is delicious.

Among northern Indians "ricing" means harvesting wild rice by canoe and preparing it for winter storage. The primitive methods employed by them still yield a superior product. Unless kept in wet, cool storage, wild rice loses its viability. (T. K. J.)

RICEBIRD: *see* BOBOLINK.

RICE PAPER. The substance which has received this name in Europe, through the mistaken notion that it is made from rice, consists of the pith of a small tree, *Aralia papyrifera,* which grows in the swampy forests of Formosa. The cylindrical core of pith is rolled on a hard flat surface against a knife, by which it is cut into thin sheets of a fine ivorylike texture. Dyed in various colours, rice paper is extensively used for the preparation of artificial flowers, while the white sheets are employed by native artists for water-colour drawings.

RICH, BARNABE (1542–1617), English author and soldier whose *Farewell to Militarie Profession* was the source for *Twelfth Night,* was born in 1542. He entered military service in 1562 and fought in the Low Countries and Ireland, eventually becoming a captain and a self-styled gentleman. Later he was an informer for the crown in Ireland, under Elizabeth I, and, again, under James I. He died on Nov. 10, 1617.

Rich wrote at least 26 books, including five romances and translations, five military works, seven reports on Ireland, six commentaries on manners and morals and three miscellaneous pamphlets. *Riche His Farewell to Militarie Profession* (1581), a collection of eight tales, is the best-known because of Shakespeare's borrowings in *Twelfth Night.* Though in this he emulated the euphuistic prose of John Lyly and appealed to English gentlewomen, ordinarily Rich boasted of his self-education, his "homely style" and his freedom from the affectations of the university. Despite his fulminations against iniquities in such tracts as *The Honestie of This Age* (1614), he appropriated material from other books and exhibited many of the hack writer's tactics of exploitation.

See T. Cranfill and D. Bruce, *Barnaby Rich* (1953). (E. H. MR.)

RICH, JOHN (1682?–1761), English theatre manager and actor, was the originator of English pantomime and founder of Covent Garden theatre. He was a manager by inheritance, receiving a half share in Lincoln's Inn Fields theatre from his father, Christopher Rich (d. 1714), and after running that house successfully for 18 years he founded Covent Garden theatre (1732). At both he staged entertainments of a new type based on Italian foundations, known as "pantomime," in which, from 1717 until the year before his death, he played Harlequin (under his stage name of Lun). He has thus a claim to be the inventor of the harlequinade of English pantomime tradition. After Rich's death David Garrick paid tribute to the matchless expressiveness of his miming.

Rich has another special claim to be remembered. Some time in 1727 he was offered John Gay's Newgate pastoral *The Beggar's Opera,* which Drury Lane had refused. Rich, though not an educated man, nevertheless appreciated Gay's satire and produced the play on Jan. 29, 1728, at Lincoln's Inn Fields theatre. It ran 62 performances, the longest then known, and, as was said at the time, "made Gay rich and Rich gap." (W. A. DN.)

RICH, PENELOPE, LADY (*c.* 1562–1607), the Stella of Sir Philip Sidney's *Astrophel and Stella*, was the daughter of Walter Devereux, 1st Earl of Essex. She was a child of fourteen when Sir Philip Sidney accompanied the queen on a visit to Lady Essex in 1576, on her way from Kenilworth, and must have been frequently thrown into the society of Sidney, in consequence of the many ties between the two families. Essex died at Dublin in Sept. 1576. He had sent a message to Philip Sidney from his deathbed expressing his desire that he should marry his daughter, and later his secretary wrote to the young man's father, Sir Henry Sidney, in words which seem to point to the existence of a definite understanding. But her relative and guardian, Henry Hastings, earl of Huntingdon, secured Burghley's assent in March 1581 for her marriage with Robert Rich, 3rd Baron Rich. Penelope is said to have protested in vain against the alliance with Rich, who is represented as a rough and overbearing husband. The evidence against him is, however, chiefly derived from sources as interested as Sir Philip Sidney's violent denunciation in the twenty-fourth sonnet of *Astrophel and Stella*, "Rich fooles there be whose base and filthy hart." Sidney's serious love for Penelope appears to date from her marriage with Rich. The eighth song of *Astrophel and Stella* narrates her refusal to accept him as a lover.

Lady Rich was the mother of six children by her husband when she contracted in 1595 an open liaison with Charles Blount. 8th Lord Mountjoy, to whom she had long been attached. Rich obtained a legal separation in 1601, and Mountjoy acknowledged her five children born after 1595. Mountjoy was created earl of Devonshire on the accession of James I, and Lady Rich was in high favour at court. In 1605 they legitimized their connection by a marriage celebrated by William Laud, the earl's chaplain. This proceeding, carried out in defiance of canon law, was followed by their banishment from court. Devonshire died on April 3, 1606, and his wife within a year of that date.

See the editions of *Astrophel and Stella* by A. B. Grosart, E. Arber and A. W. Pollard; also the various lives of Sir Philip Sidney, and Mrs. Aubrey Richardson's *Famous Ladies of the English Court* (London, 1899). *See* also reierences under SIDNEY.

RICH, RICHARD, 1ST BARON RICH (*c.* 1496–1567), lord chancellor of England, was born in the parish of St. Lawrence Jewry. London. His great grandfather. a mercer, had been sheriff of London. Richard, a lawyer of the Middle Temple and M.P. for Colchester (1529), held various minor offices before becoming solicitor general in 1533. He took part in the trials of Sir Thomas More and Bishop Fisher and was one of Thomas Cromwell's agents in the dissolution of the monasteries, himself obtaining large grants of monastic property. In 1536 he was M.P. for Essex and speaker of the house of commons. That year also he was knighted and became the first chancellor of the newly established court of augmentations. By Aug. 1540 he was a privy councillor. He was one of the executors of Henry VIII's will, was created Baron Rich in Feb. 1547, and succeeded the earl of Southampton as lord chancellor in October. In Oct. 1549 he joined the earl of Wanvick and Southampton in overthrowing the duke of Somerset, the Protector, over whose trial he presided. He resigned the lord chancellorship, on grounds of ill health, in Dec. 1551, at the time of the final breach between Warwick (now duke of Northumberland) and Somerset. Like other councillors, he had to subscribe Edward VI's settlement of the succession on Northumberland's daughter-in-law. Lady Jane Grey, but after Edward VI's death he soon declared for Mary Tudor. whose religious policy he now supported, although henceforward he did not take a prominent part in public affairs. A "civil servant" rather than a politician he had never been an heroic or a very attractive figure. He died at Rochford, Essex. on June 12, 1567. and was buried in Felsted church. (R. B. WM.)

RICH, RICHARD (*fl.* 1610), English soldier and adventurer, the author of *Newes* From *Virginia*, sailed from England on June 2, 1609, for Virginia, with Capt. Christopher Newport and the three commissioners entrusted with the foundation of the new colony.

In his verse pamphlet he relates the adventures undergone by the expedition, and describes the resources of the new country with the advantages offered to colonists. The only known copy of this tract, dated 1610, is in the Huth library. A reprint edited by J. O. Halliwell-Phillips appeared in 1865.

RICHARD, ST., of Wyche (c. 1197–1253), English saint and bishop, was named after his birthplace, Droitwich in Worcestershire. Educated at Oxford, he soon began to teach in the university, of which he became chancellor, probably after he had studied in Paris and in Bologna. About 1235 he became chancellor of the diocese of Canterbury under Archbishop Edmund Rich, and he was with the archbishop during his exile in France. Having returned to England some time after Edmund's death in 1240 he became vicar of Deal and chancellor of Canterbury for the second time. In 1244 he was elected bishop of Chichester, being consecrated at Lyons by Pope Innocent IV. in March 1245, although Henry III. refused to give him the temporalities of the see, the king favouring the candidature of Robert Passelewe (d. 12 52). In 1246, however, Richard obtained the temporalities. He died at Dover in April 1253. It was generally believed that miracles were wrought at his tomb in Chichester cathedral, which was long a popular place of pilgrimage, and in 1262 he was canonized at Viterbo by Pope Urban IV.

His life by his confessor, Ralph Bocking, is published in the *Acta Sanctorum* of the Bollandists, with a later life by John Capgrave.

RICHARD (d. 1184), archbishop of Canterbury, was a Norman, who became a monk at Canterbury, where he acted as chaplain to Archbishop Theobald and was a colleague of Thomas Becket. In 1173, more than two years after the murder of Becket, it was decided to fill the vacant archbishopric of Canterbury; there were two candidates, Richard, at that time prior of St. Martin's, Dover, and Odo, prior of Canterbury, and in June Richard was chosen, although Odo was the nominee of the monks. Objections were raised against this election both in England and in Rome, but in April 1174 the new archbishop was consecrated at Anagui by Pope Alexander III., and he returned to England towards the close of the year. The ten years during which Richard was archbishop were disturbed by disputes over the respective rights of the sees of Canterbury and York. Richard died at Rochester on Feb. 16, 1184, and was buried in his cathedral.

See the article by W. Hunt in the *Dict. Nat. Biog.* vol. xlviii. (1896); and W. F. Hook, *Lives of the Archbishops of Canterbury.*

RICHARD *I.* (1157–1199), king of England, nicknamed "Coeur de Lion" and "Yea and Nay," was the third son of Henry II. by Eleanor of Aquitaine. Born in Sept. 1157, he received at the age of 11 the duchy of Aquitaine, and was formally installed in 1172. In his new position he was allowed, probably from regard to Aquitanian susceptibilities, to govern with an independence which was studiously denied to his brothers in their shares of the Angevin inheritance. Yet in 1173 Richard joined with the young Henry and Geoffrey of Brittany in their rebellion; Aquitaine was twice invaded by the old king before the unruly youth would make submission. Richard was soon pardoned and reinstated in his duchy, where he distinguished himself by crushing a formidable revolt (1175) and exacting homage from the count of Toulouse. In a short time he was so powerful that his elder brother Henry became alarmed and demanded, as heir-apparent, that Richard should do him homage for Aquitaine. Richard having scornfully rejected the demand, a fratricidal war ensued; the young Henry invaded Aquitaine and attracted to his standard many of Richard's vassals, who were exasperated by the iron rule of the duke. Henry II. marched to Richard's aid; but the war ended abruptly with the death of the elder prince (1183).

Richard, being now the heir to England and Normandy, was invited to renounce Aquitaine in favour of Prince John. The proposal led to a new civil war; and, although a temporary compromise was arranged, Richard soon sought the help of Philip Augustus, to whom he did homage for all the continental possessions in the actual presence of his father (Conference of Bonmoulins, Nov. 18, 1188). In the struggle which ensued the old king was overpowered, chased ignominiously from Le Mans to Angers, and forced to buy peace by conceding all that was demanded of him; in particular the immediate recognition of Richard as his successor.

But the death of Henry II. (1189) at once dissolved the friendship between Richard and Philip. Not only did Richard continue the continental policy of his father, but he also refused to fulfil his contract with Philip's sister, Alais, to whom he had been betrothed at the age of three. An open breach was only delayed by the desire of both kings to fulfil the crusading vows which they had recently taken. Richard, in particular, sacrificed all other interests to this scheme, and raised the necessary funds by the most reckless methods. He put up for auction the highest offices and honours; even remitting to William the Lion of Scotland, for a sum of 15,000 marks, the humiliating obligations which Henry II. had imposed at the Treaty of Falaise. By such expedients he raised and equipped a force which may be estimated at 4,000 men-at-arms and as many foot-soldiers, with a fleet of 100 transports (1191).

Richard did not return to his dominions until 1194. But his stay in Palestine was limited to 16 months. On the outward journey he wintered in Sicily, where he employed himself in quarrelling with Philip and in exacting satisfaction from the usurper Tancred for the dower of his widowed sister, Queen Joanna, and for his own share in the inheritance of William the Good. Leaving Messina in March 1191, he interrupted his voyage to conquer Cyprus, and only joined the Christian besiegers of Acre in June. The reduction of that stronghold was largely due to his energy and skill. But his arrogance gave much offence. After the fall of Acre he inflicted a gross insult upon Leopold of Austria; and his relations with Philip were so strained that the latter seized the first pretext for returning to France, and entered into negotiations with Prince John (see JOHN, king of England) for the partition of Richard's realm.

Richard also threw himself into the disputes respecting the crown of Jerusalem, and supported Guy of Lusignan against Conrad of Montferrat with so much heat that he incurred grave, though unfounded, suspicions of complicity when Conrad was assassinated by emissaries of the Old Man of the Mountain. None the less Richard, whom even the French crusaders accepted as their leader, upheld the failing cause of the Frankish Christians with valour and tenacity. He won a brilliant victory over the forces of Saladin at Arsuf (1191), and twice led the Christian host within a few miles of Jerusalem. But the dissensions of the native Franks and the crusaders made it hopeless to continue the struggle; and Richard was alarmed by the news which reached him of John's intrigues in England and Normandy. Hastily patching up a truce with Saladin, under which the Christians kept the coast-towns and received free access to the Holy Sepulchre, Richard started on his return (Oct. 9, 1192).

His voyage was delayed by storms, and he appears to have been perplexed as to the safest route. The natural route overland through Marseilles and Toulouse was held by his enemies; that through the empire from the head of the Adriatic was little safer, since Leopold of Austria was on the watch for him. Having adopted the second of these alternatives, he was captured at Vienna in a mean disguise (Dec. 20, 1192) and strictly confined in the duke's castle of Diirenstein on the Danube. His mishap was soon known to England, but the regents were for some weeks uncertain of his whereabouts. This is the foundation for the tale of his discovery by the faithful minstrel Blondel, which first occurs in a French romantic chronicle of the next century. Early in 1193 Leopold surrendered his prize, under compulsion, to the emperor Henry VI., who was aggrieved both by the support which the Plantagenets had given to the family of Henry the Lion and also by Richard's recognition of Tancred in Sicily. Although the detention of a crusader was contrary to public law, Richard was compelled to purchase his release by the payment of a heavy ransom and by doing homage to the emperor for England. The ransom demanded was 150,000 marks; though it was never discharged in full, the resources of England were taxed to the utmost for the first instalments; and to this occasion we may trace the beginning of secular taxation levied on movable property.

Richard reappeared in England in March 1194; but his stay lasted only a few weeks, and the remainder of his reign was entirely devoted to his continental interests. He left England to be governed by Hubert Walter (*q.v.*), and his personal authority was seldom asserted except by demands for new subsidies. The rule of the Plantagenets was still popular in Normandy and Aquitaine; but these provinces were unable or unwilling to pay for their own defence. Though Richard proved himself consistently the superior of Philip in the field, the difficulty of raising and paying forces to resist the French increased year by year. Richard could only stand on the defensive; the keynote of his later policy is given by the building of the famous Chdteau Gaillard at Les Andelys (1196) to protect the lower courses of the Seine against invasion from the side of France. He did not live to see the futility of such bulwarks. In 1199 a claim to treasure-trove embroiled him with the viscount of Limoges. He harried the Limousin and laid siege to the castle of Chdlus; while directing an assault he was wounded in the shoulder by a crossbow bolt, and, the wound mortifying from unskilful treatment or his own want of care, he died on April 6, 1199. He was buried by his own desire at his father's feet in the church of Fontevrault. Here his effigy may still be seen[1]. Though contemporary, it does not altogether agree with the portraits on his Great Seal, which give the impression of greater strength and even of cruelty. The Fontevrault bust is no doubt idealized.

The most accomplished and versatile representative of his gifted family, Richard was, in his lifetime and long afterwards, a favourite hero with troubadours and romancers. This was natural, as he belonged to their brotherhood and himself wrote lyrics of no mean quality. But his history shows that he by no means embodied the current ideal of chivalrous excellence. His memory is stained by one act of needless cruelty, the massacre of over two thousand Saracen prisoners at Acre; and his fury, when thwarted or humbled, was ungovernable. A brave soldier, an experienced and astute general, he was never happier than when engaged in war. As a ruler he was equally profuse and rapacious. Not one useful measure can be placed to his credit; and it was by a fortunate accident that he found, in Hubert Walter, an administrator who had the skill to mitigate the consequences of a reckless fiscal policy. Richard's wife was Berengaria, daughter of Sancho VI., king of Navarre, whom he married in Cyprus in May 1191. She was with the king at Acre later in the same year, and during his imprisonment passed her time in Sicily, in Rome and in France. Husband and wife met again in 1195, and the queen long survived the king, residing chiefly at Le Mans. She died soon after 1230. Berengaria founded a Cistercian monastery at Espau.

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RICHARD II. (1367–1400), king of England, younger son of Edward the Black Prince by Joan "the Fair Maid of Kent," was born at Bordeaux on Jan. 6, 1367. He was brought to Eng-

[1] The remains of Richard, together with those of Henry II. and his queen Eleanor, were removed in the 17th century from their tombs to another part of the church. They were rediscovered in 1910 during the restoration of the abbey undertaken by the French Government.

land in 1371, and after his father's death was, on the petition of the Commons in parliament, created prince of Wales on Nov. 20, 1376. When Edward III. died, on June 21, 1377, Richard became king. Popular opinion had credited John of Gaunt with designs on the throne. This was not justified; nevertheless, the rivalry of the boy-king's uncles added another to the troubles due to the war, the Black Death and the prospect of a long minority. At first the government was conducted by a council appointed by parliament. The council was honest, but the difficulties of the situation were too great. The ill-considered poll-tax of 1381 was the occasion, though not the real cause, of the Peasants' Revolt in that year. The ministers were quite unequal to the crisis, and when Wat Tyler and his followers got possession of London, Richard showed a precocious tact and confidence in handling it. He met and temporized with the rebels on June 13 at Mile End, and again next day at Smithfield; and with courageous presence of mind, he saved the situation when Tyler was killed, by calling on them to take him for their leader.

From this time Richard began to assert himself. His chief ministers, appointed by parliament in 1382, were the earl of Arundel and Michael de la Pole. Arundel Richard disliked, and dismissed next year, when he began his personal government. Pole, whom he retained as chancellor and made earl of Suffolk, was a well-chosen adviser. But others, and especially his youthful favourite Robert de Vere, promoted to be marquess of Dublin and duke of Ireland, were less worthy. Further, Richard made his own position difficult by lavish extravagance and by outbursts of temper. He chafed under the restraint of his relatives, and therefore encouraged John of Gaunt in his Spanish enterprise.

Thereupon, Thomas of Gloucester, supported by Arundel, attacked his nephew's ministers in the parliament of 1386, and by open hints at deposition forced Richard to submit to a council of control. When Richard, with the aid of his friends and by the advice of subservient judges, planned a reversal of the parliament, Gloucester, at the head of the so-called lords appellant, anticipated him. Richard had been premature and ill-advised. Gloucester had the advantage of posing as the head of the constitutional party. The king's friends were driven into exile or executed, and he himself forced to submit to the loss of all real power (May 1388). Richard changed his methods, and when the lords appellant had lost credit, asserted himself constitutionally by dismissing Gloucester's supporters from office, and appointing in their place well-approved men like William of Wykeham. In the next parliament of 1390 the king showed himself ready to meet and conciliate his subjects. The simultaneous return of John of Gaunt from Spain put a check on Gloucester's ambition. For seven years Richard ruled constitutionally and on the whole well.

In Jan. 1383 Richard had married Anne of Bohemia (1366–1394), daughter of the emperor Charles IV. Her death on June 7, 1394 was a great shock to Richard, and incidentally had important consequences. Richard sought distraction by an expedition to Ireland, the first visit of an English king for more than two centuries. In his policy there he showed a wise statesmanship. At the same time he was negotiating for a permanent peace with France, which was finally arranged in Oct. 1396 to include his own marriage with Isabella, daughter of Charles VI., a child of seven. Gloucester criticized the peace openly, and there was some show of opposition in the parliament of Feb. 1397.

Period of Absolute Monarchy. — But there was nothing to foreshadow the sudden stroke by which in July Richard arrested Gloucester and his chief supporters, the earls of Arundel and Warwick. The others of the five lords appellant, Henry of Bolingbroke, afterwards King Henry IV., and the earl of Nottingham, now supported the king. Richard's action was apparently in deliberate revenge for the events of 1387–88. Gloucester, after a forced confession, died in prison at Calais, smothered by his nephew's orders. Arundel, in a packed parliament, was condemned and executed; his brother Thomas archbishop of Canterbury was exiled. The king's friends, including Nottingham and Bolingbroke, made dukes of Norfolk and Hereford, were all promoted in title and estate. Richard himself was rewarded for ten years' patience by the possession of absolute power. He might perhaps have established it if he could have exercised it with moderation. But he declared that the laws of England were in his mouth, and supported his court in wanton luxury by arbitrary methods of taxation. By the exile of Norfolk and Hereford in Sept. 1398 he seemed to have removed the last persons he need fear. He was so confident that in May 1399 he paid a second visit to Ireland, taking with him all his most trusted adherents.

Rebellion and Deposition. — Thus when Henry landed at Ravenspur in July he found only half-hearted opposition, and when Richard himself returned it was too late. Ultimately Richard surrendered to Henry at Flint on Aug. 19, promising to abdicate if his life was spared. He was taken to London riding behind his rival with indignity. On Sept. 30, he signed in the Tower a deed of abdication, wherein he owned himself insufficient and useless, reading it first aloud with a cheerful mien and ending with a request that his cousin would be good lord to him. The parliament ordered that Richard should be kept close prisoner, and he was sent secretly to Pontefract. There in Feb. 1400 he died: no doubt of the rigour of his winter imprisonment, rather than by actual murder as alleged in the story adopted by Shakespeare. The mystery of Richard's death led to rumours that he had escaped, and an impostor pretending to be Richard lived during many years under the protection of the Scottish government. But no doubt it was the real Richard who was buried without state in 1400 at King's Langley, and honourably reinterred by Henry V. at Westminster in 1413.

Richard II. is a character of strange contradictions. It is difficult to reconcile the precocious boy of 1381 with the wayward and passionate youth of the next few years. Even if it be supposed that he dissembled his real opinions during the period of his constitutional rule, it is impossible to believe that the apparent indifference which he showed in his fall was the mere acting of a part. His violent outbursts of passion perhaps give the best clue to a mercurial and impulsive nature, easily elated and depressed. He had real ability, and in his Irish policy, and in the preference which he gave to it over continental adventure, showed a statesmanship in advance of his time. But this, in spite of his lofty theory of kingship, makes it all the more difficult to explain his extravagant bearing in his prosperity. In appearance Richard was tall and handsome, if effeminate. He had some literary tastes, which were shown in fitful patronage of Chaucer, Gower and Froissart. Richard's second queen, Isabella (1389–1409), was born in Paris on Nov. 9, 1389, and was married to the English king at Calais in October, or November, 1396, but on account of the bride's youth the marriage was never consummated.

When Richard lost his crown in 1399 Isabella was captured by Henry IV.'s partisans and sent to Sonning, near Reading, while her father, Charles VI., asked in vain for the restoration of his daughter and of her dowry. In 1401 she was allowed to return to France; in 1406 she became the wife of the poet, Charles, duke of Orleans, and she died on Sept. 13, 1409.

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RICHARD III. (1452–1485), king of England, youngest son of Richard, duke of York, by Cicely Neville, was born at Fotheringhay on Oct. 2, 1452. After the second battle of St. Albans in Feb. 1461, his mother sent him with his brother George for safety to Utrecht. They returned in April, and at the coronation of Edward IV. Richard was created duke of Gloucester. As a mere child he had no importance till 1469–70, when he supported his brother against Warwick, shared his exile and took part in his triumphant return. He distinguished himself at Barnet and Tewkesbury; according to the Lancastrian story, after the latter battle

he murdered the young Edward of Wales in cold blood; this is discredited by the authority of Warkworth (Chronicle, p. 18); but Richard may have had a share in Edward's death during the fighting. He cannot be so fully cleared of complicity in the murder of Henry VI., which probably took place at the Tower on the night of May 22, when Richard was certainly present there.

Richard shared to the full in his brother's prosperity. He had large grants of lands and office, and by marrying Anne (1456–1485), the younger daughter of Warwick, secured a share in the Neville inheritance. This was distasteful to George, duke of Clarence, who was already married to the elder sister, Isabel. The rivalry of the two brothers caused a quarrel which was never appeased. Richard does not, however, seem to have been directly responsible for the death of Clarence in 1478; Sir Thomas More, who is a hostile witness, says that he resisted it openly "howbeit somewhat (as men deemed) more faintly than he that were heartily minded to his wealth." Richard's share of the Neville inheritance was chiefly in the north, and he resided usually at Middleham in Yorkshire. In May 1480 he was made the king's lieutenant-general in the north, and in 1482 commanded a successful invasion of Scotland. His administration was good, and brought him well-deserved popularity.

Protectorate.--On Edward's death he was kept informed of events in London by William, Lord Hastings, who shared his dislike of the Woodville influence. On April 29, 1483, supported by the duke of Buckingham, he intercepted his nephew at Stony Stratford and arrested Lord Rivers and Richard Grey, the little king's half-brother. It was in Richard's charge that Edward was brought to London on May 4. Richard was recognized as protector, the Woodville faction was overthrown, and the queen with her younger children took sanctuary at Westminster. For the time the government was carried on in Edward's name, and June 22 was appointed for his coronation. Richard was nevertheless gathering forces and concerting with his friends. In the council there was a party, of whom Hastings and Bishop Morton were the chief, which was loyal to the boy-king. On June 13 came the famous scene when Richard appeared suddenly in the council baring his withered arm and accusing Jane Shore and the queen of sorcery; Hastings, Morton and Stanley were arrested and the first-named at once beheaded. A few days later, probably on June 25, Rivers and Grey were executed at Pontefract. On June 22 Dr. Shaw was put up to preach at Paul's Cross against the legitimacy of the children of Edward IV. On the 25th a sort of parliament was convened at which Edward's marriage was declared invalid on the ground of his precontract with Eleanor Talbot, and Richard rightful king. Richard, who was not present, accepted the crown with feigned reluctance, and from the following day began his formal reign.

Usurpation of the Throne.--On July 6, Richard was crowned at Westminster, and immediately afterwards made a royal progress through the Midlands, on which he was well received. But in spite of its apparent success the usurpation was not popular. Richard's position could not be secure whilst his nephews lived. There seems to be no reasonable doubt that early in August Edward V. and his brother Richard (whom Elizabeth Woodville had been forced to surrender) were murdered by their uncle's orders in the Tower. Attempts have been made to clear Richard's memory. But the report of the princes' death was believed in England at the time, "for which cause king Richard lost the hearts of the people" (Chronicles of London, 191), and it was referred to as a definite fact before the French states-general in January 1484. The general, if vague, dissatisfaction found its expression in Buckingham's rebellion.

Richard, however, was fortunate, and the movement collapsed. He met his only parliament in Jan. 1484 with some show of triumph, and deserves credit for the wise intent of its legislation. He could not, however, stay the undercurrent of disaffection, and his ministers, Lovell and Catesby, were unpopular. His position was weakened by the death of his only legitimate son in April 1484. His queen died also a year later (March 16, 1485), and public opinion was scandalized by the rumour that Richard intended to marry his own niece. Elizabeth of York. Thus the feeling in favour of his rival Henry Tudor strengthened. Henry landed at Milford Haven on Aug. 7, 1485, and it was with dark forebodings that Richard met him at Bosworth on the 22nd. The defection of the Stanleys decided the day. Richard was killed fighting, courageous at all events. After the battle his body was carried to Leicester, trussed across a horse's back, and buried without honour in the church of the Greyfriars.

Richard was not the villain that his enemies depicted. He had good qualities, both as a man and a ruler, and showed a sound judgment of political needs. Still it is impossible to acquit him of the crime, the popular belief in which was the chief cause of his ruin. He was a typical man in an age of strange contradictions of character, of culture combined with cruelty, and of an emotional temper that was capable of high ends, though unscrupulous of means. Tradition represents Richard as deformed. It seems clear that he had some physical defect, though not so great as has been alleged. Extant portraits show an intellectual face characteristic of the early Renaissance, but do not indicate any deformity.

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RICHARD, earl of Cornwall and king of the Romans (1209–1272), was the second son of the English king John by Isabella of Angoulême. Born in 1209, Richard was the junior of his brother, Henry III., by fifteen months; he was educated in England and received the earldom of Cornwall in 1225. From this date to his death he was a prominent figure on the political stage. In the years 1225–27 he acted as governor of Gascony; between 1227 and 1238, owing to quarrels with his brother and dislike of the foreign favourites, he attached himself to the baronial opposition and bade fair to become a popular hero. But in 1240 he took the command of a crusade in order to escape from the troubled atmosphere of English politics. He was formally reconciled with Henry before his departure; and their amity was cemented on his return by his marriage with Sancha of Provence, the sister of Henry's queen (1243). In 1257 a bare majority of the German electors nominated Richard as king of the Romans, and he accepted their offer at Henry's desire.

In the years 1257–68 Richard paid four visits to Germany. He obtained recognition in the Rhineland, which was closely connected with England by trade relations. Otherwise, however, he was unsuccessful in securing German support. In the English troubles of the same period he endeavoured to act as a mediator. On the outbreak of civil war in 1264 he took his brother's side, and his capture in a windmill outside Lewes, after the defeat of the royalist army, is commemorated in the earliest of English vernacular satires; he remained a prisoner till the fall of Montfort. But after Evesham he exerted himself to obtain reasonable terms for those who had suffered from the vengeance of the royalist party. He died on April 2, 1272. (H. W. C. D.)

RICHARD OF ST. VICTOR (d. 1173), theologian and mystic of the 12th century. Little is known of his life; he was born in Scotland or in England, and went to Paris, where he entered the abbey of St. Victor and was a pupil of the great mystic, Hugh of St. Victor. He succeeded as prior of this house in 1162. The best known of Richard's writings are mystical treatises and two works on the Trinity. According to him, six steps lead the soul to contemplation: (1) contemplation of visible and tangible objects; (2) study of the productions of nature and of art; (3) study of character; (4) study of souls and of spirits; (5) en-

trance to the mystical region which ends in (6) ecstasy.

His theory of the Trinity is chiefly based on the arguments of Anselm of Canterbury. The influence of neo-Platonic terminology, as well as of the works of the pseudo-Dionysius, can be clearly detected in his works. In the *Paradiso* Dante placed Richard among the greatest teachers of the church His writings came into favour again in the 16th and 17th centuries, six editions of his works having been printed between 1506 and 1650.

RICHARDS, DICKINSON WOODRUFF (1895–), U.S. physician and co-winner of the Nobel prize, noted for research on the human heart, was born at Orange, S.J., on Oct. 30, 1895. He graduated from Yale university in 1917. took a master's degree at Columbia university in 1922 and received his medical degree from Columbia the next year. After study in England he began his research in heart and lung physiology at Columbia university's College of Physicians and Surgeons in 1928. In 1947 he was appointed Lambert professor of medicine there. In 1945 he also became director of the Columbia medical division at Bellevue hospital in New Pork city.

Adapting the pioneer experiments of Werner T. Forssmann, German surgeon who explored his own heart with a long, flexible tube passed through an artery (1929), Richards and André F. Cournand of Columbia university measured blood pressure and make-up inside the heart and later extended the measurements to the lungs and general circulatory system. The research of the three physicians led to important methods of diagnosis and treatment of heart disease and to discoveries concerning the behaviour of circulation in a great variety of diseases and under the influence of various drugs. Richards shared the 1956 Nobel prize in medicine and physiology with Cournand and Forssmann.

RICHARDS, THEODORE WILLIAM (1868–1928), U.S. chemist, who received the Nobel chemistry prize in 1914 for his researches on atomic weights and demonstrated the existence of isotopes (*q.v.*). He was born in Germantoun, Pa., on Jan. 31, 1868. He graduated from Haverford college (S.B., 1885) and Harvard university (A.B., 1886; Ph.D., 1888); he also studied as a Harvard traveling fellow at Gottingen, Leipzig and the Dresden Technical university, and became instructor (1891), assistant professor (1894) and professor (1901) of chemistry at Harvard. He was made director of the Wolcott Gibbs memorial laboratory and Erving professor of chemistry in 1912.

Richards greatly improved the technique of gravimetric atomic weight determinations, introducing quartz apparatus, the bottling device and the nephelometer. Although the atomic weight values of Jean Servais Stas had been regarded as standard. about 1903 physiochemical measurements showed that some were not accurate. Richards and his students revised these figures, lowering, for instance, Stas's value for silver from 107.93 to 107.88. Richard's investigations of the atomic weight of lead from different sources definitely proved the existence of isotopes. He died at Cambridge, Mass.. on April 2, 1928. (R. E. O.; X.)

RICHARDSON, DOROTHY MILLER (1873–1957), English pioneer in stream-of-consciousness fiction, was born in Abingdon, Berkshire, on May 17, 1873, and passed her childhood and youth in secluded surroundings in late-Yictorian England. After her schooling, which ended when, in her 17th year, her home broke up, she engaged in teaching, clerical work and journalism. In 1917 she married the artist Alan Elsden Odie (1888–1948). She commands attention for her sequence novel *Pilgrimage* (published in separate volumes—she preferred to call them chapters—as *Pointed Roofs,* 1915; *Backwater,* 1916; *Honeycomb,* 1917; *The Tunnel,* 1919; *Interim,* 1919; *Deadlock,* 1921; *Revolving Lights,* 1923; *The Trap,* 1925; *Oberland,* 1927; *Dawn's Left Hand,* 1931; *Clear Horizon,* 1935; the last part, *Dimple Hill,* appeared under the collective title. 4 vol., 1938).

She died June 17, 1957, at Beckenham. Kent.

Pilgrimage is the extraordinarily sensitive story, seen cinematically through her eyes, of Miriam Henderson, an attractive, spinsterish and mystical New Woman. Unfortunately, she is more new than woman, since. for a character committed to the stream-of-consciousness technique of self-revelation, her reactions to her various experiences are selected and edited with peculiarly improper reticence; while hers is entirely a woman's consciousness, it is not nearly a woman's entire consciousness. Moreover, the author too often lavishes her surpassingly delicate perceptiveness upon dull material. Nevertheless, no student of fiction can afford to overlook *Pilgrimage,* one of the significant novels of the 20th century.

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RICHARDSON, HENRY HANDEL (pseudonym of ETHEL FLORENCE LINDESAY RICHARDSON ROBERTSON) (1870–1946), considered by some to be Australia's greatest novelist. Born at East Melbourne, Victoria, Jan. 3, 1870, she was educated at the Presbyterian Ladies' college, Melbourne, and in 1887 she went to Leipzig to study music. She was influenced by continental rather than English literature and thought. and apart from a short visit in 1912 to obtain material for her work, she did not return to Australia. In 1895 she married J. G. Robertson, who was appointed in 1903 to the chair of German literature in the Gniversity of London. Her first novel, *Maurice Guest* (1908), was based on her experiences in Leipzig and like much of her work was partly autobiographical. *The Fortunes of Richard Mahoney (Australia Felix,* 1917; *The* Way *Home,* 1925; *Ultima Thule,* 1929) is the story of an Irish immigrant who bears a strong resemblance to her father. Other works published during her life were: *Two Studies* (1931); *The End of a Childhood* (1934); *The Young Cosima* (1939).

She died at Hastings, Sussex, March 20, 1946, leaving an unfinished autobiography, *Myself When Young,* published in 1948.

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RICHARDSON, HENRY HOBSON (1838–1886), U.S. architect, was both the initiator of the Romanesque revival and a pioneer figure in the development of an indigenous. modern American style. He was born on Sept. 29, 1838, in St. James parish, La. After graduating from Harvard college in 1859, he studied architecture at the École des Beaux-Arts, Paris, returning to the United States in 1865. Shunning the neoclassical traditions in which he had been trained, Richardson experimented briefly with Victorian Gothic and then turned to the French Romanesque style epitomized in his famous Trinity church of Boston (1872–77).

The Marshall Field Wholesale building, Chicago (1887; demolished 1930), was the masterpiece of the bold, original style that he gradually evolved: characterized by an unornamented exterior and rows of tall, arched windows, it relied for effect upon its lines and the skillful handling of material. This style survives in his Ames-Pray building. Boston. Among his other notable works are the Pittsburgh courthouse and jail; the capitol at Albany, N.Y.; Sever hall. Harvard university; and many distinctive, shingled country houses such as Stoughton house, Cambridge, Mass. His Romanesque had an integrity and grace seldom achieved by his many imitators in the latter half of the 19th century; his modern style presaged the revolutionary work of Louis Sullivan (*q.v.*). Richardson died on April 27, 1886, in Boston.

See Henry Russell Hitchcock, *The Architecture of H. H. Richardson and His Times* (1936).

RICHARDSON, LEWIS FRY (1881–1953), British mathematician and meteorologist especially remembered for his application of mathematics to weather forecasting. was born at Newcastle upon Tyne on Oct. 11, 1881, of an old Quaker family of tanners. Educated at Bootham school, York. and at King's college, Cambridge, he worked in universities, in industry, in technical colleges and in governmental scientific institutions (notably in the meteorological office). His mathematical work, marked by great originality of thought, mainly concerned the calculus of finite differences, the prediction of weather by computation, the study of diffusion and, later, the use of mathematics to elucidate the causes of war (speculations arising from religious conviction). Richardson made major contributions to numerical methods of

solving boundary-value problems in physics. and during 1913–22 applied these ideas to meteorology in a bold attempt to produce a systematic method of forecasting depending entirely on calculation. This work culminated in his classic *Weather Prediction by Numerical Process* (1922), with its scheme for "numerical" forecasting including a worked-out example. This example was a failure. The failure was caused partly by inadequate upper-air data and partly by the limitations of the mathenlatical method. but the line of thought thus pioneered and the later invention of the high-speed electronic computer together made numerical forecasts practicable. In his work on diffusion Richardson mas likewise ahead of his time, in that concepts which he advanced in 1926 were not fully recognized as valid until 20 years later, when they were rediscovered by others. His name is preserved in studies of convection by the "Richardson number." a fundamental quantity involving the gradients of temperature and velocity. He died at Kilmun, Argyll, on Sept. 30, 1953.

See E. Gold, Obituary Notices of Fellows of the Royal Society, 9 (1954); J. R. hrewman (ed.), *World of Mathematics,* vol. *2* (1956). (G. SN.)

RICHARDSON, SIR OWEN WILLANS (1879–1959), English physicist awarded the Nobel prize for physics in 1928, was one of the founders of atomic physics. He discovered the Richardson law, concerning the emission of electricity from hot bodies, on which is based the action of wireless valves; his work on valves helped to revolutionize radio communication through the development of the hard thermionic valve. Born at Dewsbury, Yorkshire, on April 26. 1879. Richardson was educated at Trinity college, Cambridge. He was professor of physics at Princeton university, 1906–13, and at King's college: London, 1914–24, Yarrow research professor of the Royal society, director of research in physics at King's college and, from 1944, emeritus professor of physics of London university. Richardson was elected fellow of the Royal society in 1913 and was knighted in 1939. He died at Alton, Hampshire, on Feb. 1 j j 1959. Among other standard works he wrote *The Emission of Electrżcżty From Hot Bodies* (1916; 2nd ed., 1921).

RICHARDSON, SAMUEL (1689–1761), English novelist, the father of the novel of sentimental analysis, was born in Derbyshire in 1689. He was apprenticed at 17 to an Aldersgate printer named John Wilde. There he became successively compositor, corrector of the press, and printer on his own account; married his master's daughter; set up newspapers and books; dabbled in literature by compiling indexes and "honest dedications," and ultimately became printer of the journals of the house of commons, master of the Stationers' company, and law printer to the king. Like all a-ell-to-do citizens, he had his city house of business and his "country box" in the suburbs; and, after a thoroughly "respectable" life, died on July 4, 1761.

The origin of his first novel *Pamela* dates back to a request from Rivington of St. Paul's Churchyard and Osborn of Paternoster Row! two book-selling friends who were aware of Richardson's epistolary gifts, to suggest that he should prepare a little model letter writer for such "country readers" as "were unable to indite for themselves." The result mas *Pamela; or Virtue Rewarded.* He completed it in a couple of months (Nov. 10, 1739, to Jan. 16, 1740). In Nov. 1740 it was issued by Messrs. Rivington and Osborn, who, a few weeks afterward (Jan. 1741), also published the model letter writer under the title of *Lettevs written to and for Particular Friends, on the most Important Occasions.* Both books were anonymous. The letter writer and *Pamela* were noticed in the *Gentleman's Magazine* for January. Such was the immediate popularity of *Pamela* that not to have read it was judged "as great a sign of want of curiosity as not to have seen the French and Italian dancers"—*i.e.*, Mme. Chateauneuf and the Fausans, who were then delighting the town. In February a second edition appeared, followed by a third in March and a fourth in May. At public gardens ladies held up the book to show they had got it; Dr. Benjamin Slocock of Southwark openly commended it from the pulpit; Pope praised it; and at Slough, when the heroine triumphed, the enraptured villagers rang the church bells for joy.

Such popularity, of course, was not without its drawbacks. That it would lead to *Anti-Pamela,* censures of *Pamela* and all the spawn of pamphlets which spring round the track of a sudden success, was to be anticipated. One of the results to which its rather sickly morality gave rise was the *Joseph Andrews* (1742) of Henry Fielding (*q.v.*). But two other works prompted by *Pamela* need brief notice: the *Apology for the Life of Mrs. Shamela Andrews,* a clever and very gross piece of raillery which appeared in April 1741, and by which Fielding is supposed to have alluded to *Joseph Andrews;* and *Pamela's Conduct in High Life* (Sept. 1741), a spurious sequel by John Kelly of the *Universal Spectator.* Richardson tried to prevent the appearance of the latter, and, having failed, set about two volumes of his own, and professed to depict his heroine "in her exalted condition." It attracted no permanent attention.

About 1744 something was heard of Richardson's second and greatest novel, *Clarissa; or the History of a Young Lady,* usually miscalled *Clarissa Harlowe.* The first edition was in seven volumes, two of which came out in Nov. 1747, two more in April 1748 and the last three in December. Upon the title-page its object was defined as showing the distresses that may attend the misconduct both of parents and children in relation to marriage. Virtue, in *Clarissa,* is not "rewarded," but hunted down and outraged. The chief drawbacks of *Clarissa* are its merciless prolixity (seven volumes, which cover only 11 months); the fact that (like *Pamela)* it is told by letters; and a certain haunting and uneasy feeling that many of the heroine's obstacles are only molehills which should have been readily surmounted.

Between *Clarissa* and Richardson's next work appeared Fielding's *Tom Jones,* a rival by no means welcome to Richardson, although a rival who generously (and perhaps penitently) acknowledged *Clarissa's* rare merits in the *Jacobite's Journal.* But even this could not console Richardson for the popularity of the "spurious brat" whom Fielding had made his hero, and Richardson's next effort was the depicting of a genuine fine gentleman. In the *History of Sir Charles Grandison,* "by the Editor of *Pamela* and *Clarissa"* (for he still preserved the fiction of anonymity). he essayed to draw a perfect model of manly character and conduct. In the pattern presented there is, however, too much buckram, too much ceremonial—in plain words, too much priggishness—to make him the desired exemplar of propriety *in excelsis.* Yet he is not entirely a failure. When Richardson delineated Sir Charles Grandison he was at his best. and his experiences and opportunities for inventing such a character were infinitely greater than they had ever been before. And he lost nothing of his gift for portraying the other sex. Harriet Byron, Clementina della Porretta and even Charlotte Grandison, are no whit behind Clnrissa and her friend Miss Howe. *Sir Charles Gmndison,* in fine, is a far better book than *Pamela.*

Grandison was published in 17j3. and by this time Richardson was 64. Although the book was welcomed as warmly as were its predecessors, he nrote no other novel, contenting himself instead with indexing his works. and compiling an anthology of the "maxims." "cautions" and "instructive sentiments" they contained. To these things, as a professed moralist, he had always attached the greatest importance. He continued to correspond relentlessly with a large circle of worshippers, mostly women. He was a nervous. highly strung little man, intensely preoccupied with his health and his feelings. hungry for praise when he had once tasted it, and afterward unable to exist without it; but apart from these things. well meaning. benevolent, honest, industrious and religious. Seven vast folio volumes of his correspondence with his lady friends, and with a few men are preserved in the Forster library at South Kensington. Parts of it only have been printed

Richardson is the father of the novel of sentimental analysis. As Sir Walter Scott has said. no one before had dived so deeply into the human heart. No one, moreover, had brought to the study of feminine character so much prolonged research, so much patience of observation. so much interested and indulgent apprehension. That he did not more materially control the course of English fiction was probably due to the new direction which was given to that fiction by Fielding and Smollett,

whose method, roughly speaking, was synthetic rather than analytic. Still, his influence is to be traced in Sterne and Henry Mackenzie, as well as in Miss Burney and Miss Austen, both of whom, it may be noted, at first adopted the epistolary form. But it was in France, where the sentimental soil was ready for the dressing, that the analytic process was most warmly welcomed. Extravagantly eulogized by the great critic, Diderot, modified with splendid variation by Rousseau, copied (unwillingly) by Voltaire, the vogue of Richardson was so great as to tempt French critics to seek his original in the *Marianne* of a contemporary analyst, Marivaux. As a matter of fact, though there is some unconscious consonance of manner, there is nothing whatever to show that the little-letter author of *Pamela,* who was also ignorant of French, had the slightest knowledge of Marivaux or *Marianne.* In Germany Richardson was even more popular than in France. Gellert, the fabulist, translated him; Wieland, Lessing, Hermes, all imitated him, and Coleridge detects him even in the *Robbers* of Schiller. What was stranger still, he returned to England again under another form. The French *comédie larmoyante,* to which he had given a fillip, crossed the channel as the sentimental comedy of Cumberland and Kelly, which, after a brief career of prosperity, received its death-blow at the hands of Goldsmith and Sheridan.

Richardson's novels were edited by Mangin (19 vols., 1811), and an edition in 12 vols. was published by Sotheran in 1883 with preface by Sir Leslie Stephen. A *Collection of the Moral and Instructive Sentiments,* etc., was published in 1755. A selection from Richardson's *Correspondence* was published by Mrs. A. L. Barbauld in 1804, in six volumes, with a valuable Memoir. Recent lives are by Miss Clara L. Thornson, 1900, and by Austin Dobson ("Men of Letters"), 1902. A convenient reprint of the novels, with copies of the old illustrations by Stothard, Edward Burney and the rest, and an introduction by Mrs. E. M. M. McKenna, was issued in 1901 in 20 volumes.

(A. Do.; X.)

RICHBOROUGH, a port on the Stour, in Kent, Eng., 15½ mi. N. of Dover by road.

Richborough castle is one of the most remarkable monuments of the Roman occupation of Britain. It marked the beginning of Watling street and guarded the channel of the Wantsum, then separating the Isle of Thanet from the mainland. The site shoas signs of occupation in the Early Iron Age but it only entered history with the invasion of Claudius in A.D. 43. A base, *Rutupiae,* was established there nhich was used throughout the occupation. The extant remains include the north mall of the Saxon Shore fort, possibly built by Carausius in the 3rd century, 460 ft. long and 22 ft high. There is a cruciform platform of concrete, 126 ft. long and 82 ft. wide. It was probably a monument to the emperor Domitian A subterranean passage runs under the foundations of the platform. In 1926 excavations revealed a double series of ditches surrounding the fortifications.

During World War I, to relieve the traffic in military stores through Dover, the old port was re-established. The Stour was widened and deepened, a canal cut across a bend, and 250 ac. of marsh were reclaimed. Nearly a mile of wharfage was built and equipped. The port eventually became derelict.

RICHELIEU, ARMAND EMMANUEL SOPHIE SEPTEMANIE DU PLESSIS, DUC DE (1766–1822), French statesman, was born in Paris on Sept. 25, 1766, the son of Louis Antoine du Plessis, duc de Fronsac and grandson of the marshal de Richelieu (1696–1788). The comte de Chinon, as the heir to the Richelieu honours was called, was married at fifteen to Rosalie de Rochechouart, a deformed child of twelve, with whom his relations were never more than formal. After two years of foreign travel he entered the Queen's dragoons and next year received a place at court, where he had a reputation for Puritan austerity. He left Paris in 1790 for Vienna, and in company with his friend Prince Charles de Ligne joined the Russian army as a volunteer, reaching the Russian headquarters at Bender on the 21st of November. By the death of his father in February 1791, he succeeded to the title of duc de Richelieu. He returned to Paris shortly afterwards on the summons of Louis XVI., but he was not sufficiently in the confidence of the court to be informed of the projected flight to Varennes. In July he obtained a passport from the National Assembly for service in Russia. In 1803 he became governor of Odessa. Two years later he became governor general of the Chersonese, of Ekaterinoslav and the Crimea, then called New Russia. In the eleven years of his administration, Odessa rose from a village to an important city. The central square is adorned with a statue of Richelieu (1826). A magnificent flight of nearly 200 granite steps leads from the Richelieu monument down to the harbours.

Richelieu returned to France in 1814; on the triumphant return of Napoleon from Elba he accompanied Louis XVIII. in his flight as far as Lille, whence he went to Vienna to join the Russian army, believing that he could best serve the interests of the monarchy and of France by attaching himself to the headquarters of the emperor Alexander. As the personal friend of the Russian emperor his influence in the councils of the Allies was likely to be of great service. He refused, indeed, Talleyrand's offer of a place in his ministry, pleading his long absence from France and ignorance of its conditions; but after Talleyrand's retirement he succeeded him as prime minister.

The events of Richelieu's tenure of office are noticed elsewhere. *(See* FRANCE: *History.)* It was mainly due to his efforts that France was so early relieved of the burden of the allied army of occupation. It was for this purpose mainly that he attended the congress of Aix-la-Chapelle in 1818. There he had been informed in confidence of the renewal by the Allies of their treaty binding them to interfere in case of a renewal of revolutionary trouble in France; and it was partly owing to this knowledge that he resigned office in December of the same year, on the refusal of his colleagues to support a reactionary modification of the electoral law. After the murder of the duc de Berry and the enforced retirement of Decazes, he again became president of the council (Feb. 21, 1821); but his position was untenable owing to the attacks of the "Ultras" on the one side and the Liberals on the other, and on Dec. 12 he resigned. He died of apoplexy on May 17, 1822.

Part of Richelieu's correspondence, his journal of his travels in Germany and the Turkish campaign, and a notice by the duchesse de Richelieu, are published by the Imperial Historical Society of Russia, vol. 54. *See* also L. de Crousaz-Crétêt, *Le Duc de Richelieu en Russie et en France* (1897); L. Rioult de Neuville in the *Revue des questions historiques* (Oct. 1897); R. de Cisternes, *Le Duc de Richelieu, son action aux conférences d'Aix-la-Chapelle* (1898).

RICHELIEU, ARMAND JEAN DU PLESSIS DE, CARDINAL (1585–1642), French statesman, was born of an ancient family of the lesser nobility of Poitou. The cardinal's father, François du Plessis, seigneur de Richelieu (d. 1590), fought through the wars of religion, first as a favourite of Henry III., and after his death under Henry IV. His mother, Susanne de La Porte, belonged to a legal family. Armand was the third son and was born in Paris, Sept. 9, 1585. In 1606, at the age of twenty-one, he was nominated bishop of Luçon by Henry IV. As he was under the canonical age, he went to Rome to obtain a dispensation and was consecrated there in April 1607. In the winter of 1608 Richelieu went to his poverty-stricken little bishopric, and for the next six years devoted himseii seriousiy to his episcopal duties. In 1614 he was elected by the clergy of Poitou to the last States-general which met before the Revolution. There he attracted the attention of Marie de' Medici, the queen-mother, and was chosen at its close to present the address of the clergy embodying its petitions and resolutions. After the States-general was dissolved he remained in Paris, and the next year he became almoner to Anne of Austria, the child-queen of Louis XIII. He was appointed in 1616 a secretary of state to the king. But he owed all to Concini, and his taste of power ended with the murder of his patron on Aug. 24, 1617.

The reign which Richelieu was to dominate so absolutely began with his exile from the court. He resigned himself to the post of chief adviser to Marie de' Medici in her exile at Rlois. Here he sought to ingratiate himself with Luynes and the king by reporting minutely the actions of Marie and by protestations of loyalty. As this ungrateful work brought no reward, Richelieu retired once more to his bishopric. But he was exiled to Avignon, with his brother and brother-in-law, on April 7, 1618. There he wrote "A Defence of the Main Principles of the Catholic Faith," but

the escape of Marie de' Medici from Blois, on Feb. 22, 1619, again opened paths for his political ambition. Luynes and the king recalled him to the post at Angoulême with the queen-mother, who allowed him to sign the treaty of Angoulême with the Cardinal de la Rochefoucauld, acting for the king. By this treaty Marie was given liberty to live wherever she wished, and the government of Anjou and of Normandy with several castles was entrusted to her. Richelieu was made a cardinal by Pope Gregory XV., on Sept. 5, 1622.

Luynes's death on Dec. 15, 1621, made possible a reconciliation a month later between the king and his mother. Richelieu seized his opportunity. He furnished Marie de' Medici with political ideas and acute criticisms of the king's ministry, especially of the Brularts. Marie zealously pushed her favourite towards office, and eventually, in 1624, the king named him a member of his council. In August he became chief minister of Louis XIII.

Home Policy. — For the next eighteen years, he worked to make the royal power — his power — absolute and supreme at home, and to crush the rival European power of the Habsburgs. At home there were two opponents to be dealt with: the Huguenots and the feudal nobility. The former were crushed by the siege of La Rochelle and the vigorous campaign against the duc de Rohan. But the religious toleration of the edict of Nantes was reaffirmed while its political privileges were destroyed, and Huguenot officers fought loyally in the foreign enterprises of the cardinal. The suppression of the independence of the feudal aristocracy was inaugurated in 1626 by an edict calling for the destruction of castles not needed for defence against invasion. There was no serious opposition to the new minister. The first serious conspiracy took place in 1626, the king's brother, Gaston of Orleans, being the centre of it. His governor, Marshal D'Ornano, was arrested by Kichelieu's orders, and then his confidant, Henri de Talleyrand, marquis de Chalais and Vendôme, the natural son of Henry IV. Chalais was executed and the marshal died in prison. The overthrow of the Huguenots in 1629 made Richelieu's position seemingly unassailable, but the next year it received its severest test. Marie de' Medici had turned against her "ungrateful" minister with a hatred intensified, it is said, by unrequited passion. In September 1630, while Louis XIII. was very ill at Lyons, the two queens, Marie and Anne of Austria, reconciled for the time, won the king's promise to dismiss Richelieu. He postponed the date until peace should be made with Spain. When the news came of the truce of Regensburg Flarie claimed the fulfilment of the promise. On Nov. 10, 1630, the king went to his mother's apartments at the Luxembourg palace. Orders were given that no one should be allowed to disturb their interview, but' Richelieu entered by the unguarded chapel door. When Marie had recovered breath from such audacity she proceeded to attack him in the strongest terms, declaring that the king must choose between him or her. Richelieu left the presence feeling that all was lost. The king gave a sign of yielding, appointing the brother of Marillac, Marie's counsellor, to the command of the army in Italy. But before taking further steps he retired to Versailles, then a hunting lodge, and there, listening to two of Richelieu's friends, Claude de Saint-Simon, father of the memoir writer, and Cardinal La Valette, sent for Richelieu in the evening, and while the salons of the Luxembourg were full of expectant courtiers the king was reassuring the cardinal of his continued favour and support. The "Day of Dupes," as this famous day was called, was the only time that Louis took so much as a step toward the dismissal of a minister who was personally distasteful to him but who was indispensable. The queen-mother followed the king and cardinal to Compiègne, but as she refused to be reconciled with Richelieu she was left there alone and forbidden to return to Paris. The next summer she fled across the frontiers into the Netherlands, and Richelieu was made a duke. Then Gaston of Orleans, who had fled to Lorraine, came back with a small troop to head a rebellion to free the king and country from "the tyrant." The only great noble who rose was Henri, duc de Montmorenci, governor of Languedoc, and his defeat at Castelnaudary on the 1st of September 1632, was followed by his speedy trial by the parlement of Toulouse, and by his execution. Richelieu had sent to the block the first noble of France, the last of a family illustrious for seven centuries, the head of the nobility of Languedoc. He knew no mercy. The only other conspiracy against him which amounted to more than intrigue was that of Cinq Mars in 1642, at the close of his life. This vain young favourite of the king was treated as though he were really a formidable traitor, and his friend, De Thou, son of the historian, whose sole guilt was not to have revealed the plot, was placed in a boat behind the stately barge of the cardinal and thus conveyed up the Rhone to his trial and death at Lyons.

Foreign Policy. — Richelieu's foreign policy was as inflexible as his home policy. To humble the Habsburgs he aided the Protestant princes of Germany against the emperor, in spite of the strong opposition of the disappointed Catholic party in France, which had looked to the cardinal as a champion of the faith. The year of Richelieu's triumph over the Huguenots (1629) was also that of the Emperor Ferdinand's triumph in Germany, marked by the Edict of Restitution, and France was threatened by a united Germany. Richelieu, however, turned against the Habsburgs young Gustavus Adolphus of Sweden, paying him a subsidy of a million livres a year by the treaty of Bärwalde of Jan. 23, 1631. The dismissal of Wallenstein was of double value to Richelieu when his Swedish ally marched south. After the treaty of Prague, in May 1635, by which the emperor was reconciled with most of the German princes, Richelieu was finally obliged to declare war, and, concluding a treaty of offensive alliance at Compiègne with Oxenstierna, and in October one at St. Germain-en-Laye with Bernard of Saxe-Weimar, he proceeded himself against Spain, both in Italy and in the Netherlands. The war opened disastrously for the French, but by 1642, when Richelieu died, his armies, — risen from 12,000 men in 1621 to 150,000 in 1638 — had conquered Roussillon from Spain; they held Catalonia, which had revolted from Philip IV. of Spain, and had taken Turin and forced Savoy to allow French troops on the borders of the Milanese. In Germany Torstensson was sweeping the imperialist forces before him through Silesia and Moravia. The lines of the treaty of Westphalia, six years later, were already laid down by Richelieu; and its epochal importance in European history is a measure of the genius who threw the balance of power from Habsburg to Bourbon.

Personality. — His own personality was his strongest ally. The king himself quailed before that stern, august presence. His pale, drawn face was set with his iron will. His frame was sickly and wasted with disease, yet when clad in his red cardinal's robes, his stately carriage and confident bearing gave him the air of a prince. His courage was mingled with a mean sort of cunning, and his ambition loved the outward trappings of power as well as its reality; yet he never swerved from his policy in order to win approbation, and the king knew that his one motive in public affairs was the welfare of the realm — that his religion, in short, was "reason of state."

No courtier was ever more assertive of his prerogatives. He claimed precedence over even princes of the blood, and one like Condé was content to draw aside the curtains for him to pass, and to sue for the hand of Richelieu's niece for his son, the "Great Condé." His pride and ambition were gratified by the foundation of a sort of dynasty of his nephews and nieces, whose hands were sought by the noblest in the realm. Like all statesmen of his time. Richelieu made money out of politics. He came to court in 1617 with an income of 25,000 livres from his ecclesiastical benefices. In the later years of his life it exceeded 3,000,000 livres. He lived in imperial state, building himself the great Palais Cardinal, now the Palais Royal. in Paris, another at Rueil near Paris, and rebuilding his ancestral château in Poitou. In January 1641 the tragedy of *Mirame,* which was said to have been his own, was produced with great magnificence. Richeliru was anxious for literary fame, and his writings are not unworthy of him. But more important than his own efforts as an author were his protection and patronage of literary men, especially of Corneille, and his creation of the French Academy

in 1635. When he died, on Dec. 4, 1642. he was buried in the chapel of the Sorbonne, which still stands as he built it. His tomb, erected in 1694, though rifled at the Revolution, still exists.

Many writings are attributed to Richelieu, although because of his habit of working with substitutes and assistants it is difficult to settle how much of what passes under his name is authentic. *Les Tuileries, La Grande Pastorale, Mirame* and the other plays have long been forgotten, hut a permanent interest attaches to his *Mémoires* and correspondence: *Mémoire d'Armand du Plessis de Richelieu, l'année 1607 à 1610,* ed. by A. Baschet (1880); *Histoire de la mère et du fils* (Marie de Medici and Louis XIII), sometimes attributed to Mézeray (Amsterdam, 1730) and, under title *Histoire de la régence de reine Marie de Medici, femme de Henry IV* (The Hague, 1743); *Mémoires sur le règne de Louis XIII,* 1610 to 1638, and of which the earlier portion is a reprint of the *Histoive de la mère et du fils,* Petitot's collection (1823, *seq.*); *Testament politique d'Armand du Plessis, cardinal de R.* (Amsterdam, 1687, *seq.); Journal de 1630–31* (1645); "Lettres, instructions diplomatiques, et papiers d'état," publ. in the *Coll. de doc. ined.* (1853–77); these, with the *Mdmoires* in J. F. Michaud and J. Poujalat's collections, are the most important sources for Richelieu's statesmanship.

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RICHELIEU, LOUIS FRANÇOIS ARMAND DU PLESSIS, DUC DE (1696–1788), marshal of France, was a grandnephew of Cardinal Richelieu and was born in Paris on March 13, 1696. As ambassador to Vienna (1725–29) he settled in 1727 the preliminaries of peace; in 1733–34 he served in the Rhine campaign. He fought with distinction at Dettingen and Fontenoy; three years afterward he made a brilliant defense of Genoa: in 1756 he expelled the English from Minorca by the capture of the San Felipe fortress; and in 1757–58 he closed his military career by those pillaging campaigns in Hanover which procured him the sobriquet of *Petit Pbre de la Maraude.* In his early days he was thrice imprisoned in the Bastille: in 1711 at the instance of his stepfather. in 1716 in consequence of a duel, and in 1719 for his share in Alberoni's conspiracy against the regent Orléans. He died in Paris on Aug. 8, 1788.

See H. Noel Williams. *The Fascinating Duc de Richelieu* (1910); *L.* A. F. Du Plessis, *Mémoires authentiques du Maréchal de Richelieu, 1725–1757* (1918); P. d'Estrée, *Le Maréchal de Richelieu 1696–1788* (1917)

RICHEPIN, JEAN (1849–1926), French writer in the tradition of Villon and the poets of low life. Born at Médéa, Algeria, Feb. 4, 1849, the son of an army doctor, he left the École Normale early and during the Franco-German War joined the *francs-tireurs.* He worked as a sailor, an actor and a docker before his first book of poems. *La Chanson des gueux* (1876), won him both instantaneous fame and a month's imprisonment for its immorality. When Zola revolutionized the French novel by introducing naturalism, Richepin did the same for poetry in *Les Caresses* (1877), *Les Blasphbmes* (1884) and *La Mer* (1886). He wrote novels himself: *Les Morts bizarres* (1876), *La Glu* (1881) and *Miarka* (1883); besides very successful plays: *Nana Sahib* (1883), in which he acted with Sarah Bernhardt, *Le Flibustier* (1888), *Par le glaive* (1892), *Les Truands* (1899) and *Le Chemineau* (1897; Eng. tr. by W. Wallace, 1910), a lyric drama with music by Xavier Leroux. To be properly appreciated he should be considered in his period, when thinkers were preoccupied with materialism and "scientism" as expounded by Ernst Haeckel and Ludwig Biichner. *Les Blasphbmes* translates this philosophy into verse of great power, and it has been said that Richepin's very defiance of God was almost a tribute to Him. He was director of the Académie Française (to which he was elected in 1908) nhen he died in Paris on Dec. 11, 1926. (R. DL.)

RICHERUS (*fl.* 10th century), monk of St. Remi at Reims and a chronicler of the 10th century, studied at Reims under Gerbert, afterward Pope Silvester II. He was still living in 998, but there is no later mention of him. His *Historiae* has a unique value as giving the only tolerably full account by a contemporary of the revolution of 987, which placed the Capets on the throne of France. From 969 Richerus had no earlier history before him, and he is the chief source for the period.

There are French translations by Guadet (1845) and Poinsignon (1855).

RICHET, CHARLES (ROBERT) (1850–1935), French physiologist, was born in Paris on Aug. 26, 1850, the son of Alfred Richet, a well-known surgeon. He obtained his M.D. in 1877, but before this he had carried out important researches on the role of conditioned reflexes in the digestive process and had discovered that the acid of gastric juice is hydrochloric acid. In 1881 he was appointed codirector of the *Revue Scientifique* and in 1887 he was nominated professor of physiology in the faculty of medicine of the University of Paris. He worked on the physiology of respiration, on epilepsy and on the treatment of tuberculosis by feeding with raw meat.

More important were his researches on immunity. He discovered that an animal can be immunized against an infection by introducing blood taken from another animal that has already been immunized against the infection in question. On Dec. 16, 1890, he gave the first serotherapeutic injection into a human being. Richet's discovery of anaphylaxis followed upon and was connected with his work on serum therapy. He found that the injection of certain protein substances, instead of producing immunity, caused the development of a state of hypersensitivity. Anaphylaxis ("without protection") was recognized as the converse of immunity. Its discovery threw new light on diseases like hay fever and asthma and on drug reactions and serum sickness; and it provided an explanation for many mysterious cases of intoxication and sudden death. For this work—which was of profound significance both for theory and practice—Richet was awarded the Nobel prize for medicine in 1913.

Richet made outstanding contributions in many other fields. He was distinguished not only as a physiologist, bacteriologist, pathologist, psychologist and medical statistician, but also won fame as a pioneer of aviation, as an earnest worker on behalf of peace, as a scientific investigator of occult phenomena and as a poet, novelist and playwright. Among his many works the most outstanding were *Physiologie: Travaux du laboratoire de C. Richet* (1882–1909); *L'Anaphylaxie* (1911; Eng. trans. 1925); *L'Homme stupide* (1919; Eng. trans. 1925); *Traitk de métapsychique* (1922; Eng. trans. 1923); *Le Savant* (1923); and *L'Intelligence de l'homme* (1927). He died in Paris on Dec. 4, 1935. (W. J. BP.)

RICHFIELD, a village of Hennepin county in southeastern Minnesota, U.S., is located immediately south of Minneapolis. It experienced rapid growth between 1950 and 1960.

Originally called Harmony and Richland, it was renamed in 1858 when the early residents of the area held their first town meeting in a schoolhouse near Richfield Mills. It was incorporated as a village in 1908; in 1950 it adopted a village-manager form of government.

Although mainly a residential suburb of Minneapolis, it has several small light-industrial establishments that manufacture metal and wood products. Agriculture was once the dominant industry and, while its importance has diminished in the economy of the community, there is still significant dairying and truck farming of small vegetables, fruits and berries.

For comparative population figures *see* table in MINNESOTA: *Population.* (R. W. F.)

RICHLAND, a planned city and atomic-industry town in Benton county, Wash., U.S., is located near the confluence of the Yakima and Columbia rivers about 50 mi. W. of Walla Walla. Once it was the home of the Wanapam, or Wanapum, Indians, a division of the Sahaptin stock. Nelson Rich, builder of a local irrigation system, laid out a town there in 1892; incorporated in 1910, its population of about 250 remained virtually static until the site became part of the 400,000-ac. reservation of the Hanford atomic energy plant.

Its population was 1,415 by 1944, grew to 13,453 the next year

and rose to 23,548 by 1960. (For comparative population figures see table in WASHINGTON: Population.)

First administered by the U.S. army corps of engineers and E. I. du Pont de Nemours & Co., the Atomic Energy commission and the General Electric company took over on Jan. 1, 1947. Transfer of real estate to its residents began in 1951, and in 1959 it became incorporated as a city with a council-manager form of government. (H. J. DE.)

RICHMOND, EARLS AND DUKES OF. The title earl of Richmond appears to have been in existence in England a considerable time before it was held in accordance with any strict legal principle. Alan III, duke of Brittany (997–1040), had a brother Eudon who at first disputed the ducal title with him and with his successor Conan II (1040–66) but was eventually satisfied with a partition of the family's lands and the style of "count of Brittany." Two of Eudon's sons. likewise "counts of Brittany," Alan Rufus (d. 1089) and Alan Niger (d. 1093), took part in William the Conqueror's invasion of England.

Alan Rufus was rewarded with grants in various parts of England, including manors formerly held by Earl Edwin in Yorkshire, on one of which he built the castle of Richmond. His possessions there were formed into the honour of Richmond. to which first Alan Niger and after him his youngest brother Stephen (d. 1135 or 1136) succeeded. Stephen, moreover. succeeded to all the Breton lands that had previously been divided among the sons of Eudon. These "counts of Brittany" are often reckoned as earls of Richmond, though they were not so in the strict and later sense. The first to style himself and to be styled earl of Richmond was Stephen's son Alan III Niger (d. 1146).

This Alan married Bertha, daughter and heiress of Conan III, the reigning duke of Brittany; and his son Conan IV (d. 1171), who married Margaret, sister of Malcolm IV of Scotland, asserted his right to Brittany and transferred it in his lifetime to his daughter Constance (d. 1201). As he left no sons the honour of Richmond and his other English possessions passed to Constance. Constance was three times married: first to Geoffrey Plantagenet (1158–1186), son of Henry II, king of England; then to Ranulf de Blundevill. earl of Chester (c. 1172–1232), the marriage with whom Constance treated as null on the ground of consanguinity; and finally to Guy, brother of the viscount of Thouars, who survived her. Geoffrey and Ranulf in turn assumed the title earl of Richmond: and Guy for a time at least acted as if he held the honour. The only son of the first marriage. Arthur of Brittany (1187–1203). was styled earl of Richmond in his mother's lifetime. On his murder at the hands of his uncle, King John, the earldom was resumed by the crown.

By her third husband Constance had two daughters, the elder of whom, Alice, was given in marriage by Philip II Augustus, king of France, to Peter of Braine (Peter of Dreux or Pierre Mauclerc) in 1212. after which date Peter was styled duke of Brittany. In 1219 he received seisin of the lands of the earldom of Richmond; but in 1235 he finally renounced his allegiance to the king of England and thereupon suffered forfeiture of his English earldom.

In 1240 Henry III granted the honour of Richmond to Peter of Savoy (c. 1203–68), uncle of Queen Eleanor. who was thereafter described as earl of Richmond by contemporary chroniclers, though never in official documents. By his will Peter left the honour of Richmond to his niece, the queen consort, who transferred it to the crown. In the same year (1268) Henry III granted the earldom specifically to John, duke of Brittany (1216–86), son of Peter of Braine. in whose family the title continued — though it frequently was forfeited or reverted to the crown and was regranted to the next heir — till 1342, when Edward III granted it to his son John of Gaunt, who surrendered it in 1372. It was then given to John de Montfort, duke of Brittany, but on his death without heirs in 1399 it was seized by the crown.

The earldom now became finally separated from the duchy of Brittany. with which it had been loosely conjoined since the Conquest. although the dukes of Brittany continued to assume the title till a much later date. From 1414 to 1435 the earldom of Richmond was held by John Plantagenet, duke of Bedford, and in 1452 it was conferred on Edmund Tudor, uterine brother to King Henry VI, whose wife, Margaret Beaufort, was the foundress of St. John's college, Cambridge, and of the Lady Margaret professorships of divinity at Oxford and Cambridge. (See BEAUFORT, MARGARET.)

When Edmund Tudor's son Henry ascended the throne as Henry VII in 1485 the earldom of Richmond merged in the crown, but in 1525 Henry Fitzroy, natural son of Henry VIII by Elizabeth Blount, was created duke of Richmond and Somerset and earl of Nottingham, all these titles becoming extinct at his death without children in 1536.

Ludovic Stuart: 2nd duke of Lennox (1574–1624), who also held other titles in the peerage of Scotland, was created earl of Richmond in 1613 and duke of Richmond in 1623. These became extinct at his death in 1624, though his Scottish honours devolved on his brother Esmé, who was already earl of March in the peerage of England. (See MARCH, EARLS OF; and LENNOX.) Esmé's son, James. 4th duke of Lennox (1612–55), was created duke of Richmond in 1641, the two dukedoms as well as the lesser English and Scottish titles thus becoming again united. In 1672, on the death of his nephew Charles, 3rd duke of Richmond and 6th duke of Lennox, whose wife was the celebrated beauty called "La Belle Stuart" at the court of Charles II (see RICHMOND AND LENNOX. FRANCES TERESA STEWART. DUCHESS OF). his titles became extinct.

In 1675 Charles II created his illegitimate son Charles duke of Richmond) earl of March and Baron Settrington. This Charles (1672–1723), on whom the king bestowed the surname of Lennox, was the son of the celebrated Louise de Kéroualle, duchess of Portsmouth. His son Charles, 2nd duke (1701–50), added .to the titles he inherited from his father that of duke of Aubigny in France, to which he succeeded in 1734 on the death of his grandmother the duchess of Portsmouth; these honours continued to be held by his descendants, the later dukes of Richmond.

The 2nd duke, by his marriage with Sarah, daughter of the 1st Earl Cadogan, was father of Lady Caroline Lennox, who eloped with Henry Fox and was the mother of Charles James Fox. Another daughter of the 2nd duke was the beautiful Lady Sarah Lennox (1745–1826) with whom George III fell in love and contemplated marriage. and who afterward married, first. Sir Thomas Bunbury, from whom she was divorced, and second; George Napier, by whom she was the mother of Generals Sir Charles and Sir William Napier.

Charles, 3rd duke of Richmond (1735–1806), was famous for his advanced views on the question of parliamentary reform. Having succeeded to the peerage in 1750 and fought at Minden (1759), he was appointed British ambassador extraordinary in Paris in 1765, and in the following year he became a secretary of state in the Rockingham administration, resigning office on the accession to power of the earl of Chatham. In the debates on the policy that led to the American War of Independence Richmond was a firm supporter of the colonists. Richmond also advocated a policy of concession in Ireland, with reference to which he originated the famous phrase "a union of hearts." In 1779 the duke brought forward a motion for retrenchment of the civil list; and in 1780 he embodied in a bill his proposals for parliamentary reform. which included manhood suffrage, annual parliaments and equal electoral areas. Richmond sat in Rockingham's second cabinet as master general of the ordnance; and from Dec. 1783 he held the same office under William Pitt. He now developed strongly Tory opinions, and his alleged desertion of the cause of reform led to a violent attack on him by Lauderdale in 1792. Richmond died in Dec. 1806 and, leaving no legitimate children, was succeeded in the peerage by his nephew Charles.

The 5th duke (1791–1860), while still known by the courtesy title of earl of March, served on Wellington's staff in the peninsula and fought at Waterloo. He was M.P. for Chichester (1812–19). He was afterward a vehement opponent in the house of lords of Catholic emancipation, and at a later date a leader of the opposition to Peel's free trade policy. In 1836, on inheriting the estates of his maternal uncle, the 5th and last duke of Gordon. he assumed the name of Gordon before that of Lennox. On his death in 1860 he was succeeded in his titles by his son Charles Henry. 6th duke of Richmond (1818–1903), a statesman who held various

cabinet offices in the Conservative administrations of Lord Derby, Disraeli and the marquess of Salisbury; and who in 1876 was created earl of Kinrara and duke of Gordon. These honours in addition to the numerous family titles of more ancient creation passed on his death to his son Charles Henry Gordon-Lennox (1845–1928) and later to his son's descendants.

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RICHMOND, GEORGE (1809–1896), English portrait painter. was born at Brompton (now within Kensington, London), on March 28, 1809. In 1824 he went to study under Henry Fuseli at the Royal Academy schools, there forming friendships with Samuel Palmer and Edward Calvert. Through them, and John Linnell, he met William Blake, who profoundly affected his early life and art. After his runaway marriage in 1831, however, he turned to portraiture for a livelihood, earning a national reputation for work in water colour and crayon. He was a staunch supporter of the Oxford church reformers, and the large group of his works in the National Portrait gallery, London, includes likenesses of John Keble, J. H. Newman and Edward Pusey. Richmond was elected to the Royal Academy in 1866. He died in London, March 19, 1896.

His second son, SIR WILLIAM BLAKE RICHMOND (1842–1921), was early a disciple of John Ruskin and the Pre-Raphaelites, later a painter of antique mythological subjects and a successful portraitist He executed mosaics in the sanctuary of St. Paul's cathedral (1891 ff.) He succeeded Ruskin in the Oxford Slade professorship (1879–83); and was appointed knight commander of the Bath in 1897.

See A M W Stirling (ed.), *Richmond Papers* (1926).

RICHMOND, a municipal borough in the Richmond parliamentary division of Surrey, Eng., on the right bank of the Thames, 9 mi. S.W. of Charing Cross, London. Pop. (1951) 41,944. Area 6 4 sq mi. Richmond was the site of the royal manor house of Sheen in the 12th century. Rebuilt as a palace by Edward III, who died there in 1377, it was also the scene of the deaths of Henry VII and Elizabeth I and of Anne of Bohemia, queen of Richard II who afterward razed it. It was rebuilt by Henry V, but burned down again in 1498. Henry VII finally re-erected it in 1501, renaming village and palace after his earldom of Richmond in Yorkshire. It was a favourite home of Henry VIII, who gave it to Cardinal Wolsey after the latter had presented him with Hampton Court. During the Civil War much of the building was demolished and today only the gateway remains. The site is now occupied by gracious Georgian houses. Attached to the palace was a large park, now known as the Old Deer park, and there Henry V founded a Carthusian priory in 1416. All traces of this disappeared in the mid-18th century, and on the site stands Kew observatory, built in 1768–69 by Sir William Chambers for George III, and now an important meteorological station. To the south lies Richmond park, enclosed by Charles I in 1637 and containing White lodge, built for George II and the birthplace of Edward VIII. The main gate is on Richmond hill, which commands the famous view of the Thames valley. A theatre has existed on various sites since 1719, and the many celebrated figures associated with it include Dorothy Jordan and Edmund Kean. The latter is buried in the parish church, uhere also is the grave of James Thomson, the poet (1700–48), who lived for 12 years in a house which is now part of the Royal hospital.

Richmond was incorporated in 1890, and the borough now includes Kew. Petersham. North Sheen and Ham, where Ham house, built in 1610, contains Stuart furniture.

RICHMOND, a municipal borough in the Richmond (Yorks) parliamentary division of the North Riding of Yorkshire, Eng , 45 mi. N.N.W. of York by road. Pop. (1951) 6,166. Area 3.9 sq mi. It lies on the left bank of the Snale, where the valley is still narrow and steep-sided before the river emerges from the Pennines into the Vale of York.

The town is chiefly interesting because of the castle, which occupies the summit of a high cliff. The castle was founded about 1071 by Alan Rufus of Penthièvre in Brittany, who is said to have rebuilt the town on obtaining from William the Conqueror the estates of the Saxon earl Edwin, which embraced some 200 manors of Richmond and extended over nearly a third of the North Riding. This tract was called Richmondsbire at that time, but the date of the creation of the shire is uncertain. William the Lion of Scotland was imprisoned in the castle in the reign of Henry II; otherwise the town owes its importance chiefly to its lords. It was a valuable possession in the middle ages, and was usually in royal or semiroyal hands. The whole shire reverted to the crown on the accession of Henry VII. The original castle covered an area of 5 ac., but the only portions remaining are the Norman keep, with pinnacled tower and walls 109 ft. high by 11 ft. thick, and some smaller towers.

The French name of Richmond (Richemund) was not traced farther back than about 1100, but it is probable that there was an earlier settlement on the site. As far as is known, the earliest charter was granted in 1145 giving the burgesses the borough of Richmond to hold for ever in fee farm at an annual rent of £29. but a charter dated 1146 shows that the burgesses enjoyed some municipal liberties at an earlier period. In 1278, a yearly fair was granted and in 1329, Edward III gave the first royal charter to the town. A charter of incorporation, under the title of aldermen and burgesses, mas granted in 1576 by Queen Elizabeth I who also allowed a market each Saturday, an animal market every fortnight, and a fair each year on the vigil of Palm Sunday. In 1668, Charles II granted a charter under the title of mayor and aldermen. This charter, though superseded later, uas restored in the reign of James II, and, until the passing of the Municipal Corporations act of 1835, was regarded as the governing charter of the borough. Although Richmond received a summons as early as 1328, it was not represented in parliament until 1584, from which time it usually sent two members. From 1867 to 1885 one member was sent. In 1889, Richmond became the seat of a bishop suffragan in the diocese of Ripon, but the second and last bishop died in 1921.

The church of St. Mary is transitional Norman, Decorated and Perpendicular, and is largely restored. The church of the Holy Trinity, in the large market place, is ancient and was restored to use from ruins; only the nave and a detached tower remain. A curfew bell is tolled every evening and in the mornings the 'Prentice bell. The 16th-century tower of a Franciscan abbey, founded in 12 58, still stands. Close to the town are the ruins of Easby abbey, a Premonstratensian foundation of 1152, beautifully situated by the river. The remains include a Decorated gateway, an Early English chapel and fragments of the transepts and choir of the church, with sufficient portions of the domestic buildings to enable the complete plan to be traced. In Friar's Wynd is the Theatre Royal, a Georgian theatre (1788). In Hill house lived Frances l'Anson or Janson, "the lass of Richmond Hill," to whom her future husband, Leonard MacNally, wrote the verses of the famous song.

The free grammar school existed in 1390, and was refounded in 1567, but the present building dates from 1850.

The principal trade is in agricultural produce, and as Richmond possesses the only railway station in Swaledale, the market is still important.

See R. Gale, *Registrum Honoris de Richmund* (London, 1722); C. Clarkson, *The History and Antiquities of Richmond* (Richmond, 1821); T. D. Whitaker, *A Hzstory of Richmondshire,* 2 vol. (London. 1823); *Victoria County Hzstory of Yorkshtre: North Riding,* 2 vol. and index (London, 1914–23).

RICHMOND, a city of Contra Costa county, Calif., U.S., is situated on the eastern shore of San Francisco bay, 16 mi. N.E. of San Francisco via the San Francisco-Oakland bay bridge. The Richmond-San Rafael bridge connects it nith Marin county.

The city, which is in the San Francisco-Oakland standard metropolitan area, experienced a phenomenal growth during World War II, and the population grew from 23,642 in 1940 to 99,545 in 1950, but with removal of wartime public housing declined to 71,854 in 1960.

Development of the area dates from 1899, when the Santa Fe railway purchased a right of way to the bay shore. In 1900 Point Richmond became the western terminal of the system, and ferry service was established to San Francisco. The construction of a large oil refinery in 1902 furthered settlement. The city is an important industrial centre! and its harbour is one of the busiest on the Pacific coast. Major industries include petroleum refining, railroad shops; food processing and the manufacture of chemicals, electronic equipment, aircraft parts and plumbing fixtures.

The city was incorporated in 1905 and adopted the council-manager form of government in 1920. Richmond civic centre includes the city hall, hall of justice, a public library and an auditorium. (M. H. Mo.)

RICHMOND, a city of Indiana, U.S., is located 68 mi. E. of Indianapolis; the seat of Wayne county. Settled in 1806 by migrating North Carolina antislavery Quakers and German and Irish immigrants, Richmond has always been a centre of Quaker influence and organizations. The publications office and the general offices of the Five Years Meeting of Friends (Quakers) are located there. and the sessions of this group are regularly held in the city. Earlham college, a Quaker-controlled liberal arts co-educational institution founded in 1847 and noted for the large number of its graduates who have distinguished themselves in public life, is also located in Richmond, on a modern 120-ac. campus.

The Art association, civic theatre, symphony orchestra. Musical Arts society and Wayne County Historical museum are civic enterprises. Richmond also has several golf courses and city parks. Located in a prosperous agricultural area, early industries included grain threshers and steam engines, buggies and carriages, and lawn movers; later industries were diversified and include automotive parts, school-bus bodies and cut-flower production. It was chartered as a city in 1840.

For comparative population figures see table in INDIANA: *Population.* (WI. R.)

RICHMOND, a borough of New York city and a county of New York, U.S., the two having identical boundaries. Richmond includes all Staten Island and part or all of several smaller islands in New York harbour. It was named after the duke of Richmond, son of Charles II of England.

Indian attacks wiped out the earliest settlements. The first permanent settlement was made under Dutch authority in 1661 at Oude Dorp ("Old Town"). Three years later the British drove out the Dutch and took control. Gen. William Howe landed his forces on Staten Island in 1776, making it a base for his successful attack on Gen. George Washington's positions on Long Island and Manhattan. During the 19th century, Richmond grew more slowly than other sections of modern New York city, partly because it was cut off by water barriers and had to rely on ferries for transportation. When greater New York city was formed in 1898, Richmond county became one of its five boroughs.

Modern Richmond is linked by bridges to the New Jersey mainland. It is an important shipping and manufacturing centre and an expanding residential area. In Richmond are Wagner Lutheran college (established 1883), Notre Dame College of Staten Island (Roman Catholic, established 1931), a community college, a zoo, museums, libraries, hospitals and several historic houses. There at Billopp house in 1776 Adm. Richard Howe tried to persuade representatives of the Continental congress to reconcile their differences with England. See also NEW YORK (CITY).

(J. A. FR.)

RICHMOND, the capital of Virginia, U.S., and the seat of Henrico county, is located at the falls of the James river, 100 mi. S. of Washington, D.C. Its maximum elevation above sea level is 312 ft. The annual precipitation is 43 in. and the mean annual temperature is 57.9" F., combining to give the city a moderate and comfortable climate. In 1960 Richmond had a population of 219,958 in the city itself and 408,494 in the standard metropolitan statistical area (comprising the city of Richmond and Chesterfield and Henrico counties). For comparative population figures for the city see table in VIRGINIA: *Population.* Although the city lost population between 1950 arid 1960. the metropolitan area made a substantial gain of 23.8%. Residential suburbs have grown with great speed since World War II. Despite this rapid growth. Richmond has managed to preserve a civic personality which, in its friendliness and good humour, is usually found only in much smaller communities.

History. — The first Europeans to visit the present site of Richmond were a party of 21 men led by Christopher Newport and John Smith, who sailed up the James in 1607 a short time after the founding of Jamestown. In 1637 Thomas Stegg established a trading post at the falls of the James, and in 1644, following the Indian massacre of that year, Ft. Charles was built. Indian attacks continued to harass the settlers, and in exchange for a grant of land William Byrd I undertook to maintain 50 men at Ft. Charles to protect the frontier. In 1737 William Byrd II, who had inherited a large tract of land at the falls, allowed Maj. William Mayo to lay out a town on what is now Church hill; it was incorporated by the general assembly in 1742 and in that year had a population of 250.

In the period of the American Revolution, Richmond was the scene of the Virginia conventions of 1774 and 1775, and in 1780 was made the state capital, replacing Williamsburg. At that time the town still had less than 300 buildings and when it was occupied by the British in 1781 the capitol was so humble a structure that the invaders were unable to find and destroy it. Construction of the present capitol was begun four years later.

By the beginning of the 19th century, Richmond's population had grown to 5,735. and the city was becoming a commercial and transportation centre of increasing prominence In 1840 it was linked to Lynchburg by the James river and Kanawha canal. By 1860 there were 43 tobacco factories, several iron foundries, flour and corn mills, and establishments manufacturing carriages, textiles. nails. cutlery and paper; the census of 1860 ranked Richmond 13th among American cities in manufacturing. By that same year six railroads terminated in the city. Culturally the ante-bellum years were brightened by visits of such famous literary and stage figures as Charles Dickens, William Thackeray, Jenny Lind and Joseph Jefferson. Edgar Allan Poe edited the *Southern* Literary Messenger in Richmond from 1834 to 1837.

The coming of the American Civil War brought Richmond into a national and international prominence unparalleled in the city's history. Following the secession of Virginia in April 1861, the capital of the Confederacy was moved to Richmond from Montgomery. Ala. As the seat of government, and also because of its factories and railroads, Richmond was the major military objective of Union armies for four years.

In 1862 Gen. George B. McClellan's army of the Potomac mas within hearing of the city's church bells but was driven away in the Seven Days' battle (*q.v.*), June 26–July 2. Although threatened from time to time by cavalry raids, the city was not again closely beset until June 1864, when the siege of Richmond and Petersburg began. Finally, on April 2, 1865, Gen. U. S. Grant broke through the Coniederate defenses, and the city was abandoned that same night, a large part of the business section being destroyed by fire in the course of the evacuation. (See also PETERSBURG CAMPAIGN and WILDERNESS.)

During the difficult postwar years Richmond was more fortunate than other southern cities in having an industry with a seemingly unlimited market: tobacco, especially cigarettes. With this as an economic base, rebuilding and recovery were soon under way. Flour mills and an iron foundry were revived; railroads were reconstructed; paper and chemical factories were established. By 1890 the population was 85.000, more than twice that of 1860. The depression of the 1930s once again demonstrated the value of the tobacco industry to the municipal economy, for Richmond suffered much less than many other U S. cities. Economic revival and growth mere greatly stimulated by the advent of World War II. After the war, in 1948, the strong mayor type of government was discarded in favor of the council-manager system.

Historic Sites. — Richmond is pre-eminently a historic city, a fact in which its citizens have always taken great pride. The capitol was designed by Thomas Jefferson. after the Maison Carrée at Nîmes, France, and contains the famous Houdon statue of George Washington. St. John's church, where Patrick Henry

delivered his "Liberty or Death" address, is still a place of worship. At the corner of 9th and Marshall streets stands the house designed. built and occupied by Chief Justice John Marshall. Reminders of the American Civil War period are numerous. Richmond is, in fact, perhaps the chief repository and guardian of the Confederate legend. The Confederate White House, the Valentine museum, Battle abbey and the Virginia Historical society all contain books, paintings, relics and manuscripts from the war years. On Monument avenue stand large bronze statues portraying Jefferson Davis, Generals Lee, Jackson and Stuart and Comdr. Matthew Fontaine Maury. Remains of elaborate entrenchments that encircled the city can still be found in many places.

Commerce, Industry and Transportation. — In the economic life of the city, commerce is more significant than manufacturing. The chamber of commerce estimates that retail stores draw customers from 40 counties and 9 cities, including a population of over 1,000,000. The three leading components of this trade are general merchandise, food and automobiles. Richmond's wholesale market embraces most of the state plus the eastern half of North Carolina, with a sales volume twice that of retail trade. The most important products manufactured or processed in the Richmond area (ranked according to employment) are tobacco, chemicals, food, metals, paper products, printing, clothing, lumber and wood products. The presence of the Fifth Federal Reserve bank makes the city a financial centre for five states and the District of Columbia.

Richmond is the state's most important transportation centre and is served by several major railroads and airlines, as well as bus and truck lines. The Richmond-Petersburg turnpike allows north-south traffic to bypass both cities. At the Deepwater terminal on the James ocean-going vessels bring cargoes from the Gulf coast, Cuba, Canada and elsewhere.

Education and Cultural Activities. — Richmond has a vigorous public-school system, which absorbs one-fourth of the municipal income, and a number of excellent private and parochial schools. Among the institutions of higher learning are the University of Richmond (Baptist, founded 1830), Medical College of Virginia (state-supported), Union Theological seminary (Presbyterian, founded 1812) and Virginia Union university (Baptist, established 1865).

The Mosque, a municipal auditorium seating over 4,500, is the scene of dramatic productions, as well as concerts by the Richmond Symphony orchestra and visiting orchestras. The state's finest collection of paintings and *objets d'art,* including the works of Rubens. Murillo and Reynolds, is exhibited by the Virginia Museum of Fine Arts. Library facilities include the Virginia State library and the Richmond Public library. (L. H. J.)

RICHMOND AND LENNOX, FRANCES TERESA STEWART, DUCHESS OF (1648–1702), daughter of a physician in the household of Queen Henrietta Maria when she was in exile after 1649. was born in 1648 and was brought up in France. Henrietta Maria sent her to England, where she was appointed maid of honour to Catherine of Braganza. queen of Charles II. Charles II became infatuated with her. and it is stated that in 166; he was considering the possibility of obtaining a divorce in order to make her his uife. This was at a time when he feared to lose her as his mistress, since her hand was sought in marriage by Charles Stewart, duke of Richmond and Lennox. In March 1667 she eloped with Richmond and married him secretly; but on her return to court she retained her hold on the king's affections.

See C H. Hartmann, La Belle *Stuart* (New York, London, 1924).

RICHMOND RIVER AND BASIN, together with the basins of the Tweed and Clarence rivers, forms the largest area of coastal lowland in New South Wales, Australia (c. 125 mi. N.-S.; 20–40 mi. E.-W.). The area is subject to violent rainstorms which cause wide flooding on the lower ground. Electric power is developed on the Nymboida tributary of the Clarence. Dairying, the main feature of local farming, produces about two-thirds of the state production of butter, with large factories at Byron bay, Lismore and Grafton. The whole of the cane sugar produced in New South Wales (about 5% of Australian output) is grown in the area. Yields per ton of cane are somewhat lower than in Queensland and the growing period is nearly double (20–24 months against 12–14 months). The district is linked by rail with Sydney, and by both a through route and a coastal route to Brisbane. (T. HER.)

RICHTER, EUGEN (1839–1906), German politician, was born on July 30, 1839 at Düsseldorf. After attending the universities of Bonn, Heidelberg and Berlin, he entered the government service. In 1864 he was chosen burgomaster of Neuwied; but he was already known for his Liberal opinions, and the government refused to confirm the appointment and transferred him to Bromberg, in East Prussia. In consequence, he resigned from the public service, went to Berlin and entered journalism. A consistent advocate of the economic doctrines of the Manchester school, he was also keenly interested in the working-class co-operative movement, on which he wrote a book. In 1867 he was tried for revolutionary tendencies but acquitted. In 1867 he was elected a member of the Reichstag. and in 1869 of the Prussian parliament. A member of the Progressive party, in 1880 one of the founders, and eventually the leader, of the Freisinnige, he was always in opposition. Next to Ludwig Windthorst he was Bismarck's most dangerous opponent, and leader of the opposition to the introduction of protection, to the new colonial policy introduced after 1878, and to state socialism. He also strongly opposed all increases in the army and navy; and it was his opposition to the army measures of 1893 which finally split his party. leaving him with only a small following. In 1885 he founded the *Freisinnige Zeitung,* which he edited himself; he also wrote many political brochures and works on Prussian finances. He died at Jena, on Jan. 26. 1906.

See his reminiscences *Jugenderinnerungen* (1892) and *Im alten Reichstag* (2 vols, 1894–96).

RICHTER, HANS (1843–1916), Austro-Hungarian musical conductor, born at Gyor on April 4, 1843, was the son of the chapel master at the cathedral, whose wife, *née* Josephine Csazinsky, was an operatic singer. He studied (1860–65) at the Vienna Conservatoire and in 1866–67 he assisted Richard Wagner in Switzerland, making a fair copy of the *Meistersinger* score. In 1878 he assisted in the domestic performance of the *Szegjried Idyll.*

In 1871, after holding some minor posts, Richter was appointed conductor of the Hungarian National opera at Budapest, and in May 1875 began his long connection with the Vienna opera, which terminated only with the century. In 1876 he directed the rehearsals and performances of Wagner's *Ring* at Bayreuth. and in 1877 paid his first visit to England to conduct the Wagner concerto at the Albert Hall. In 1879 he founded the Richter concerts in London and quickly established himself as a prime favourite there. Later, in 1882, he conducted a famous series of performances of Wagner's works (including the first in England of *Die Meistersinger* and *Tristan)* at Drury Lane; special performances of German opera mere also conducted by him at Covent Garden from 1904 until his retirement. In 1897 he became conductor of the Hallé orchestra in Manchester, doing splendid service in this capacity, while previously in 1885 he had established an equally happy connection with Birmingham as conductor of the Birmingham Triennial festival. His last performance of *Die Meistersinger* nas given at Bayreuth in 1912, and his last years were spent in retirement there. He died on Dec. 5, 1916. As a conductor Richter nas supreme in the interpretation of Wagner, though hardly less great in that of Mozart. Beethoven, Brahms and other German classical masters. He took no interest in non-German composers, but made an exception of Sir Edward Elgar.

RICHTER, JOHANN PAUL FRIEDRICH (1763–1825), usually called JEAN PAUL, German author, was born at Wunsiedel, in Bavaria, on March 21, 1763. His father was a schoolmaster and organist at Wunsiedel, but in 176j he became a pastor at Joditz near Hof, and in 1776 at Schwarzenbach, where he died in 1779. After attending the gymnasium at Hof. Richter went in 1781 to the University of Leipzig. Unable to maintain himself at Leipzig he returned in 1784 to Hof, mhere he lived with his mother. From 1787 to 1789 he served as a tutor at Töpen, a village near Hof; and afterward he taught the children of several families at Schwarzenbach.

Richter's first work was *Grönländische Prozesse* and *Auswahl*

aus des Teufels Papieren, the former of which was issued in 1783–84, the latter in 1789. In later life Richter had little sympathy with their satirical tone. His next book, *Die unsichtbare Loge,* a romance. published in 1793, had all the qualities which were soon to make him famous, and its power was immediately recognized. He then produced in rapid succession *Hesperus* (1; 95), *Biographische Belustigungen unter der Gehirnschale einer Riesin* (1796), *Leben des Quintus Fixlein* (1796), *Blumen- Frucht- und Dornenstücke, oder Ehestand, Tod und Hochzeit des Armenadvokaten Siebenkäs* (1796–97), *Der Jubelsenior* (1797), and *Das Kampaner Tal* (1797). This series of writings won for Richter an assured place in German literature.

In 1797 he went to Leipzig, and in the following year to Weimar, where he had much pleasant intercourse with Herder: by whom he was warmly appreciated. He did not become intimate with Goethe and Schiller, to both of whom his literary methods were repugnant; but in Weimar, as elsewhere, his good talk and genial manners made him a favourite in general society. In 1801 he married Caroline Meyer, whom he met in Berlin in 1800. They lived first at Meiningen, then at Coburg; and finally, in 1804, they settled at Bayreuth. Here Richter spent a quiet, simple and happy life, constantly occupied with his work as a writer. in 1808 he was delivered from anxiety as to outward necessities by the prince-primate, K. T. von Dalberg, who gave him a pension of a thousand florins. Before settling at Bayreuth, Richter had published his most ambitious novel, *Titan* (1800–3); and this was followed by *Flegeljahre* (1804–5), two works which he himself regarded as his masterpieces. His later imaginative works were *Dr. Katzenbergers Badereise* (1809), *Des Feldpredigers Schmelzle Reise nach Flatz* (1809), *Leben Fibels* (1812), and *Der Komet, oder Nikolaus Marggraf* (1820–22). In *Vorschule der Aesthetik* (1804) he expounded his ideas on art; he discussed the principles of education in *Levana, oder Erziehungslehre* (1807); and the opinions suggested by current events in *Friedenspredigt* (1808), *Dämmerungen fur Deutschland* (1809), *Mars und Phöbus Thronwechsel im Jahre 1814* (1814), and *Politische Fastenpredigten* (1817). In his last years he began *Wahrheit aus Jean Pauls Leben,* to which additions from his papers and other sources were made after his death by C. Otto and E. Förster. In 1821 Richter lost his only son, and never quite recovered from the shock. He died of dropsy, at Bayreuth, on Nov. 14, 1825.

Schiller said of Richter that he would have been worthy of admiration "if he had made as good use of his riches as other men made of their poverty." And it is true that in the form of his writings he never did full justice to his great powers. In working out his conceptions he found it impossible to restrain the expression of any powerful feeling by which he might happen to be moved. He was equally unable to resist the temptation to bring in strange facts or notions which occurred to him Hence every one of his works is irregular in structure, and his style lacks directness, precision and grace. But he had an amazingly fertile imagination and a surprising power of suggesting great thoughts by means of the simplest incidents and relations Richter was a great nature-lover and deeply religious in spirit; to him visible things were but the symbols of the invisible, and in the unseen realities alone he found elements which seemed to him to give significance and dignity to human life. His humour, the most distinctive of his qualities, cannot he dissociated from the other characteristics of his writings. It determined to some extent the form in which he embodied even his most serious reflections. It is sometimes extravagant and grotesque but never harsh or vulgar, and generally it springs naturally from the perception of the incongruity between ordinary facts and ideal laws. With all his wilfulness and eccentricity Richter was a man of a pure and sensitive spirit, with a passionate scorn for pretence and an ardent enthusiasm for truth and goodness.

RICHTHOFEN, FERDINAND, BARON VON (1833–1905), German geographer and traveler, was born near Karlsruhe. Silesia, on May 5, 1833. He was educated at Breslau and Berlin, and in 1856 carried out geological investigations in the Tirol, subsequently extending them to Transylvania In 1859 he accompanied. as geologist. the Prussian diplomatic mission to the Far East under Count von Eulenburg, and visited Ceylon. Japan, Formosa, the Philippines and Java, subsequently making an overland journey from Bangkok to Moulmein and reaching Calcutta in 1862. No important work resulted from these rravels, for much of Richthofen's records and collections was lost. China was at the time inaccessible owing to the Taiping rebellion, but Richthofen was impressed with the desirability of exploring it, and after a visit to California. where he remained till 1868, he returned to the east. In a remarkable series of seven journeys he penetrated into almost every part of the Chinese empire. He returned home in 1872, and a work comprising three large volumes and an atlas, which, however, did not cover the entire field or complete the author's plan, appeared at Berlin in 1877–85 under the title of *China; Ergebnisse eigner Reisen und darauf gegründeter Studien.* In this standard work the author deals not only with geology but with every subject necessary to a general geographical treatise. Notably he paid close attention to the economic resources of the country he traversed; he wrote a valuable series of letters to the Shanghai Chamber of Commerce, and first drew attention to the importance of the coalfields of Shantung, and of Kiaochow as a port In 1875 Richthofen was elected professor of geology at Bonn. but being fully occupied with his work in China he did not take up professorial duties till 1879; in 1883 he became professor of geography at Leipzig, and in 1886 was chosen to the same office at Berlin, and held it till his death. He died Oct. 16. 1905.

Among his other works are *Natural System of Volcanic Rocks* (San Francisco, Calif, 1867); *Aufgaben und Methoden der heutzgen Geographie* (an address delivered at Leipzig, 1883); *Führer* fur *Forschungsreisende* (Berlin, 1886); *Triebkrafte und Richtungen dev Erdkunde in neunzehnten Jahrhundert* (address on his election as rector, Berlin, 1903)

RICIMER (d. 472), master of the Roman empire in the west during part oi the 5th century, was the son of a prince of the Suebi and the daughter of Wallia, king of the Visigoths. His youth mas spent at the court of Valentinian III, and he won distinction under Aetius. In 456 he defeated the Vandals in a sea fight near Corsica, and on land near Agrigentum in Sicily. He then gained the consent of the Roman senate to an expedition against the emperor Avitus. whom he defeated at Piacenza on Oct. 16, 456. Ricimer then obtained from Leo I, emperor at Constantinople, the title patrician, but in 457 set up Majorianus as his own emperor in the west. When, however, Majorianus tried to rule by himself, Ricimer forced him to abdicate and caused his assassination on Aug. 7, 461. The successor whom Ricimer placed upon the throne was Libius Severus. who proved to be more docile than Majorianus. Upon his death in 465—said to be due to the poison of Ricimer—this emperor-maker ruled the west for eighteen months without an emperor, and then accepted Leo's candidate, Anthemius. Before long. however, Ricimer moved to Milan, ready to declare war upon Anthemius. St. Epiphanius, bishop of Milan, patched up a truce, but in 472 Ricimer proclaimed as emperor, Olybrius, whom Leo had sent to pacify the two enemies, and after three months' siege captured Rome, on July 1, 472. Anthemius was massacred and Rome was a prey to Ricimer's soldiers. Ricimer died on Aug. 18, 472.

The main authorities for this period are in Mommsen's *Chron. Minora,* 3 vol. (1892–98). *See* also Gibbon ed. Bury pp. 15-49 (1907); L. M. Hartmann. *Geschichte Italiens im Mittelalter.* vol. i (1897).

RICKARD, THOMAS ARTHUR (1864–1953), U.S mining engineer and author, was born in Pertusola, Italy, on Aug. 29, 1864, of English parents. His early life was spent in Switzerland, Russia and England, and he was graduated from the Royal School of Mines, London, in 1885. Moving to the United States in that year, he began practice as a mining engineer in Colorado; subsequently he served as manager or consultant for mining operations in Australia, New Zealand, France. Mexico, Nova Scotia, Yukon Territory and Alaska. Rickard was the author of many books, both technical and nontechnical, and during the period 1903–22 he was editor, for varying periods, of *Engineering and Mining Journal,* New York, *Mining and Scientific Press,* San Francisco, and *Mining Magazine,* London. Two of Rickard's books dealt with the techniques of writing. and his stated ambition was to help improve the writing of those in the engineering profession.

We died Aug. 15, 1953, at Victoria. B.C. (C. N. S.)

RICKENBACKER, EDWARD VERNON (1890–), U.S. airline executive, was born in Columbus. O., Oct. 8, 1890. He had little formal education but very early became interested in internal combustion engines and in engine-driven vehicles of all kinds. By the time the United States entered World War I, Rickenbacker had become famous for his reckless preoccupation with speed on the race tracks. He was one of the country's top three racing drivers and had set a world speed record of 134 m.p.h. at Daytona Beach, Fla. He went overseas as an army sergeant-driver attached to Gen. John J. Pershing's staff but quickly gravitated into aviation. He proved to be a natural fighter piiot and ended the war as America's outstanding "ace." with the rank of captain. He was awarded almost every decoration attainable.

Rickenbacker returned to the automobile industry after World War I. He headed his own company, the Rickenbacker Motor Car company, for a time and on its dissolution joined Cadillac Motor Car company and then its associated aviation interest, General Aviation Mfg. Co. He transferred to the airline business in 1932, first with American Airways and then with North American Aviation, Inc. On Jan. 1, 1935, he began his career with Eastern Air Lines. rising from general manager to chairman of the board of directors. Except for a period during World War II when he toured many of the combat theatres as a special representative of the U.S. secretary of war, he applied his energies to build Eastern Air Lines into one of the leading air-transport systems of the world. (S. P. J.j

RICKETS, a deficiency disease of infancy and childhood characterized by a disturbance of the normal process of ossification of bones with resultant deformity. Rickets is a systemic disease and most commonly eccurs toward the end of the first year and during the second year of life. Rare instances of congenital rickets are caused by a deficient maternal diet, Factors predisposing to the development of rickets are rapid growth, prematurity and increased susceptibility to the disease. Negro children are singularly susceptible. Genetic factors play a minor role in infantile rickets although multiple cases have been observed in a family. usually caused by similar dietary inadequacies. Common early symptoms may include profuse sweating particularly during sleep, vomiting and diarrhea. History of an inadequate dietary intake of vitamin D is usually obtained. *(See* VITAMINS: *Vitamin D.)* Softening of the bones of the skull in the first few months of life may he an early sign. Enlargement of the ends of the long bones in the region of the epiphyses and a knobbed appearance of the ribs at their junctions with the costal cartilages are common findings. The diagnosis is easily made by X-ray examination of the ends of the long bones. If no treatment is instituted early in the disease the bones show various degrees and types of curving and deformity. the legs being more deformed than the arms so that "bow-legs" or "knock-knees" develop. Bending may occur in the legs before walking is begun although with weight-bearing the bending increases. Curvature of the spine. deformity of the pelvis and the bowing of the legs result in reduction in height. The deformity of the pelvis in the female may lead to difficulty with childbearing later in life. The head of the rachitic child appears large in its upper part, the individual bones of the cranium sometimes remaining ununited for a prolonged time. The face appears small, the teeth appear late and fall out or decay early. Commonly the disease terminates in spontaneous recovery, the bones firmly ossifying although remaining altered in shape. Complications associated with rickets include bronchitis, bronchopneumonia, gastroenteritic disturbances, muscular weakness, enlargement of the liver and spleen and anemia. *See* also BONE. DISEASES ASD INJURES OF.

Rickets is recognized to be largely, if not entirely. the result of a deficiency of vitamin D. Early treatment of rickets with vitamin D in the form of concentrates, irradiated ergosterol, fish oils, exposure to sunlight or ultraviolet light or at times merely with an adequate enriched diet can prevent all the deformities mentioned above. Rickets is observed in conjunction with, or as a complication of, other diseases such as scurvy, coeliac disease, cystinosis and renal failure. A rare form of rickets is refractory to vitamin D therapy. The cause for this is unknown. Conditions which are mistaken for rickets include chondrodystrophy (formerly known as fetal rickets). familial osseous dystrophy (Morquio's disease), osteogenesis imperfecta, congenital hypothyroidism (cretinism) and hyperparathyroidism. ***See*** also MALNUTRITION.

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RICKETTS, CHARLES (1866–1931), English artist, editor and publisher. was born in Geneva. Switz., on Oct. 2, 1866, and educated in France. In 1889 he became joint editor with Charles Shannon of the *Dial.* In 1896 he founded the Yale press. the output of which was a series of beautifully designed and printed books. Of his pictures "The Plague" (1911) is in the Luxembourg at Paris and "Don Juan" (1916) in the National gallery, London. He published *The Prado and Its Masterpieces* (1903): *A Bibliography of the Books Issued by Hacon and Ricketts* (1904); *Titian* (1906); *Pages on Art* (1913).

RICKETTS, LOUIS DAVIDSON (1859–1940), U.S. mining engineer who brought more of the world's great copper-mining properties into production than perhaps any other engineer, was born in Elkton, Md., on Dec. 19, 1859. He received the degrees of B.S. and Sc.D. from Princeton university in 1881 and 1583, respectively, and then spent seven years acquiring experience in various western mining camps. He was given important assignments as consulting engineer and manager by the Phelps Dodge corporation and the Anaconda Copper Mining company chiefly in properties in which those firms were interested in Arizona and Mexico. Though he was consultant to many companies, his connection with the Inspiration company. beginning in 1912, was perhaps his most important administrative post, as he became president of the firm. His specialty was the design and construction of copper-ore concentrators. smelters and leaching plants.

He was president of the American Institute of Mining Engineers in 1916, and was designated Arizona's "most useful citizen" in 1915. He died on March 4, 1940. (E. H. R.)

RICKETTSIAE are minute microorganisms which resemble very small bacteria but which grow only within susceptible cells and occur in certain arthropods (insects, mites. ticks). Some cause important diseases in man or domestic animals. (See Q FEVER; TYPHUS FEVER; ROCKY MOUNTAIN SPOTTED FEVER AND OTHER SPOTTED FEVERS.) Numerous other organisms resembling rickettsiae occur both in vertebrates and. as symbiotes. in arthropods, but their exact relation to the human pathogens is unknown.

History. — The history of the rickettsiae is intimately associated with those forms causing human disease. Epidemic typhus, one of the great plagues of mankind. was first differentiated from typhoid fever on clinical grounds in 1837. Its nature was so catastrophic that it completely dominated the field. and sporadic occurrences of other similar diseases were hardly noticed. Late in the 19th century, however, a typhuslike disease (Rocky mountain spotted fever) was recognized in the United States and river fever (tsutsugamushi disease. or scrub typhus) was first clearly described in Japan. By 1910 association of these diseases with arthropods was being established on firm scientific grounds with the demonstration of tick transmission of spotted fever and louse transmission of typhus. Elucidation of the microbes causing these diseases began with the work of Howard Taylor Ricketts, who described the new organism of spotted fever in 1909 and who, with Wilder in 1910, also described the organism of typhus fever from the blood of patients in Mexico. Confirmatory reports appeared in rapid succession, and in 1916 the typhus-fever organism was named *Rickettsia prowazekii* in honour of Ricketts and Stanislas von Prowazek, both typhus victims themselves. For a time the etiology of typhus again became clouded because of technical diffitulties, isolation of spurious agents and the discovery of nonpathogenic rickettsialike microorganisms in lice, hut the relation between the louse-borne *Rickettsia prowazekii* and typhus fever was finally clearly settled by 1922. Another rickettsialike agent causing trench fever was discovered during World War I.

Meanwhile, productive studies continued on spotted fever in the United States; variants of spotted fever were recognized in dif-

ferent parts of the world; and scrub-typhus rickettsiae were isolated. In the 1920s and 1930s numerous symbiotic organisms resembling rickettsiae were found in various arthropods. The tick-transmitted agent of heartwater fever in ruminants was identified with the rickettsiae, as were several other agents from domestic animals.

A mild typhuslike disease (Brill-Zinsser disease) was first noted in 1898 in New York. later also in other eastern seaboard cities, in immigrants from typhus-afflicted areas of Europe; the disease existed under conditions precluding louse transmission. A very similar disease, for a time confused with Brill's disease, was recognized in the southern United States beginning about 1913. However, on epidemiological grounds Kenneth F. Maxcy (1929) brilliantly postulated that the southern disease was harboured by rodents and transmitted by a biting arthropod. Eventually, during the 1930s, murine (flea-borne) and epidemic (louse-borne) typhus were clearly differentiated. Still, the northern cases did not fit this pattern. Hans Zinsser imaginatively suggested that they were sporadic recrudescences of past epidemic typhus infections, a hypothesis later verified.

In the late 1930s Q fever (*q.v.*), recognized first independently in Australia and the United States and subsequently shown to enjoy wide geographic distribution in man and domestic animals, yielded a new rickettsial agent, Coxiella *burnetii* (or Rickettsia burneti). Finally. still another rickettsial disease, rickettsialpox, caused by R. akari, was recognized in New York city in 1946.

Morphology and Chemistry. — Rickettsiae are minute (usually under 0.5 μ in diameter), nonspore-forming, nonmotile organisms which vary in form from round to rod shaped. They stain poorly with ordinary aniline dyes, are Gram-negative but may be seen readily under the ordinary light microscope with special stains. A cell wall from which the protoplast inside readily shrinks on drying is clearly visible under the electron microscope and, at least in typhus rickettsiae, contains an antigenic polysaccharide. Like bacteria, rickettsiae of typhus and Q fever contain both ribonucleic and deoxyribonucleic acids and purified suspensions of some, unlike small viruses, display a modest array of independent metabolic activities.

Taxonomy. — Despite a long-felt and still-growing impression among many authorities that rickettsiae are closely related to bacteria, they have been placed in a separate class (Microtatobiotes) along with the viruses. Controversy has long existed about the inclusion of numerous other pathogenic and nonpathogenic morphologically similar organisms with the rickettsiae. While there is no sound biological basis for excluding nonpathogenic rickettsialike organisms from the rickettsial group, the fact remains that the human pathogens have been subjected to the greatest study. Controversy about classification will undoubtedly persist until more adequate information is at hand on all forms to provide sound taxonomic criteria.

Biological Properties. — Most rickettsiae are peculiarly adapted to arthropods. The mite- and tick-borne forms are especially well adapted, being harmless to the vector and transmitted from one generation to the next through the egg. Spotted-fever rickettsiae from overwintering ticks must undergo a unique reactivation phenomenon to gain full virulence for mammals. The association of R. prowazekii with body lice, wherein the vector itself succumbs to the infection and passage through the egg does not occur, suggests less complete and possibly more recent adaptation. From the widespread occurrence of rickettsialike symbiotes in arthropods and the prominent role of arthropods in rickettsial transmission has evolved the idea that pathogenic forms may have developed originally from symbiotes accidentally introduced into the vertebrate host by biting arthropods. Man appears only as an incidental host except in epidemic typhus, and probably trench fever, where man is the only known reservoir.

Most rickettsiae pathogenic for man (except possibly R. *quintana*) grow only within animal cells (in intact animals, embryonated eggs or tissue cultures), where they multiply by binary fission There is no confirmed growth in cell-free media. Optimal growth occurs at about 35° C., lower than the body temperature of most mammalian hosts. Outside cells, most rickettsiae perish quickly unless they are preserved by freezing (−70° C.) or lyophilization. Suspensions of some pathogenic rickettsiae exert a rapid toxic effect on the vascular systems of susceptible laboratory animals as well as a lytic action on the red blood cells of certain animal species.

Some Important Human Rickettsioses

Disease	Causative rickettsia	Main vector	Vertebrate reservoir
Typhus group			
Epidemic typhus (including Brill-Zinsser disease)	*Rickettsia prowazekii*	body louse	man
Murine typhus (endemic typhus)	*Rickettsia typhi (mooseri)*	rat flea	rats
Spotted fever group (selected examples)			
Rocky mountain spotted fever	*Rickettsia rickettsii*	ticks	probably wild rodents
Fièvre boutonneuse	*Rickettsia conorii*	ticks	dogs, rodents (?)
Rickettsialpox	*Rickettsia akari*	mites	mice
Scrub typhus (tsutsugamushi disease)	*Rickettsia tsutsugamushi*	chiggerlike mites	wild rodents
Trench fever	*Rickettsia quintana*	body louse	man
Q fever	*Coxiella burnetii*	occasionally tick; mainly air, dust, contact	cattle, sheep goats, bandicoots

Rickettsial Diseases. — Most human rickettsial diseases resemble one another remarkably. Symptoms include abrupt onset of fever, lasting one to two weeks and accompanied by headache, varying degrees of mental clouding, prostration and. after a few days, a rash. Q fever, an outstanding exception, is generally mild, produces no rash but commonly presents lung infiltrations. All are naturally transmitted by some arthropod. Q fever, however, is more often contracted by contact with infected domestic animals, their carcasses or by the inhalation of contaminated air-borne particles.

During infection the organisms are disseminated throughout the body by the blood, although some proliferate also at the site of introduction to produce a small ulcer (eschar). Except for R. quintana and *C.* burnetii, rickettsiae causing human disease tend to proliferate in, and damage, the cells lining small blood vessels. Vascular damage in the skin is often associated with rash, hemorrhage or necrosis.

The intracellular habitat is probably responsible for certain unusual features of rickettsial infections, for within some body cells rickettsiae seem to be protected from antibodies and other deleterious substances. Despite the appearance of circulating antibodies just preceding and during convalescence. some viable rickettsiae persist within lymphoid tissues for months and even years after apparent recovery from epidemic (louse-borne) typhus, Rocky mountain spotted fever and scrub typhus (tsutsugamushi disease). In most instances they persist there harmlessly, but sometimes recrudescence of the latent epidemic typhus infection at a later date gives rise to a relatively mild, recurrent, typhuslike illness (Brill-Zinsser disease). During recrudescences rickettsiae again circulate in the blood. Lice feeding upon such a patient may become infected and capable of transmitting fully virulent epidemic typhus. See also BACTERIAL AND INFECTIOUS DISEASES; BACTERIOLOGY.

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RICKMAN, THOMAS (1776–1841), English architect whose work reflected the Gothic revival, was born on June *8.* 1776, at Maidenhead, Berkshire, and died at Birmingham on Jan. 4, 1841. He designed many churches, the new court of St. John's college, Cambridge, and a palace for the bishop of Carlisle. These are all in the Gothic style but show more knowledge of its outward form than real acquaintance with its spirit. Rickman played

a part in the revival of medievalism perhaps second only to A. W. N. Pugin. Rickman's *Attempt to Discriminate the Styles of Architecture in England* ran through many editions.

RICKMANSWORTH, an urban district in the South West Herts parliamentary division of Hertfordshire, Eng., lies at the confluence of the Colne, the Gade and the Chess on the borders of Buckinghamshire and Middlesex. Pop. (1951) 24,508; (1957 est.) 26,640. Area 11.9 sq.mi. Rickmansworth is an old market town which has grown since World War I into a large residential district spreading into the river valleys and the surrounding woodland. Stretches of water meadows and woods have been acquired by the council as part of London's greenbelt. In the long High street are some red-brick Georgian buildings including St. Joan of Arc's Convent school and Basing house, once the home of William Penn, the founder of Pennsylvania, and now the council offices. The Royal Masonic School for Girls was built in Rickmansworth in 1928–33 and Merchant Taylors' school was built (2 mi. E.) in 1931–33. Moor park, to the east, is a splendid 18th-century mansion built on the site of a house once belonging to Cardinal Wolsey. Designed in 1720, it has a classical front with a four-column portico, a lavishly decorated great entrance hall and gardens laid out by Lancelot ("Capability") Brown. It now belongs to the council and is used as a golf clubhouse; there are three golf courses in its 400 ac. of parkland.

RICOCHET, a military term denoting the rebound of a projectile that strikes a hard surface; it is also applied to the projectile itself In the now obsolete ricochet fire in war, the shot, after striking the ground at a small angle, described for the remainder of its course a succession of leaps and falls. The discovery of this type of fire. usually attributed to Vauban (siege of Ath in 1697), had the greatest influence both on sieges and on operations in the field. In siege warfare, ricochet. especially when combined with enfilade (*i.e.*, when directed along the enemy's line of defense), soon became the principal weapon of the besieger. Enfilade (q *v.*) fire by itself was neutralized by traverses, or banks of earth at right angles to the line of defense, but by the new method a shot could be so aimed as to skip over each successive traverse and thus to search ground that was immune from direct fire The application of ricochet fire to operations in the field came somewhat later. In the 18th century field artillery. which, before Napoleon's time, was not sufficiently mobile to close with the enemy, relied principally upon the ricochet of round shot. which. sweeping a considerable depth of ground, took effect upon several successive lines of hostile troops. But once artillery was able to gallop up to the enemy and to use its far more terrible close-range projectile, case shot, ricochet fire came to be used less and less. Finally, with the general adoption of explosive-filled shells (which usually burst at the first contact with the ground). the round shot disappeared altogether from the battlefield.

Similarly in siege warfare, as soon as high-angle fire with shells became sufficiently accurate, there was no further need of round shot and ricochet. Ricochet fire with delayed action fuzes was occasionally used in World War II to obtain air burats after initial impact

The term "ricochet" is now only applied, in modem rifle shooting, to the graze of a bullet that has struck short. A modern bullet that has ricocheted inflicts a very severe mound.

RIDGWAY, MATTHEW BUNKER (1895–), U.S. army officer uho, during World War II, wastresponsible for the planning and execution of the first major air-borne assault in the history of the U S. army aith the attack on Sicily. He was born at Fort Monroe. Va., March 3, 1895, and graduated from the Cnited States Military academy in 1917. Before World War II he served in various staff positions. As commanding general of the 82nd air-borne division, he parachuted with his troops into Normandy in 1944 and subsequently led the 18th air-borne corps in action in the Netherlands, Belgium and Germany.

Assuming command of the U.S. 8th army in Korea during the Chinese Communist offensive in late 1950, Ridgway rallied the United Nations forces and initiated a counteroffensive that drove the enemy out of South Korea. Assigned in 1951 as the over-all Allied commander in the far east. succeeding Gen. Douglas MacArthur, he continued the successful defense of the Republic of Korea and assisted in the rehabilitation of Japan. In 1952 he succeeded Gen. Dwight D. Eisenhower as supreme commander, Allied forces in Europe, and in 1953 was appointed chief of staff of the U.S. army. He retired in 1955, having reached the rank of general in 1951. Ridgway's war memoirs appeared in 1956 under the title of *Soldier*. (W. SI.)

RIDING, THRPTHING or **THRIDING,** a Scandinavian term for the third part of a shire or county, *e.g.,* the ridings of Yorkshire and of Lindsey in Lincolnshire. In Iceland the third part of a *thing* which corresponds roughly to an English county was called *thrithjungr;* in Norway, however, the *thrithjungr* seems to have been an ecclesiastical division. To the riding causes were brought which could not be determined in the wapentake, and a matter which could not be determined in the riding was brought into the court of the shire. There is abundant evidence that riding courts were held after the Norman Conquest.

Each of the ridings of Yorkshire has its own lord lieutenant and commission of the peace, and under the Local Government Act of 1888 forms a separate administrative county. They are distinguished as the north, east and west ridings, but the ancient divisions of Lindsey were known as the north, south and west ridings respectively.

RIDING: *see* HORSEMANSHIP AND RIDING.

RIDLEY, NICHOLAS (*c.* 1500–1555), English bishop and martyr, was the second son of Christopher Ridley of Unthank Hall, near Willemoteswick, Northumberland. He was sent about 1518 to Pembroke Hall, Cambridge. Having graduated M.A. in 1526 he went to study at the Sorbonne in Paris and at Louvain, and on his return to Cambridge was appointed junior treasurer of his college. In 1534 he was one of the university proctors, and signed the decree of the university against the jurisdiction of the pope in England. Ridley was now chaplain to the university and began to show leanings to the reformed faith. In 1537 he became chaplain to Thomas Cranmer, archbishop of Canterbury, and in April 1538 vicar of Herne, Kent. In 1540 he was chosen master of Pembroke Hall; in 1541 he became chaplain to Henry VIII. and canon of Canterbury. In 1543 he was accused of heretical teaching and practices but acquitted, although just after his exculpation he finally abandoned the doctrine of transubstantiation.

In September 1547 Ridley was nominated bishop of Rochester. He was one of the visitors who were appointed to establish protestantism in the University of Cambridge; in 1548 helped to compile the English prayer book, and in 1549 was one of the commissioners who examined Bishops Gardiner and Bonner. He concurred in their deprivation, and succeeded Bonner in the see of London. Having signed the letters patent settling the English crown on Lady Jane Grey, Ridley, in a sermon preached at St. Paul's cross on July 9th, 1553, affirmed that the princesses Mary and Elizabeth were illegitimate, and that the succession of the former would be disastrous to the religious interests of England. When Lady Jane's cause was lost, however, he went to Framlingham to ask Queen Mary's pardon, but was at once arrested and sent to the Tower of London. From his prison he wrote in defence of his religious opinions, and early in 1554 he, with Cranmer and Latimer, was sent to Oxford to be examined. He defended himself against a number of divines, but was declared a heretic. and excommunicated. He refused to recant, and in Oct. 1555 he was tried for heresy under the new penal laws, being degraded and sentenced to death. With Hugh Latimer he met his end at the stake in Oxford on Oct. 16, 1555.

See *Works of Nicholas Ridley D.D.* (ed. *H.* Christmas, Parker Soc., 1841). His *Life* was written *by* Dr. Gloucester Ridley in 1763, and there is a memoir of him in Moule's edition of the bishops' *Declaration* of *the Lord's Supper* (1895).

RIDOLFI or RIDOLFO, **ROBERTO DI** (1531–1612), Italian conspirator, born at Florence on Nov. 18, 1531, settled in London about 1555. In 1570 he set to work on the plot against Elizabeth which is usually associated with his name. His intention was to marry Mary, queen of Scots, to the duke of Norfolk and to place her on the English throne. In 1571 he visited the duke of Alva at Brussels, Pius V. at Rome, and Philip II. at

Madrid to explain to them his scheme and to gain their active assistance thereto. His messenger, by name Charles Baillie (1542–1625), was, however, seized at Dover; Norfolk and Lesley were arrested, the former being condemned to death in January 1572. Ridolfi, who was then in Paris, died at Florence on Feb. 18, 1612.

RIEGER, PHILIPP FRIEDRICH VON (1818–1903), Bohemian politician and publicist, was born on Dec. 18, 1818, at Semil, Bohemia. He first came into prominence as one of the Czech leaders in the revolution of 1848. In 1853 he married a daughter of the historian Palacky. In 1858 he started the *Slovnik naučny,* the Czech national encyclopaedia and also helped to found the first Czech political daily newspaper published in Prague (1861), of which he was for a while the editor. After the issue of the "October diploma" of 1860, Rieger, with Palacky, undertook the leadership of the reconstituted Czech party. In 1871 he conducted the negotiations with the Hohenenwarth ministry for a federal constitution of the empire, which broke down owing to his extreme attitude in the matter of Bohemian independence On the reappearance of the Czechs in the Bohemian diet (1878) and the Austrian *Reichsrath* (1879) Rieger, as chief of the so-called "Old Czechs," supported Count Taaffe's government. In 1891, together with the other "Old Czechs," he was defeated at the poll. In March 1897 he was created a baron (*Freiherr*) and given a seat in the Upper House, but his influence was now at an end. He died on March 3, 1903.

RIEL, LOUIS (1844–1885), Canadian agitator, son of Louis Riel and Julie de Lagemaundière, was born at St. Boniface, on Oct. 23, 1844, according to his own account, though others place his birth in 1847. Though known as a half-breed, or Métis, and though with both Indian and Irish ancestors, his blood was mainly French. From July 1866 he worked for two years at various occupations in Minnesota, returning in July 1868 to St. Vital, near St. Boniface. In 1869 the transfer of the territorial rights of the Hudson's Bay Company to the dominion of Canada gave great uneasiness to the Métis, and in October 1869 a party led by Riel turned back at the American frontier the newly appointed Canadian governor; in November they captured Fort Garry (Winnipeg), the headquarters of the Company, and called a convention which passed a bill of rights.

In December a provisional government was set up, of which on Dec. 29, Riel was made president, and which defeated two attacks made on it by the English-speaking settlers of the vicinity. So far the Métis had been within their rights, but Riel was flighty, vain and mystical, and his judicial murder on March 4, 1870. of Thomas Scott, an Orangeman from Ontario, roused against him the whole of English-speaking Canada. An expedition was sent out under Colonel Garnet, later Lord Wolseley, which captured Fort Garry on Aug. 24. 1870; Riel decamped.

Riel was not arrested and on Aug. 4. 1871, urged his countrymen to combine with the Canadians against a threatened attack from American Fenians, for which he was publicly thanked by the lieutenant governor. In 1872 for religious reasons he changed his name to Louis David Riel. In October 1873 he became a member of the dominion parliament for Provencher, came to Ottawa and took the oath but did not sit. On April 16, 1874, he was expelled from the house but in September was again elected for Provencher; on Feb. 10. 1875. he was outlawed and the seat thereby again vacated. In 1877–78 he was a patient in the Beauport asylum for the insane; from 1879 to 1884 he lived in Montana.

In 1884 in response to a deputation from the Métis, who had moved west to the forks of the Saskatchewan river, he returned to Canada to win redress for their wrongs. His own rashness and the ineptitude of Canadian politicians and officials brought on a rising, which was crushed after some hard fighting, and on May 15, 1885, Riel surrendered. He was imprisoned at Regina, was tried and on Aug. 1 found guilty of treason and on Nov. 16 was hanged at Regina, meeting his fate with courage. His death was the signal for a fierce outburst of racialism in Quebec and Ontario, which nearly overthrew the Conservative government.

See J. S Willison, *Sir Wilfrid Laurier,* vol. i; George Bryce, *History of the Hudson's Bay Company* (1900)

RIEMANN, GEORG FRIEDRICH BERNHARD (1826–1866), German mathematician, exerted a profound influence on several branches of mathematics, particularly geometry and function theory (see RIEMANNIAN GEOMETRY). He was born on Sept. 17, 1826, in the village of Breselenz in Hanover, the son of a Lutheran pastor. From 1846 to 1851 he studied at the universities of Gottingen and Berlin

In 1851 he obtained his doctorate at Göttingen with his celebrated dissertation, "Foundations for a General Theory of Functions of a Complex Variable." In it he set forth an approach to function theory based on general principles and geometrical ideas rather than on formal calculation. His probationary essay for admission to the faculty in 1853 was "On the Representation of a Function by Means of a Trigonometrical Series." His trial lecture for admission to the faculty in 1854 was "On the Hypotheses Which Form the Foundation of Geometry." In this he introduced a new approach to geometry which covered ordinary Euclidean geometry, the non-Euclidean geometry of Nikolai Lobachevski, Johann Bolyai and C. F. Gauss and other possible non-Euclidean geometries as special cases. His idea was to study the properties of a geometrical space locally rather than to insist on one over-all framework for the whole space.

He became successively a Privatdocent (official but unpaid lecturer), assistant professor (1857) and professor (1859), succeeding P. G. L. Dirichlet (who had succeeded Gauss four years earlier). Consumption began to take its toll in the early 1860s and he died on July 19, 1866, at Selasca. in northern Italy.

In addition to the work mentioned above he published equally significant papers on Abelian functions, the distribution of primes, and air waves of finite amplitude. His posthumously published papers and even the fragments published in his collected works proved to be rich in new ideas. Some idea of his influence can be obtained from the impressive list of methods. theorems and concepts that bear his name: the Riemann approach to function theory, the Riemann-Roch theorem on algebraic functions, Riemann surfaces, the Riemann mapping theorem, the Riemann integral, the Riemann-Lebesgue lemma on trigonometrical integrals, the Riemann method in the theory of trigonometrical series, Riemannian geometry, Riemann curvature, Riemann matrices in the theory of Abelian functions, the Riemann zeta function, the Riemann hypothesis, the Riemann method of solving hyperbolic partial differential equations, Riemann-Liouville integrals of fractional order and others. In fact, it has been said that he anticipated a large part of 20th-century research in geometry and analysis.

Riemann was interested in physical problems and for a time was an assistant in the Gottingen physics laboratory. His idea of defining analytic functions and geometrical spaces in terms of their local properties no doubt was motivated by physical considerations. His approach to geometry made possible the general relativity theory of Einstein.

Riemann also gave the first mathematical treatment of shock waves.

In view of the tremendous importance of Riemann in the history of mathematics, it is somewhat surprising that his collected works occupy only one moderately sized volume edited by R. Dedekind and H. Weber (1876; 2nd ed., 1892; Fr. trans., 1898; reprint of 2nd Ger. ed.. with the 1902 supplement. 1953).

BIBLIOGRAPHY.—For further biographical details *see* the account of his life by R. Dedekind in the German editions and in the reprint edition. For evaluations of his work *see* an article *by* F. Klein in the French edition and an article by H. Lewy in the reprint edition. For a popular discussion *see* E. T. Bell. *Men of Mathematics* (1937). For technical discussion *see* G. Springer, *Introduction to Riemann Surfaces* (1957); L. P. Eisenhart, *Riemannian Geometry* (1949); *E.* C. Titchmarsh, *The Theory of the Riemann Zeta-Function* (1951). *(P.T.* B.)

RIEMANNIAN GEOMETRY. Any n independent variables x_i where i takes the values 1 to n may be thought of as the co-ordinates of an n-dimensional space, or variety V_n in the sense that each set of values of the x's defines a point of V_n. In a space as thus defined there is not an *a priori* basis for the determination of magnitude nor for the comparison of directions at two different points. Riemann proposed the study of the metric properties of a general V_n by introducing as the basis for measurement a quad-

ratic differential form

$$\sum_{i,j}^{1,\ldots,n} g_{ij}dx_i dx_j,$$

where the g's are functions of the x's, subject to the restrictions that the determinant of the g's is not zero and that for all values of the differentials the above sum is positive. By definition the distance ds between the points of co-ordinates x_i and $x_i + dx_i$, is given by

$$ds^2 = \sum_{i,j}^{1,\ldots,n} g_{ij}dx_i dx_j. \qquad (1)$$

This is a generalization of the first fundamental form of a surface (*q.v.*) in ordinary space when the surface is defined in terms of two parameters, as proposed by Gauss (see DIFFERENTIAL GEOMETRY). In this case the metric on the surface is induced by the Euclidean metric of the enveloping space. whereas in a general Riemannian space the metric is assigned.

From the hypotheses concerning (1) it can be shown that at any point

$$\sum_{i,j}^{1,\ldots,n} g_{ij}\frac{dx_i}{ds}\frac{\delta x_j}{\delta s}$$

is less than unity for two different sets of differentials dx_i and δx_i. Consequently a real angle θ is determined by the equation

$$\cos\theta = \sum_{i,j}^{1,\ldots,n} g_{ij}\frac{dx_i}{ds}\frac{\delta x_j}{\delta s}; \qquad (2)$$

by definilion it is the angle between the directions at the point determined by the two sets of differentials. This, is in keeping with the fact that the cosine of the angle between two tangents, at a point, to a surface in ordinary space uhen expressed in terms of the induced metric is given by an equation of the form (2).

When we have n independent functions ϕ_i of the x's the equations

$$x'_i = \phi_i(x_1, \cdots, x_n) \qquad (i = 1, \cdots, n)$$

define a transformation of co-ordinates of the space. If the g's in (1) are such. which is rarely the case, that by a suitable transformation the form (1) is reducible to

$$ds^2 = \sum_{i}^{1,\ldots,n} (dx'_i)^2, \qquad (3)$$

which is a generalization of the metric of ordinary space in cartesian co-ordinates, we say that the space is flat, or plane; otherwise it is *curved*. The locus of points defined by

$$x_1 = f_1(t), \cdots, x_n = f_n(t)$$

for all values of the parameter t is called a curve (*q.v.*). When these expressions are substituted in (1) we obtain an expression of the form $ds = F(t)dt$, and then the length of arc of the curve is given by integration. If the result of the integration is $s = \phi(t)$, by means of this equation the co-ordinates at points of the curve are expressible as functions of the arc s as parameter. The theory of curves involves n–I principal curvatures, which are generalizations of the curvature and torsion of a curve in ordinary space.

Using the terminology of the calculus of variations. we say that the extremals of the integral

$$\int\left(\sum_{i,j}^{1,\ldots,n} g_{ij}\frac{dx_i}{ds}\frac{dx_j}{ds}\right)^{\frac{1}{2}} ds$$

are the shortest lines, or geodesics, of the space. The geodesics are found to be the integral curves of a system of differential equations

$$\frac{d^2x_i}{ds^2} + \sum_{j,k}^{1,\ldots,n} \Gamma^i_{jk}\frac{dx_j}{ds}\frac{dx_k}{ds} = 0 \qquad (i = 1, \cdots, n), \qquad (4)$$

where the Γ's are certain functions of the g's and their first derivatives. When the space is flat and the co-ordinates are those for which the fundamental form is (3), all the functions Γ vanish identically. Consequently in the co-ordinate system the equations of the geodesics of the flat space are

$$x_i = a_i s + b_i, \qquad (i = 1, \cdots, n), \qquad (5)$$

where the a's and b's are constants. Thus the geodesics of a Riemannian space are the analogues of straight lines of a Euclidean space. Riemann showed that in a general space a co-ordinate system exists such that all the geodesics through a given point are defined by $a_i s$ (i = 1, . . . ,n) = 1, but those through other points are not given by (5). In such a co-ordinate system that Γ's vanish at the given point. but not their derivatives.

Two sets of differentials, dx_i and Ax, determine two directions at a point and adx, + $b\delta x_i$, where a and b are parameters, a linear pencil of directions at the point. The geodesics issuing from a point P in a linear pencil of directions constitute a surface; the Gaussian curvature (see DIFFERENTIAL GEOMETRY) of this surface at P was taken by Riemann as the measure of curvature of the space for the given pencil. It is expressed in terms of the directions, and the components of a tensor of the fourth order, which involves the functions Γ^i_{jk} and their first derivatives; it is now known as the *Riemannian curvature* tensor (see TENSOR ANALYSIS). Ordinarily the curvature varies with the choice of the pencil. Schur showed that if it is the same for all pencils at each point of the space then it has the same value at every point; these are the spaces of constant Riemannian curvature; when, and only when, the constant is zero the space is flat.

From time to time important contributions to Riemannian geometry were made by Bianchi, Beltrami, Christoffel, Voss and others, and Ricci co-ordinated and extended the theory simultaneously with the development of tensor calculus. These contributions include the study of a subspace of a Riemannian space analogous to that of a surface in ordinary space. Such a subspace of order r is the locus of points defined by the equations

$$x_i = \psi_i(u_1, \cdots, u_r) \qquad (i = 1, \cdots, n), \qquad (6)$$

where the u's are independent parameters. When these expressions are substituted in (1) we obtain an induced metric for the subspace—a generalization of the first fundamental differential form of a surface (see DIFFERENTIAL GEOMETRY). There is also a generalized second fundamental form, whose coefficients enter in the relations between the curvatures of a curve in the subspace relative to the latter and the curvatures of the curve as of the enveloping space. Among the curves of the subspace there are geodesics, lines of curvature. asymptotic lines and conjugate systems of curves, which are generalizations of these types of curves on a surface in ordinary space. Einstein based his theory of gravitation upon the assumptions that physical space and time constitute a four-dimensional continuum whose metrical character is determined by the presence of matter and that these spaces are of a particular kind defined in invariantive form by means of the curvature tensor; in this theory the fundamental form (1) is not positive for every choice of the differentials. This and other physical interpretations of differentia! geometry of spaces have stimulated the development of the theory.

Notable among contributions is the concept of parallelism of vectors in a general Riemannian space as introduced by Levi-Civita (1873–1942). In such a space parallelism is not absolute. as it is in Euclidean space, but is relative to the curve joining the points of application of the vectors. Thus for a curve $x_i = f_i(s)$ each set of solutions of the equations

$$\frac{d\xi^i}{ds} + \sum_{j,k}^{1,\ldots,n} \Gamma^i_{jk}\xi^i\frac{dx_k}{ds} = 0 \qquad (i = 1, \cdots, n) \qquad (7)$$

are the components of a family of vectors at the points of the curve which are parallel to one another with respect to the curves. Certain Riemannian spaces admit one or more fields of vectors such that any two of them are parallel with respect to any curve joining their points of application. When there are n independent fields of this kind the space is flat. In particular, the tangents to a geodesic are parallel with respect to the geodesic, as follows from (7) and (4), when we put $\xi^i = \frac{dx_i}{ds}$; geodesics are the straight lines of the space. This concept of parallelism is involved in many of the recent developments of Riemannian geometry and its gen-

eralizations have opened up new fields (see TENSOR ANALYSIS).

One type of generalization of Riemannian geometry is that in which there is no assigned metric, but the basic concept is a generalization of geodesic lines. These curves, called paths by Veblen and Eisenhart, are defined by equations of the form (4), in which now the quantities Γ^i_{jk} are assigned, and not derived as in the case of geodesics from the quadratic form (1). When the same interpretation is put upon the functions Γ^i_{jk} in equations (7), there is thus defined parallelism in this geometry, and the paths are straight lines, in the sense that all the tangents to a path are parallel to one another with respect to the path (see DIFFERENTIAL GEOMETRY). From this basis a geometry has been developed in many respects analogous to Riemannian geometry which Eisenhart termed Non-Riemannian geometry. This term may be applied, however, to other geometries. For example, Finsler in his Goettingen Dissertation in 1918 proposed a metric different from that of Riemann, and there has been considerable study of Finsler spaces. Also. Cartan has developed the geometry of metric spaces founded on the notion of area (Paris, 1933).

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RIENZI, COLA DI (c. 1313–1354), tribune of the Roman people, was born in Rome, the son of a tavern keeper named Lorenzo Gabrini. His early years were passed at Anagni. The study of the Latin writers, historians! orators and poets filled his mind with stories of the glories and the power of ancient Rome, and he dreamed of restoring his native city to its pristine greatness. His zeal was quickened by the desire to avenge his brother. who had been killed by a noble. Rienzi became a notary and a person of some importance in the city and was sent in 1343 on a public errand to Pope Clement VI at Avignon. He won the favour and esteem of the pope. Returning to Rome about April 1344 he gathered a band of supporters, plans were drawn up and at length all was ready for the rising. On May 20. 1347, dressed in full armour and attended by the papal vicar. Cola headed a procession to the Capitol; here he addressed the assembled crowd on "the servitude and redemption of Rome." A new series of laws were adopted by acclamation, and unlimited authority was given to the author of the revolution. The nobles left the city or went into hiding, and a few days later Rienzi took the title of tribune.

The new ruler governed the city with a stern justice, in marked contrast to the recent reign of licence. In July he proclaimed the sovereignty of the Roman people over the empire, but before this he had set to work to restore the authority of Rome over the cities and provinces of Italy. He invited the cities of Italy to send representatives to an assembly on Aug. 1, at which, after elaborate and fantastic ceremonial Rienzi, as dictator, issued an edict citing the emperor Charles IV and the imperial electors to appear before him in order that he might pronounce judgment in the case. Rienzi then seized, but soon released, Stephen Colonna and other barons who had spoken disparagingly of him. But his power was waning. His extravagant pretensions excited ridicule. His government was costly, and he was obliged to lay heavy taxes upon the people. He offended both pope and emperor by his proposal to set up a new Roman empire, and in October Clement gave power to a legate to depose him and bring him to trial. The exiled barons gathered some troops, and war began. On Nov. 20 Rienzi's forces defeated the nobles in a battle outside the gates of Rome. But this victory did not save him. The pope denounced him as a criminal, a pagan and a heretic, until! terrified by a slight disturbance on Dec. 15, he abdicated and fled from Rome. He sought refuge in Naples, but soon left that city and spent over two years in a mountain monastery.

Emerging from his solitude Rienzi in July 1350 threw himself upon the protection of the emperor Charles IV. Denouncing the temporal power of the pope he implored the emperor to deliver Italy, and especially Rome, from their oppressors; but Charles kept him in prison for more than a year in the fortress of Raudnitz. and then handed him over to Clement. At Avignon, where he appeared in August 1352, Rienzi mas tried by three cardinals, and was sentenced to death, but this judgment was not carried out, and he remained in prison. In December 1352 Clement died, and his successor. Innocent VI, anxious to strike a blow at the baronial rulers of Rome, pardoned and released his prisoner. Giving him the title of senator, he sent him to Italy with the legate. Cardinal Albornoz, and Rienzi. with a few mercenaries, entered Rome in August 1354. He was received with great rejoicing, and regained his former position. A tumult broke out on Oct. 8, the building in which Rienzi stood was fired, and while trying to escape in disguise he was murdered.

Rienzi's life and fate formed the subject of a famous novel by Bulwer Lytton, of an opera by Wagner and of a tragedy by Julius Mosen. His letters, edited by A. Gabrielli, are published in vol. vi of the *Fonti per la storia d'Italia* (1890).

RIESA, a town in the district of Dresden. Germany, on the Elbe. 30 mi. N.W. of the city of Dresden. Pop. (1959 est.) 36.303. Riesa received municipal rights in 1632, and after a period of decay was again raised to the rank of a town in 1859. The town contains a castle, which is now used as a town hall. There are rolling mills and sawmills and ironworks. Other industries are the manufacture of furniture, beer, soap, marble wares. and bricks. Riesa is the lading place for goods to and from Bavaria, and a mart for herrings, petroleum. wood and grain.

RIESENER, JEAN HENRI (1734–1806), French cabinetmaker, the greatest of his time, was born at Gladbeck, Ger., on July 4, 1734. the son of a courtroom usher. Coming to Paris as a young man, he began work under Jean François Oeben, whose widow he subsequently married, thereafter taking control of the Oeben workshop. Having qualified as a master craftsman in 1768, he embarked on a long and successful career. His first great achievement was the completion, in 1769. of the celebrated *bureau du roi* (now in the Louvre, Paris) that Oeben had begun for Louis XV; and this was followed by his supplying the contents for the king's garde *meuble* or personal furniture store. In recognition of this work he mas appointed "ordinary cabinet maker to the king" (Louis XVI) in 1774; and from then onward he was the regular supplier of furniture to the queen, Marie Antoinette. He died in Paris on Jan. 6, 1806.

Riesener was a consummate craftsman. His graceful furniture is often richly finished with marquetry of exceptional delicacy and with perfectly carved bronzes. His early work naturally shows Oeben's influence in the strength and architectural quality of the design, but he gradually developed a more individual, more delicately conceived style. This was to become the pure Louis XVI style, with its rectilinear side view and harmoniously distributed ornamentation. Riesener used both European and exotic woods, with a preference for mahogany; he occasionally used lacquer and mother-of-pearl to enrich the surfaces of his works.

See Pierre Verlet, *Mobel von J H. Riesener* (1955), for a description of many exquisite pieces of furniture now in museums or private collections in Europe and America. *See* also F. de Salverte, *Les Ébénistes français du XVIIIe siècle,* new ed (1953). (S. GR.)

RIESENGEBIRGE or GIAKT MOUNTAINS (KRKONOSE, KARKONOSZE), a lofty and rugged group of the Sudetes, on the boundary between Poland and Czechoslovakia, between the upper courses of the Flbe and the Oder. They are continued toward the northwest in the Erzgebirge. the Thuringian Forest and the Harz hfountains. Adjoining the Isergebirge and the Lausitzergebirge on the west. and the Eulengebirge and the Adlergebirge on the east and southeast, the Riesengebirge proper trend southeast and northwest between the sources of the Zacken and the Bober, for a distance of 23 mi.. with a breadth of 14 miles. They cover an area of about 425 sq.mi. On its northern side this mountain group has a rugged and precipitous slope from the Hirschberg valley. but on its southern slope, a more gradual one. The southern ridge is cleft about the middle by a deep gorge through which pour the headwaters of the Elbe river, which finds its source in the Siebengriinde. The Great and Little Schneegruben—two deep rocky gorgelike valleys in which snow remains all the year round —lie to the north of the Hohes Rad.

The lower parts of the mountains are clad with forests of oak, beech, pine and fir; above 1,600 ft. only the last two kinds of

trees are found, and beyond about 3,950 ft. only the dwarf pine (*Pinus Pumilio*). Wheat is grown to an elevation of 1,800 ft. above the sea and oats as high as 2,700 ft.

The Riesengebirge is the legendary home of Number Nip (Rübezahl), a goblin of German folklore.

RIETI (anc. *Reate*), a city and episcopal see of Italy. the capital of the province of Rieti, 25½ mi. by rail and 1j mi. direct S.S.E. of Terni, which is 70 mi. by rail from Rome. Population (1957 est.) 35,216 (commune). It is 1,318 ft. above sea level on the right bank of the Velino (a torrent subtributary to the Tiber), which at this point issues from the limestone plateau; the old town occupies the declivity and the new town spreads out on the level. While with its quaint red-roofed houses, its old town walls (some Roman fragments, restored about 1250), its cathedra] (13th and 15th centuries), its episcopal palace (1283) and its various churches and convents Rieti has much medieval picturesqueness. it also displays a good deal of modern activity in corn, vine and olive growing and cattle-breeding. The fertility of the neighbourhood is celebrated both by Virgil and by Cicero.

In 1149 the town was besieged and captured by Roger I of Sicily. In the struggle between church and empire, it always held with the former and defied the forces of Frederick II and Otho IV. Pope Nicholas IV long resided at Rieti, and it was there he crowned Charles II of Anjou king of the Two Sicilies. In the 14th century Robert and afterward Joanna of Naples managed to keep possession of Rieti for many years, but it returned to the States of the Church under Gregory IX.

About the year 1500, the liberties of the town, long defended against the encroachments of the popes, were entirely abolished. An earthquake in 178j was in 1799 followed by the pillage of Rieti by the Neapolitans. Rieti suffered extensive damage during air raids in World War II.

RIEVAULX, a village in the Helmsley rural district of the North Riding of Yorkshire. Eng., about 3 mi. W.N.W. of Helmsley. Pop. (1951) 173. It stands on the Rye before it emerges from the Yorkshire moors into the Vale of Pickering. The name probably comes from Rye Vale. Rievaulx abbey, one of the most beautiful ruins in Yorkshire, was founded by the Cistercians in 1131. The principal remains, now maintained by the ministry of works, are those of a cruciform church which is mainly Early English in style and is of fine workmanship. Considerable fragments of the refectory remain; domestic buildings may be traced.

RIFIS, the name given to the Berbers of the Rif district of Morocco, the mountain region bordering the north coast from Ceuta eastward nearly to the borders of Algeria and forming part of the Atlas range. The Rif dialect changes the Arabic "l" to "r," and this supports the derivation of "Rifi" from "Libi," "b" and "f" being interchangeable.

See Morocco.

RIFLE. In the broadest sense of the term, a rifle is any firearm with a rifled bore, *i.e.*, with shallow spiral grooves cut in the surface of the bore to impart a spin to the bullet or projectile. The term is most often applied to small-bore weapons fired from the shoulder and used either for sport or for military service. (*See* SMALL ARMS, MILITARY.) In military language the term also denotes larger weapons with rifled bores, such as recoilless rifles and big naval guns. Though field guns, howitzers, and machine guns have rifled bores they are not normally reierred to as rifles.

The practice of rifling the bore of a weapon is old. dating back at least to the 15th century. As the earliest examples of rifled guns had straight rather than spiral grooves. it is thought the purpose of the grooves may have been to receive the powder residue or fouling that was an annoying problem with all early firearms. Gunmakers soon discovered that spiral grooves caused bullets to spin and that the spinning action increased their range and improved their accuracy. The spinning principle increased in importance when spherical lead balls were replaced by elongated bullet-shaped projectiles. The latter type oi bullet rotated on its longitudinal axis in the same manner that an arrow rotated due to the angle of its feathers. Over the years. gun designers experimented with a great variety of rifling forms to achieve the best results. Most military rifles of the 20th century have four grooves with a right-hand twist of one turn in something between 10 and 20 inches.

A major difficulty with early muzzle-loading rifles was the problem of loading. As the bullet had to fit tight against the grooves, it had to be rammed down the bore with a ramrod. Rifles of the muzzle-loading era could not be loaded as rapidly as smooth-bore muskets and therefore never gained wide acceptance as military arms. With the advent during the 19th century of breech-loading repeating rifles using metallic cartridges the picture changed completely; the rifle soon replaced the musket as a military weapon. The repeating rifle that held sway during World War I was succeeded during and after World War II by the semi-automatic rifle, notably the U.S. army's Garand rifle. In the 1950s improved rifles capable of both semiautomatic and full automatic fire came into common use. (H. C. T.)

RIFLEBIRD (RIFLEMAN BIRD): the name applied to birds of paradise (*q.v.*) of the genera *Ptilorrhis* and *Craspidornis*, probably because their plumage bears some resemblances to the full-dress uniform (green and black) of the British rifle regiments.

There are five species. of which one inhabits New Guinea and the others the Australian continent. The best known is *P. paradisea*.

See R. B. Sharpe, *Monograph of the Paradiseidae*.

RIGA, a seaport of Latvian S.S.R., of which it is the capital. in 57° 3' N., 24" 1' E. Pop. (1959) 580,423. It is situated at the southern extremity of the Gulf of Riga, 8 mi. above the mouth of the n-estern Dvina, which is connected by means of inland canals with the basins of the Dnieper and Volga. The Gulf of Riga is 100 mi. long and 60 mi. wide, with shallow waters of slight salinity and a greatest depth of 22 fathoms. It is frozen for an average of 12i days in the year. The sea entrance has a depth of 24½ ft. which is dredged constantly to 26 ft. The channel up to the town is 26 ft. deep, and the depth at the quays varies from 18 to 26 ft. There are vast warehouses and a large grain elevator.

The Riga Exchange committee's slip dock at Bolderaja was made capable of taking ships up to 1,000 tons. Large ships unload at Ust-Dvinsk (formerly Dünamünde). The imports ordinarily are herrings, foodstuffs, clothing, sugar, tobacco, industrial and agricultural machinery, mechanical tools, railway equipment, coal, coke and fertilizers. and the exports flax, timber, wooden goods, dairy produce and meat (pork and ham). The town manufactures paper, wood pulp, cellulose, matches, veneered goods, paints and varnishes, textiles (especially cotton and linen goods), boots and shoes, rubber goods, cement! vegetable oils, tobacco and alcoholic drinks.

Manufactures were seriously hampered by the destruction of factories and plants during World War I; Riga was occupied by German troops in Sept. 1917 and held to the end of the war and was occupied again by Germany in World War II.

Riga consists of four parts—the old town and suburbs on the right bank of the Dvina (Latvian, *Daugava*), and the Mitau suburb on the left bank. the two sides being connected by a floating bridge, which is removed in winter, and by a viaduct, 820 ft. long.

The old town still preserves its Hanseatic features—high storehouses, with spacious granaries and cellars, flanking the narrow winding streets. The only open spaces are the market place and two other squares.

The suburbs, with their broad and quiet boulevards on the site of the fortifications. grew steadily during the period of Latvian independence, 1918–39.

Few antiquities of the mediaeval town remain. The oldest church, the Dom (St. Mary's), founded in 1215, was burned in 1547, and the present building dates from the second half of the 16th century, but has been thoroughly restored since 1883. Its organ, dating from 1883, is one of the largest in the world. St. Peter's church, with a beautiful tower 412 ft. high, was erected in 1406–9. The castle was built in 1494–1515 by the master of the Knights of the Sword, Walter ron Plettenberg, a spacious building often rebuilt. The "House of the Black Heads," a corporation, or club, of foreign merchants, was founded in 1330, and subsequently became the meeting-place of the wealthier youth.

The Livlandische Ritterhaus, the former place of meeting of the Livonian nobility, still stands. Near the city are extensive summer bathing beaches, with little wooden chalets. When Dorpat (Tartu) university, which served all the Russian Baltic provinces, became Estonian property in 1919, Riga Polytechnic institute was made a university. In 1939 7,231 students were enrolled.

History.—Riga was founded in 1158, as a storehouse at the mouth of the river, by a few Bremen merchants. About 1190 the Augustinian monk Meinhard erected a monastery there, and in 1199–1201 Bishop Albert I of Livonia obtained from Pope Innocent III permission for German merchants to land at the new settlement, and chose it for his seat, exercising his power over the neighbouring district in co-operation with the Teutonic Knights. As early as the first half of the 13th century the city obtained the right of electing its own magistracy. It joined the Hanseatic League, and from 1253 refused to recognize the rights of the bishop and the knights. The bishop ruled it from 1420 to 1566, when it was abolished in the Reformation. Sigismund II, king of Poland, took Riga in 1547, and in 1558 the Russians burned its suburbs. In 1561 Gotthard Rettler abdicated his mastership of the order of the Teutonic Knights, and Riga became a Polish possession. After unsuccessful attempts to reintroduce Roman Catholicism, Stephen Bathory, king of Poland, recognized the religious freedom of the Protestant population. In 1621 Gustavus Adolphus, king of Sweden, took it from Poland, and the Swedes held it when the Poles and Russians besieged it in 1656. During the Northern War between Sweden and Russia. it was defended (1700); after the battle of Poltava the Russians took it in 1710. In 1919 it became the capital of the independent republic of Latvia.

RIGAUD, HYACINTHE (HYACINTHE FRANÇOIS HONORAT MATHIAS PIERRE MARTYR ANDRÉ JEAN RIGAU Y ROS) (1659–1743), French portrait painter, born at Perpignan on July 20. 1659, was the descendant of a line of artists. He was sent to Montpellier to study under Pezet. and afterward went to Lyons, and in 1681 to Paris. There he obtained the Grand Prix de Rome, but on the advice of Jean Le Brun he allowed it to lapse and devoted himself to painting portraits. For 62 years he did as many as 30 to 40 portraits a year. But Rigaud, although purely a portrait painter, set his heart on gaining admission to the Academy as a historical painter, and succeeded in Jan. 1700. He died on Dec. 27, 1743.

His principal portraits at the Louvre are those of himself and his mother (Marie Serre). of the sculptor Desjardins, of Mignard and Le Rrun, of Bossuet and of Louis XIV.

RIGAUDON, a lively dance of frivolous nature in 2/2 or 4/4 time. It should properly begin (although exceptions occur) with two eighth-note upbeats on the count of 4. Most authorities believe it to be truly French, specifically a Provençal sailors' dance. deriving its name from a famous Marseilles ballet master named Rigaud who brought it t~ Paris around 1630. It became very popular in England as the Rigadoon. The dance itself included much running. hopping and turning; also *balancés* done with quick little jumps. The music. the melodic structure of which closely resembles that of most English hornpipes, is only occasionally found in the suite. (L. HT.)

RIGEL, the bright star at the heel of the constellation Orion (*q.v.*). It is one of the brightest stars in the sky. Its equivalent in the alphabetical series is β Orionis. Rigel is in reality—as well as apparently—one of the brightest stars known.

Rigel is a blue supergiant located at a probable distance from the sun of about 1,100 light-years. If Rigel were as close to the sun as the bright star Sirius (nine light years)! it would shine with a brilliancy similar to that of the half-moon. (*See* STAR.) (W. W. M.)

RIGG, JAMES HARRISON (1821–1909), English Nonconformist divine, was born at Newcastle-on-Tyne on Jan. 16, 1821. In 1845 he entered the Wesleyan ministry, and during the agitation of 1849–52 wrote successfully in exposition and defence of the polity of Methodism. In 1857 he published *Modern Anglican Theology,* an acute criticism of the writings of Coleridge, Hare, Maurice, Kingsley and Jowett. In 1868 Rigg was appointed Principal of the Westminster U'esleyan Training College for day-school teachers, a post which he held for 35 years. In 1870 he was elected on the first School Board for London. In 1886 he sat on the Royal Commission of Education. In 1878 he was elected president of conference—and again in 1892. He resigned his principalship in 1903 and died at Brixton on April 17, 1909.

See *Life* by John Telford (1909). His other works include: *National Education in its Social Conditions and Aspects* (1873); *The Living Wesley* (1875, reissued as *The Centennial Life of Wesley* in 1891); *Character and Life-work of Dr. Pusey* (1893); *Oxford High Anglicanism and its chief Leader;* (1895).

RIGGING, a general term denoting the whole apparatus of masts, yards, sails and cordage of a ship. (*See* also SAILS; SEAMANSHIP; SHIP; YACHT.) The word is also used to mean cordage only. Sailing vessels are classed according to their rig; *i.e.,* the arrangement of their spars, sails and cordage. Cutter, brig and ship are really convenient abbreviations for cutter-rigged, brig-rigged and ship-rigged.

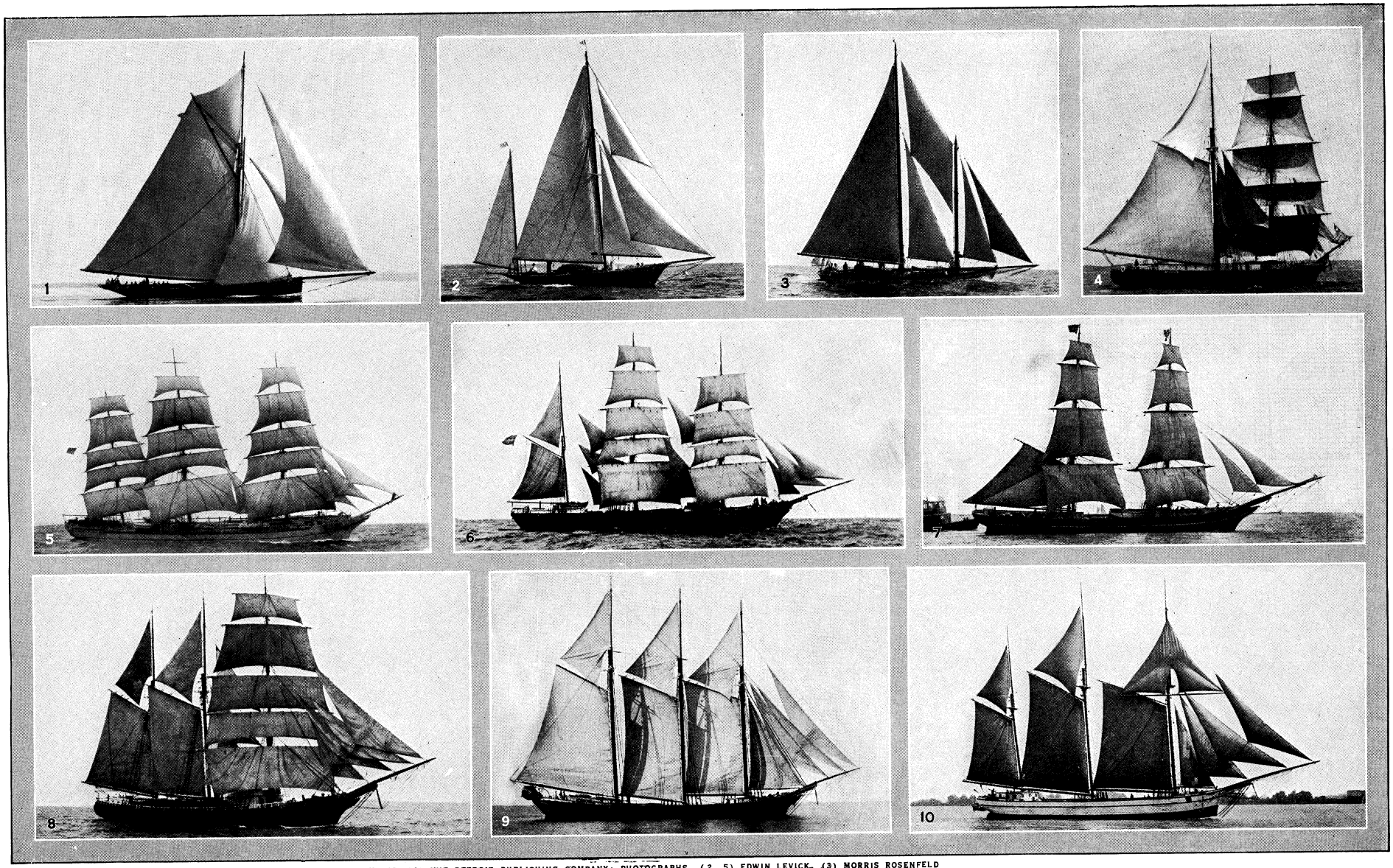
Elements of Rigging.—The basis of all rigging is the mast, which may be composed of one or many pieces of wood or steel. The mast is supported against fore and aft or athwartship strains by fore and backstays and by shrouds, known as the standing rigging, because they are made fast, and not hauled upon. The bowsprit, though it does not rise from the deck but projects from the bow, is in the nature of a mast. The masts and bowsprit support all the sails, whether they hang from yards slung across the mast: or from gaffs projecting from the mast; or. as in the case of the jibs or other triangular sails, travel on the ropes called stays. which go from the mast to the bowsprit or deck.

The bowsprit is subdivided like the masts. The bowsprit proper corresponds to the lower fore-, main- or mizzen mast. The jib boom, which is movable and projects beyond the bowsprit, corresponds to a topmast: the flying jib boom. which also is movable and projects beyond the jib boom. answers to a topgallant mast.

The ropes by which the yards, booms and sails are manipulated for trimming to the wind or for making or shortening sail are known as the running rigging. The rigging also provides the crew with the means of going aloft and for laying out on the yards to let fall or to furl the sail. The shrouds (*see* below) are utilized to form ladders, the steps of which are called ratlines. Near the heads of the lower masts are the tops—platforms on which men can stand—and in the same place on the topmasts are the crosstrees n-hose main function is to extend the topgallant shrouds. The yards are provided with ropes, extending from the middle to the extremities or yardarms, called footropes, which hang down about two or three feet and on which men can stand. The material of which the cordage is made varies greatly, Leather has been used, but the prevailing materials have been hemp or grass rope, chain and wire.

As the whole of the rigging is divided into standing and running so a rope forming part of the rigging is divided into the standing part and the fall. The standing part is that which is made fast to the mast, deck or block. The fall is the loose end or part on which the crew hauls. The block is the pulley through which the rope runs. A tackle is a combination of ropes and blocks which gives increased power at the lifting or moving end, as distinct from the end being manned. If the ship in the illustration is followed from the bow to the mizzenmast, it will be seen that a succession of stays connect the masts with the hull of the ship or with one another. All pull together to resist pressure from the front. Pressure from behind is met by the backstays, which connect the topmasts and topgallant masts with the sides of the vessel. Lateral pressure is met by the shrouds and breast backstays. A temporary or preventer backstay is used when great pressure is to be met. The bobstays hold down the bowsprit. which is likely to be lifted by the tug of the jibs and of the stays connecting it with the fore-topmast. If the bowsprit is lifted the fore-topmast loses part of its support.

The running rigging by which all spars are hoisted or lowered and sails spread or taken in may be divided into those which lift and lower—the lifts, jeers, halyards (haulyards)—and those which hold down the lower corners of the sails—the tacks and sheets. A long technical treatise would be required to name the



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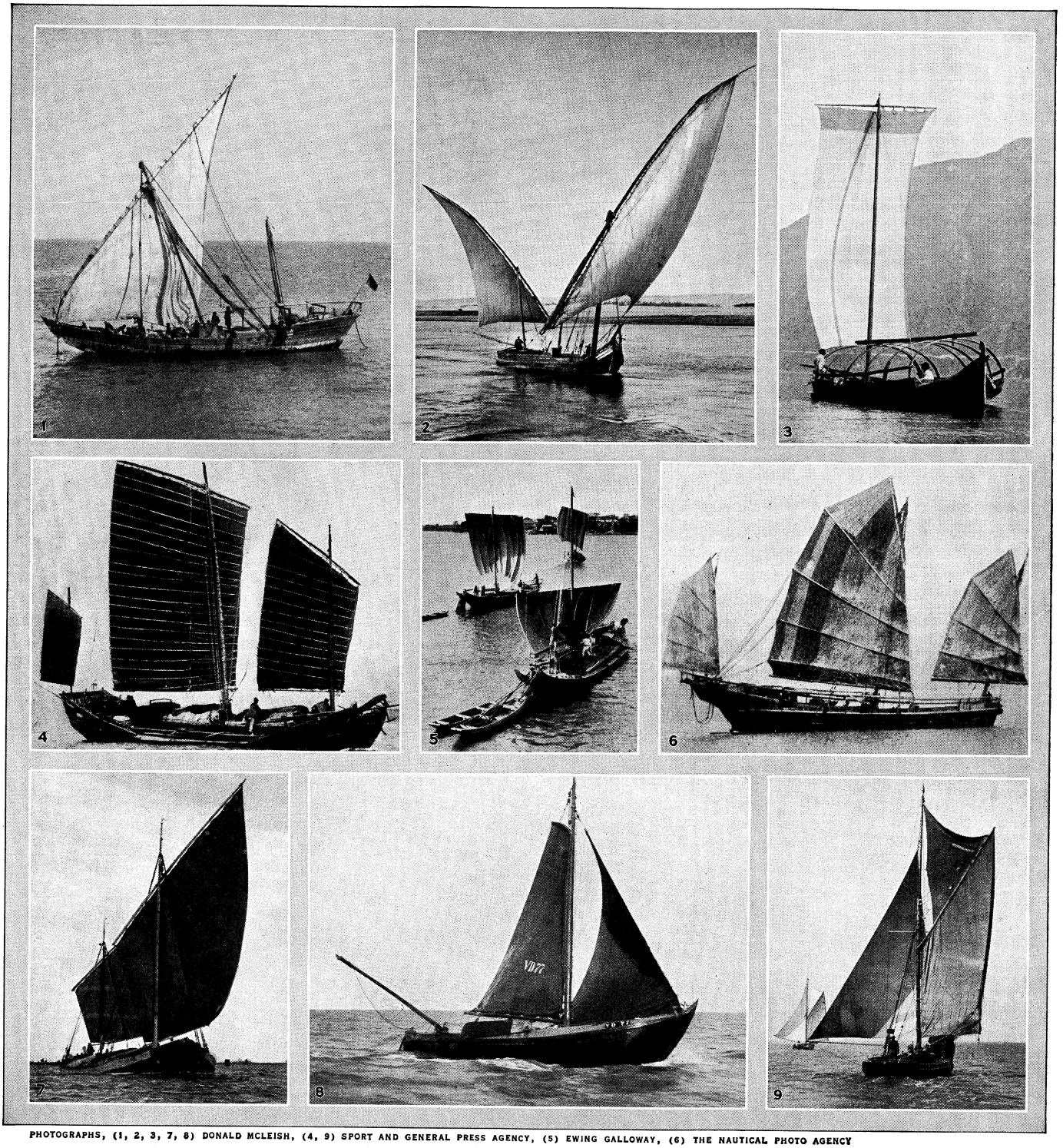
VARIOUS TYPES OF SAILING VESSELS AND THEIR RIGGING

1. A cutter, with gaff-mainsail and topsail
2. A yawl, with Bermuda or jib-headed rig
3. A staysail schooner, so-called because of the staysails between the masts instead of the regular foresail
4. A brigantine, or hermaphrodite brig
5. A full-rigged ship, square-rigged on all three masts
6. A barque, square-rigged on fore and main masts and fore and aft rigged on the mizen
7. A brig; two-masted ship, square-rigged on both masts
8. A barquentine; three-masted ship, square-rigged on foremast only
9. A three-masted schooner, fore-and-aft-rigged on all three masts
10. A Great Lakes schooner, with a raffee or triangular sail on the foremast

RIGGING



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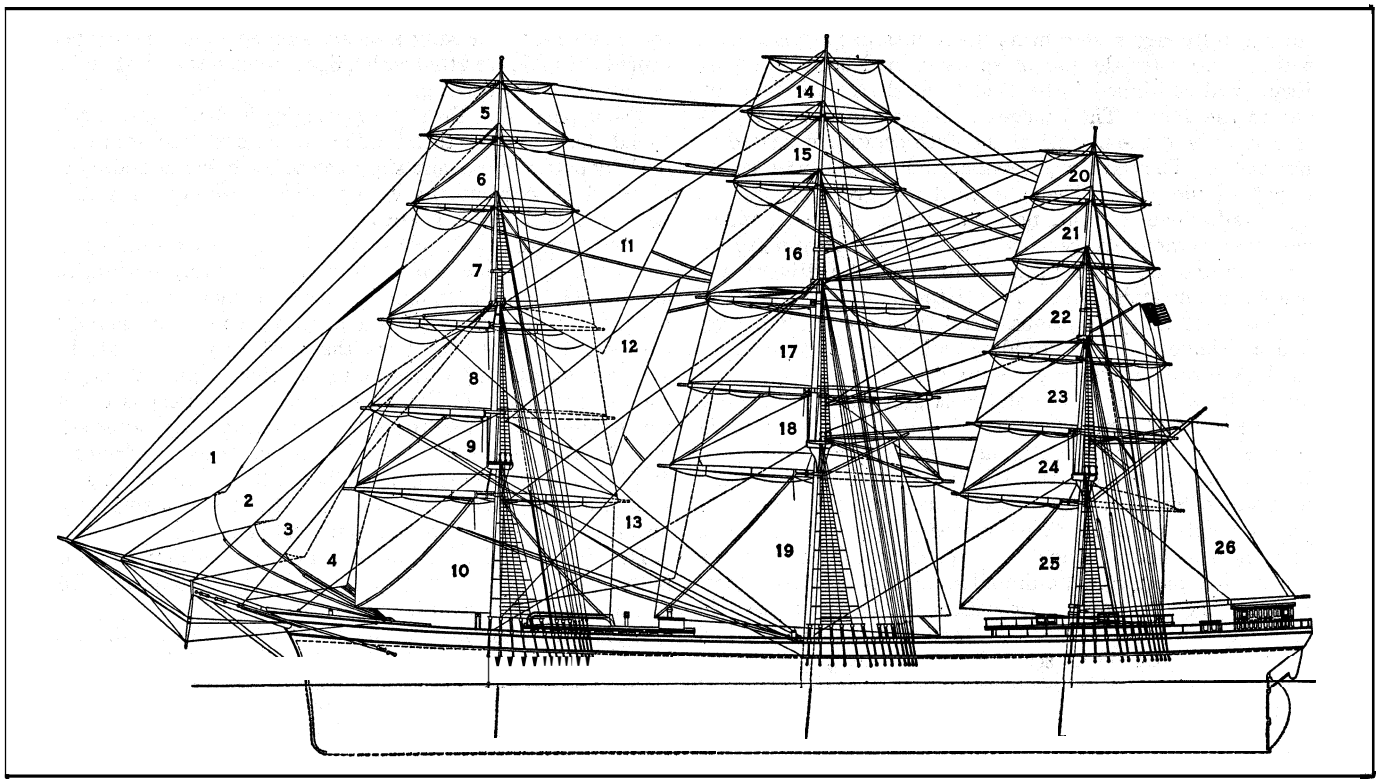
SAILING BOATS OF DIFFERENT NATIONS

1. Arab dhow with long overhanging forepart, an open waist and high poop
2. Native trading boat of the type frequently found on the River Nile
3. Small fishing boat on an Italian lake
4. Chinese junk
5. Japanese sampans
6. Chinese junk
7. Broad beamed Venetian trading boat
8. Dutch fishing boat as used on the Zuider Zee
9. English fishing smacks



THE SPARS. SAILS AND RIGGING OF A FULL-RIGGED SHIP

1. Flying jib; 2. Outer jib; **3,** Inner jib; **4.** Jib; 5. Fore skysail; 6. Fore royal; 7. Fore topgallant sail; **8.** Fore upper topsail; **9.** Fore lower topsail: **10.** Foresail; **11.** Main royal staysail; 12. Main topgallant staysail; **13.** Main topmast staysail; 14. Main skysail; 15. Main royal; 16. Main topgallant sail; 17. Main upper topsail; **18.** Main lower topsail; 19. Mainsail; 20. Mizzen skysail; 21. Mizzen royal; 22. Mizzen topgallant sail: **23.** Mizzen upper topsail; 24. Mizzen lower topsail; 25. Crossjack; 26. Spanker

many parts of standing and running rigging and their uses. All that is attempted here is to give the main lines and general principles or divisions.

The vessel dealt with here is the fully rigged ship with three masts. But the principles of others are the same. The simplest of all forms of rigging is the dipping lug, a quadrangular sail hanging from a yard and always hoisted on the side of the mast opposite to that on which the wind is blowing (the lee side). When the boat is to be tacked so as to bring the wind on the other side, the sail is lowered and rehoisted. One rope can serve as halyard to hoist the sail and as a stay when it is made fast on the side on which the wind is blowing. The difference between such a craft and the fully rigged ship is that between a simple organism and a very complex one; but it is one of degree, not of kind. The steps in the scale are innumerable. Every sea has its own type. Some in eastern waters are of extreme antiquity, and even in Europe vessels are still to be met with which differ very little if at all from ships of the Norsemen of the 9th and 10th centuries.

Types of Rigging.— When the finer degrees of variation are neglected, the types of rigging may be reduced to comparatively few, which may be classed by the shape of their sail and the number of their masts. At the bottom of the scale is such a craft as the Norse herring boat. This boat has one quadrangular sail suspended from a yard which is hung (or slung) by the middle to a single mast which is placed (or stepped) in the middle of the boat. She is the direct representative of the ships of the Norsemen. Her one sail is a course such as is still used on the fore- and mainmasts of a fully developed ship; a topsail may be added (above the course) and then we have the beginning of a fully clothed mast. A similar craft called a Humber keel is used in the north of England.

The lug sail is an advance on the course, since it is better adapted for sailing on the wind, with the wind on the side. When the lug is not meant to be lowered, and rehoisted on the lee side, as in the dipping lug mentioned above, it is slung at a third from the end of the yard, and is called a standing lug. A good example of the lug is the junk. As the lug is a lifting sail, and does not tend to press the vessel down as the fore-and-aft sail does, it is much used by fishing vessels in the North sea.

The type of the fore-and-aft rig is the schooner. The sails on the masts have a gaff above and a boom below. These spars have a prong called the jaws, which fit to the mast and are held in place by a jaw rope on which are threaded beads called trucks. Sails of this shape are carried by fully rigged ships on the mizzen-mast, and can be spread on the fore and main. They are then called trysails and are used only in bad weather when little sail can be carried, and are hoisted on the trysail mast, a small mast above the great one. The lateen sail, a triangular sail akin to the lug, is the prevailing type of the Mediterranean.

These original types, even when unmodified by mixture with any other, permit of large variations. The number of masts of a lugger may vary from one to five, and of a schooner from two to five or even seven. A small lug may be carried above the large one, and a gaff topsail may be added to the sails of a schooner. A one-masted fore-and-aft-rigged vessel may be a cutter or sloop. But the pure types also may be combined, in topsail schooners, brigantines, barkentines and barks, when the topsail, a quadrangular sail hanging from and fastened to a yard, slung by the middle, is combined with fore-and-aft sails. The lateen rig has been combined with the square rig to make such a rigging as the xebec, a three-masted vessel square rigged on the main, and lateen on the fore and mizzen. Triangular sails of the same type as the jibs can be set on the stays between the masts of a fully rigged ship, and are then known as staysails. Studding sails (pronounced "stunsails") are lateral extensions to the courses, topsails, etc., of a square-rigged ship to increase the spread of sails.

Historical Development.— The development of the rigging of ships is a very obscure subject. It was the work of centuries and of practical men who wrote no treatises. It has never been universal, yet a comparison of a four-masted junk with the figures of shi'ps on medieval seals shows much similarity. By selecting

a few leading types of successive periods it is possible to follow the growth of the fully rigged ship in its main lines in modern times.

For a time, and after the use of spritsails had been given up, the spritsail yard continued to be used to discharge the function now given to the gaffs. The changes in the mizzen have an obscure history. About the middle of the 18th century it ceased to be a pure lateen. The yard was retained, but no sail was set on the fore part of the yard. Then the yard was given up and replaced by a gaff. The resulting new sail was called the spanker. It was, however, comparatively narrow, and when a greater spread of sail was required, a studding sail (at first called a driver) was added, with a boom at its foot. At a later date "spanker" and "driver" were used as synonymous terms, and the studding sail was called a "ringtail." The studding sails are the representatives of a class of sail once more generally used.

In modern times a sail is cut of the largest size that can be carried in fine weather, and when the wind increases in strength it is reefed; *i.e.*, part is gathered up and fastened by reef points, small cords attached to the sail. Till the 17th century at least the method was often to cut the courses small, so that they could be carried in rough weather. When a greater spread of sail was required, a piece called a bonnet was added to the foot of the sail, and a further piece called a drabbler could be added to that. An example of the tenacious conservatism of the sea is seen in the retaining of this practice by the Swedish small craft called *lodjor* in the Baltic and White seas. It will be easily understood that no innovation was universally accepted at once. Jib and sprit topsail. lateen-mizzen and spanker, and so forth, would be found for long on the sea together.

The history of the development of rigging is one of adjustment. The size of the masts had to be adapted to the ship, and it was necessary to find the proper proportion between yards and masts. As the size of the medieval ship increased, the natural course was to increase the height of the mast and of the sail it carried. Even when the mast was subdivided into lower, top and topgallant, the lower mast was too long, and the strain of the sail racked the hull. Hence the constant tendency of the ships to leak. Sir Henry Manwayring, when giving the proper proportions of the masts, says that the Flemings (*i.e.*, the Dutch) made them taller than the English but were forced to make the sails less wide.

A few words may be added concerning the tops. In the earlier form of ship the top was a species of crow's-nest placed at the head of the mast to hold a lookout, or in military operations to give a place of advantage to archers and slingers. Tops appeared occasionally as mere bags attached to one side of the mast. As a general rule they were round. In the 16th century there were frequently two tops on the fore- and mainmasts, one at the head of the lower, another at the head of the topmast, where in later times there have been only the two traverse beams which make the cross-trees. The upper top dropped out by the 17th century. The form was round, and so continued until the 18th century when the quadrangular form was introduced.

Power Ships.—Steam and motor ships still carry one or more masts for supporting derricks, for lifting heavy weights in and out of the ship, for carrying wireless antennas, for providing a platform for lookout aloft, for mounting the steaming lights and for visual signaling. In the bigger ships the masts are usually hollow steel structures, occasionally with an internal ladderway, while in some merchant ships they also act as uptake ventilators. Stays are usually provided on the same principle as in sailing days, but dead-eyes have given way to bottle screws as rope has to wire. Where masts are provided with ladderways, either internally or externally on the iron structure itself, ratlines on the rigging are dispensed with. Modern battleships, battle cruisers and light cruisers in the Royal Navy usually have a tripod foremast in which the lower mast is supported by two inclined steel struts instead of rigging. This is to give the necessary rigidity for mounting the gun director and range finder (see GUNNERY, NAVAL).

The main mast usually carries the main derrick and is stayed on the old lines. Wooden topmasts and sometimes topgallant masts are fitted for wireless and signaling, while one or more signal yards are always carried on the foremast. In light cruisers the main mast is usually a small wooden pole. Destroyers and other light craft are fitted with a light wooden foremast and usually a short main or mizzen mast.

The upper end of the standing rigging is shackled to steel bands round the lower masthead. The lower ends are secured to the deck by bottle screws and slips, the screw being locked by a check piece which prevents its easing back; together with its slip it is covered with painted canvas.

The topmast rigging, consisting of the usual shrouds, stays and backstays, is fitted with insulators to avoid interference with radio and danger from lightning. A Jacob's ladder gives access to the masthead, while above all is a lightning conductor connected by a copper strap running down the mast to the hull of the ship. Where a masthead flashing lamp is fitted, a gallows is provided for its reception. In flagships a pole 16 ft. long is clamped to the fore topmast or fore topgallant masthead to carry the admiral's flag. Clothes lines and hammock gantlines (used for drying clothes and hammocks) are of thin flexible steel rope in warships. They lead through blocks on a shroud near the fore or main lower mastheads and are set up well forward or well aft.

Dressing lines lead from the foremast awning stantion over both topmasts and down to the after awning stantion. To these are attached flags for dressing ship.

Signal halyards, made of light white line, lead through blocks on the yards and trucks for hoisting signal flags.

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RIGHT ASCENSION, in astronomy, the co-ordinate on the celestial sphere analogous to longitude on the earth. It is the angle at the celestial pole reckoned eastward from the hour circle through the vernal equinox to the one through the body in question, or the arc of the celestial equator measured eastward from the vernal equinox to the foot of the object's hour circle. (Hour circle is a great circle passing through the celestial poles, perpendicular to the equator). The one through the vernal equinox, the origin for this measurement, takes the place of the Greenwich meridian in earth geography. Right ascension is expressed in time more often than in angular units, and is measured entirely around the equator, having any value from 0 hours to 24 hours, or 0° to 360° (15° is equivalent to 1 hour, and 1° to 4 minutes of time). The common abbreviation is the Greek letter, α.

(H. M. Lo.)

RIGHT-HANDEDNESS: see HANDEDNESS.

RIGHTS OF MAN AND OF THE CITIZEN, DECLARATION OF, a sort of manifesto issued in 1789, by the constituent assembly in the French Revolution, to be inscribed at the head of the constitution when it should be completed. It stated the fundamental principles which inspired the revolution. The declaration was first drafted and proposed by the marquis de Lafayette, who had returned from America full of enthusiasm for the principles proclaimed in the Declaration of Independence. The final text voted by the assembly and accepted by the king on Oct. 5, 1789, is much fuller than the American prototype. It contains a preamble and 17 articles. They proclaim and define political equality and liberty in its various manifestations.

See E. Blum, *La Dtclaration des droits de l'homme et du citoyen,* text with commentary (1902); G. Jellinck, *Die Erklarung der Menschen und Bzirgerrechte* (1895). This study was translated into English by Rudolf Tombo, and aroused considerable controversy.

RIGHT WHALE (Eubalaena) is found in the northern and southern hemispheres. The allied Greenland whale (Balaena mysticetus), also called the bowhead whale. attains a length of 60 ft. to 70 ft.. the largest and most valuable of the whalebone whales, a single specimen sometimes furnishing 3,500 lb. of whalebone It was formerly the mainstay of the whaling trade, but is now almost extinct. (See WHALE; WHALE FISHERIES)

RIGORD (*c*. 1150–c. 1209), French chronicler. was probably born near Alais in Languedoc, and became a physician. He entered the monastery of Argenteuil, and then that of St. Denis,

and described himself as *regis Francorum chronographus.* Rigord wrote the *Gesta Philippi Augusti,* covering the period 1179–1206. It was abridged and continued by William the Breton.

See Dom Bouquet's *Recueil des historiens des Gaules et de la France* (1738–1876); another ed. by H. F. Delaborde (1882–85); French trans. in tome xi of François Guizot's *Collection des mémoires relatifs à l'histoire de France jusqu'au XIII^e siècle* (1825).

RIGORISM, in general, means stern attachment to a rule, as in asceticism or monasticism (*qq.v.*). In the 18th century, however, the term was applied in particular to the practice of those moral theologians who insisted on the strictest interpretation of the laws of God and of the church in cases of conscience (*see* CASUISTRY). The Jansenists, especially, were described as rigorist in their opposition to probabilism (*q.v.*). In philosophical ethics, Kant took the term to describe a system of morality based on reason alone, without any appeal to hedonism.

RIJEKA (Ital. FIUME), a port of Croatia, Yugoslavia, on the Gulf of Quarnero (Rijecki Zaliv, Kvarner). The old town is built on a ridge of the Karst, while the newer parts are crowded into the amphitheatre between the ridge and the shore. The modern names date from the 13th century and refer to the river (in Italian called Eneo or Fiumara; in Croatian, Recina, "rivulet") which separates Rijeka from the eastern suburb of Susak.

The old town, which has a 3rd-century Roman triumphal arch, was known in ancient times as Tarsatica. Captured by Charlemagne, it long remained under the Franks. Later it was held by the bishop of Pola. The counts of Duino held it from 1139 to *c.* 1400, and in 1377 the cathedral of the Assumption was founded. Next held by the counts of Walsee, Rijeka was incorporated in Austria in 1466. It was made a free port in 1723, was united to Croatia in 1776 and was declared a *corpus separatum* of the Hungarian crown in 1779. The French held it from 1809 to 1813, when the English took it. Restored to Austria in 1814, it passed to Hungary in 1822, was Croatia's from 1848 to 1870 and was thereafter under Hungary until World War I.

Rijeka-Fiume became a matter of controversy after World War I. Although the secret treaty of London between Italy, Great Britain, France and Russia (April 26, 1915) had assigned Rijeka to Yugoslavia, the Italians claimed the port at the Paris peace conference on the principle of self-determination, because in 1910 its population had comprised 22,488 Italians as against 13,351 Yugoslavs and certain others, while Susak had been estimated to have 1,500 Italians as against 11,000 Yugoslavs.

On Sept. 12, 1919, Gabriele d'Annunzio (*q.v.*), who mustered a body of men at Ronchi near Trieste, occupied Rijeka and proclaimed himself the "commandant" of the "Reggenza Italiana del Carnaro." The Italian government, however, on concluding the treaty of Rapallo (Nov. 12, 1920) with Yugoslavia, resolved to turn D'Annunzio out of Rijeka. Giovanni Giolitti, the prime minister, ordered the battleship "Andrea Doria" to shell D'Annunzio's palace only, predicting that the surprise would cause the "commandant" to escape at once—as indeed it did. Riccardo Zanella, who then took office, representing the Autonomist party as opposed to the Italian Nationalist, supported Count Carlo Sforza's solution of the problem, namely a free state of Rijeka with an Italo-Fiuman-Yugoslav consortium for the port; and such a solution was approved by the town's electorate on April 24, 1921. But on March 3, 1922, a *coup d'état* brought the Nationalists to power in Rijeka. With Benito Mussolini as head of a new regime in Italy (Oct. 30, 1922) the Rapallo plan for a free state came to nothing. A new Italo-Yugoslav treaty, signed in Rome on Jan. 27, 1924, recognized Rijeka itself as Italian while Susak became Yugoslav. As Italy was unable to feed three Adriatic ports, Rijeka's traffic declined. The port handled only 770,000 metric tons of merchandise in 1938 as against 2,100,000 in 1913.

In Sept. 1943, Rijeka was occupied by the Germans; but on May 3, 1945, after two weeks' fighting, the Yugoslavs occupied the city, the Germans having blown up the port installations. By the treaty of Paris (Feb. 10, 1947), Fiume-Rijcka became part of Yugoslavia. The port was rebuilt, and by 1949 its sea traffic amounted to 2,179,298 tons.

In 1936 the population of Rijeka was 53,896 and that of Susak 16,111. After 1945 Rijeka and Susak merged. Pop. (1961) 100,-339; about 25,000 Italians had left by 1947. (K. SM.)

RILEY, JAMES WHITCOMB (1849–1916), U.S. poet famous for nostalgic dialect verse. was born in Greenfield, Ind., on Oct. 7, 1849. "The poet of the common people," Riley was elected to the American Academy of Arts and Letters, received the gold medal of the National Institute of Arts and Letters and was given several honorary degrees. His boyhood experience as an itinerant sign painter, entertainer and assistant to patent-medicine venders gave him the opportunity to compose songs and dramatic skits, to gain skill as an actor and to come into intimate touch with the rural folk of Indiana. His first reputation was gained by the series in Hoosier dialect ostensibly written by a farmer, "Benj. F. Johnson, of Boone," contributed to the *Indianapolis Daily Journal* and later published as *The Old Swimmin' Hole and 'Leven More Poems* (1883). Riley was briefly local editor of the *Anderson* (Ind.) *Democrat,* but his later life was spent in Indianapolis, where he died on July 22, 1916. Among Riley's numerous volumes are: *Pipes o' Pan at Zekesbury* (1888), *Old-Fashioned Roses* (1888), *The Flying Islands of the Night* (1891), *A Child-World* (1896) and *Home Folks* (1900). The best collected edition is the memorial edition of his *Complete Works,* 10 vol. (1916).

See M. Dickey, *The Youth of James Whitcomb Riley* (1919), *The Maturity of James Whitcomb Riley* (1922); J. Nolan *et al., Poet of the People; an Evaluation of James Whitcomb Riley* (1951).

RILKE, RAINER MARIA (1875–1926), the most influential German poet of his time, whose impact was felt far beyond the borders of the German-speaking countries.. He was born in Prague on Dec. 4, 1875, the only surviving child of Joseph and Sophia (Phia) Rilke. He was educated at the military academies of St. Pölten and Weisskirchen, then at a commercial institution in Linz and later at the universities of Prague, Munich and Berlin. He visited Italy and in 1899 and 1900 made two important journeys to Russia in the company of his lifelong friend Lou Andreas-Salomé. He then settled for a short time in an artists' colony at Worpswede. On April 29, 1901, he married the sculptress Clara Westhoff and settled at Westerwede. Their daughter Ruth was born on Dec. 12 of the same year. But in 1902 Rilke went to Paris to write a monograph on Auguste Rodin; and, although he remained attached to his wife and daughter, he began to drift away from family life and the tie between them slackened with the years. Returning to Paris after a sojourn in Rome and Sweden, he acted as Rodin's secretary from 1905 to 1906, when the arrangement was abruptly terminated by the irascible sculptor. From then until the outbreak of World War I, Paris was the centre to which the poet always returned for spells of concentrated creative activity; but with the failure of inspiration after 1910 his existence became increasingly disrupted and nomadic. He was in Capri in 1907 and later he traveled through Germany, Austria, Italy, Algeria, Tunis, Egypt and Spain, often staying in the castles or on the estates of his numerous aristocratic admirers.

During the first half of his life this shrinking, sensitive and delicate poet, who had suffered greatly in body and mind from the rigorous military training of his boyhood, wrote prolifically, both poetry and prose. Strong lyrical compulsion is evident in both, but verse was his natural idiom and already in *Das Buch der Bilder* (1902) individuality of expression, originality of thought and a haunting music in the metres are noticeable. But the inspiration he derived from Russia (which he regarded as his spiritual home) transformed him in *Das Stundenbuch* (1905) into a quasi-religious rhapsodist. whose mystical approach to God with its inexhaustible flow of images and its rushing rhythms revealed previously unsuspected depths and heights in the poet's thought. Another transformation then took place through the influence of Rodin. In the two parts of *Neue Gedichte* (1907 and 1908), Rilke set out to do with words what the sculptor did with marble or stone: to give the external reality of objects contemplated with the outward and the inward eye their spiritual reality as well. Essentially all these poems are *Dinggedichte* (poems of "things"), even when they evoke human beings. Cathedrals and statues, palaces and parks, fountains, pavilions and staircases; dolphins, panthers, flamingos and gazelles; hydrangeas,

heliotropes, poppies and roses; young girls and lovers, the beggars and the blind—Rilke seems to have entered into them all and to speak for them rather than of them. There is magic in the "things" presented in this manner, steeped as they are in their own atmosphere and most of them impregnated with the sense of the past. In Rilke's interpretation of the legends of Alcestis and of Orpheus and Eurydice, as well as in other poems in these collections and in the contemporary requiems, he voiced that absorption with the problem of death which was a lifelong preoccupation. It plays a major part in the prose work of the period, *Die Aufzeichnungen des Malte Laurids Brigge* (1910). This penetrating study of the dark side of existence and the night side of the mind reveals the mental and spiritual terrors which the young Danish hero undergoes in Paris, and the agonies of fear he lived through in his childhood. It is confessional in much the same way as Goethe's *Werther;* but, unlike Goethe, Rilke did not succeed in exorcising the horrors which haunted him. On the contrary the emotional exhaustion involved in the effort resulted in a prolonged period of poetical sterility which only began to yield during a solitary sojourn at Castle Duino on the Adriatic, placed at his disposal by his friend and benefactress Princess Marie von Thurn und Taxis-Hohenlohe (Nov. 1911–May 1912). Here a type of inspiration, different in kind from anything he had so far experienced, seized upon him and dictated the first two poems of the cycle which was finally completed in 1922 and called *Duineser Elegien.* During the ten years between its inception and its consummation Rilke lived in a state of suspension, waiting, working and hoping for the miracle of Duino to recur.

When war broke out he was in Germany and, strangely uplifted by the greatness of the calamity, he composed five magnificent hymns addressed to the god of war. Holderlin's influence is discernible in the apocalyptic quality of the style of these and one or two other poems of the period; but the rising tide of inspiration was checked by the mental suffering the war induced, aggravated by Rilke's short period of war service (Nov. 1915–June 1916), first for a few weeks in the infantry of the second reserve and then for a few months as a clerk in the war ministry in Vienna. This was a kind of sinecure. but it increased the poet's hopelessness and apathy, which were hardly lessened by the many friends he made in Munich where he spent most of the war years. In 1919 he accepted an invitation to Switzerland to give readings of his poems; and he remained in that country until his death, undertaking short visits to Venice and Paris, but never returning to Germany or Austria. The last five years of his life were spent in the little castle of Muzot in the Valais, first lent and then given to him by one of his devoted Swiss admirers. Here, in Feb. 1922, during about 18 days of tumultuous inspiration, he not only completed the ten *Duineser Elegien,* of which two further poems and several fragments had been written between 1912 and 1922, but he also wrote two complete sequences of *Sonette an Orpheus.* After this almost miraculous release of pent-up inspiration, there was a period of recuperation. But another curious transformation took place. Rilke, who had earlier translated Elizabeth Barrett Browning's *Sonnets from the Portuguese,* some of Michelangelo's poems and the sonnets of Louise Labé, was engaged at the time in translating Paul Valéry; and this resulted in a series of original poems in French. Nor was the German vein yet played out; and reminiscences in prose were also occupying the poet's mind. But his health was deteriorating rapidly and he died of leukemia in a sanatorium in Valmont on Dec. 29, 1926.

The international fame to which Rilke attained in his lifetime continued to increase after his death, as the innumerable memoirs, monographs, commentaries, biographies and translations in many European languages bear witness. His personality has aroused almost as much controversy as Byron's; and his voluminous correspondence constitutes both a literary and a psychological phenomenon of absorbing interest. The larger part of this is unpublished; but, in addition to the collected and selected letters in the general edition, many separate volumes to individual correspondents, mostly women, have appeared in print. Some of the most important are listed below; but they all contribute to the picture of the man and the poet and form an integral part of his work. Some read almost like literary essays of a descriptive or reflective nature; others contain first sketches or rough drafts of poems to come; passages from letters to his wife and to Lou Andreas-Salomé were later used almost *verbatim* in *Malte Laurids Brigge;* there are many confessional outpourings, and elaborate essays in self-portraiture and self-exegesis. When the whole is available, a revaluation of the facts of his life and facets of his character will doubtless result in a definitive biography.

Rilke's poetical reputation achieved its summit with *Duineser Elegien* and *Sonette an Orpheus.* For lovers of pure poetry *Neue Gedichte* will always rank high and the number of exquisite lyrics to be found in all the collections is an outstanding feature of his work. But the mysterious philosophical undertow of the elegies and the sonnets with its doctrinal implications creates that impression of something greater than art which great works of art produce. The cosmic isolation of man facing the glorious, austere, aloof and indifferent angels, the tragic nature of his attempts to transcend mortality by love as he journeys irrevocably deathwards, the summons received by the poet toward the end of the elegies to justify his existence by transforming the visible world into invisible art—all this, expressed with visionary intensity, embodies an appeal or a message to humanity which also pervades the sonnets. Some of these practice the doctrine they preach by magically transforming objects, already half-dematerialized in *Neue Gedichte,* into sound so pure that only their vibrations seem to linger in the air. In spite of obscurities and difficulties, the depth of thought in the elegies and the sonnets and the beauty of the expression justify Rilke's belief in their supreme importance in his work as a whole.

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(E. M. BR.)

RIMBAUD, JEAN ARTHUR (1854–1891), French poet and adventurer, born at Charleville, in the Ardennes, on Oct. 20, 1834. He was the second son of a captain in the French army who in 1860 abandoned his wife and family. From early childhood Arthur Rimbaud, who was severely brought up by his mother, displayed rich intellectual gifts and a sullen, violent temperament. He began to write when he was 10, and some of the poems which now appear in his works belong to his 15th year.

Before he was 16, in consequence of a violent quarrel with his mother, the boy escaped from Charleville with a packet of his verse, was arrested as a vagabond, and for a fortnight was locked up in the Mazas prison, Paris. A few days after being taken home Rimbaud escaped again, into Belgium, where he lived for some time as a tramp, almost starved, but writing verses with feverish assiduity. In Feb. 1871 he left his mother for a third time and made his way to Paris, where he knew no one and whence, after very nearly dying of hunger and exposure, he begged his way back to Charleville. There he wrote in the same year the extraordinary poem of *Le Bateau ivre,* which is now hailed as the pioneer of the entire Symbolist or "decadent" movement in French literature in all its forms. He sent it to Paul Verlaine, who encouraged the boy

of 17 (whom he supposed to be a man of 30) to return to Paris. Rimbaud spent from Oct. 1871 to July 1872 in the capital. partly with Verlaine, partly as the guest of Théodore de Banville, and served in the army of the Commune. With Verlaine he traveled for 13 months, after the fall of the Commune. through England and Belgium, where in 1873 he published the only work which he ever printed, *Une Saison en Enfer,* in prose; in this he gives an allegorical account of his extravagant relations with Verlaine, which ended at Brussels by a double attempt of the latter to murder his young companion. On the second occasion Rimbaud was dangerously wounded by Verlaine's revolver. and the elder poet was imprisoned at Mons for two years.

Meanwhile Rimbaud, deeply disillusioned, determined to abandon Europe and literature, and he ceased at the age of 19 to write poetry. He settled for a while at Stuttgart. studying German, and in 1875 he disappeared. He set out on foot for Italy, and after extraordinary adventures found employment as a day labourer in the docks at Leghorn. Returning to Paris, he obtained a little money from his mother, and then definitely vanished. For 16 years nothing whatever was heard of him. but it is now known that he embarked as a Dutch soldier for the Sunda Isles, and, presently deserting. fled to Sumatra and then to Java where he lived for some time in the forest. Returning to Europe, after a vagabond life in every capital, in 1880 he obtained some menial employment in the quarries of Cyprus. and then worked his way to Aden and up into Abyssinia, where he was one of the pioneers of European commercial adventure. There he settled at Harrar as a trader in coffee and perfumes, to which he afterward added gold and ivory; for the next 11 years, during which he led many commercial expeditions into unknown parts of northern Africa, Shoa and Harrar were his headquarters, and he lived almost entirely with the natives and as one of them. From 1888 to 1891, having prospered greatly as a merchant, he became a sort of semi-independent chieftain, intriguing for France, just outside the borders of civilization. From documents which were first produced in 1902 it appears that from 1883 to 1889 Rimbaud mas in close relations with the Ras hlakonnen and with Rlenelek, then only king of Shoa. At the death of the Negus John. in 1888, he was concerned in the formation of the empire of Ethiopia. From this time Rimbaud had a palace in the town of Harrar and intrigued with the French government in favour of Menelek and against Italy.

Meanwhile. in 1886, believing Rimbaud to be dead, Verlaine had published his poems under the title of *Les Illuminations,* and they had created a great sensation in Paris. In this collection appeared the sonnet on the vowels, attributing a different colour to each: "A noir, E Blanc, I rouge, U vert. O bleu voyelles." But the author, in his Abyssinian hut of palm leaves, was, and remained. quite unconscious of the fact. In March 1891 a tumour in his knee obliged Rimbaud to leave Harrar and go to Europe for surgical advice. He reached Marseilles, but the case was hopeless; the leg had to be amputated, and Rimbaud died there on Nov. 10, 1891.

The poems of Rimbaud all belong to his earliest youth. Their violent originality, the influence which they have exercised upon younger writers. the tumultuous existence of their author and the strange veil of mystery which still hangs over his character and adventures have given to Rimbaud a remarkable fascination. His life was written by Paterne Berrichon (1897), and reminiscences by his sister, Mlle. Isabella Rimbaud. His *Oeuvres* were collected in 1898 by Berrichon and E. Delahaye, and in 1901 his statue was unveiled at Charleville. (E. G.)

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RIME, a beautiful, white, friable, crystalline ice deposit formed by freezing of supercooled cloud- or fog-water droplets on objects exposed to the cloudy or foggy air. It occurs in two typical shapes: (1) growths of uniformly short, projecting, feathery branching crystal aggregates on all sides of a freely exposed object; and (2) asymmetrical growths of crystal aggregates in the form of long plumes or flags orientated into the direction held by the wind during the formation of the deposit. The latter type, which may reach a length of six feet, is common on exposed upper slopes of mountains in middle and high latitudes; the terms "frozen fog deposit" and "frost feathers" are often applied to the phenomenon in such places. The first type is less common and occurs chiefly in valleys from winter ground fogs with calm air. Under the microscope, rime appears to be a mosaic agglomeration of minute crystal accretions, almost amorphous, with spaces of entrapped air. Often wind-blown snowflakes become embedded in the deposit. giving it a greasy consistency when crushed between the fingers. When the temperature at formation is just below 32° F. the rime becomes a denser, smoother deposit which is hard and tenacious like ordinary ice. sometimes called rough frost, or hard rime. in contradistinction to the more usual types. or soft rime. Some hydrologists and glaciologists claimed that the larger part of the alimentation of the icecaps in such regions as Greenland, Norway, Iceland and Spitzbergen is provided by rime depositing on the surfaces of the mountain snowfields. Field measurements. however, cast some doubt on the general validity of this assumption. (R. G. SE.)

RIME ROYAL, the name given to a strophe or stanza form! which is of Italian extraction but is almost exclusively identified with English poetry from the 14th to the early 17th century. It appears to be formed out of the stanza called ottava rima (*q.v.*), by the omission of the fifth line, which reduces it to seven lines of three rhymes. arranged ababbcc. It was earliest employed with skill, if not invented, by Chaucer, who composed his long romantic poem of *Troilus and Cressida* in rime royal, of which the following is an example:

And as the new-abashid nightingale,
Thet stinteth first when she beginneth sing,
When that she heareth any herde tale,
Or in the hedges any wight stirring,
And, after, siker doth her voice out-ring,—
Right so Cresseyda. when her drede stint,
Opened her heart, and told all her intent.

In the 15th century this stanza was habitually used, in preference to heroic verse, by Thomas Occleve and John Lydgate, and, with more melody and grace. by the unknown writer of *The Flower and the Leaf.* In the 16th century it was regarded as the almost exclusive classical form for heroic poetry in England, and it had long been so accepted in Scotland, where *The King's Quair* of King James I. the Fables of Henryson and *The Thistle and the Rose* of Dunbar had closely followed the pattern of Chaucer. After the first decade of the 17th century rime royal went out of fashion. Since then it has been occasionally revived. but not in poems of great length or particular importance. Rime royal should always be written in iambic metre! and be formed of seven lines of equal length, each containing ten syllables.

RIMINI (anc. ARIMINUM), a town of Forli province. Italy, and the seat of a bishopric. lies on the Riviera del Sole of the northern Adriatic coast, a short distance from the foot of the Apennines where the steep Monte Titano is crowned by the republic of San Marino. Pop. (1957 est.) 81.663 (commune). Area of commune 152.49 sq.km. (59 sq.mi.).

The plan of the old Roman city is apparent in the area between the hlarecchia river, the Ausa torrent and the railway, where streets follow the ancient lines. The crumbling remains of 15th-century walls raised under the rule of the Malatesta family, when the town was extended, stretch along the left bank of the Marecchia. The town was divided into four quarters, known since the 18th century as Cittadella. Clodio. Pataso and Montecavallo. In the mid-19th century the suburbs of S. Giuliano, Mazzini and Marina grew up outside the walls and the first bathing stations on the coast were joined to the town by Principe Amedeo avenue. Since 1920 the town expanded farther south and the seaside suburbs of Marebello, Riva Azzurra and Miramare came into being,

and many fashionable houses and hotels were built. In spite of the destruction of 90% of its houses during World War II the town recovered, and its seaside resorts stretch for nearly 10 mi. from Torre Pedrera to Miramare. The centre of the town is the Piazza Giulio Cesare, the meeting point of ihe old Roman roads Via Flaminia and Via Aemilia; nearby are most of the monuments.

Monuments.— The oldest monument is the arch of Augustus. erected in 27 B.C. over the south gate of the city, but not finished until A.D. 22, by Tiberius; it was dedicated to Augustus. 'It has a single opening and a frieze added in the middle ages. The bridge built by Augustus over the Marecchia and also completed by Tiberius (A.D. 21) had a fifth arch added in 552. There are some remains of a Roman amphitheatre. Only ruins remain of the castle built by Sigismondo Pandolfo Malatesta (see History, below) in 1446. Rimini's most famous building is the Malatesta temple, designed to glorify Sigismondo's love for the beautiful Isotta degli Atti. Converted from the old Gothic church of S. Francesco, the temple was designed by Leon Battista Alberti, and the decoration of the interior was mostly the work of Agostino di Duccio, who enriched it with exquisite reliefs: figures of the liberal arts, the sybils. angels with fluttering veils, shields with the Malatesta arms. the planets and the moon, dancing children holding festoons of flowers and fruit; everywhere are repeated the intertwined initials S and I. The scheme for the temple, a monument of frankly pagan character, remained unfinished on Sigismondo's death.

Churches include S. Giovanni Evangelista (1247), with painted murals of the 13th-century Romagna school; S. Giuliano (16th century), built on the site of a Benedictine abbey. which preserves an altarpiece by Paolo Veronese; the little octagonal temple of S. Antonio on the Piazza Giulio Cesare; and the church of the Servi (14th century, rebuilt in the 16th). Other buildings include the restored Palazzo dell'Arengo (1202). The Piazza Cavour has a 15th-century fountain of Giovanni da Carrara. A bronze statue of Paolo V, begun by Niccolo Cordier and finished by Sebastiani di Recanati, was later transformed into S. Gaudenzio, patron saint of the town. The picture gallery contains Dutch arras of the 16th and 17th centuries and pictures by Giovanni Bellini, Ghirlandaio and Giuliano da Rimini. The Gambalunghiana civic library (1619), badly damaged in World War II, was afterward repaired, and preserves valuable incunabula and illuminated manuscripts.

Communications and **Commerce.**—Rimini is an important railway junction of the lines to Brindisi in the south, Venice and Trieste in the north and Bologna and Turin in the west, and is also a road centre. It has sea links with Ancona. Ravenna, Venice and Trieste, and an airport at Miramare. The district is rich in cereals and fruit and the town is equipped with processing factories and railway repair shops. The principal occupation. however, is the tourist industry. The gently sloping beaches backed by promenades and hotels are an attractive feature: and international shows. sporting events: concerts. etc., take place.

History.— The Roman city, called Ariminum from the old name of the Marecchia, Ariminus, stood on the boundary of Aemilia and Umbria. According to Strabo it belonged to the Umbro-Etruscan civilization. It was occupied in 268 B.C. by the Romans, and a Latin colony founded there. During the Second Punic War it was a base for military and naval operations. It became a Roman municipality and was later sacked by Sulla's troops. It witnessed the decisive step taken by Julius Caesar, when he crossed the Rubicon and marched on Rome.

In A.D. 359 the town was host to the Council of Rimini, which failed to resolve the Arian dispute. Rimini passed to the Byzantines and from them to the Goths, from whom it was recaptured by Narses, and then fell to the Lombards and Franks. It was for a long time governed for the pope by dukes and counts till the end of the 10th century when the imperial power became dominant. Transformed in the 13th century into an independent commune, it was the scene of struggles between the Guelphs and Ghibellines (*q.v.*). The leaders of the Guelphs were the Malatesta family who had established themselves at Verucchio and Rimini.

In 1239 Malatesta da Verucchio was made *podestà* ("mayor") of Rimini. The struggle with the Ghibellines had a respite when his son Malatesta II married Concordia Pandolfini, daughter of the Ghibelline leader. but her death broke the truce. Malatesta II's long life was filled with struggles and misfortunes, among them the tragedy when his son Gianciotto the Lame killed his own wife, Francesca da Polenta, daughter of the lord of Ravenna, and his brother Paolo the Fair, her secret lover. This episode was immortalized by Dante (*Inferno*, v, 73 ff.) and in Silvio Pellico's tragedy Francesca da *Rimini*. In 1334 the Council of Rimini recognized the family as lords of the town and for two centuries the town's history was united with that of this family.

Sigismondo Pandolfo Malatesta (1417–68), lord of Rimini, Fano and Senigallia, was the personage to whom Rimini principally owes its renown during the Renaissance. An unscrupulous tyrant but a valiant soldier who understood the science of fortification, he was a man of letters and a patron of the arts. Both his first wife, Ginevra d'Este. daughter of Lionello, duke of Ferrara, and his second, Polissena. daughter of Francesco Sforza, later duke of Milan, died. and Sigismondo was accused of having killed them in order to marry Isotta degli Atti.

The quarrels and rivalries of Sigismondo with other rulers and the papacy led to Pope Pius II's indictment of him in 1461. Sigismondo was compelled to submit and yielded most of his territory to the pope. keeping only Rimini and a few lands. After commanding an expedition for the I'enetians against the Turks in the Morea he returned to Rimini in the hope of recovering his dominions from the new pope, Paul II. Unsuccessful in this, he went to Rome with the intention of stabbing the pope; when Paul received him in the presence of his cardinals, Sigismondo lost courage and returned to Rimini where he died on Oct. 3, 1468, appointing his wife Isotta and their son Sallustio to succeed him.

Sigismondo's illegitimate son. Roberto, had assisted him in his struggle against Pius II, and on his father's death got rid of the legitimate heirs and made himself lord of Rimini. Reconciled with the pope, Roberto became commander in chief of the papal army. His son Sigismondo failed to defend his lands against Cesare Borgia.

Following the league of Cambrai in 1508, Rimini and its lands passed to the papal states. In 1815 it was occupied by Joachim Murat, king of Naples and brother-in-lax of Napoleon. whose "Rimini proclamation," promising the Italians a constitution, failed in its purpose when Murat was defeated by the Austrians at Tolentino. Rimini then returned to the papal states. The Rimini manifesto which accompanied the insurrection of Sept. 23, 1845, reflected the ideas of the moderate party and asked for political reforms in the modern sense. In 1860 Rimini was annexed to the kingdom of Italy. During World War II it suffered severe bombardment for it lay on the easiest route to the Po plains.

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(M. T. A. N.)

RIMMER, WILLIAM (1816–1879), U.S. sculptor and anatomist, was born in Liverpool. Eng., on Feb. 20, 1816, of obscure parentage, his father Thomas claiming to be Louis XVIII of France, the "lost dauphin" of the Revolution. His family emigrated to Nova Scotia, then to Boston, Mass.. where he was trained as a lithographer. He informed himself deeply in gross anatomy, as a basis for instruction in painting and sculpture. He practised medicine, lectured on anatomy and design and made notable figures. of which the best known is the "Hamilton" facing the public gardens in Boston. His plaster "Gladiator" (1861) was the most important American nude to its date; it was cast in bronze after his death by Daniel Chester French, one of his grateful pupils. His *Art Anatomy* (1887) is a work of ingenuity and great beauty of draftsmanship. Rimmer died on Aug. 20, 1879.

See Truman H. Bartlett, *The Art Life of William Rimmer* (1882); Lincoln Kirstein, *William Rimmer* (1814–1879) (1946); William Rimmer, *Elements of Design,* rev. ed. (1879).

(L. E. K.)

RIMSKY-KORSAKOV, NICOLAS ANDREIEVICH (1844–1908), Russian composer, was born at Tikhvin, Novgorod,

on March 18, 1844. He spent six years (1856–62) in the Naval college at St. Petersburg, and at the end of that time received a commission and spent three years afloat. But as a cadet he had been one of the musical amateurs who, with Borodin, Cui and Moussorgsky, gathered round Balakirev in St. Petersburg in the days when Wagner was still unknown. During his cruise he had written a symphony (in E minor) which in that year was performed — the first by a Russian composer — under Balakirev's direction, and in 1873 he definitely retired from the navy, having been appointed a professor in the St. Petersburg Conservatoire. The same year witnessed his marriage to a talented pianist, Nadejda Pourgold, and the production of his first opera, *Pskovitianka*. This was followed by *May Night* (1878), *The Snow Maiden* (1880), *Mlada* (1892), *Christmas Eve* (1894), *Sadko* (1895). *Mozart and Salieri* (1898), *The Tsar's Brzde* (1899), *Tsar Saltana* (1900), *Seruilia* (1902), *Kostchei the Immortal* (1902), *The Tale of the Invisible City of Kitezh* (1905), and *Le Coq d'Or* (1910). For all of these, with the exception of *Mozart and Salieri*, he chose Russian national subjects. But his operas attracted less attention abroad than his symphonic compositions, which show a mastery of orchestral effect combined with a fine utilization of Russian folk-melody. Notable among these works are his first symphony, his second (op. 9) *Antar*, his third (op. 32), and his orchestral suites including the well known *Scheherazade* and overtures. He also wrote a number of beautiful songs, pianoforte pieces, etc., and he eventually took Balakirev's place as the leading conductor in St. Petersburg, where he died on June 20, 1908.

The influence of Rimsky-Korsakov on the Russian composers of his day was very great. His instrumentation was fresh and original; he was direct and clear, with something of a painter's vision, and he brought a wealth of learning and study to bear on his subject. Many came directly under his influence as his pupils at the Conservatoire, while many more studied his great treatise of *The Foundations of Instrumentation*. He did much also to promote the better appreciation of Moussorgsky and others of his fellow Russians. although during recent years he has been severely criticized for his alleged tampering with Moussorgsky's original text in his edition of *Boris Godounov*.

See his own *History of My Musical Life* (which has been translated into English); Stassov, *Rimsky-Korsakov* (1890); Rosa Newmarch, *The Russian Opera* (1914) and Montagu Nathan, *History of Russian Music* (1915); G. E. Abraham, *Studies in Russian Music* (1936).

RINCEAU (from the French, meaning "foliage"), in architecture and the decorative arts, is a decorative form consisting of a continuous wavy stemlike motif from which smaller leafy stems or groups of leaves branch out at more or less regular intervals. Its use is frequent in the friezes of Roman buildings, in the jamb ornament and capitals of Romanesque structures and in friezes and panels of buildings in the various Renaissance styles.

RINDERPEST. A disease, primarily of cattle, which has been known also as steppe murrain, contagious bovine typhus. peste bovine and cattle plague, rinderpest was first recognized in early Christian times. The earliest records of the disease suggest that it originated in Asia or eastern Europe, its incursions into western Europe having followed the paths of invading armies in the periodic sweeps of barbarous tribes from the east. Rinderpest reached Africa in the latter half of the 19th century and, after spreading throughout that continent with disastrous effect, was eventually cleared from the southern half but remained endemic or enzootic in the northern parts, its southernmost extension being in Tanganyika territory. The disease is also endemic in India and certain parts of southeastern Asia. In all these areas rinderpest is considered a major obstacle to development of the livestock industry, and in unmechanized sections. particularly those in which the water buffalo is used as the principal beast of burden, agriculture in general is retarded.

Characteristics. — Rinderpest is an acute, highly contagious disease of ruminants characterized by an unusually rapid course and a high mortality in areas where the disease is not endemic. The causative agent is an ultravisible virus, provisionally named *Tortor bovis*.

When infection is introduced into a herd of susceptible animals, signs of illness appear after an incubation period of three to five days. Early signs are depression, loss of appetite and a staring coat. These are accompanied by a pyrexia generally of the order of 105° to 107° F. In the midcourse of the disease, ocular and nasal discharges and salivation with buccal ulceration and a disagreeable fetid odour are characteristic. Profuse diarrhea with progressive emaciation and dehydration occur, often with dysentery and eventually marked tenesmus.

In many cases, a cutaneous, eruptive condition termed streptothricosis develops on the back and flanks. In the terminal stages of fatal cases, prostration, coma and death supervene generally after 10 to 14 days.

Autopsy of such an animal shows involvement of the mucous membrane of the entire alimentary tract. This is usually most marked in the mouth, where ulcers containing cheesy deposits are often found, and in the abomasum, ileum, cecum, colon and rectum. where deep congestion and sometimes ulceration occur. In the lower bowel the congestion is often in well-defined, dark streaks and has been referred to as zebra marking. Pneumonia frequently is seen as a complication, and often cystitis and vaginitis are present. Diagnosis is made on the clinical appearance of the disease and autopsy findings, but, since these may be similar to those found in certain other diseases, virus transmission and cross-immunity tests are necessary for confirmation.

Spread of the Disease. — The virus is generalized in the animal body and is passed out in all the secretions. It gains access to the tissues of a susceptible animal via the mucous membranes, most probably those of the nostrils. In areas where the disease is endemic, wild animals play an important part in the epidemiology. Many species of wild ruminants, together with wild pigs and warthogs in such areas as Tanganyika and Uganda, have been found to be susceptible to rinderpest. These animals, in competition with domestic animals for limited grazing and water, present great difficulties in the way of control. It is seen, therefore, that control of the disease is complicated by the maintenance of the virus in wild animals which form vast reservoirs of infection. Eradication in areas where wild animals exist in large numbers is dependent on the control of the disease in these animals or the elimination of their contact with the domestic animal populations.

Control. — Control of rinderpest has been attempted by several methods. Strict quarantine measures alone can be effective, provided the control of susceptible wild animals can be assured. However, it was early recognized that some form of immunization combined with quarantine was the most promising method of control, and efforts were made to find effective immunogens. As recovery from an attack of the disease leaves a durable immunity, early workers experimented with serum of recovered animals. Later, the bile of infected animals was tried. The former produced only a transient or passive immunity, while the latter caused a manifestation of the disease, often mild, which left an active immunity. The "serum simultaneous" method, which comprised the simultaneous inoculation of virulent virus and sufficient immune or hyperimmune serum to modify the reaction, proved the most satisfactory of the early methods of artificial immunization used. The use of this method, however, has some serious disadvantages, the major one being that an animal reacting to this treatment is virtually suffering from rinderpest and is a possible source of infection to other susceptible animals, and so the use of this method may set up new focuses of infection. Later work gave rise to the production of vaccines made from virulent tissues, principally spleens, in which the virus is inactivated by means of some chemical agent. These so-called inactivated vaccines produce a solid immunity which, however, lasts only for a matter of months; nevertheless, they were of great value in the control of rinderpest. Although still used in some regions under special circumstances at mid-20th century, they had been superseded by the use of living rinderpest virus which had been attenuated by repeated passage in a species other than the bovine. The first step in this direction was taken with the adaptation of bovine virus to goats, followed by the widespread use of the so-called caprinized virus in India and east Africa. Other workers, by adaptation of the virus to the

rabbit and to the developing chick embryo, opened the way to the possible use of new vaccines. (J.A. BR.; J. K. H. W.)

RINEHART, MARY ROBERTS (1876–1958), U.S. novelist and playwright best known for her mystery stories beginning with *The Man* in *Lower Ten* (serialized 1907) and *The Circular Staircase* (1908). her first book. Born in 1876 in Pittsburgh. Pa., she received nurse's training there and in 1896 married Stanley M. Rinehart, a physician. In 1903 the family found itself in financial difficulties as a result of a stock market crash, and Mrs. Rinehart turned to writing; her work proved to be a great popular success almost from the beginning. A long series of comic tales about the robust, redoubtable "Tish" (Miss Letitia Carberry) appeared in the *Saturday Evening Post* through many years. Of her plays (most of them written in collaboration with Avery Hopwood), the most successful was *The Bat* (1920). derived with significant changes from *The Circular Staircase.* She produced as well, always with a keen responsibility to her craft, a number of romances and several books of travel, some of the latter reflecting her experience as a correspondent during World War I. She died in New York city on Sept. 22, 1958.

Mrs. Rinehart established what has been called the "had-I-hut-known" sort of mystery, and her tales make it plain that she was mistress of a form in which few other writers excelled.

(J. S. SA.)

RING, a band of circular shape, made of any material and for various purposes. but, particularly, a circular band of gold. silver or other precious or decorative material used as an ornament, not only for the finger. but also for the ear, or even for the nose, as worn by certain races in India and Africa.

Egyptian Rings.—The earliest existing rings are those found in the tombs of ancient Egypt. The finest examples date from about the 18th to the 20th dynasty; they are of pure gold. simple in design, very heavy and massive, and have usually the name and titles of the owner deeply sunk in hieroglyphic characters on an oblong gold bezel. Rings worn in Egypt by the poorer classes were made of less costly materials. such as silver! bronze, glass or pottery covered with a siliceous glaze and coloured brilliant blue or green with various copper oxides. Some of these had hieroglyphic inscriptions impressed while the clay was moist. Other examples have been found made of ivory, amber and hard stones. such as carnelian. Another form of ring used in the 12th and subsequent dynasties of Egypt had a scarab in place of the bezel, and was mounted on a gold hoop which passed through the hole in the scarab and allowed it to revolve.

Cylinders.— In ancient Babylonia and Assyria the signet took the form of a cone seal or of a cylinder cut in crystal or other hard stone and perforated from end to end. A cord was passed through the cylinder. and it was worn on the wrist like a bracelet.

Within the limits necessarily imposed by its purpose the finger ring assumed a considerable variety of form, according to its date and place of origin.

In the Cretan and Mycenaean periods a characteristic form of ring had a broad flat bezel, not organically connected with the hoop, and having an incised design in the gold. The use of inset stones hardly occurs. but rings from Enkomi and Aegina of the late Mycenaean period have inset paste decorations.

The Phoenician type of ring was primarily intended to carry a scarab or scarabaeoid. usually in a box setting on a swivel, called for by the fact that the flat base of the scarab would be wanted for sealing purposes, but in wear would be most conveniently turned inward. Strength being necessary, the hoop became massive. A similar arrangement of the signet-scarab is found attached to a tmisted ring, which, from its shape. must have been meant to be suspended, and which is shown thus worn on some of the Cypriote terra cottas.

The Greek ring of an early period has a characteristic flattened bezel, for an intaglio design in the gold. An alternative form was a snivel ring for a scarab or scarabaeoid.

Etruscan Rings.—The Etruscans used very largely the gold swivel ring mounted with a scarab, a form of signet probably introduced from Egypt. Some found in Etruscan tombs have real Egyptian scarabs with legible hieroglyphs; others, probably the work of Phoenician or native engravers, have rude copies of hieroglyphs. either quite or partially illegible. A third and more numerous class of Etruscan signet rings have scarabs. cut usually in sard or carnelian. One from Etruria. now in the British museum, is formed by two minutely modeled lions whose bodies form the hoop. while their paws hold the bezel, a scarab engraved with a lion of heraldic. character. An alternative type of Etruscan ring has an incised design on the gold bezel: or a flat stone set in the rigid bezel.

Roman Rings.—The Romans appear to have imitated the simplicity of Lacedaemonia. Throughout the republic none but iron rings were worn by the bulk of the citizens. and even these were forbidden to slaves. Ambassadors were the first who were privileged to wear gold rings, and then only while performing some public duty. Next senators. consuls, equites and all the chief officers of state received the *ius annuli aurei.* In the Augustan age many valuable collections of antique rings were made. and were frequently offered as gifts in the temples of Rome. One of the largest and most valuable of the *dnctyliotkecae* was dedicated in the temple of Apollo Paiatinus by Augustus' nephew Marcellus (Pliny, *H.N.* xxxvii, 5).

Different laws as to the wearing of rings existed during the empire: Tiberius made a large property qualification necessary for the wearing of gold rings in the case of those who were not of free descent; Severus conceded the right to all Roman soldiers; and later still, all free citizens possessed the *ius annuli aurei,* silver rings being worn by freedmen and iron by slaves. Under Justinian even these restrictions passed away.

Early Christian Rings.—Most early Christian rings date from the 4th century onward. Generally of bronze or gold they are often engraved with acclamations and invocations and occasionally with the owner's bust or with Christian symbols.

Celtic Rings.—Large numbers of gold rings have been found in many parts of Europe in the tombs of early Celtic races. They are usually of pure gold, often penannular in form; that is, with a slight break in the hoop so as to form a spring. They are often of gold wire formed into a sort of rope, or else a simple bar twisted in an ornamental way. Some of the quite plain penannular rings were used in the place of coined money.

Throughout the middle ages the signet ring was a thing of great importance in religious. legal, commercial and private matters.

Episcopal Rings.—The episcopal ring was solemnly conferred upon the newly made bishop together with his crozier, a special formula for this being inserted in the Pontifical. In the earliest references to rings worn by bishops, there is nothing to distinguish them irom other signet rings. In A.D. 610 the first mention has been found of the episcopal ring as a well-understood symbol of dignity. It is clear that it was derived from the signet. It was only in the 12th century and onward that it was brought into mystical connection with the marriage ring. In the time of Innocent III (1194) the ring was ordered to be of pure gold mounted with a stone that was not engraved; but this rule appears not to have been strictly kept. It was the custom upon the death of a bishop for his ring to be handed over to the royal treasurer, but many rings with all the appearance oi consecration rings have been discovered in the coffins of bishops. Among the collection of rings formed by the naturalist Edmund Waterton, and now in the South Kensington museum, is a fine gold episcopal ring decorated with niello, and inscribed with the name of Alhstan, bishop of Sherborne irom 824 to 867. In many cases an antique gem was mounted in the bishop's ring, and oiten an inscription was added in the gold setting of the gem to give a Christian name to the pagan figure. The monks of Durham, for example, made an intaglio oi Jupiter Serapis into a portrait of St. Oswald by adding the legend CAPVT S. OSWALDI. In other cases the engraved gem appears to have been merely regarded as an ornament without meaning—as, for example, a magnificent gold ring iound in the coffin of Seffrid, bishop of Chichester (1125–1151), in which is mounted a Gnostic intaglio.

Papal Rings.—The papal "Ring of the Fisherman" (*annulus piscatoris*) bears the device of St. Peter in a boat, drawing a net from the water. The first mention of it, as the well-understood personal signet ring oi the pope, that has been iound occurs in a letter of Clemeni IV in 1265. After the middle of the 15th century it was no longer used as the private seal oi the popes, but mas always attached to briefs. After the death of a pope the ring is broken. A new ring with the space for the name left blank is taken into the conclave, and placed on the finger of the newly elected pontiff, who thereupon declares what narne he mill assume, and gives back the ring to be engraved. (See Waterton, *Archaeologia,* 40, p. 138.)

The so-called papal rings, of which many exist dating from the 15th to the 17th century, are very large thumb rings, usually of gilt bronze

coarsely worked, and set with a foiled piece of glass or crystal On the hoop is usually engraved the name and arms of the reigning pope, the bezel being without a device. They are sometimes described as rings of investiture and according to another hypothesis they were carried as credentials by envoys. Such cumbrous ornaments could not have been worn by the popes and cardinals themselves.

Other Varieties.— The giving of a ring to mark a betrothal was an old Roman custom. The ring was probably a mere pledge, *pignus,* that the contract would be fulfilled. In Pliny's time conservative custom still required a plain ring of iron, hut the gold ring was introduced in the course of the 2nd century. This use of the ring, which was thus of purely secular origin, received ecclesiastical sanction, and formulas of benediction of the ring exist from the 11th century. The exact stages by which the wedding ring developed from the betrothal ring can no longer be traced Gold marriage rings enriched with niello date from the 5th century though they may not have been used in the actual ceremony of marriage.

Posy rings, so called from the "poesy" or rhyme engraved on them, were specially common in the same centuries. The name "posy ring" does not occur earlier than the 16th century. A posy ring inscribed with "Love me and leave me not" is mentioned by William Shakespeare *(Mer.* of ***Ven.,*** act v, sc. 1). The custom of inscribing rings with mottoes or words of good omen dates from a very early time. Greek and Roman rings exist with words such as ZHCAIC, XAIPE, KAAH, or *votis meis Claudia vivas.* In the middle ages many rings mere inscribed with words of cabalistic power, such as *anam zapta,* or Caspar, Melchior and Balthasar, the supposed names of the Magi

In the 17th century memorial rings with a name and date of death were frequently made of very elaborate form, enamelled in black and white; a not unusual design was two skeletons bent along the hoop, and holding a coffin which formed the bezel

Cramp rings were much worn during the middle ages as a preservative against cramp They derived their virtue from being blessed by the king; a special iorm of service was used ior this, and a large number of rings were consecrated at one time, usually when the sovereign touched patients ior the king's evil.

Decade rings were not uncommon, especially in the 15th century; these were so called from their having ten knobs along the hoop oi the ring, and were used, after the manner of rosaries, to say nine Aves and a Pater Noster.

In the 15th and 16th centuries signet rings engraved with a badge or trademark were much used by merchants and others; these were not only used to form seals, but the ring itself was oiten sent by a trusty bearer as the proof of the genuineness of a bill oi demand At the same time private gentlemen used massive rings wholly of gold with their initials cut on the bezel, and a graceful knot of flowers twining round the letters. Other fine gold rings of this period have coats of arms or crests with graceful lambrequins.

Poison rings with a hollow bezel were used in classical times; as, for example, that by which Hannibal killed himself, and the poison ring of Demosthenes. Pliny records that. after Crassus had stolen the gold treasure from under the throne of Capitoline Jupiter, the guardian of the shrine, to escape torture, "broke the gem of his ring in his mouth and died immediately" The mediaeval *anello della morte,* supposed to be a Venetian invention, was actually used as an easy method of murder. Among the elaborate ornaments of the bezel a hollow point made to work with a spring was concealed; it communicated with a receptacle for poison in a cavity behind, in such a way that the murderer could- give the fatal scratch while shaking hands with his enemy. This device was probably suggested by the poison fang of a snake. *(See* also GEM; JEWELLERY; SEALS.)

(J. H. MI.; A. H. SM.; X.)

In Mathematics.— In mathematics the term "ring" is used for an important type of algebraic system. By a ring R is meant a set of elements in which two compositions, called addition (+) and multiplication (.), are defined in such a way that the following conditions obtain:

A 1	$a+b$ is in the set R.
A 2	$(a+b)+c=a+(b+c)$.
A 3	$a+b=b+a$.
A 4	There is an element O in R such that $a+O=a$ for all a in R.
A 5	For each a in R there is an element $-a$, called the negative of a, such that $a+(-a)=O$.
M 1	ab is in R.
M 2	$(ab)c=a(bc)$.
D 1	$a(b+c)=ab+ac$.
D 2	$(b+c)a=ba+ca$.

The conditions A 1 to A 5 imply that R is a commutative group *(see* GROUPS) relative to the addition operation. Conditions M 1 and M 2 imply that R is a system of the type called a semigroup relative to multiplication, and D 1 and D 2 are the distributive laws connecting the two operations of addition and multiplication.

The concept oi a ring is used in advance developments in algebra and details of such work may be found in the treatises listed in the bibliography. (N. J.)

RINGWORM OF THE SCALP (TINEA CAPITIS) is a highly contagious fungus disease of the scalp of children It is caused by a group of fungi which form small spores after invading the hair, hence the name *Microsporum.* The most common species, *Microsporum audouini,* causes the development of circular and rapidly spreading areas in which all the hairs break off close to the surface. The disease never causes serious harm but it is unpleasant because of its unsightliness and because the cure is difficult. Its public health significance is considerable because major epidemics may arise at any time to involve vast numbers of children. A spectacular feature of this infection is that with the onset of adolescence it disappears. The cause for this peculiar immunity in adults is the pubertal development of the oil glands of the scalp. These glands secrete fatty acids which have a powerful killing action on *Microsporum audouini.*

The scalp infection spreads in schools, orphanages, children's camps or wherever there are concentrations of children. Also contamination of barber shop instruments or the backs of public seats (on trains, in theatres, etc.) is a possible factor. In England and France, epidemics have been common for centuries. After World War I. the disease invaded central Europe. In the United States it never reached epidemic proportions before World War II, but after 1943 many large cities had major epidemics.

Other species of *Microsporum* are transferred to man from cats and dogs and cause similar ringworm diseases. The animal types of scalp ringworm usually run shorter courses than the epidemic type. There are many more types of ringworm of the scalp which are rare and difficult to treat. See also FAVUS; SKIN DISEASES.

(RD. B. S.)

RIOBAMBA, a city in highland Ecuador, capital of the province of Chimborazo. Pop. (1950) 29,830. It is located at an elevation of about 9,000 ft. in the basin of Riobamba, just south of Mt. Chimborazo, and about 100 mi. S. of Quito. It is reached by railroad or by the Inter-American highway from both Quito and Guayaquil. Domestic airlines serve its airport. The railroad and highway pass a short distance to the west of the city, and connection is by branch line and an all-weather road. A weekly fair held in the central plaza attracts Indian farmers from the surrounding countryside. Small-scale manufacturing industries produce cotton and woolen textiles, carpets, shoes, beer, liquor, butter and cheese. The first constitution of Ecuador was proclaimed there in 1830. **(P. E. J.)**

RIO BRANCO, one of four federal territories in Brazil. Formerly a part of the state of Amazonas, it was created by decree law in 1943. Area 89,058 sq.mi. Pop. (1950) 18,116. Located in the northernmost part of Brazil, it is bounded on the northeast by British Guiana, on the south by Amazonas, and on the northwest and north by Venezuela. It is drained from north to south by the Rio Branco, a tributary of the Rio Negro. Much of the territory is covered with rain forest or selva, but around Boa Vista, pop. (1950) 5,132, the chief city and capital, there are extensive woodland savannas which extend across the border into British Guiana (the Rupununi savanna). Along the Venezuelan border there are high tablelands, covered partly with forest, partly uith savanna. At the border of Rio Branco, British Guiana and Venezuela is the plateaulike Mt. Roraima. Rio Branco is scantily inhabited, especially along its borders. The savannas are used for cattle ranching, and some gold and diamonds are found in the streams. (P. E. J.)

RÍO CUARTO, a town of Argentina in the province of Córdoba, 140 mi. S. of the city of that name, and about 385 mi. N.W. of Buenos Aires. Pop. (1956 est.) 59,900. It stands 1,440 ft. above sea level and about halfway across the great Argentine pampas, on the banks of a river of the same name. The town is built on the open plain and is surrounded with attractive suburbs. It is the commercial centre of a big district and has a large and lucrative trade. Its geographical position gives it great strategic importance, and the government maintains there a large arsenal and a garrison of the regular army. Before 1872 this region was overrun by the Ranqueles, a warlike tribe of Indians. The surrounding country belongs to the partially arid pampas region and is devoted to stock-raising agriculture. Irrigation is employed in its immediate vicinity. There are some manufacturing industries in the town, although it is primarily an agricultural centre. The

San Martin and the Mitre railways pass through Rio Cuarto, giving railway communication with Buenos Aires, Rosario, Tucumin, Córdoba, San Luis, Mendoza and other cities.

The revolution which overthrew President Perón in 1955 began with an uprising at the Rio Cuarto military air base. (GE. P.)

RIO DE JANEIRO, one of Brazil's maritime states, is bounded by the Atlantic ocean and the states of Espirito Santo, Minas Gerais and São Paulo. Brazil's former federal district containing the city of Rio de Janeiro and fronting on the Guanabara bay forms a small enclave near the middle of the state. Area 16,443 sq.mi., pop. (1950) 2,297,194.

Historically it is closely associated with the city Rio de Janeiro. Its territory was selected by the Portuguese for some of their first settlements, and on parts of its coast the French waged their early struggles for the control of Brazil's resources. When Brazil was divided into captaincies in 1642, Rio de Janeiro was one of the original ten. The city of Rio de Janeiro was the seat of the captaincy's government and centre of its social and economic life throughout the colonial period. After independence was declared the *município* or county containing the national capital was separated from the state and made into a federal district.

The territory of the state may be divided roughly into four regions, namely: a low, narrow and irregular coastal plain; the Baixada Fluminense, a large basin surrounding Guanabara bay; the rugged chain of mountains, Serra do Mar, which traverses the state longitudinally; and the large valley through which the Paraiba river flows northeastward to the Atlantic. In the northeastern part of the state this river cuts through the mountain chain and its valley then broadens out into a rich alluvial plain on which for centuries sugar plantations were the basis for the wealth of some of Brazil's most opulent families. The climate is tropical or subtropical depending on altitude.

Agriculture long was the mainstay of the state's economy, but since World War II industrialization has proceeded rapidly. The chief crops are coffee, oranges, bananas, sugar cane, rice and corn, but many other fruits and truck crops are grown. The cattle population numbers more than 2,000,000; and the salt refineries and fisheries are among the most important in Brazil. Since 1945 the industrial belt surrounding the city of Rio de Janeiro and the iron and steel centre at Volta Redonda in the upper Paraiba valley developed tremendously. Pig iron, steel, steel products, textiles, cement and food products are the principal industrial products. Rio de Janeiro is a leading state in hydroelectric power production.

The major cities are: Niterói (*q.v.*), the state capital, on Guanabara bay opposite the city of Rio de Janeiro; Campos; Petrópolis (*qq.v.*), the nation's summer capital; Duque de Caxias, Nova Iguaçu, São João de Meriti and Nilópolis, all suburbs of Rio de Janeiro.

The state is served by road and rail networks which radiate from the great port of Rio de Janeiro. Most of the 1,663 mi. of railroads in service belong to two systems, the Central do Brasil whose main lines connect the city of Rio de Janeiro with São Paulo and with Belo Horizonte, and the Leopoldina railway which links Rio de Janeiro and Niterói with places to the north and east.

(T. L. SH.)

RIO DE JANEIRO (in full, SAO SEBASTIÃO DO RIO DE JANEIRO, colloquially shortened to RIO), a city and port of Brazil, capital of the republic until 1960, when Brasilia (*q.v.*) became the capital, on the western side of Rio de Janeiro, or Guanabara bay. The city occupies about 60 sq.mi. in the southeast angle of Guanabara state, formerly the Federal District, which was until 1960 an independent commune with an area of 524 sq.mi., detached from the province of Rio de Janeiro in 1834. The city stands in great part on an alluvial plain formed by the filling in of the western shore of the bay, which extends inland from the shore line in a northwesterly direction between a detached group of mountains on the south known as the Serra da Carioca, and the imposing wooded heights of the Serra do Mar on the north. The spurs of the Carioca range project into this plain, in some places close up to the margin of the bay, forming picturesque valleys within the limits of the city. Some of the residential quarters follow these valleys up into the mountains and extend up their slopes and over the lower spurs, which, with the hills covered with buildings rising in the midst of the city, give the city a distinctive charm. At the entrance to the bay is Sugar Loaf mountain (Pão de Açúcar), a conical rock rising 1,296 ft. above the water level and forming the terminal point of a short range between the city and the Atlantic coast. The culminating point of that part of the Carioca range which projects into and partly divides the city is the Corcovado (Hunchback), a sharp rocky peak, 2,310 ft. above the Botafogo inlet, on whose narrow summit towers the imposing statue 98½ ft. high of Christ the Redeemer, the construction of which was completed in 1931. The Corcovado, approachable either by road or inclined railway, provides a point of vantage from which the entire capital, the bay and its surrounding districts may be viewed. Considerably beyond the limits of the city on its southwest side is the huge isolated flat-topped rock known as the Gávea, 2,736 ft. high, which received its name from its resemblance to the square sail used on certain Portuguese craft. The sky line of this range of mountains, as seen by the approaching traveler several miles outside the entrance to the bay, forms the rough outline of a reclining figure called "the sleeping giant."

The entrance to the bay, between the Sugar Loaf on the west and the Pico do Papagaio (Parrot's Beak) on the east, with the fortress of Santa Cruz on one side and the fort of São João on the other, is about a mile wide. Although the entrance is free from obstructions, dangerous swells are produced by a deeply submerged bar whenever storms come out of the south or southwest. Almost midway in the channel is the little island and fort of Laje, temporary site of the first Huguenot settlement in Rio de Janeiro. On the west is the semicircular bay of Botafogo, round which are grouped the residences of one of the wealthiest suburbs; on the east, the almost landlocked bay of Jurujuba. (See NITERÓI.)

The bay extends northward about 16 mi, from the entrance channel, opening to a maximum width of about 15 mi. near its head. The irregular shore line was modified by the construction of sea walls and the filling in of shallow bays. Close to the shore are the islands of Villegaignon (occupied by the national naval academy), Cobras (occupied by fortifications, naval storehouses, hospital and dry docks), Santa Bárbara and Enxadas.

The oldest part of the city, which includes the commercial section, lies between Castle and Santo Antônio hills on the south, and São Bento, Conceição and Livramento hills on the north, and extends inland to the Praqa da República, though the defensive works in colonial times followed a line much nearer the bay. This section was extended southward along the bay shore during the 19th century and led to the development of a string of suburbs such as Catete and Botafogo, with that of Laranjeiras behind Catete in a pretty valley of the same name, Leme, Copacabana, Ipanema and Gavea, the last including Rio's famous botanical garden, nhich dates from the early 19th century. The major trend of later development was northward and westward, where are to be found the suburbs of Cidade Nova, São Cristóvão, Engenho Novo, Praia Formosa, Pedregulho, Vila Isabel, Tijuca, Rio Comprido, Cajú and others, some of which are residential, while others are essentially industrial. The outlying, poorer suburbs are reached by the Central do Brasil railway; those closer in are served by street railways and buses. The population of the former Federal District, according to the census of 1950, was 2,377,451; and of the city 2,303,063. Rio's citizens are known locally as cariocas.

Climate.—The climate of Rio de Janeiro is warm and humid, the average temperature for the year being about 74° F., with July, the coolest month, having an average temperature of 68.7". The rainfall averages about 44 in. annually, with July and August being the least rainy months. Formerly the low-lying and poorly drained areas which are marginal to the bay, plus the lack of adequate sanitary facilities, created a serious health problem in Rio de Janeiro, which was, however, in no way connected with the climate. Yellow iever, the first recorded appearance of which was in Dec. 1849, was for many years almost a regular occurrence, and the mortality from it was exceedingly high. This and other dangerous diseases disappeared as epidemics as a result of improved sanitary conditions following the notable work begun by

Oswaldo Cruz, under whose direction Rio de Janeiro was made one of the most healthful of tropical cities.

Streets and Parks.—Some of the most modern streets were laid out with Spanish-American regularity, but much the greater part seems to have sprung into existence without any plan. Most of the streets of the old city are parallel and cross at right angles, but they are narrow and enclose blocks of unequal size. Each suburb is laid out independently, with straight streets where the ground permits, and crooked ones where the shore line or mountain contour compels. From the beginning of the 20th century, large sums were expended on new avenues, the widening and straightening of old streets and the improvement of the water front between the Passeio Público and the southern extremity of the Praia de Botafogo by the construction of a grand boulevard. partly on reclaimed land. One of these improvements consists of a central avenue (Avenida Rio Branco) cut across the old city from a point on the water front near the Passeio Pitblico northward to the Saitde water front. More than a mile long from north to south. it is lined with brazilwood trees, mosaic sidewalks and has fine private and public buildings. The military, naval and jockey clubs are situated there, and also the offices of some of the principal ne spapers, besides fashionable shops, cafés and business places. The shore line boulevard, called the Avenida Beira Mar, is more than four miles long, the wider parts being filled in with gardens. Toward the south, outside the Guanabara bay, the shore along the beaches of Leme, Copacabana and Ipanema was built into one of the most fashionable resorts of the continent.

The Mangue canal, originally designed as an entrance to a central market for the boats plying the bay, is used for drainage purposes. The canal is nearly two miles long, enclosed with stone walls, crossed by a number of iron bridges and bordered by lines of royal palms. The most famous street of the old city is the Rua do Ouvidor. running westward from the market place to the church of São Francisco de Paula, and lined with retail shops, cafés and newspaper offices. It has long been a favourite promenade, and fills an important part in the social and political life of the city. The principal business section includes a number of short and narrow streets between the Rua Primeiro de Março, once called Rua Direita, which extends from the Praqa 15 de Novembro northward to São Bento hill and the Avenida Rio Branco. The widest boulevard in the city is the Avenida Presidente Vargas, which begins at the Candeliria church and, crossing the Avenida Rio Branco at right angles, extends toward the west for more than two miles. The streets and suburbs are served by lines of the Rio de Janeiro Tramway, Light and Power Co., Ltd., which also supplies electric power to the city from hydroelectric plants.

The public parks and gardens are numerous and include the Parque Azurem Furtado, the largest park in the central district; the botanical garden with its avenue of royal palms; the Passeio Publico (dating from 1783), a small garden on the water front facing the harbour entrance; the Praça Tiradentes with its magnificent equestrian statue of Dom Pedro I; the Praça 15 de Novembro on the water front, facing the old city palace; the Quinta da Boa Vista in São Cristóvão; and many smaller parks and squares.

Water Supply.—The water supply is derived from three sources: the small streams flowing down the mountainsides which serve small localities; the old Carioca aqueduct, dating from colonial times; and the modern Rio do Ouro waterworks, which bring in an abundant supply from the Serra do Tinguá, 30 mi. N.W. of the city. An extensive system of sewers was constructed and a separate system of rain-water drains.

Buildings.—There remain many public edifices and dwellings of the colonial period, severely plain in appearance, with heavy stone walls and tile roofs. The old city palace facing upon Praça 15 de Novembro, once the residence of the fugitive Portuguese sovereign Dom João VI, is a good example. The 19th century brought no important modifications until near its close, when French and Italian styles began to appear, both in exterior decoration and in architectural design. The Praqa do Comércio (merchants' exchange) and post office on Rua 1° de Março and the national printing office near the Largo da Carioca are notable examples. After that time architectural styles changed radically, and apartments, hotels, office buildings and public buildings of the most advanced modern design and construction were built. At the southern end of the Avenida Rio Branco is a group of elegant state edifices, the Municipal theatre, the Monroe palace and the National library and Academy of Fine Arts. The buildings of the ministries of finance, education and war are also among the most beautiful in the city. There are more than 200 churches in the city, including the cathedral which was built in 1761. The most noteworthy church is that of Our Lady of Candelária, in the commercial district, with twin towers and graceful dome.

Hospitals and *Asylums*.—Rio de Janeiro has a number of hospitals, asylums and benevolent institutions. Chief of these is the Misericórdia hospital, popularly known as the "Santa Casa," belonging to a religious brotherhood dating from 1591. Other public hospitals are a lepers' hospital in São Cristóvão, the military and naval hospitals, the São Sebastião hospital and the isolation and contagious diseases hospitals in Jurujuba. The government participated in a program of remodeling and improving existing institutions and of building such new ones as the Jesus, Miguel Couto and Getulio Vargas hospitals. There are also a number of private hospitals maintained by church brotherhoods and charitable associations; among them are the Portuguese hospital in Rua de Santo Amaro and the Strangers' hospital in Botafogo. Most prominent among the asylums is the Hospicio Nacional for the insane, which was erected in 1842–52.

Education.—Rio de Janeiro was always an important educational centre. A Jesuit school (*colégio*) transferred there in 1567 was a foremost institution of pre-university training for almost two centuries. The 19th century saw the creation of a "model" secondary school, the Colégio Dom Pedro II (1837), as well as military (1838), naval (1858) and engineering (1874) schools. The military school became famous as a stronghold for the positivist ideology which influenced the republican coup *d'état* of 1889. In 1920, Brazil's adoption of the university system was marked by the creation of the University of Brazil in Rio de Janeiro. An educational reform program inaugurated in the Federal District in 1928 made the city the focus for a renovation of pedagogical ideas and techniques which affected the whole country. As part of this reform, a presidential decree of 1931 created faculties of education, sciences and letters. At the same time, such pre-existing institutions as the schools of law, medicine, pharmacy, dentistry. mines and fine arts, the Polytechnic school, the National museum, the Geological and Mineralogical institute, the Oswaldo Cruz institute (medical research), the Astronomical observatory, the Institute of Chemistry, the Botanical garden, the Institute of Legal Medicine, the Central Meteorological institute and other centres of higher learning were made integral parts of the university. Considerable progress was made in the field of teacher training. which was climaxed in Rio de Janeiro by the creation in 1935 of the University of the Federal District—comprising the teachers' college, schools of letters, sciences, economics and law and an institute of arts. In 1939 this institution was merged with the University of Rio de Janeiro, as the University of Brazil had been temporarily renamed two years earlier. A Catholic university was founded in the city in 1940. In addition to its two universities, Rio de Janeiro has many other institutes of learning, including preparatory schools, vocational schools and schools for the deaf and blind.

Harbour, Communications and Commerce.—The port and harbour of Rio de Janeiro are the largest in the republic. The entrance is open to vessels of the largest draught, and there is sufficient deepwater anchorage inside for the navies of the world. The lower anchorage, where the health officers visit vessels, is below Ilha Fiscal, and the upper or commercial anchorage is in the broad part of the bay above Ilha das Cobras, the national coasting vessels occupying the shallower waters near the Saude and Gamboa districts. The customhouse occupies a considerable part of the shore line before the old city.

The newer port works consists of an improved water front for the Saúde. Gamboa and Saco do Alferes districts, in which the shipping interests are centred, and a continuation of the sea wall across the shallow São Cristóvão bay to the Ponta do Cajú, the

large reclaimed area being filled in by the removal of some small hills. The commercial quays are built in deep water and permit mooring alongside the largest vessels. The total length of the commercial quays is about 7,500 yd. Railway and streetcar connections are provided, and both electric and hydraulic power are available Special surtaxes are levied on imports to meet the Interest and redemption charges on the loans raised for the execution of these important works.

Railway communication with the interior is maintained by the Central do Brasil and the Leopoldina lines, besides which there is a short passenger line to Corcovado mountain about two and one half miles long, an electric line to Tijuca and a narrow-gauge line to the Rio do Ouro waterworks. There is communication with Petrópolis hy a branch line of the Leopoldina system, and also by a steamer to the head of the bay and thence by rail up the *serra*.

Rin de Janeiro is the seaport for a large area of the richest, most productive and most thickly settled parts of Brazil, including the states of Rio de Janeiro and Minas Grrais and a small part of eastern São Paulo. Its exports include coffee, sugar, hides, cabinet woods, tobacco and cigars, tapioca, gold, diamonds, iron ore. manganese and sundry small products.

The city is also a distributing centre in the coasting trade, and many imported products, including jerked beef (*xarque*), hay, flour and nines appear among the coastwise exports, as nell as domestic manufactures. The total exports for 1957 amounted to 838 286 metric tons; imports in the same year totaled 4,231,618 metric tons Formerly Rio de Janeiro led all other ports in Brazil in the export of coffee, but the enormous increase in production in the state of São Paulo later gave Santos the lead

Air travel is of increasing importance for the city's communication with other coastal cities and with the vast hinterland of Brazil, as well as with the rest of the world Rio de Janeiro is served by tno airports, Santos Dumont and Galeão.

Manufactures. — Inspite of Rio's leading role as a commercial port. the city is not equally important as an industrial or manufacturing centre. Manufactures consist largely of consumers' goods for the domestic market. and include such items as flour (from imported nheat), biscuits, macaroni, chocolate, fruit conserves, refined sugar, confectioneries and other foodstuffs. beer, liquors, ice mineral waters, cigars and cigarettes; soap, candles, perfumes, furniture, boots and shoes. hats, clothing, rape matches ink printing type, glass chemicals and tires. In addition there are plants which manufacture finished products from processed imports especially drugs and sundries. There are machine and repair shops, notably the shops of the Central do Brasil railway. One of the most important industrial enterprises in the city is that nf the Rio de Janeiro Tramway Light and Power Co. whose generating plants are located about 50 mi from the city In the late 1950s there were more than 4,000 industrial establishments employing nearly 200,000 persons. Promotion of trade in the city is largely a function of the chamber of commerce of Rio de Janeiro and the Federation of Brazilian Chambers of Commerce.

Government--Until it became the state of Guanabara in 1960, the Federal District. including Rio de Janeiro, was governed by a prefect representing the national government. and a municipal council, representing the people. The prefect was appointed by the president of the republic for a term of four years, subject to confirmation by the senate. There were seven *diretorias*, oi boards, under the prefect, each one assigned to a special field of work. chief among them being education, public health and social welfare public works and transportation. finance. police, archives and statistics. forestry, and game and fishing The municipal council of *intendentes* was elected by direct suffrage for a term of two years and was composed of 50 members meeting in ordinary session twice a year. In April 1960, a national law ordered the election, the following October. of a governor for the new state of Guanabara and a legislative assembly that would meet during its first four months as a constituent body.

Mistory. — It has been said that the Bay of Rio de Janeiro was discovered by André Gonçalves and Amerigo Vespucci on Jan. 1. 1502 and that Gonçalves named it "River of January." More probably it was discovered in 1504 by Gonçalo Coelho. The name "Rio de Janeiro" appeared on maps only in about 1515. Another Portuguese navigator. Martim Afonso de Sousa, visited the bay in 1531, but passed on south to São Vicente, where he established a colony. The first settlement in the bay was made by an expedition of French Huguenots under the command of Nicolas Durand de Villegaignon, who established his colony on the smail island that bears his name. The French called their colony La France Antarctique, and the island stronghold Fort Coligny. In 1560 the fort was captured and destroyed by a Portuguese expedition from Bahia under Gov. Mem de Sá, and in 1565 another expedition under Estácio de Sá, cousin of the governor, founded a Portuguese settlement in another part of the bay which was called São Sebastião do Rio de Janeiro. in honour of King Sebastian of Portugal. Two years later the French were decisively defeated by Mem de Sá, nho moved the settlement to the hill later known as the Morro do Castelo. He laid out streets and a plaza, and encouraged construction of the first houses The following governor built a sugar mill on the island that is still called the Ilha do Governador. Twice during the next hundred years Brazil mas divided for short periods into two governorships, with Rio serving as capital of the southern jurisdiction. In 1710–11 the French made two expeditions against Rio and finally withdrew after exacting a heavy ransom.

The discovery of gold in Minas Gerais at the end of the 17th century greatly increased the importance of Rio de Janeiro. During the governorship of Gomes Freire de Andrade (1733–63) the Carioca aqueduct, the governor's palace, the convent of St Teresa and other architectural landmarks were built; fortifications were strengthened; urbanism and public health received attention; intellectual life was encouraged; and Brazil's first printing press mas established. In 1763 Rio succredcd Bahia as the capital.

In 1808 the fugitive Portuguese court, under the regent Dom João VI, took refuge in Rio de Janeiro and gave a new impulse to its growth. It was thrown open to foreign commerce. foreign mercantile houses were permitted to settle there, printing was permanently established, industrial restrictions were removed and a college of medicine, a military academy and a public library were founded. Dom João VI returned to Portugal in 1821. and on Sept 7, 1822, Brazil was declared independent mith Dom Pedro I as its first emperor and Rio de Janeiro as its capital. In 1834 Rio became an autonomous municipality and was declared capital of the empire. In 1839 a steamship service along the coast was opened. but direct communication with Europe was delayed until 1850 and with the United States until 1865. These services added largely to the prosperity of the port The first section of the Dom Pedro II railway was opened in 1858, and the second or mountain section in 1864, which brought the city into closer relations with the interior. In 1874 cable communication with Europe was opened, which was soon afterward extended southward to the river Plate republics.

During the five years following the declaration of the republic in 1889 life in Rio de Janeiro was interrupted by political disorders,, particularly by a six-month blockade of the port and desultory bombardment. Under the presidency of Francisco de Paula Rodrigues Alves (1902–06), honever, the problems arising from the city's narrow, congested streets and deplorable health conditions were attacked in a co-ordinated effort led by Lauro Muller (federal minister of industry). Pereira Passos (city prefect) and the physician Dr. Oswaldo Cruz. The avenues. parks and port facilities for which Rio is famed were planned, while the diseases of yellow fever. bubonic plague and smallpox were eiiminated or greatly reduced. Until 1930 Rio was the scene of a number of political outbreaks, notably the short-lived revolt of the army officers of Fort Copacabana in 1922, but none was of great importance. Under the first regime of President Getulio Vargas (1930–45) and thereafter the rapid expansion of the government bureaucracy and the congestion and overbuilding of Rio de Janeiro gave impetus to plans. dating from even before the republican period, for moving the national capital to an inland site that would enjoy a cooler climate and be a stimulant for opening up Brazil's unexploited hinterland. President Juscelino Kubitschek (1956–61) resolved to effect the transfer during his

administration and ssnctioned a law for the construction of the new capital, Brasilia, 600 mi. N.W. of Rio. The official change of capitals took place on April 21. 1960. See also Index references under "Rio de Janeiro" in the Index volume. (R. M. M)

RÍO DE ORO, the name commonly used for all of Spanish Sahara on the northwest coast of Africa, though strictly applicable only to the southern two thirds of the territory between Capes Bojador and Blanco (Blanc). Its length is about 425 mi. and it extends inland about 150 mi from Cape Bojador in the north and about 250 mi. along its southern boundary North of Cape Bojador are the other parts of Spanish Sahara the so-called Free Zone of Occupation or Sekia el Hamara (Sp. Saguia del Hamra) extending from Cape Bojador to Cape Juby, The two districts are surrounded by Mauretania, Algeria and Morocco. Sekia el Hamara and Rio de Oro proper are administered together as the province of Spanish Sahara. The seat of the governor is at Villa Cisneros, on the peninsula of Río de Oro; in 1950 the town had a population of 1,096. including 312 Europeans. The peninsula projects about 23 mi. into the sea and is 1½ to 2 mi. broad. Rio de Oro bay, between it and the mainland, is about 5 mi, broad and affords a good anchorage.

The territory of Río de Oro proper has an area of 71,042 sqmi., and its population in 1950 nas 1,304 settled inhabitant, Most of Río de Oro is desert and there is hardly any agriculture. Camels, goats, sheep and zebus are reared; their meat and milk afford sustenance and there is some exportation of their skins. Villa Cisneros is connected with the rest of Spanish Sahara and the outside world by air, and there are tracks north to Cape Juby, and south to Tichlá and La Guera (on Cape Blanco), as well as several caravan routes. A shipping service links Villa Cisneros with La Guera, Tantan and the Canaries. The total population of the Spanish Sahara province (area 102,702 sq.mi) is 7.749 (1950).

Río de Oro takes its name from the bay enclosed by the promontory on which Villa Cisneros stands. It was discovered by the Portuguese in the mid-15th century, mistaken for a rive: and ndmed Rio de Ouro (Port "river of gold"; Sp Río de Oro) on account of gold dust obtained from the natives. The Spaniards had already begun the colonization of the Canary Islands and in 1476 established the fort of Santa Cruz de Mar Pequeña on the mainland in the northern part of the territory: it was abandoned in 1524, and the territory remained independent until the 19th century. In 1878 a British trading port was established by Donald Mackenzie on Cape Juby, but it was surrendered to the ruler of Morocco in 1895. Meanwhile French travelers had visited Sekia el Hamara: the Spaniard Benitez and others explored the coast in 1882, and Bonelli signed treaties with the natives on behalf of the Sociedad Española de Africanistas. In 1884 a Spanish protectorate was declared over the coastal zone from Cape Bojador to Cape Blanco and nominally subordinated to the captain-general of the Canaries. A factory was established at Villa Cisneros in 1885, but abandoned in the face of native attacks. Spanish claims were challenged by the French, who claimed a protectorate over the Sahara. and a Franco-Spanish convention of June 27. 1900, established the landward frontier of Rio de Oro proper, awarding the salt deposits of Vjil to the French. Other agreements betneen the two powers resulted in French recognition of Spanish rule between Capes Bojador and Juby (1906 and 1912), and between Cape Juby and the Wad Draa. By the convention of 1912 Spain bound itself not to alienate its rights in these zones. It was only in 1916 that Colonel Bens took effective possession of Cape Juby. In 1920 La Gdera was founded as an outpost facing Port Étienne. Other centres of Spanish influence are Tichli and Bir Gandus.

See Foreign Office, London, *Spanish Sahara* (1920); A Flores Morales, *El Sahara español (1945): E,* and F. Hernandez-Pechero *et al., El Sahara español* (1949). (H. V. L.)

RIO GRANDE (Rio GRANDE DO SUL), a port in the state of Rio Grande do Sul, Brazil. It is located on the western side of the Rio Grande, the name also given to the wide outlet to the Atlantic of the Lagôa dos Patos. The city is built on a low peninsula, barely 5 ft. above sea level, and about 8 mi. upstream from the mouth of the river. Pop. (1950) 63,235.

The peninsula on which Rio Grande has been built is a part of a long sand bar extending from north of Pôrto Alegre southwestward into eastern Uruguay. Cut off from the ocean by the bar are several shallow lagoons, the largest of uhich are Lagôa dos Patos and Lagôa Mirim. For hundreds of miles on either side ot Rio Grande the ocean is bordered by a smooth, sandy beach. backed by strings of live sand dunes, in many nays similar to the coast of southern Georgia The outlet of the lakes in back of the bar is located at the southern end of Lagôa dos Patos. Where the river enters the ocean it passes over a submerged bar which once limited passage to ships of 26 ft. draft or less. The bar was dredged and the channel is kept open so that ocean-going vessels of larger size can dock at Rio Grande or Pelotas, 20 mi. N N W.

Rio Grande was founded in 1737 by José da Silva Paes, who built a fort on the river near the site of the present city and called it Estreito. In 1745 the garrison and settlement were removed by Gornes Freire d'Andrade to its present site, which became a *vila* in 1751, with the name of São Pedro do Rio Grande and a *cidade* (city) in 1807 It was the capital of the captaincy until 1763, when it was occupied by a Spanish force from Buenos Aires under the command of Don Pedro Zeballos. The seat of government was then removed to Viamão at the northern end of the Lagôa dos Patos. The city was occupied by the national forces in the ten years' war of secession. nhich began in 1835, and in 1894 it was unsuccessfully besieged by a small insurgent force that attempted to overthrow the government at Rio de Janeiro.

Rio Grande competes with Pelotas as the outlet for the products of Rio Grande do Sul. As the outport for Pôrto Alegre, with nhich it is connected by shallow-draft lake boats. Rio Grande has an advantage; but for the products of the south, Pelotas is better situated. The exports, mostly to other parts of Brazil, include jerked beef (*xarque*), hides, lard, tallow, wool, rice, wheat and fish. In the city are factories processing meat products, nsh and vegetable canneries, a woolen textile mill, breweries, cigarette manufactures and a shoe factory. The city is linked with Pelotas by rail. A rail line also extends 12 mi. south to a bathing beach and casino. (P. E J.)

RIO GRANDE, the fifth longest North American river, has its sources in the snow fields and alpine meadows of the San Juan mountains of southwestern Colorado. It flows southeast and south 175 mi in Colorado, southerly some 470 mi across New Mexico, and southeasterly between Texas and the Mexican states of Chihuahua, Coahuila, Nuevo Leon and Tamaulipas, for about 1,240 mi. to the Gulf of Mexico. The total length (in compromise "river miles") is approximately 1,885 mi.

It starts as a clear Rocky mountain stream, fed by springs at an elevation of more than 12.000 ft., then flows in a canyon through forests of spruce, fir and aspen, into the broad San Luis valley in Colorado. after which it cuts the Rio Grande gorge and White Rock canyon and enters the open terrain of the basin and range and Mexican highland physiographic provinces. There declining elevation, decreasing latitude and increasing aridity and temperature produce a transition from a cold steppe climate with a vegetation of piñon, juniper and sagebrush, to a hot steppe and desert climate characterized by a vegetation of mesquite, creosote bush. cactus, yucca and other desert plants. Shortly before entering the Gulf coastal plain, the Rio Grande cuts three canyons between 1,500 and 1,700 ft. in depth across the faulted area occupied by the "big bend" where the Texas side of the river is included in the Big Bend National park. In the remainder of its course the river wanders sluggishly across the coastal plain to end in a true delta in the Gulf of Mexico.

The principal tributaries are the Pecos and Devils rivers from the left bank in the United States. and from the right bank the Chama and Puerco in the United States and the Conchos, Salado and San Juan in Mexico. The productive basin contains about 182,000 sq.mi., of uhich about 89,300 are in the United States—half of these being in New Mexico. The peak of flow may occur in any month from April to Oct., but in the upper reaches it usually is in May or June due to melting snow and occasional summer thunderstorms. while the lower portion commonly has highest water in June or Sept. due to summer rain storms. It has been estimated that the Rio Grande has an average annual yield or

more than 9,000,000 ac.ft. of which about one third reached the gulf before the building of the Falcón dam in 1953.

Irrigation has been practised in the Rio Grande basin since prehistoric times, as among the Pueblo Indians of New Mexico. Increase in population and in use of water made necessary the 1905–07 and 1944–45 water treaties between the United States and Mexico, as well as the Rio Grande compact (1939) among Colorado, New Mexico and Texas concerning the waters of the upper Rio Grande sub-basin (above Ft. Quitman, Tex.), and the Pecos river compact between New Mexico and Texas (1948) concerning the Pecos above Girvin, Tex. Essentially all of the average annual production of more than 3,000 000 ac.ft. in the upper Rio Grande (including the 60,000 ac ft allotted to Mexico by treaty) is consumed within this sub-basin. Not only below Ft. Quitman, but in many stretches of the river from the New Mexico-Colorado border to below Brownsville there has been no surface flow at various times. In some places the depth has varied from nearly 60 ft. to a bare trickle or nothing. The lower Rio Grande (below Ft. Quitman) is renewed by the Conchos and other Mexican rivers which produce about two-thirds of the available water. A number of large springs in the area between Hot Springs and Del Rio, Tex., including many in the bed of the river, are important and dependable producers of water. The total storage capacity of the reservoirs in the basin is about 13,000,000 ac ft., with a normal storage of less than 5,000,000 ac.ft., chiefly in the International Falcón reservoir on the lower Rio Grande. Lago Toronto (La Boquilla) on the Conchos. Elephant Butte on the Rio Grande in New Mexico, Marte Gómez (El Azhcar) reservoir on the San Juan and Venustiano Carranza (Don Martin) on the Salado. About 3.000 000 ac. are irrigated within the basin (about two-thirds of these are in the U.S.). The leading crops raised by irrigation vary from potatoes and alfalfa in Colorado to cotton, citrus fruits and vegetables in the valley of the deltaic lower Rio Grande in Texas and Tamaulipas.

After agriculture and animal husbandry, the leading industries are mining (petroleum, natural gas, coal, silver, lead. gold, potash, gypsum, etc.), and recreation (national and state parks and monuments, dude ranches, fishing and hunting, summer and winter resorts, etc.). More than 3,000,000 people live in the basin principally in urban communities. the largest of which are Monterrey, Mex.; Ciudad Jubrez, Mex.; El Paso, Tex.; Albuquerque, N M.; Chihuahua, Mex.; Saltillo, Mex.; Matamoros, Mex.; Nuevo Laredo, Mex ; Laredo, Tex.; and Reynosa. Mex.

During the Spanish period the middle and upper portions commonly were termed the Rio del Norte or Rio Grande del Norte and the loner course usually was called the Rio Bravo (apparently because of the turbulent flash floods). The river is officially the Rio Grande in the United States and the Rio Bravo in Mexico. The earliest European settlements were in the Conchos basin of Chihuahua in the 16th century, but many of the Pueblo Indian settlements of New Mexico date back to before the Spanish conquest. Small steamboats were used for navigation on the lower Rio Grande up to Rio Grande City, and even to Roma when the river was high, from the 1850s until the great hurricane of 1874 swept the river clean. Since then accelerated erosion, silting and sand-bar formation have precluded navigation, and have forced the U.S and Mexico to spend much money and time in adjusting the boundary to the numerous changes in the river channel. There has been considerable development of hydroelectricity within the basin.

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(D. D. B.)

RIO GRANDE DO NORTE, a state in the northeast'of Brazil, bounded by the Atlantic ocean on the north and the east, by the state of Paraiba on the south, and by Cearb on the west. Area 20,490 sq.mi., pop. (1950) 967,921. The state capital is Natal (*q.v.*); the only other town of importance is Mossoró.

Except for the coastal strip from Natal southward, which receives adequate rainfall to support a forest, the state is semiarid. It was originally covered with a deciduous, thorny, scrub woodland (caatinga). The northern coast, beyond Cape São Roque, is low and sandy, but the land rises inland to some low mesas (taboleiros). Inland from Natal, along the southern border of the state, is the northern edge of the Borborema, a hilly upland with rounded slopes and steep margins. The Apodi, the Piranhas and the Potengi rivers rise in the Borborema and flow northward across the state.

The first settlement was near Natal in 1599. The Dutch held this region for 25 years in the 17th century. Because of semiarid conditions the land was useful mostly for the grazing of cattle and goats, but from Natal southward some sugar cane mas, and still is grown. Carnauba wax is produced in the western part of the state and cotton is grown in the south. The Borborema is known to contain a number of slightly exploited rare minerals —including beryl, diatomite, columbite and tantalite.

(P. E. J.)

RIO GRANDE DO SUL, the southernmost state of Brazil, is bounded on the north by Santa Catarina state, on the east by the Atlantic ocean, on the south by Uruguay, and on the west by Argentina. The Uruguay river (*q.v.*) forms the boundary on the west. Area 109,066 sq.mi., including inland waters; pop. (1950) 4,164,821.

Physical Geography. — In the north, the state occupies the southern part of the Paranb plateau. This highland which extends from southern São Paulo state to the middle part of Rio Grande do Sul and which crosses the border into Argentina and Paraguay, is made up of a succession of outpourings of dark-coloured basaltic lava now solidified into sheets of rock known as diabase. The surface of the plateau stands between 2.000 and 3,000 ft. above sea level. Along the streams it was dissected into a rolling hilly country, but because of the resistance of the diabase its margins are everywhere marked by steep cliffs or *cuestas*. In Rio Grande do Sul the diabase cliffs cap the southern extremity of the Great Escarpment (the eastern edge of the Brazilian highland) along the Atlantic coast almost as far south as Pdrto Alegre. Just north of this city, however, the diabase cliffs turn westward and form a sharply marked descent facing to the south along the northern side of the Jacui valley. The southern half of Rio Grande do Sul is much lower. The Jacui river drains a lowland along the base of the plateau. floning into the northern end of the Lagda dos Patos near Pôrto Alegre. South of the Jacui there are gently rolling hills, standing only some 1,000 to 1,500 ft. above sea level and extending across the border into Cruguay. West of Livramento the land forms are tabular rather than rounded, for here the diabase continues southward into western Uruguay, but at a much lower elevation than on the Paraná plateau to the north. The Uruguay river cuts through the diabase, its course frequently interrupted by rapids. All along the immediate Atlantic coast there are long sand bars and lagoons, the largest of which are Lagda dos Patos and Lagda Mirim.

Climate.—Rio Grande do Sul is far enough south to experience mild winters, but sometimes with freezing temperatures. At this time of the year cold air masses from the south pass by at frequent intervals, bringing heavy rains along their fronts. Occasionally colder minters bring snow to the higher elevations. In summer, the winds from the northeast prevail and there is less rain. Hot weather prevails, especially inland from the open ocean. Although the whole state has abundant rainfall, the prevailing vegetation cover is that of a tall-grass prairie. Forests occur only along the steep slopes of the Great Escarpment, along the south-facing margin of the Paraná plateau and along the deeper valleys that are cut into the plateau.

The Economy. — There are four chief agricultural regions in Rio Grande do Sul. The first is the oldest—the zone of large cattle and sheep ranches which lies south of the Jacui river and extends almost unbroken to the borders of Uruguay and Argentina. This is the domain of the Gauchos, the herdsmen whose cattle and sheep feed on the unimproved pastures. The beef produced is lean and tough, the kind chiefly required for the manufacture of *xarque* or jerked beef (sometimes called *carne* seca) which is eaten by the poorer Brazilians; it is also the beef most desired by the people of Italy who import it directly from this region. The

second region from south to north is the flood plain of the Jacui river, and of its northern tributary, the Taquari. It supports a dense population of Brazilians of Portuguese descent. The main product is rice. The properties are large, and each owner provides his own irrigation and drainage. The river floods in winter, but there is usually enough moisture left to support the rice crop during the following summer. The better estates are equipped with pumps to raise water from the river during the summer. The Jacui valley produces something like 25% of the Brazilian rice crop, a crop that is consumed partly in PBrto Alegre, but chiefly in the large cities of Rio de Janeiro and São Paulo. The third agricultural region is the zone of the German colonies, located on the terraces above the Jacui valley and on the lower slopes of the Paraná plateau. Maize, rye and wheat are raised here, and maize is fed to hogs. Around Santa Cruz is one of Brazil's chief tobacco-growing areas. The fourth region is higher up on the plateau—the Italian colonies with their vineyards. Each of the four regions is strikingly different not only in agriculture, but also in rural landscape, kinds of roads and buildings, and in traditions of the people.

On the plateau top large tracts of land are still used for pasture, but since 1940 there has been a considerable increase of wheat farming. In the forests of the Uruguay valley there is pine to be cut for timber, and also the leaves of the Yerba Maté which are collected and roasted to prepare the beverage known as maté. or Paraguay tea, widely used through south Brazil and the neighbouring countries.

Coal of an inferior quality is mined at São Jerônimo, just south of the Jacui river a short distance upstream from Pôrto Alegre to which it is shipped by river barge. The coal contains so much sulfur and other impurities that special grates must be used to burn it. In PBrto Alegre, however. the cost of bringing in better coal is so great that the local product is used to manufacture gas and to generate electricity.

The principal industries of the state are concentrated at Pôrto Alegre (*q v.*), the state capital, and the outports Rio Grande and Pelotas (*qq.v.*). Bagé, Santa Maria, Uruguaiana (*qq.v.*) and Livramento are important towns of the interior.

History.— The Rio Grande area, the so-called "Mission" country, was a zone of conflict between the Portuguese and Spanish. The open grasslands were entered both by Portuguese coming from São Paulo and by Spaniards from Buenos Aires, but neither group established settlements excepting for forts at key positions around the edge. Seven Jesuit missions were established, along the Uruguay river between 1632 and 1707 and the scanty Indian population was gathered together around these places. In 1737 the Portuguese established a fort near the present site of Rio Grande, and in 1738 a large extent of territory which included the present states of Santa Catarina and Rio Grande do Sul, and a part of Uruguay was named the captaincy of El Rei, to be administered from Rio Grande. But the Spaniards resented the proximity of Portuguese settlements to what they considered their domain and from 1763 to 1776 they occupied Rio Grande. The Portuguese moved their administration centre to the northern end of Lagôa dos Patos, first to Viamão, then to Porto dos Cazães which aas renamed PBrto Alegre.

When Brazil declared its independence in 1822, its territory extended southward to the shores of the Rio de la Plata. But the Argentines promptly invaded and were in process of pushing the Portuguese back, when, in 1828, Great Britain succeeded in getting the marring countries to agree to the existence of an independent Uruguay. The boundary between Rio Grande do Sul and both Uruguay and Argentina was then fixed. In 1865 a Paraguayan army captured Uruguaiana and held it for a month or so. To this day the Brazilian army spends much of its time training to protect this southern frontier.

In 1822 Emperor Dom Pedro I realized that if this southern territory was to be secured for Brazil colonies should be established there. In 1824 a small group of German peasants and craftsmen was settled at São Leopoldo (*q.v.*), just to the north of PBrto Alegre. By the time of independence all the open grasslands were divided into large private properties for use as cattle and mule ranches. The Portuguese were never attracted by forested country; it was German pioneers who occupied the forests. Between 1824 and 1859 more than 20,000 Germans were settled on small farms along the lower slopes of the plateau to the west of São Leopoldo. They planted rye and potatoes, and grew maize to feed to hogs—an agricultural procedure unknown to the Portuguese. The farm products were sent to PBrto Alegre by boat on the Jacui river. Between 1870 and 1890 a large group of Italian pioneers came to Rio Grande do Sul, and these settled above the German settlements. along the upper slopes of the plateau, especially around the town of Caxias. The Italians introduced vineyards and made wine.

The present progressive economy of the state is due in part to the contribution of these colonists.

Rio Grande do Sul, because of its position on the edge of the Brazilian nation, has often tried to secede. In 1835 a war of secession broke out which lasted for ten years. Rio Grande do Sul was kept a part of Brazil less by military force than by gifts from the federal treasury. Under Dom Pedro II, who ruled Brazil until 1889, even the more remote states were made to feel contented. But in 1892, during the presidency of Floriano Peixoto too much interference with the state government led again to insurrection in the south. The revolutionaries carried the war northward even as far as Curitiba, but were forced to surrender in 1894 because of the lack of munitions. In 1930, the revolt led by Getúlio Vargas against the domination of São Paulo started in Rio Grande do Sul. (P. E. J.)

RIOJA, LA: *see* LA RIOJA.

RIOM, a town of central France, capital of an *arrondissement* in the *département* of Puy-de-Dôme, 8 mi. N. by E. of Clermont-Ferrand by rail. Pop. (1954) 10,571. Riom (*Ricomagus* or *Ricomum* of the Romans) was, along with Auvergne, seized for the crown by Philip Augustus, and was the capital of this province under the dukes of Berry and Bourbon.

Riom stands on the left bank of the Ambène, on a height above the fertile plain of Limagne. The houses, some of the 15th and 16th centuries, being built of black lava, have a sombre appearance.

The church of St. Amable, restored, of Romanesque and early Gothic architecture, dates from the 12th century. The church of Notre-Dame du Marthuret (15th century) has a well-known statue of the Virgin at its western entrance. The Sainte-Chapelle of the 14th and 15th centuries is a relic of the palace of Jean de Berry, duke of Auvergne. The rest of the site of the palace is occupied by the law courts. The 16th-century belfry and a mansion of the same period known as the Maison des Consuls are notable. Riom is the seat of a subprefect and tribunal of commerce.

RÍO NEGRO, a province of Argentina lying within the windswept region generally referred to as Patagonia (*q.v.*). It was created a territory of the republic in 1884 dnd was raised to the status of a province in 1955. It stretches from the Atlantic coast to the Chilean frontier in the Andes. Pop. (1956 est.) 185,304. Area 78.383 sq.mi.

The land between the Colorado and Negro rivers is similar in formation and characteristic to the "dry pampas"; but a great dam was built on the Negro river near Neuquén, making possible the irrigation of a large district and the growing of alfalfa (lucerne) for cattle fodder and the planting of extensive fruit orchards, particularly pears and apples, which have earned fame for the province, The other important occupation is sheep breeding.

South of the Negro river most of the country consists of a series of arid tablelands, but there are several chains of lakes in the forested valleys of the Andes that are held to rival Sniss scenery. The principal lake is Nahuel Huapi, which lies partly in the province of Neuquén (*q.v.*).

The Atlantic coast line has one deep indentation, the Gulf of San Matías, in the northern bend of which is the little port of San Antonio Oeste. The provincial capital is Viedma on the right bank of the Negro river about 20 mi. from its mouth and opposite Carmen de Patagones, a port of the province of Buenos Aires.

There are numerous small settlements along the Negro river valley and on the railway that runs inland from San Antonio Oeste, but the only other town of importance is San Carlos de Bariloche. a holiday resort consisting of hotels and wooden chalets picturesquely situated among trees on the shore of Lake Nahuel Huapi. Bariloche is one of the two terminals of the railway from San Antonio. It can also be reached by road from Buenos Aires (1,200 mi.) and by air. (GE P.)

RÍO NEGRO, a riverside department, established 1880, in west Uruguay. Area 3,655 sqmi, pop. (1954 est.) 57 403 Its rich pastures are used to fatten livestock from northern Uruguay and from Argentine areas across the Uruguay river. The only industrial town is the departmental capital. Fray Bentos (*q.v*), an important meat packing and canning centre. Wheat is the principal farm crop, but sunflower seeds. flax, corn, fruits and vegetables are also grown. (M. I. V.)

RÍO PIEDRAS, a former city, mhich has been incorporated into the sprawling metropolis of San Juan (q *v.*), the capital of Puerto Rico. Pop (1950) 143,989. Rio Piedras is the home of the University of Puerto Rico and its very active commercial life is directed to the servicing of 14,000 university students It is connected with San Juan by modern throughways. and from Rio Piedras highways branch out to the coastal cities of the east and the interior towns of Caguas and-Humacao. (T G Ms.)

RÍO SAN JUAN, a department in southeastern Nicaragua, adjoining Costa Rica Pop (1959 est.) 11,925; area 2 801 sq mi San Carlos, pop. (1959 est.) 1.816, departmental capital and largest town, is at the junction of Lake Sicaragua and Rio San Juan Although San Juan del Norte (*q.v.*) is no longer an ocean port. small steamers use Rio San Juan between Lake Sicaragua and the Caribbean. The people of the department are concentrated mostly between the central highlands and Lake Nicaragua, where they are engaged chiefly in raising livestock and groning corn, rice, beans, cassava, other vegetables and tropical fruits (C. F. J.)

RIOT, in general terms, is a temporary violent outbreak of civil disorder, falling short of an attempt to overthrow the government, and thereby distinguished from insurrection or rebellion. As a legal concept, riot has a more limited meaning, it is a criminal offense against public order involving a group, however small, and the use of violence. honever slight. In some countries, the gravamen of the offense is the breach of peace occasioned by it. That is notably the case in the criminal law of England and of the United States. In other countries, such as those under the continental codes. the offense requires interference with or resistance to public authority.

At common law, there are three offenses which. in ascending order of seriousness, denounce group breaches of the peace. unlawful assembly, rout and riot. An assembly of persons is unlawful if the participants share a common illegal purpose. regardless of whether steps are taken to effect that purpose. Rout is a kind of way station between unlawful assembly and riot: it consists of an unlawful assembly which has taken some step. short of actual violence, to put its illegal purpose into operation.

Rout becomes riot when violence is used. Riot has been judicially stated to consist of the folloning elements: (1) the presence of three or more persons; (2) a common unlawful purpose; (3) the execution or inception of the common purpose; (4) an intent to help one another by force if necessary against any person nho may oppose them in the execution of their unlawful purpose; (5) force or violence not merely used in demolishing. but displayed in such a manner as to alarm at least one person of reasonable firmness and courage.

A person is guilty of riot if he shares the common unlawful purpose of the assembly and has the requisite intent to use force if necessary, regardless of uhether he himself has used force once actual force has been used or threatened by others. The concept is obviously a broad one. capable of embracing a wide range of group conduct from a bloody clash betneen picketers and strikebreakers to the antics of a street-corner gang.

At common law, riot nas an indictable misdemeanour, punishable by fine and imprisonment. In England the Riot act of 1714 made it a felony under certain circumstances of aggravation. The act was passed in response to the widespread rioting which attended the accession to the throne in that year of the first Hanoverian king, George I. Under its provisions, as subsequently modified. whenever an unlawful assembly of twelve or more persons (as contrasted with the three or more required for the common-law misdemeanour) fail to disperse within an hour after a magistrate has read or tried to read a proclamation. couched in language prescribed by the statute, directing them to disperse, those present cease to be merely misdemeanants and become guilty of a felony, punishable by life imprisonment. The procedure of reading the proclamation came to be known. inaccurately but inevitably, as "reading the riot act," a phrase nhich has enriched the language in situations far removed from its original meaning. An oddity of the law is that the proclamation must be read verbatim in the prescribed language; otherwise the prosecution fails. A conviction was quashed on this ground in 1830 because the proclamation omitted the concluding words "God save the King."

In spite of the severe penalties prescribed by the Riot act, there are several well-known instances of riots in England subsequent to 1714, including the Gordon anti-Catholic riots of 1780, the Bristol riots of 1831 and the Chartist riots of 1839.

Other provisions of English criminal law impose punishment for various harms to property committed in the course of a riotous assembly and prescribe various rights and duties arising out of the occurrence of a riot. For instance, the law imposes on magistrates the duty of assembling subjects of the realm, whether civil or military, for the purpose of quelling the riot. It is the magistrate's duty to keep the peace; if the peace is broken, honesty of intention will not avail him if he has been guilty of neglect of duty. A somewhat unsettled question is the extent of the protection afforded at common law and by the Riot act to persons acting under orders for the suppression of riots. Although, as just stated. the law of England requires everyone to aid the magistrates in the suppression of riotous assemblages, the degree of force which may be used in effecting that end depends on the nature of the riot. The use of deadly force can only be justified nhere lesser measures are inadequate to prevent the commission of violent felonies. These rather vague rules apply to soldiers and civilians alike. A matter of some importance is the availability of a civil remedy for persons whose property has been damaged by riot. Under the Riot Damage act of 1886. compensation is payable out of the taxes levied for police maintenance in the district where the riot occurred. Thus a form of public liability for riot damage is provided.

In the United States, lans relating to riot have in general followed the common-law view. at least to the extent of focusing upon the disturbance of the peace rather than the resistance to public authority as the gravamen of the offense The major difference between English and U.S. law is that the typical U.S. provision on this subject imposes comparatively mild penalties.

The old common-law distinctions among unlawful assembly, rout and riot are preserved in the laws of some states. Others have created a consolidated offense. Aggravated penalties are commonly provided for failing to disperse after having been called upon by a public authority to do so; but the formal requirements of the English Riot act are not often imposed. Inciting to riot is in some states made a separately punishable offense. Some states have adopted the English view that reparation should be made out of public funds to persons whose property has been damaged or destroyed in a riot.

Canadian law is based on the common-law concepts but departs from them in several important respects. An assembly of three or more persons is unlawful not if it has an unlawful purpose but if it causes persons in the vicinity to fear that the assembly will disturb the peace tumultuously or cause others to do so. A riot is an unlawful assembly which has begun to disturb the peace tumultuously. There is no statutory offense of rout. Provision is made for reading a proclamation directing the rioters to disperse and severe penalties are provided for interfering with its reading or failing to obey its injunction to disperse.

All legal systems make some provision for dealing with con-

duct analogous to that covered by the Anglo-American law of riot but the formal definitions vary, as the following examples will illustrate.

Under German law. there are two separately defined offenses which are analogous to the Anglo-American concept of riot. Riot itself (*Aufruhr*) is an offense against public authority. It consists of taking part in a public riotous gathering in the course of which an official engaged in the exercise of his duties is resisted or assaulted, or in the course of which an official is subjected to force or threats to compel the commission or omission of an official act. The penalty is aggravated if the accused actually performed one of the enumerated overt acts or was a ringleader (*Rädelsführer*). Breach of the public peace (*Landfriedensbruch*) consists of several persons publicly banding together and committing jointly act of violence against persons or property. Aggravated penalties are provided. as in the case of *Aufruhr,* for ringleaders and those who have committed overt acts. In general, the penalties for *Aufruhr* are more severe than those for *Landfriedensbruch.*

French law does not separately define riot but treats it as a special case of resistance to public authority under the general heading of *rebellion,* the punishment for which varies in seriousness depending upon the number of persons involved and whether or not they are armed. The breach of peace aspect of the offense. which is centra! to the Anglo-American concept of riot, is not treated as a group offense in French law. (H. L. PR.)

RIOT AND CIVIL COMMOTION INSURANCE. These policies cover all that is provided for by explosion insurance and in addition protect against losses due to riot. insurrection, civil commotion and strike. The rates are comparatively low, but in the case of strike, for example, they are substantially increased if the policy is taken out after the strike has been declared.

RÍOTINTO (MINAS DE RÍOTINTO), a mining town of southwestern Spain, in the province of Huelva; near the source of the Tinto river, and at the terminus of a light railway from the port of Huelva. Pop. (1950) mun.. 7,323.

Ríotinto is one of the greatest copper-mining centres of the world. Its modern importance dates from 1872. when a syndicate of London and Bremen capitalists purchased the mines from Spain.

RIOUW ARCHIPELAGO, five groups of islands oif the east coast of Sumatra. Indon.. extending from the Stra ts of Singapore in the north to the Straits of Berhala in the south. They comprise the Karimon group. the Batam group, the Bintang group, the Lingga group and the Singkep group, with territory on the mainland opposite known as Indragiri. Collectively they formerly comprised a residency of the Netherlands Indies; total area 12,235 sq.mi. and pop. (1930) 298.225. The islands vary in height and area, from rocky crags and small coral reefs, to Bintang, or Riouw, the largest island. area 4i5 sq.mi., with a height of 1,673 ft.; Lingga and Singkep are almost as large, and the former attains a height of 3.816 ft. and has the largest alluvial plain of the archipeiago. Coral reefs and currents make navigation difficult.

The people of the islands are Malays. Buginese and Chinese. with a few aboriginals known as Benua. The chief products of the islands are gambir, rubber. pepper and rice. There are large deposits of bauxite, of which those on Bintang were mined after 1935.

RIPLEY, a market town and urban district in the Ilkeston parliamentary division of Derbyshire, Eng.. 11 mi. N.N.E. of Derby by road. Pop. (1951) 18,192. Area 8.5 sq.mi. The charter for the market, held on Saturdays. was granted by Henry III. Heavy engineering, iron founding and coal mining are the principal industries The urban district of Heage was transferred to Ripley in 1934.

Ripley. Surrey. is a small town 5½ mi. N.E. of Guildford. Nearby are the Royal Horticultural society's gardens at Wisley.

RIPON, GEORGE FREDERICK SAMUEL ROBINSON, 1ST MARQUESS OF (1827–1909), British statesman, only son of the 1st earl of Ripon and his wife Lady Sarah, daughter of Robert Hobart. 4th earl of Buckinghamshire. was born in London on Sept. 24, 182;. Ripon began his political life as attaché to a special mission to Brussels in 1849. Cnder his courtesy title of Viscount Goderich he was returned to the house of commons for Hull in 1852 as an advanced Liberal. In 1853 he was elected for Huddersfield, and in 1857 for the West Riding of Yorkshire. In Jan. 1859 he succeeded to his father's title, and in November of the same year to that of his uncle, Earl de Grey. A few months after entering the upper house he was appointed undersecretary for war. and in Feb. 1861 undersecretary for India. Upon the death of Sir George Cornewall Lewis in April 1863 he became secretary for war, with a seat in the cabinet. In 1866 he was appointed secretary of state for India. On the formation of the Gladstone administration in Dec. 1868, Lord Ripon was appointed lord president of the council, and held that office until within a few months of the fall of the government in 1873, when he resigned on purely private grounds.

In 1871 Lord Ripon was appointed chairman of the High Joint-Commission on the Alabama claims, which arranged the treaty of Washington. In recognition of his services he was elevated to a marquessate (1871). In 1874 he became a convert to Roman Catholicism.

On the return of Gladstone to power in 1880 Lord Ripon was appointed viceroy of India, the appointment exciting a storm of controversy, the marquess being the first Roman Catholic to hold the vice-regal office. He went out to reverse the Afghan policy of Lord Lytton, and Kandahar was given up, the whole of Afghanistan being secured to Abdur Rahman. The new viceroy extended the rights of the natives, and in certain directions curtailed the privileges of Europeans. For the Ilbert bill of 1883—so named after its author Sir Courtenay Ilbert—see INDIA: History.

In 1886 he became first lord of the admiralty in the third Gladstone ministry; and on the return of the Liberals to power in 1892 he was appointed colonial secretary, which post he continued to hold until the resignation of the government in 1895. He was included in Sir Henry Campbell-Bannerman's cabinet at the close of 1905 as lord privy seal, an office which he retained in 1908 when Asquith formed his new ministry, but which he resigned later in the same year. He died at his seat, Studley Royal, near Ripon, on July 9, 1909, when his only son. Earl de Grey, treasurer of the queen's household since 1901, became the 2nd marquess.

RIPON, a cathedral city and municipal borough in the Ripon parliamentary division of the West Riding of Yorkshire, Eng., 24 mi N.W. of York and 27 mi. N. of Leeds by road. Pop. (1951) 9,480. Area 2.8 sq.mi. It lies at the foot of Wensleydale at the confluence of the Ure and its tributaries the Laver and the Skell. The Saxon village of Ripon first comes into history in the pages of Bede who describes how Abbot Eata of Melrose founded a Celtic monastery there *c.* 651. About ten years later Wilfrid founded a Benedictine monastery and became its abbot. Soon after this he was made bishop of York and became one of the leading figures in the English church. At Ripon he built a famous church, whose crypt may still be seen under the present cathedral. Wilfrid's church and monastery mere both destroyed by the Danes in the 9th century, and the monastery was never rebuilt. According to a local tradition of not very ancient date, Ripon received a charter from Alfred the Great in 886 By the time of the Norman Conquest, Ripon minster was a collegiate church with secular clergy. The archbishops of York owned large properties in the neighbourhood ("the Liberty of Ripon") and had an episcopal palace which stood on the site of the present courthouse, on the north side of the cathedral. In 1132 Archbishop Thurstan gave land in Skelldale to a band of monks from St. Mary's abbey, and escorted them from Ripon to the place where the ruins of Fountains abbey stand, 3 mi. W.

The greatest attraction for the modern visitor to Ripon is its lovely cathedral. Apart from the Saxon crypt the oldest parts are the chapter house and the Norman undercroft, the architecture of the present building belongs mainly to the Norman Transitional and Perpendicular periods. The nave (without aisles) north transept and part of the choir were built by Archbishop Roger in 1154, while the side aisles were added about 1500 when the central toner and south transept were rebuilt The central tower is of special interest because it has two round and tmo pointed arches, indicating that the Perpendicular work was left unfinished. The

twin towers of the west front are Early English (about 1216), and the Lady loft (now the library) dates from the 14th century. The chancel contains misericords, carved by the Ripon woodcarvers between 1489 and 1494, and also some fine canopies. The cathedral library, collected since c. 1608, has some exceptionally rare books and manuscripts. The 12th-century Leper chapel, within a few minutes' walk of the cathedral, contains a pre-Reformation stone altar.

Ripon has a large and beautiful market square, surrounded by a variety of houses, shops and inns of different dates. One of these buildings is a 15th-century house where Hugh Ripley, the last wakeman and the first mayor of Ripon, once lived. The name of the chief official was changed from wakeman to mayor in 1604 when James I gave the town a charter of incorporation. Another building in the square is the town hall (1798) on which these words are inscribed: "Except the Lord keep the City the Wakeman waketh but in vain." The ritual of the hornblowing, dating from before the Conquest, is of great interest. Every evening at nine o'clock curfew is rung on the cathedral bells, and the horn is blown at each corner of the market place and also outside the mayor's house. Originally this was a sign that the watch had been set and the citizens could sleep in peace. The original 9th-century Saxon horn may still be seen at the town hall.

The diocese of Ripon was re-established in 1836 by the division into two parts of the ancient diocese of York. The dioceses of Wakefield and Bradford have since been carved out of Ripon, which non includes Leeds and the country north as far as the Tees. A church training college for women teachers was founded in 1863.

Outside the town of Ripon is a race course which holds several meetings a year. (A. M. W.)

RIPPLE MARKS. The alternating parallel ridges and troughs formed on the surface of sand by waves and currents of water or air are known as ripple marks. Granular materials of little cohesion are essential for the formation of ripple marks by water waves and currents; they may be made by wind on dust as well as on sand.

Under some conditions ripple marks may be made on deposits of small pebbles.

Wave-formed or oscillation ripple marks have sharp. symmetrically sloped crests and rounded troughs. Current-formed ripple marks have rounded, asymmetrically sloped crests and troughs, the upcurrent slope being the longer and more gently inclined. Ripple marks are readily preserved when the sediments on which they are formed are transformed into rocks. Fossilized current ripple marks show the directions of the forming currents.

Although most water ripple marks are formed in relatively shallow water, they may be formed at any depth at which wave and currents are able to move sand. Wave ripple marks have been reported in the Indian ocean at a depth of 617 ft., and current ripple marks may form at depths exceeding 2,000 ft.

Since deposits made over wave ripple marks have corresponding crests and troughs on their undersurfaces. and since these are readily distinguishable from the originals, a valuable method of determining bottoms and tops of overturned strata is provided. Current ripple marks are not of great value in such investigations.

See also WAVES AND SHORE CURRENTS.

See W. H. Twenhofel, *Principles* of *Sedimentation,* 2nd *ed.,* pp. 567–578 (1950). (W. H. TL.; X.)

RISDON: see HOBART.

RISHANGER, WILLIAM (c. 12jo–c. 1312), English chronicler, made his profession as a Benedictine at St. Xlban's abbey in 1271, of which he perhaps became the official chronicler. The most important of his writings is the *Narratio* de *bellis apud* Lewes et *Evesham.* Though written many years afterward and drawn from other sources, it is a spirited account of the barons' war. He is so great an admirer of Simon de Montfort that this work has been called a hagiography.

Rishanger is credited with the authorship of a chronicle covering the period 1259–1306; this has been disputed, but the work is printed under his name by Riley.

RISK is present in a situation if the result or outcome of a choice, a decision or an action cannot be anticipated with certainty. For instance, the outcome of a throw of a die or of the drawing of a card cannot be anticipated with certainty and it may be said, therefore, that risk is present. Games of chance, in fact, provide us with the best examples of situations involving risk. In such games, since no single outcome is expected with certainty, we may list all the possible outcomes and then associate with each a number between o and 1 in such a manner that the sum of these numbers equals 1. These numbers are known as the probabilities associated with the various possible outcomes. For instance, in a game with two "unbiased" dice the probability that the sum of points in a single throw will be 2 is 1/36, whereas the probability that it will be 7 is 6/36 or 1/6. This is so because of the 36 possible outcomes there is only 1 for which the sum of points is 2 and there are 6 for which the sum of points is 7.

In general, the probability of any type of outcome is equal to the ratio of the number of outcomes of that type to the total number of possible outcomes.

In the light of these remarks it should be clear that to each choice, decision or action can be assigned a probability distribution of outcomes. In the special case where a probability of 1 is assigned to some one outcome risk is absent (certainty is present). In all other cases risk is present.

When we leave games of chance and attempt to deal with the multitude of decisions made every day which are shrouded in uncertainty, the question of applicability of these notions may be raised. Business decisions, military decisions, political decisions, scientific decisions—they all seem to involve uncertainty in some sense. Can we talk in terms of probability distributions of outcomes of business decisions? How are these probabilities to be calculated? In the case of the dice game these probabilities were known to us by reason of the fact that the dice were characterized as "unbiased." Somehow they were given objectively—they did not depend on the judgment of the players. More often than not in the world of decisions the term "probability." if it is to be used at all, must be given a subjective meaning—namely it must be thought of as an expression of the "degree of belief" in the mind of the decision maker.

We distinguish, therefore, between objective and subjective probabilities. The connection between the two involves a number of subtle and not completely resolved issues which will not be explored here. (See also PROBABILITY.)

We shall assume in what follows that each decision maker is in a position to assign a (subjective) probability distribution of outcomes to each decision or course of action he may choose to make or follow. Under these circumstances (and on the assumption that the probability of no outcome is equal to 1) we shall say that he is making a decision or taking an action involving risk. The term "uncertainty" should be reserved for describing situations in which the decision maker is unwilling to assign probability distributions of outcomes to the various contemplated alternative actions. If, for instance, we are unwilling to state the odds at which we would accept a bet (say, a bet that a major war will break out next year), then the situation involves uncertainty; if, in contrast, we are willing to state the odds, then the situation involves risk. This discussion is limited to situations involving risk.

Suppose that one is asked to play the following game. A coin will be tossed. If heads come up, one wins $5; if tails come up, one loses $2. Let us assume that one attaches a subjective probability of .4 to the outcome "heads." Should one play the game? The answer seems to be in the affirmative becausr the expected value of the game is positive. The expected value of a game (a lottery ticket or a decision) may be calculated as follows: Multiply the probability of each outcome by the payoff associated with the outcome and then add up the products. In this case we have $(.4 \times \$5) + (.6 \times -\$2) = \$.8$ or 80 cents. The game is "biased" in our favour and it seems, therefore, that we should accept the bet. Would we be ready to say. however, that refusing the bet is an indication of irrationality? What if one could not afford to lose $2? It is well known that people gamble when the odds are not fair—that they play games whose expected value is nega-

tive. Also, it is suspected that people refuse to engage in business ventures whose expected value (given the subjective probabilities of the persons in question) are positive. Are these people acting irrationally? Recognition of the fact that such actions need not be irrational has led to the formulation of the concept of utility—and the associated rule that people should make decisions in such a fashion as to maximize expected utility.

An example might help introduce the notion of expected utility. Suppose, for instance, that one has $2 in his pocket and that he assigns a utility of −10 to its loss. Now, if one assigns a utility of less than 15 to the gain of $5, it will not pay him to engage in the coin-tossing game described above. Whereas the expected value of the game is positive (it is exactly 80 cents), the expected utility of the game—if, say, the utility associated with winning $5 is equal to 15—will be zero. Expected utility: $(.4\times 15)+(.6\times -10)=0$. If one assigns to $5 a utility of less than 15, the expected utility will be negative. Whether one plays the game or not, therefore, depends on the relative valuations one places on the outcomes—as well as on the subjective probabilities one assigns to them.

The schema can easily be extended to a wide variety of situations. For instance, a business firm contemplating alternative investments (say types of expansion of plant capacity) could associate with each one of these investments, A, B, C, ... an expected utility—the expected utility for each one to be calculated by taking the sum of the products of the probability of the various possible outcomes (associated with that investment) multiplied by the utility of these outcomes. If we denote by $\bar{U}_A, \bar{U}_B, \bar{U}_C, \ldots$, the expected utility associated with investment decisions A, B, C, . . . , then clearly the firm will make that investment decision which yields the highest expected utility. $\bar{U}$. In the special case where the utility of an outcome equals the profit associated with that outcome, the firm will make that investment decision which maximizes expected profit.

The objection might be raised at this point that the assignment of utilities to outcomes was completely arbitrary. Interestingly enough it has been shown that. if a person is in a position to order (in terms of his preferences) probability distributions of outcomes in a complete and consistent manner. a utility function can be constructed which fully accounts for his choice behaviour. The utility "numbers" will be arbitrary only insofar as the origin and the unit of measurement are concerned—but the ratios of differences of utilities will be preserved no matter how we choose the origin and the unit of measurement.

It should be stressed. perhaps, that the concept of maximization of expected utility is normative rather than descriptive. Fundamentally it involves a statement of how a rational man should behave rather than how he does behave. Such a descriptive theory of human behaviour under risk was not available in the mid-20th century.

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(A. G. PU.)

RISTIĆ, JOVAN (1831–1899), Serbian statesman, was born at Kragugevaz in 1831. He was educated at Belgrade, Heidelberg, Berlin and Paris. In 1861 he became Serbian diplomatic agent at Constantinople, and secured the withdrawal of the Turkish troops from the Serbian fortresses in 1867. On his return from Constantinople he became the recognized leader of the Liberal party. After the assassination of Prince Michael in 1868. he sat on the council of regency* and the first Serbian constitution (Jan. 2, 1869) was mainly his creation. When Prince Milan attained his majority in 1872, Ristić became foreign minister and then prime minister, but resigned in the following autumn (1873). He again became prime minister in April 1876, and conducted the two wars against Turkey (July 1876–March 1877 and Dec. 1877–March 1878). Because of the failure to realize Serb aspirations at the congress of Berlin, the Ristić government became unpopular, and resigned in 1880, In 1887 Milan recalled Ristić; a new constitution was granted in 1888, and in 1889 Ristić became head of the council of regency for the young king Alexander. On April 13, 1893, King Alexander, by a successful stratagem, imprisoned the regents and ministers in the palace, and, declaring himself of age, recalled the Radicals to office. Ristić died at Belgrade on Sept. 4. 1899.

RISTORI, ADELAIDE (1822–1906), Italian actress, born at Cividale del Friuli, Jan. 30, 1822, daughter of strolling players. As a child she appeared upon the stage. and at 14 made her first success as Francesca da Rimini in Silvio Pellico's tragedy. She was 18 when for the first time she played Mary Stuart in an Italian version of Schiller's play. She had been a member of the Sardinian company and also of the ducal company at Parma for several years before her marriage (1846) to the marchese Giuliano Capranica del Grillo (d. 1861); and after a short retirement she returned to the stage and played regularly in Turin and the provinces. In 1855 she took Paris by storm in the role of Alfieri's *Myrrha.* Furious partisanship was aroused by the appearance of a rival to the great Rachel. In 1857 she visited Madrid, playing in Spanish to enthusiastic audiences, and in 1866 she paid the first of four visits to the United States: where she had great success in Giacometti's *Elizabeth,* an Italian study of the English sovereign. She retired from professional life in 1885, and died on Oct. 9, 1906, in Rome. Her *Studies and Memoirs* (1888) contains valuable psychological explanations and interpretations of the characters of Mary Stuart, Elizabeth! Myrrha, Phaedra and Lady Macbeth.

RITCHIE, CHARLES THOMSON RITCHIE, 1ST BARON (1838–1906), English politician, was born at Dundee on Nov. 19, 1838. and educated at the City of London school. He went into business. and in 1874 was returned to parliament as Conservative member for the working-class constituency of Tower Hamlets. In 1885 he was made secretary to the admiralty and from 1886 to 1892 president of the local government board in Lord Salisbury's administration. with a seat in the cabinet after 1887, sitting as member for St. George's-in-the-East. He was responsible for the Local Government act of 1888. instituting the county councils; and a large section of the Conservative party always owed him a grudge for having originated the London County council. In Lord Salisbury's later ministries. as member for Croydon. he was president of the board of trade (1895–1900) and home secretary (1895–1900); and when Sir Michael Hicks-Beach retired in 1902, he became chancellor of the exchequer in Balfour's cabinet. Though in his earlier years he had been a "fair-trader." he was strongly opposed to Chamberlain's movement for a preferential tariff (*see* BALFOUR, ARTHCR JAMES BALFOUR; CHAMBERLAIN, JOSEPH), and he resigned office in Sept. 1903. In Dec. 1905 he was created a peer. He died at Biarritz on Jan. 9, 1906.

RITSCHL, ALBRECHT (1822–1889), German theologian, was born in Berlin on March 25, 1822. His father. Benjamin Ritschl (1783–1858), was from 1827 to 1854 general superintendent and evangelical bishop of Pomerania. Albrecht studied at Bonn, Halle, Heidelberg and Tiibingen. At Halle he came under Hegelian influences. In 1845 he was entirely captivated by the Tiibingen school, and in *Das Evangelium Marcions und das kanonische Evangelium des Lukas* (1846) he appears as a disciple of F. C. Baur. But the second edition (1857) of his most important work, on the origin of the Old Catholic Church *(Die Entsfehung der alt-kathol. Kirche),* shows considerable divergence from the first edition (1850), and reveals an entire emancipation from Baur's method. Ritschl was professor of theology at Bonn (extraordinarius. 1852; ordinarius, 1859) and Gottingen (1864; *Consistorialrath* also in 1874). his addresses on religion delivered at the latter university showing the impression made upon his mind by his study of Kant and Schleiermacher. Finally, in 1864. came the influence of Rudolf Lotze. He wrote *Die Christliche Lehre von der Rechtfertigung und Versöhnung* (1870–74) and *Die Geschiclzte des Pietismus* (1880–86). He died at Gottingen on March 20, 1889.

Ritschl claims to carry on the work of Luther and Schleiermacher. He criticizes especially the use of Aristotelianism and speculative philosophy in scholastic and Protestant theology. He holds that such philosophy is too shallow for theology. Hegelianism attempts to squeeze all life into the categories of logic; Aristotelianism deals with "things in general" and ignores the radical distinction between nature and spirit. Neither Hegelianism nor Aristotelianism is "vital" enough to sound the depths of religious life. Neither conceives "God" as correlative to human "trust" (cf. *Theologie und Metaphysik,* esp. p. 8 ff.). But Ritschl's recoil carries him so far that he is left alone with merely "practical" experience. "Faith" knows God in His active relation to the "kingdom." but not at all as "self-existent."

Ritschl's school, in which J. G. W. Herrmann, Julius Kaftan and Adolf Harnack were the chief names. diverged from his teaching in many directions; *e.g.,* Kaftan appreciated the mystical side of religion and Harnack's criticism was very different from Ritschl's arbitrary exegesis. They were united on the value of faith-knowledge as opposed to "metaphysic."

See H. Schoen, *Lcs Origines historiques de la théologie de Ritschl* (1893); G. Ecke, *Die theologische Schule, A. Ritschl's und die evangelische Kirche der Gegenwart* (1897); J. Orr, *The Ritschlian Theology and the Evangelical Faith* (1898), *Ritschlianism: Expositary and Critical Essays* (1903); A. E. Gavire, *The Ritschlian Theology* (1899); E. A. Edghill, *Faith and Fact, a Study of Ritschlianism* (1910); R. Mackintosh, *Ritschl* (1915). The chief authority for his biography is *Albrecht Ritschls Leben,* 2 vol. (Leipzig, 1896), by his son Otto Ritschl.

RITSCHL, FRIEDRICH WILHELM (1806–1876), German scholar who was best known as a student of Plautus, was born in 1806 in Thuringia. He was well taught in youth by Spitzner, a pupil of Gottfried Hermann, spent a year at Leipzig, and in 1826 went to Halle. He went to Bonn in 1839, where he controlled a philological seminary. The names of Georg Curtius, Ihne. Schleicher, Bernays. Ribbeck, Lorenz, Vahlen. Hiibner. Biicheler. Helbig, Benndorf, Riese. Windisch, who were his pupils either at Bonn or at Leipzig. attest his fame and power as a teacher. In 186j a violent quarrel arose between him and Otto Jahn. then his colleague; he resigned, went to Leipzig, and died there in 1876. His great faculty for organization is shown by his administration of the university library at Bonn, and by the eight years of labour which carried to success a work of infinite complexity. the famous *Priscae Latinitatis Monumenta Epigraphica* (Bonn: 1862). This volume presents in admirable facsimile. with prefatory notices and indexes, the Latin inscriptions from the earliest times to the end of the republic.

Ritschl's examination of the Plautine manuscripts was both laborious and brilliant, and greatly extended the knowledge of Plautus: for example, by the aid of the Xmbrosian palimpsest he recovered the name T. Maccius Plautus, for the vulgate M. Accius. and proved it correct by strong extraneous arguments.

In spite of the incompleteness, on many sides, of his work, Ritschl must be assigned a place in the history of learning among a very select few. His studies are presented principally in his *Opuscula* collected partly before and partly after his death. The *Trinummus* (twice edited) was the only specimen of his contemplated edition of Plautus which he completed.

The facts of Ritschl's life may be best learned from the elaborate biography by Otto Ribbeck (Leipzig, 1879). An interesting estimate of Ritschl's work is that by Lucian Miiller (1877).

RITTENHOUSE, DAVID (1732–1796), U.S. astronomer, who introduced in 1786 the use of spider lines in the focus of a transit instrument. He was born at Germantown, Pa.. on April 8, 1732. First a watchmaker and mechanician, he afterward was treasurer of Pennsylvania (1777–89), and from 1792 to 1795 director of the U.S. mint (Philadelphia).

He was a fellow of the Royal Society of London, and a member, and in 1791 president, of the American Philosophical society. His researches were published in the *Transactions of the American Philosophical Society* (1785–99). He died at Philadelphia on June 26, 1796.

RITTER, HEINRICH (1791–1869), German historian of philosophy, was born at Zerbst on Nov. 21, 1791, and died on Feb. 3, 1869, at Gottingen, where he had been professor of philosophy for nearly 30 years. Of his numerous works the most important are the *Geschichte der Philosophie* (12 vol., Hamburg, 1829–53), and, written with Preller, the *Historia philosophiae Graeco-Romanae* (1838; 7th ed.. 1888).

RITTER, KARL (1779–1859), German geographer, born at Quedlinburg on Aug. 7, 1779, is considered a founder of modern geography. His father, a physician, left his family in straitened circumstances, and Karl was received into the Schnepfenthal institution then just founded by Christian G. Salzmann (1744–1811) for the purpose of testing his educational theories. The Salzmann system was practically that of Rousseau; conformity to natural law and enlightenment were its watchwords; great attention was given to practical life, and the modern languages were carefully taught, to the complete exclusion of Latin and Greek. Ritter showed geographical aptitude at an early age, and when his school days were drawing to a close his future course was determined by an introduction to Bethmann Hollweg, a banker in Frankfurt. It was arranged that Ritter should become tutor to Hollweg's children, but that in the meantime he should attend the university at his patron's expense. His duties as tutor in the Hollweg family began at Frankfurt in 1798 and continued for 1 j years. The years 1814–19, which he spent at Gottingen in order to continue to watch over the welfare of his pupils, were those in which he began to devote himself exclusively to geographical inquiries. He had already traveled much when in 1817–18 he brought out his masterpiece *Die Erdkunde im Verhältnis zur Natur und zur Geschichte des Menschen* (Berlin, 2 vol., 1817–18). In 1819 he became professor of history at Frankfurt, and in 1820 professor extraordinarius of history at Berlin, where he remained till his death. The second edition of his *Erdkunde* (1822–58) was on a much larger scale than the first, but he completed only the sections on Africa and the various countries of Asia.

The service rendered to geography by Ritter was especially notable because he brought to his work a new conception of the subject. Geography was, to use his own expression, a kind of physiology and comparative anatomy of the earth: rivers, mountains, glaciers, etc., were so many distinct organs. each with its own appropriate functions; and, as his physical frame is the basis of the man, determinative to a large extent of his life. so the structure of each country is a leading element in the historic progress of the nation. Ritter, moreover, was a scientific compiler of the first rank.

Ritter died in Berlin on Sept. 28, 1859. After his death selections from his lectures were published under the titles *Geschichte der Erdkunde* (1861), *Allgemeine Erdkunde* (1862) and *Europa* (1863). Several of his works, for example the "Palestine" volumes of his *Erdkunde,* were translated into English.

(For a summary and comparison of the contributions to modern geography of Ritter and his contemporary Alexander von Humboldt, *see* GEOGRAPHY.)

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RITUAL, a term of religion, which may be defined as the routine of worship. This is a "minimum definition"; "ritual" at least means so much, but may stand for more. Without some sort of ritual there could be no organized method in religious worship. Indeed, viewed in this aspect, ritual is to religion what habit is to life and its function is similar; namely, by bringing subordinate functions under an effortless rule, to permit undivided attention in regard to vital issues. The chief task of routine in religion is to organize the activities necessary to its stability and continuance as a social institution, in order that all available spontaneity and initiative may be directed into spiritual channels.

But, while ritual at least represents routine, it tends, historically speaking, to have a far deeper significance for the religious consciousness. A recurrent feature of religion, which many students of its phenomena would even consider constant and typical,

is the attribution of a more or less self-contained and automatic efficacy to the ritual procedure as such. Before proceeding to considerations of genesis, it will be convenient briefly to analyze the notion as it appears in the higher religions.

Two constituent lines of thought may be distinguished. Firstly, there is the tendency to pass beyond the purely petitionary attitude which as such can imply no more than the desire, hope or expectation of divine favour, and to take for granted the consummation sought, a deity that answers. a grace and blessing that are communicated. When such accomplishment of its end is assumed, efficacy can readily be held to attach to the act of worship as such. Secondly, there is the tendency to identify such a self-accomplishing act of worship aith its objective expression in the ritual that for purposes of mutual understanding makes the body of worshippers one.

The Formal Element in Ritual.—Exactly similar tendencies—to impute efficacy and to treat the ritual procedure as the source of that efficacy—are typically characteristic of black magic, and their reappearance in religion can hardly be treated as a coincidence, seeing that magic and religion would appear to have much in common, at any rate during the earlier stages of their development. In magic a suggestion is made orally, or by dramatic action, or most often in both ways together, that is held ipso facto to bring about its own accomplishment. A certain conditionality attaches to the magical operation, inasmuch as each magician is subject to interference on the part of other magicians who may neutralize his spell by a counterspell of equal or greater power; nevertheless, the intrinsic tone is that of a categorical assertion of binding force and efficacy. Again, in magic the self-realizing force is apt to seem to reside in the suggestional machinery rather than in the spiritual qualifications of the magician, though this is by no means invariably the case. On the whole, however, spells and ceremonies are wont to be regarded as an inheritable and transferable property containing efficacy in themselves. What is true of magic is true of much primitive religion.

Sir J. G. Frazer has pronounced the following to be marks of a primitive ritual: negatively, that there are no priests, no temples and no gods (though he holds that departmental, nonindividual "spirits" are recognized); positively, that the rites are magical rather than propitiatory (The Golden *Bough,* 2nd ed., ii. 191). If we leave it an open question whether, instead of "spirits," it would not be safer to speak of "powers" to nhich there is attributed not a soullike nature, but simply a capacity for acting with mana (*q.v.*) (which roughly is what Frazer means by "magical"), this characterization may be accepted as applying to many, if not to all, the rites of primitive religion.

As A. Lang well puts it, "Ritual is preserved because it preserves luck." Given an intrinsic sacredness, it is but a step to associate definite gods with the origin or purpose of a rite, whose interest it thereupon becomes to punish omissions or innovations by the removal of their blessing (which is little more than to say that the rite loses its efficacy), or by the active infliction of disaster on the community. In the primitive society it is hard to point to any custom to which sacredness does not in some degree attach, but, naturally, the more important and solemn the usage, the more rigid the religious conservatism. Thus there are indications that in Australia, at the highly sacred ceremony of circumcision, the fire stick was employed after stone implements were known; and we have an exact parallel at a higher level of culture, the stone implement serving for the same operation when iron is already in common use. (See B. Spencer and F. Gillen, *The Native* Tribes of Australia, 401; *cf.* E. B. Tylor, Early History *of Man*kind, 3rd ed.. 217.)

The Interpretation of Ritual.—A valuable truth insisted on by W. Robertson Smith (Religion of *the* Semites, 17 ff.) is that in primitive religion it is ritual that generates and sustains myth, and not the other way about. Sacred lore of course cannot be dispensed with; even Australian aboriginal society, which has hardly reached the stage of having priests, needs its *Oknirabata* or "great instructor" (Spencer and Gillen, ibid., 303). The function of such an expert, however, is chiefly to hand on mere rules for the performance of religious acts. If his lore includes sacred histories, it is largely, we may suspect, because the description and dramatization of the doings of divine persons enter into ritual as a means of suggestional control. Similarly, the sacred books of the religions of middle grade teem with minute prescriptions as to ritual but are almost destitute of doctrine. Even in the highest religions, where orthodoxy is the main requirement and ritual is held merely to symbolize dogma, there is a remarkable rigidity about the dogma that is doubtless in large part due to its association with ritual forms, many of them bearing the most primeval stamp.

As regards the symbolic interpretation of ritual, this is usually held not to be primitive; and it is doubtless true that an unreflective age is hardly aware of the difference between "outward sign" and "inward meaning," and thinks as it were by means of its eyes. Nevertheless. it is easier to define fetishism (*q.v.*) (a fetish "differing from an idol in that it is worshipped in its own character, not as the symbol, image or occasional residence of a deity," New Oxford Dictionary, Oxford, 1901) than it is to bring such a fetishism home to any primitive people, the west African Negroes not excluded (cj. A. B. Ellis, The Tshi-speaking Peoples of *the* Gold Coast *of* W. *Africa,* 192). It is the intrinsic mana, virtue or grace residing in, and proceeding from, the material object—a power the communicability of which constitutes the whole working hypothesis of the magico-religious performance—that is valued in those cases where native opinion can be tested. Moreover. it must be remembered that in the act of magic a symbolic method is consciously pursued, as witness the very formulas employed: "As I burn this image, so may the man be consumed," or the even more explicit, "It is not wax I am scorching; it is the liver, heart and spleen of So-and-so that I scorch" (W. W. Skeat, *Malay Magic,* 570), where appearance and reality are distinguished in order to be mystically reunited.

Now it is important to observe that from the symbol as embodying an imperative to the symbol as expressing an optative is a transition of meaning that involves no change of form whatever; and, much as theorists love to contrast the suggestional and the petitionary attitudes, it is doubtful if the individual does not move quite indifferently to and fro across the supposed frontier line between magic and religion, interspersing "bluff" with blandishment, spell with genuine prayer. Meanwhile the particular meanings of the detailed acts composing a complicated piece of ritual soon tend to lose themselves in a general sense of the efficacy of the rite, as a whole, to bring blessing and avert evil. In fact, unintelligibility is so far from invalidating a sacred practice that it positively supports it by deepening the characteristic atmosphere of mystery. Even the higher religions show a lingering predilection for cabalistic formulas.

Changes in Ritual.—While ritual displays an extraordinary stability, its nature is of course not absolutely rigid; it grows, alters and decays. As regards its growth, there is hardly a known tribe nithout its elaborate body of magico-religious rites. In the exceptional instances where this feature is relatively absent (the Masai of east Africa offer a case in point), we may suspect a disturbance of tradition due to migration or some similar cause. Thus there is always a pre-existing pattern in accordance with which such evolution or invention as occurs proceeds. Unconscious evolution is perhaps the more active factor in primitive times; imitation is never exact, and small variations amount in time to considerable changes.

On the other hand, there is also deliberate innovation. In Australia councils of the older men are held day by day during the performance of their ceremonies, at which traditions are repeated and procedure determined. the effect being mainly to preserve custom but undoubtedly in part also to alter it. Moreover, the individual religious genius exercises no small influence. A man of a more original turn of mind than his fellows will claim to have had a new ceremony imparted to him in a vision, and such a ceremony will even be adopted by another tribe which has no notion of its meaning (Spencer and Gillen, ibid., 272, 278, 281). Meanwhile, since little is dropped while so much is being added, the result is an endless complication and elaboration of ritual. Side by side with elaboration goes systematization, more especially

when local cults come to be merged in a wider unity. Thereupon assimilation is likely to take place to one or another leading type of rite — for instance. sacrifice or prayer. At these higher stages there is more need than ever for the expert in the shape of the priest, in whose hands ritual procedure becomes more and more of a conscious and studied discipline. the naive popular elements being steadily eliminated, or rather transformed. Not but what the transference of ritualistic duties to a professional class is often the signal for slack and mechanical performance. with consequent decay of ceremonial. The trouble and worry of having to comply with the endless rules of a too complex system is apt to operate more widely — namely, in the religious society at large — and to produce an endless crop of evasions.

Good examples of these on the part alike of priests and people are afforded by Toda religion, the degenerate condition of which is expressly attributed by W. H. R. Rivers to "the overdevelopment of the ritual aspect of religion" (The Todas, 454–5).

It is interesting to observe that a religion thus atrophied tends to revert to purely magical practices. the use of the word of power and so on (ibid., ch. x). It is to he noted, however, that what are known as ritual substitutions, though they lend themselves to purposes of evasion (as in the case of the Chinese use of paper money at funerals), rest ultimately on a principle that is absolutely fundamental in magico-religious theory; namely, that what suggests a thing because it is like it or a part of it becomes that thing when the mystic power is there to carry the suggestion through.

The Classification of Rites. — More than one basis of division has suggested itself. From the sociological point of view perhaps the most important distinction in use is that between public and private rites. While the former essentially belong to religion as existing to further the common weal, the latter have from the earliest times an ambiguous character and tend to split into those which are licit — "sacraments," as they may be termed — and those which are considered antisocial in tendency and are consequently put beyond the pale of religion and assigned to the "black art" of magic. Or the sociologist may prefer to correlate rites with the forms of social organization — the tribe, the phratry, the clan, the family and so on.

Another interesting contrast (seeing how primary a function of religion it is to establish a calendar of sacred seasons) is that between periodic and occasional rites — one that to a certain extent falls into line with the previous dichotomy. A less fruitful method of classing rites is that which arranges them according to their inner meaning. As we have seen, such meaning is usually acquired ex post facto, and typical forms of rite are used for many different purposes; so that attempts to differentiate are likely to beget more equivocations than they clear up. The fact is that comparative religion must be content to regard all its classifications alike as pieces of mere scaffolding serving temporary purposes of construction.

Negative **Rites.**—A word must be added on a subject dealt with elsewhere (see TABU), but strictly germane to the matter in hand. Ritual interdictions have the best, if not the sole, right to rank as taboos *(see* M. Mauss in *L'Année* sociologique, ix, 249). Taboo, as understood in Polynesia, the home of the word. is as wide as, and no wider than, religion, representing one side or aspect of the sacred (see RELIGION). The very power that can help can also blast if approached improperly and without due precautions. Taboos are such precautions, abstinences prompted, not by simple dread or dislike, but always by some sort of respect as felt toward that which in other circumstances or in other form has healing virtue. Thus the negative attitude of the observer of taboo involves a positive attitude of reverence from which it becomes in practice scarcely distinguishable. To keep a fast, for instance, is looked upon as a direct act of worship. It must be noted, too, that, whereas taboo as at first conceived belongs to the magico-religious circle of ideas, implying a quasi-physical transference of sacredness from that having it to one not fit to receive it, it is very easily reinterpreted as an obligation imposed by the deity on his worshippers.

The law observed by a primitive religious community abounds in negative precepts, and if early religion tends to be a religion of fear it is because the taboo breaker provides the most palpable objective for human and divine sanctions. In the higher religions to be pure remains among the most laudable of aspirations and, even though the ceremonial aversion of a former age has become moralized, and a purity of heart set up as the ideal, it is on "virtues of omission" that stress is apt to be laid, so that a timorous propriety is too often preferred to a forceful grappling with the problems of life. There are signs, however, that the religious consciousness has at length come to appreciate the fact that the function of routine in religion as elsewhere is to clear the way for action.

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RITUAL MURDER, a general term for human sacrifice in connection with religious ceremonies. False accusations as to the practice of ritual murder by various bodies have often been made. Justin Martyr in his second apology (ch. xii) vigorously defends the Christian community against the charge; Octavius, Minucius Felix, Tertullian, Origen and other church fathers all refer to the subject and indignantly repudiate the atrocious libel that the Eucharist' involved human sacrifice. The myth was revived against the Montanists, and in the later middle ages against various dissenting sects of Christians. In modern times the accusation was leveled against "foreigners" during the disturbances in China. The chief sufferers from the libel were, however, the Jews. The earliest form of it (the first instance is the case of William of Norwich, 1144) was that they immolated a Christian child at Easter in mockery of the Passion. In the course of the next century there came about the elaboration that the blood was used in the manufacture of the unleavened bread for Passover (which generally coincided with Easter) or for other purposes. Ultimately, it was actually alleged that "the Jews of every province annually decide by lot" which congregation or town was to be the scene of the mythical murder. Almost invariably, the accusations were followed by spoliation and persecution. Among the classical instances are the "martyrdoms" of Hugh of Lincoln (1255) and Simon of Trent (1475), the Damascus affair (1840) and the Beilis case (1911–13). It is easy to understand how, in ages when the Jews mere everywhere regarded with suspicious awe, such stories would find ready credence; but the revival of the myth by the anti-Semite in modern times is a deplorable instance of degeneration. That there is no foundation whatsoever for the belief was proved in the classical treatise on the. subject by Hermann L. Strack, regius professor of theology at the University of Berlin. Many proselytes to Christianity have strenuously defended the Jews from the charge. Several of the popes issued bulls exonerating them, and temporal princes have often taken a similar step. Many Christian scholars and ecclesiastics felt it their duty to utter protests against the libel, including the most eminent Gentile students of Rabbinism of modern times. Indeed, the vast majority of the literature refuting the charge came from non-Jewish pens. That on the other side is entirely anti-Semitic, and in no case has it survived the ordeal of criticism.

See G. A. Zaviziano, *Un Raggio di Luce* (Corfu, 1891); H. L. Strack, *Das Blut im Glauben und Aberglauben,* 8th ed. (Munich,

1900; Eng trans., The *Jew and Human Sacrifice,* 1909); *D.* Chwolson, *Blutanklage* (1901); F. Frank, *Der Ritualmord vor den Gerichtshofen der Wahrheit und der Gerechtigkeit* (1901, 1902). *A* list of some of the most important cases is given by J. Jacobs in the *Jewish Encyclopaedia,* iii, 266–267.

RIVADAVIA, BERNARDINO (1780–1845), first president of the Argentine republic, was born at Buenos Aires on May 20, 1780. His education at the College of San Carlos was interrupted by the British invasion of 1806. In 1811 he became secretary to the revolutionary triumvirate and later was made a member of that body. To secure the recognition of an independent La Plata, and a Spanish prince to rule it, he was sent with tno other diplomats to Europe and was partly responsible for the British acceptance of the United Provinces into the family of nations. Upon his return to Buenos Aires he was appointed, under Gov. Martín Rodriguez, one of the two ministers of government (state) and used his office to introduce reforms in the civil government and courts and to found hospitals, asylums and schools, including the University of Buenos Aires. He introduced the Lancastrian system of elementary education.

Politically, he was a Unitarist, or nationalist. and in time became the party leader in opposition to the Federalists. He favoured the establishment of a monarchy with Spanish leanings. In 1826 he was elected president of the United Provinces of La Plata, which, a few months later, adopted a constitution for the Argentine republic.

From the outset the presidency proved to be an unhappy office. Not only was Argentina bitterly divided over the question of federalism versus nationalism, but it was also involved in mar against Brazil concerning the independence of Uruguay, then known as Banda Oriental. Handicapped by the internal dissension, Rivadavia accepted the offer of British mediation and a treaty of peace was drafted which recognized Brazilian hegemony of the disputed area. The people of Argentina refused to accept that arrangement. however, and Rivadavia was forced to continue the war. When the provinces declined acceptance of the proposed constitution, Rivadavia resigned his office (1827). In 1829 he went to Europe to study political and economic institutions. Five years later his political enemies brought charges against him in the courts, and without a hearing he was sentenced to exile within 24 hours. He went first to Brazil, then to Cádiz, Spain, where he died on Sept. 2, 1845. His remains were repatriated in 1857 and 23 years later his birthday was decreed a national holiday.

BIBLIOGRAPHY.—There is a wealth of material in Spanish concerning Rivadavia, among which may be noted C. Correa Luna, *Rivadaaia y la simulacidn monárquica de 1815* (Buenos Aires, 1929); A Lamas, *Rivadavia; su obra politica y cultural* (Buenos Aires, 1915) In English *see* Ricardo Levene, *A History of Argentina,* trans by W. S. Robertson (Chapel Hill, N.C., London, 1937). (R. G. RR)

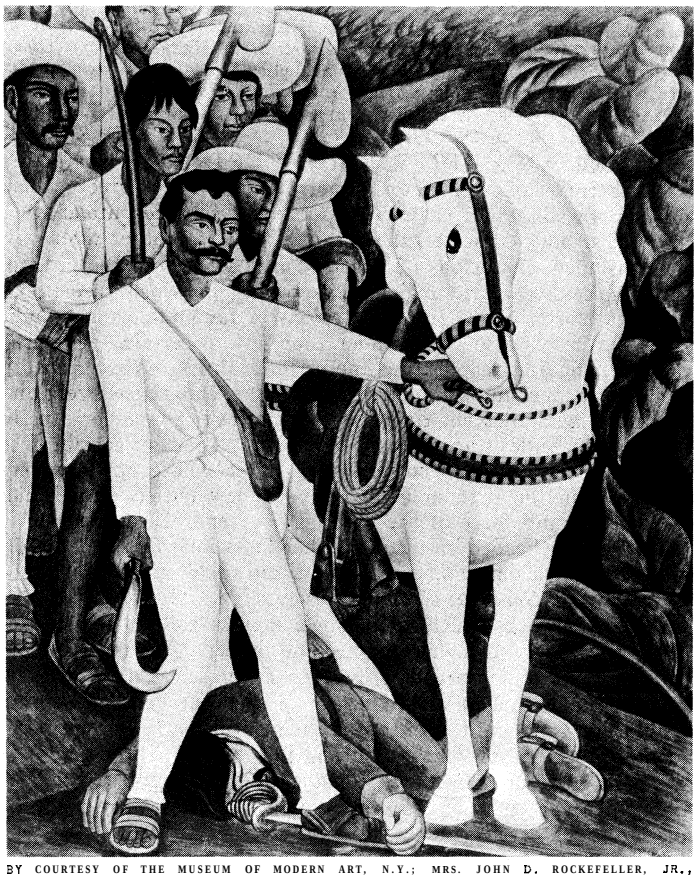
RIVAROL, ANTOINE DE (1753–1801), French writer and epigrammatist, was born at Bagnols in Languedoc on June 26, 1753, and died at Berlin on April 11, 1801. It seems that his father was an innkeeper of cultivated tastes. The son assumed the title of comte de Rivarol. and asserted his connection with a noble Italian family. After various vicissitudes he appeared in Paris in 1777. In his *Petit Almanach de nos grands hommes pour 1788,* in which he had the assistance of Richebourg de Champcenetz, he ridiculed contemporary authors. Rivarol wrote in the royalist press, in the *Journal politique* of Sabatier de Castres (1742–1817) and the *Actes des Apôtres* of Peltier (1770–1825). He emigrated in 1792, and established himself at Brussels, whence he removed successively to London, Hamburg and Berlin. Rivarol has had no rival in France in brilliant epigrams except Piron. His works include *Isman, ou le fatalisme* (1795), a novel; *Le Véridique* (1827), comedy; *Essai sur les causes de la révolution française* (1827).

See *Oeuvres,* 2nd ed., ed. by M. de Lescure (1880); G. W. Harris, *Antoine Rivarol, Journalist of the French Revolution* (Oxford, 1940).

RIVAS, ANGEL DE SAAVEDRA, DUKE OF (1791–1865), Spanish poet and politician, born at Córdova, March 19, 1791. He fought in the War of Independence, was a prominent member of the advanced Liberal party (1820–23) and in the latter year was condemned to death. He escaped to London and lived successively in Italy, Malta and France, until the amnesty of 1834, when he returned to Spain, shortly afterward succeeding his brother as duke of Rivas. In 1835 he became minister of the interior under Isturiz. and along uith his chief had again to leave the country. Returning in 1837, he joined the Moderate party became prime minister and was subsequently ambassador at Paris and Naples. He died June 22, 1865. In 1813 he published *Ensayos podticos,* and between that date and his first exile several of his tragedies (the most notable being *Alatar,* 1814, and *Lanuza,* 1822) were put upon the stage. Traces of foreign influence are observable in *El Moro Expdsito* (1834), a narrative poem dedicated to John Hookham Frere; these are still more marked in *Don Alvaro ó La Fuerza del sino* (first played March 22, 1835), a drama of historical importance inasmuch as it established the new French romanticism in Spain.

See *Obras completas del Duque de Rivas,* 7 vol. (Madrid, 1894–1904); N Gonzalez Ruiz, *El duque de Rivas* (Madrid, 1944).

RIVERA, DIEGO (1886–1957), Mexican mural painter, was one of the leaders of the revolutionary movement in public wall painting that began in Mexico in the 1920s. He was born in Guanajuato, Gto., Mex., on Dec. 8, 1886. His politically liberal father early encouraged his son's artistic bent by providing him with a studio before he mas able to read and by sending him to art classes at ten. Before 1906 Diego Rivera had studied under such Mexican masters as the romantic landscape painter José Maria Velasco and the French-trained classicist Santiago Rebull. He then went to Spain on a government scholarship, and at the beginning of the Rladero revolution in Mexico. he made an exhibition at home of his somewhat conventional Spanish canvases. Between 1911 and 1920 he lived mostly in Paris, producing hundreds of Cubist paintings and drawings in a manner largely derived from the Spanish master Picasso — though his own work retained many easily recognizable objects.



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"AGRARIAN LEADER ZAPATA" BY RIVERA IN 1931, A VARIANT OF A FRESCO IN THE CORTES PALACE. CUERNAVACA, MEX.: MUSEUM OF MODERN ART, N.Y.

After making a firsthand study of fresco painting in Italy, Rivera returned to Mexico with a newly wrought classical and didactic style, graced with lyrical elements, and began to make his famous proletarian frescoes. In the early 1930s Rivera mas the centre of wide political controversy in the United States. A mural he painted for the Detroit (Mich.) Institute of Fine Arts in 1932 was criticized as irreligious and his mural "Man at the Crossroads" (executed for Rockefeller Centre. New York city), which included a portrait of Lenin. also was the subject of strong protests. The former was defended by Institute authorities; the latter waseventually removedandreconstitutedat the Palace of Fine Arts in Mexico City.

Among Rivera's most distinguished frescoes were those painted at the National School of Agriculture, Chapingo, D.F., with its decorative studies of the nude figure: and at the Cortés palace in Cuernavaca, with its stylized and bittersweet story of the conquest of Mexico. In Mexico City he painted the lyrically landscaped staircase connecting tall frescoed corridors in the hlinistry of Education; in the National palace he portrayed Aztec history in archaistic forms and cold colours; and in the Social Security Hospital Ko. 1 he returned to his earlier lyrical style.

Rivera died Nov. 25, 1957, in Mexico City.

See also PAINTING: *Mexico and Latin America;* MURAL PAINTING: *20th Century.*

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RIVER AND RIVER ENGINEERING. A river is any natural stream of fresh water, larger than a brook or creek, which flows in a well-defined channel. Usually it discharges into another and larger body of water, the ocean, a lake or another river. In rare instances in regions of porous soil it soaks into the ground, or, in excessively arid regions, evaporates, in which case it becomes a "lost river." In other regions of favourable rock conditions it may also run underground for certain distances, disappearing and reappearing one or more times. A river with a well-cut channel and a graded bed, usually reaching base level at its mouth, is an adolescent river. Rivers as they grow older usually widen their valleys accordingly unless prevented by certain geological formations or occurrences. A river whose upper waters sometime in the past suddenly found a new outlet, diminishing the volume and force of the original river and also its length, is known as a beheaded river. For other facts relating to the origin and subsequent development of rivers and their valleys *see* GEOLOGY: *Physical Geology: Geomorphology.*

The river works which the engineer may be called upon to execute vary widely in their character and object. The more important of these which are described in the present article may be grouped under the following heads: (1) The prevention of river inundations and the mitigation of their effects; (2) the improvement for navigation of the nontidal portions of rivers; and (3) works for the improvement of navigation in the tidal compartments of rivers, in their estuaries and at the outlets of rivers flowing into tideless seas.

Other river engineering works are dealt with under separate headings, for instance, the utilization of river waters for power production (*see* ELECTRIC POWER); works for water storage and supply for various purposes including irrigation (*q.v.*); works connected with fisheries (*q.v.*); for erosion and reclamation of land (*see* BREAKWATER; LAND RECLAMATION). *See* also the articles on MECHANICS, FLUID; WATERWAYS, INLAND; WEIR; and particular rivers; *e.g.,* MISSISSIPPI RIVER; DANUBE.

PHYSICAL CHARACTERISTICS OF RIVERS

River Basins.—In general the size of rivers above any tidal limit and their average fresh-water discharge depend upon the extent of their basins, and the amount of rain over those basins. They vary in extent according to the configuration of the country, ranging from the insignificant drainage areas of streams falling from high ground near the coast and flowing straight down to the sea to the immense parts of continents. where rivers after flowing down the slopes of mountain ranges traverse vast stretches of valleys and plains before reaching the ocean. The comparative size of the principal river systems of the world is shown in the table.

River and Location	Drainage basin in square miles	Length in miles
Nile, Africa	1,110,000	4,157
Amazon, South America	2,722,000	3,915
Missouri-Mississippi, U.S.	1,243,700	3,860
Yangtze, China	756,498	3,604
Ob, U.S.S.R.	1,131,273	3,461
Yellow, China	486,486	2,902
Congo, Africa	1,425,000	2,716
Lena, U.S.S.R.	936,293	2,653
Mackenzie, Canada	682,000	2,635
Niger Africa	580,000	2,600
Amur-Kerulen, U.S.S.R.	1,035,000	2,583
Yenisei, U.S.S.R.	1,679,535	2,349
Rio de la Plata (system), South America		
Volga, U.S.S.R.	592,000	2,200
St. Lawrence, Canada/U.S.	361,000	1,800
Brahmaputra, Asia	372,000	1,800
Indus, Pakistan	315,444	1,776
Danube, Europe		
Zambezi, Africa	513,360	1,600
Murray, Australia	350,000	1,281
Orinoco, Venezuela		

Available Rainfall, Snowfall and Snow **Melting.**—All these factors vary considerably in different localities, both in their total yearly amount and in their distribution throughout the year; also their volumes fluctuate from year to year.

Even in small river basins the variations may be considerable according to differences in elevation or distance from the sea. For instance, in the Severn basin in England and Wales. with an area of only 4,350 sq.mi., the rainfall varies from an average of less than 30 in. in the year to more than 80. The proportion, moreover: of the rain falling on a river basin which actually reaches the river, or the available rainfall in respect to its flow, depends very largely on the nature of the surface strata. the slope of the ground and the extent to which it is covered with vegetation, and varies greatly with the season of the year. The available rainfall has been found to vary from 75% of the actual rainfall on impermeable, bare, sloping, rocky strata down to about 15% on flat, permeable soils.

Slope of Rivers.—The rate of flow of rivers depends mainly upon their slope and the roughness of the channel, though where two rivers of different sizes but the same roughness have the same slope, the larger river has the quicker flow. as its retardation by friction against its bed and banks is less in proportion to its volume than that of the smaller river. The fall of a river corresponds approximately to the fall of the country it traverses, but its slope is generally more gentle because of its meandering alignment. Near the source, frequently in hilly regions, the slope of rivers is usually steep, but it gradually flattens out, with occasional irregularities, until. in traversing plains along the latter part of their course, the slope usually becomes quite gentle. Accordingly, in large basins, rivers in most cases begin as torrents with a very variable flow, and end as gently flowing rivers with a comparatively regular discharge.

Variations in the Discharge **of Rivers.**—In tropical countries, subject to periodi'cal rains, the rivers are in flood during the rainy season. Where the annual flood depends to a large extent on the melting of the snows, the rivers are in their high stages in late spring and early summer. In snowless countries sudden and, to a large extent, unpredictable floods occur frequently in winter when the rate of evaporation is relatively low and the ratio of runoff to rainfall is therefore high. Occasionally heavy rainfall may then be the cause of a sudden rise of the river level, resulting in much damage—unless duly provided for by the engineer. Mixed conditions are characteristic of rivers fed partly by snow and partly by rain: though their annual floods may be due to the melting of the snow in spring, these rivers are liable to have their flow rendered more uniform by the influx of tributaries subject to different conditions, as exemplified by the Rhdne below Lyons. Fr.

Much attention was devoted by scientists in the first half of the 20th century to deriving a reliable method for predicting the

discharges of rivers according to the available meteorological data, and successful results were reported to have been achieved by Opokine on the Dnieper, U.S.S.R.

Transportation of Materials by Rivers. — In floodtime rivers bring down a large quantity of detritus, derived mainly from the disintegration of the surface layers of the hills and slopes in the upper parts of the valleys by glaciers, frost and rain. The power of a current to transport materials depends to a large extent on its velocity, so that torrents with a rapid fall near the sources of rivers can carry down rocks, boulders and large stones. These are by degrees ground by attrition in their onward course into shingle, gravel, sand and silt which are carried forward by the main river toward the sea or partially strewn over flat alluvial plains during floods. The size of the materials forming the bed of the river or borne along by the stream becomes less as the reduction of velocity diminishes the transporting power of the current.

Since the earliest days of modern hydraulics (17th century, in Italy) progressive engineering research has attempted to solve the problem of sediment transportation. Because sediment particles are generally heavier than the amount of water they displace, the Archimedean flotation law could not be used to explain the fact that heavy sediment was capable of being lifted and transported by flowing water. Another explanation was, consequently, required, the importance of the problem being that on its solution depended the means to be taken to control soil erosion and silt deposits in the channels of rivers.

Twentieth-century research distinguishes, in this connection, between "bed load" on the one hand and "suspended sediment" on the other. The former is composed of the larger particles which are either rolled or pushed along the bed of the river, or "jump" (*i.e.*, saltate) from the crest of one ripple to another if the velocity is sufficiently great. On the other hand the smaller particles, *i.e.*, the suspended sediment, once picked up and lifted by the moving water, may remain in suspension for considerable periods of time, and thus be transported over many miles.

Bed load is capable of an easier explanation than suspended sediment because in the first case the velocity of the moving particles is less than that of the water, whereas in the second both velocities are equal. In one case, therefore, there is an impact effect due to the difference of velocities, while in the other, such effect is absent.

From among the various theories suggested to explain the phenomenon of sediment suspension the following may be quoted: (1) T. Dupuit and A. Flament believe that a rigid body transported by the flowing water tends always toward the region of maximum velocities and, as the surface velocity is usually greater than the bed velocity, a sediment particle, picked up from the bed, must of necessity rise toward the surface; (2) from numerous observations of velocities in rivers N. de Leliavsky concluded that the scour of a granular river channel and the lifting of the particles of which it is composed is due to convergent currents possessing a surplus of energy, while diverging currents have the opposite effect; *i.e.*, they cause suspended sediment to be dropped; (3) a third school of thought attributes the lifting of the particles to the rising components of the cross currents. This school is subdivided into two groups depending upon whether the cross currents are visualized as forming part of a pulsating but generally orderly flow pattern, or are believed to be a numberless multitude of instantaneous and disorderly agitations characteristic of an essentially turbulent flow.

River Channels. — A river channel eroded by the current depends obviously on the flow pattern, and the flow pattern is, in turn, affected by the form of this same channel. It may therefore appear that the problem of the river channel contains the elements of a vicious circle.

A broader approach postulates that we are faced, in this case, with a process of mutual interaction between two mediums, water and granular soil, and that the channel formation due to such an interaction is controlled by certain general laws.

Among the various authors who contributed to the discovery of these laws might be mentioned James Thomson, L. Fargue, N. de Leliavsky, R. Jasmund and others. One of the main laws is that the natural shape of a river channel eroded in an alluvial plain does not follow a straight line but shows a tendency to meander, and even if it were made straight through artificial means, it would soon begin to serpentine again. In fact, Fargue showed that water depth in a river is correlated with curvity of its channel in plan in such a manner that as the curvity increases, so does the depth.

This, and various other laws belonging to the same theory of river channels, have been much discussed and modern experimental evidence tends to bear them out. The experiments of J. F. Friedkin, of the Vicksburg experiment station of the U.S. army, as reported in *A* Laboratory Study of the Meandering of Alluvial Rivers (Vicksburg, 1945), show that "Meandering is essentially a natural trading process of sediments from banks to bars. . . Under ideal conditions of uniformity, an initial bend is perfectly transmitted downstream, thus resulting in a series of uniform bends. . . The natural process might be likened to the oscillatory course taken by a ball which has been started down a grooved incline so that it oscillates from side to side. . ."

The more uniform the configuration of the earth surface, the nearer does the river channel approach the described ideal shape. Mountains and various other natural and man-made obstructions interfere with the process of the formation of a natural river channel, causing local deviations from its ideal sinusoidal shape.

Floods of Rivers. — It will be clear that floods of rivers may be of two kinds: the annual floods which take place always during the same months of the year, and the sporadic, altogether unpredictable floods, which may not occur for several years, and then come suddenly, at an unexpected date. An outstanding example of the first class is the annual flood of the Nile, always occurring during the months of August and September, which is fed by the monsoon rains falling over the equatorial districts of central Africa; whereas the floods of the Seine at Paris are typical of the second class, for though they usually occur in winter, their dates and intensities are subject to much variation. Such floods are caused by a heavy rainfall on land already sodden by recent rains at a period of the year when evaporation is inactive, and especially by rain falling on melting snow. A fairly simultaneous rainfall over the greater part of a moderate-sized river basin is a tolerably common occurrence; and under such conditions, the floods coming from the torrential tributaries reach their maximum height and begin to subside before the floods from the gently flowing tributaries attain their greatest rise.

THE REGULATION OF NONTIDAL RIVERS

Mitigation of Floods and Protection from Inundations. — As the size of the channel of a river is generally inadequate to carry down the discharge of floods, the river overflows its banks in floodtime and inundates adjacent low-lying lands. An enlargement of the bed of a large river, principally by deepening it, in order to increase its discharging capacity, is precluded by the cost, and also, in rivers bringing down sediment, by the large deposit that would take place in the enlarged channel from the reduction in the velocity of the current when the flood begins to subside. Where, however, the depth of a smaller river has been considerably increased by dredging, the enlargement of its channel and the lowering of its low-water line facilitate the passage of the land water and consequently reduce the danger of flooding. The Glasgow quays, for instance, along the deepened Clyde are no longer subject to inundation, and the lands and quays bordering the Tyne have been relieved from flooding for 10 mi. above Newcastle by the deepening of the river from Newburn to the sea. (See fig. 10.)

In certain cases it is possible to restrict or to prevent the inundation of some riparian districts by embankments; and occasionally low-lying lands are so unfavourably situated that pumping has to be employed.

The flow of water off the slopes of a valley can be retarded by planting trees on mountain slopes, which have too often been denuded by the reckless clearing of forests.

The most efficacious way of dealing with the prbblem is to reduce the peak of the flood by withdrawing at the critical period

some part of the natural discharge from the river. This may be done in two different manners; *i.e.*, either by diverting the flow in a low-lying depression, or by building a dam across the valley of the river and storing behind it a part of the flood discharge. An example of the first arrangement is the scheme of works on the Tigris and Euphrates rivers, in Iraq, part of which was inaugurated in the early spring of 1956. The floods of these rivers have always been a major problem and have caused much damage to the town of Baghdad and the surrounding cultivated area. The Ramadi barrage and Warrar regulator were built to divert part of the flood of the Euphrates into the Habbaniya lake, some of the water to be returned into the river during the drought season through the Dhiban outlet. In more or less the same manner, the Samarra barrage and inlet regulator were planned to divert the flood of the Tigris into the Tartar depression, through a 65-km. inlet canal. On the other hand, the Aswan dam on the Nile furnishes an example of a storage reservoir in the trough of the river, which may also be used for occasional flood control. The fact that floodwater is heavily laden with silt prevents this operation being carried out systematically every year as the silt would then fill the reservoir. In 1946, during an exceptionally high flood, the Aswan reservoir was used to reduce its peak, as an exceptional measure. In the United States, during the 25-year period ending in 1952, 300 projects were constructed in the interest of flood control, 77 of which were dams, while the remainder were local protection projects. The flood control project in the lower Mississippi river valley included five reservoirs, all completed by the mid-1950s.

Methods of Increasing the Discharging Efficiency of River Channels.—The discharging efficiency of a river within the limits of its bed depends on the fall and the cross section of the channel. The only way of increasing the fall is to reduce the length of the channel by substituting shorter cuts for a winding course. In the case of a large river, however, it is very difficult to maintain a straight cut because of the tendency of the current to erode the banks and form again a sinuous channel. Cuts therefore should be in the form of one or more flat curves. Nevertheless, where the available fall is exceptionally small, as in lands originally reclaimed from the sea such as the English fen districts, straight channels have been formed for the rivers and "drains."

Prediction of Floods.—This term may be interpreted in two different manners, for it may either be meant to refer to a definite flood, the levels and dates of which must be known beforehand in order to take immediate and urgent steps for alleviating its probable effect upon the safety and welfare of the riparian population, or the same term may also be used to designate a more general problem; *i.e.*, the probabilities of the flood magnitudes and flood frequencies of a river, which are of fundamental importance in many design problems in connection with flood control.

The only generally accepted solution of the first problem consists in establishing a number of gauges for recording the water levels in the upper stretches of the river itself and in all its affluents. In order to understand how the information on the flood levels in the upper regions of the river supplied by these gauges can be used for predicting the levels for its lower course, we imagine a flood as a wave (see *abc* in fig. 1) which moves slowly downstream. The velocity of propagation of this solitary wave (celerity in U.S. terminology) is not necessarily the same as that of the water in the river, but, in practice, is frequently of the same order of magnitude. Referring again to fig. 1, it will be observed that the slope of the water surface in the downstream part of the wave, *i.e.*, in *bc*, is of necessity much steeper than in *ab*. Since the velocity of water in a river depends largely on the corresponding slope of the water surface, it follows that in *ab* the velocity is much less than in *bc*. In other words, there is less water fed into the wave on its upstream side than escapes toward its downstream end, the result being that as the flood moves slowly downstream, it gradually flattens. Thus, as it reaches the position *efg*, it is shallower than in *abc*, and in *hij* its height is still less. On the other hand, if two waves such as that shown in the drawing move in two confluents and reach the main channel simultaneously, a dangerous flood may occur. The speeds of the propagation of the waves, as well as their levels can all be calculated with remarkable precision and the floods occurring in the entire basin of the river are, consequently, capable of being predicted with enough accuracy for practical purposes. The new branch of hydraulics dealing with this particular problem is frequently referred to as flood routing.

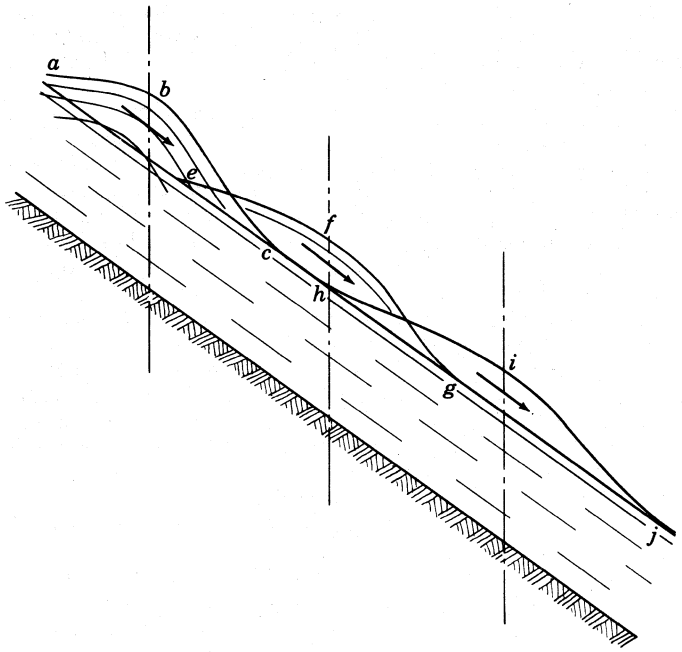

FIG. 1.—THE MOVEMENT OF A FLOOD SHOWN AS A WAVE

It remains now to consider the second, more general, problem dealing with the probability of flood levels and their incidence. Among the earliest hydraulicians who started this approach in the earlier decades of the 20th century were Allen Hazen in the United States and H. E. Hurst and P. Philips in Egypt. The bell-shaped Gaussian frequency curve, such as is represented in fig. 2, is among the best known of the popular diagrams that are used for systematizing the results of observations from which significant conclusions, capable of practical application, are derived. The numbers

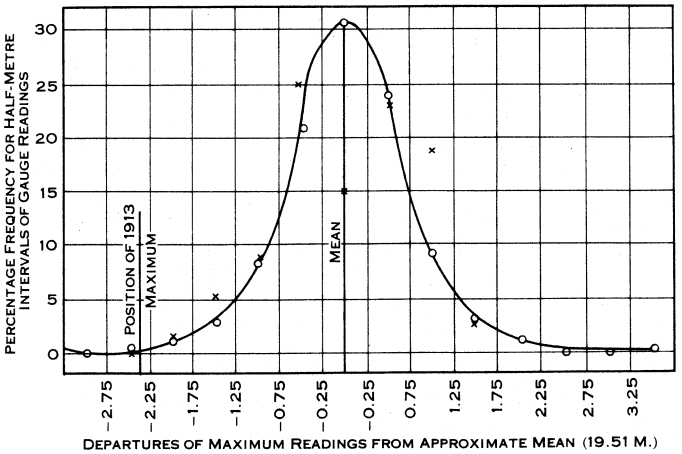

FIG. 2.—GAUSSIAN FREQUENCY CURVE, USED FOR SYSTEMATIZING FLOOD PREDICTION DATA

under the horizontal axis of the diagram are the departures of the annual Nile flood levels—measured since 640 on the Roda Nilometer at Cairo—from their mean. This mean flood level (19.51 m. above mean sea level) is, of course, the most probable, and the height of the curve above the horizontal axis gives the probabilities of the recurrence of the corresponding departures from this mean. The practical significance of such a curve is that the need for public works intended to meet conditions which may recur only once in, say, 100 or 200 years, cannot be as pressing

as in the case of a flood level recurring every 2 or 3 years. The curve may therefore be interpreted as yielding a quantitative basis for granting the yearly credits for the corresponding works.

From the standpoint of the computer the great objection against this type of diagram is that the bell-shaped curve is not so obvious as a straight line. Hazen devised, therefore, another form of computation. in which the same information is systematized in the form of a straight line—as shown, for instance, in fig. 3. It will be noted in looking at this figure that in order to convert the areas of the bell-shaped curve of fig. 2 into a straight-line representation, a special scale is used. The numbers written beneath the diagram are the figures of probabilities of lower flood levels than those indicated by the averaging straight lines drawn through the observations which appear as points. The most important conclusion derived from this diagram is that the flood levels for the period 1737–1917 are higher than for 641–1451, which means that as a result of the silt deposited by the river, the whole valley of the Nile rises gradually at a rate of about four inches per century.

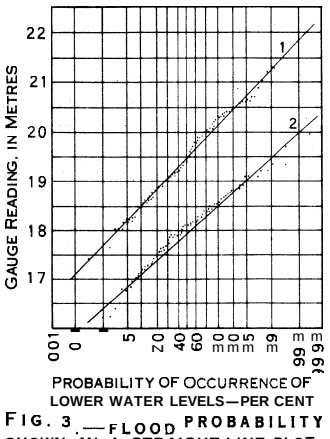

FIG. 3.—FLOOD PROBABILITY SHOWN IN A STRAIGHT-LINE PLOTTING

Fig. 2 and 3 are typical of a symmetrical frequency. Mathematical treatment of skew frequencies is somewhat more involved. This and many other problems to be solved in order to obtain in all cases an easily extrapolated straight-line diagram, involving the use of logarithmic functions and other devices, were attacked by numerous well-known mathematicians, among them Ralph W. Powell, R. D. Goodrich, E. J. Gumbel, H. Alden Foster, Ven Te Chow and many others. Both diagrams were prepared by Philips, and are reproduced here from S. Leliavsky Bey ("Underpinning and Repairing the Roda Island Nilometer," The Engineer, London, Dec. 9. 16 and 23, 1949). The gauge in question deserves mention as the oldest gauge still being used for river level measurements. It is one of the earliest masonry works erected by the Arabs after the conquest of Egypt, and is believed to be referred to by Shakespeare's Antony when he speaks about the Egyptians being particularly clever in measuring water levels (*Antony* and *Cleopatra,* act II, scene vii; the reference to the pyramid in connection with river levels would then be explained by the shape of the roof of the gauge). The maximum yearly flood levels recorded on this gauge were preserved as state documents because, according to old established routine, the yearly land tax levied from the cultivated area of the country was dependent on this level. In fact, too low a level meant insufficient irrigation, while too high a level was accompanied by inundations. Thus. the taxpaying capacity was a function of the river level, and this principle was reflected in a tradition of land-tax assessment, the origin of which dates back before the earliest recorded Egyptian history.

Embankments. — Earthen banks protecting the inhabited areas in the valley of a river against inundations during flood are possibly among the earliest types of engineering works ever created by man. For instance, in Egypt, the left-hand bank of the Nile, extending from Aswan to the Mediterranean, over a distance of more than 1,000 km., existed (partially, at least) in the time of the Pharaohs, while the right-hand bank was built somewhat later, by Arab engineers. Since the very life of the country depended on these banks during floods, legend has it that some of the earlier rulers of Egypt ordered the engineer in charge of the maintenance of a bank to be thrown into the breach in case such a breach was allowed to occur within his district. It has been suggested that, viewed in the historic perspective, the danger of inundations, forcing as it did the individual to depend for his personal safety on the construction of long and tall banks, *i.e.,* on the co-operative work of the community, must have been a strong incentive for the development of organized communal life; hence the mighty monarchies which. at the dawn of history, existed in the countries where irrigation and hydraulic engineering were practised on a large scale, such as Egypt, Mesopotamia, China, Ceylon and, possibly, Spain.

The system of embankments has been adopted in other places, also, where tracts of fertile alluvial land below flood level stretch for long distances away from the river. Thus the fens of Lincolnshire, Cambridgeshire and Norfolk in England are protected from inundations by embankments along their rivers and drains; a great portion of the Netherlands is similarly protected; and the plains of Lombardy are shut off from the floods of the Po by embankments along each side of the river for a distance of about 26j mi.

For such towns as New Orleans on the Mississippi and Szegedin on the Theiss in Hungary, which were established below the flood level of an adjoining river, the channel of the river should be improved to facilitate the passage of floods past the town. The town also should be enclosed within embankments raised above the highest possible flood level to obviate the contingency of an exceptional flood, or a gradually raised flood level leading to such a catastrophe as overwhelmed the greater part of Szegedin in March 1879 and threatened New Orleans in 1927.

The Mississippi. — A system of levee embankments has been extensively developed along the Mississippi river in its alluvial valley extending from Cape Girardeau, Mo , to the Head of Passes in the delta, a distance of 1,014 mi. by river channel. The alluvial valley has a length in latitude of 600 mi. and ranges from 20 mi. to 80 mi. in width with a total area of 35,500 sq.mi. It comprises the St. Francis, the Yazoo, the Tensas, the Lafourche, the Atchafalaya and portions of the White and Arkansas basins, as well as the alluvial lands around Lake Pontchartrain (fig. 4).

These levees, begun by the French settlers in Louisiana in the early 18th century, uere in 1735 about three feet high and had been constructed from 30 mi. above New Orleans to 12 mi. below. From this beginning the system was extended until by the mid-1950s it included 2.846 mi. of levees having an average height of 24 ft. and a content of about 1,392,000,000 cu.yd. of earth. The levees above Baton Rouge, La., are roughly parallel to the river but have a width between them of from $\frac{3}{4}$ mi. to 15 mi., thereby greatly increasing the cross-section area of the river in times of flood. Belou Baton Rouge the levees follow the bends in the river but are set back from the river bank sufficiently to prevent undercutting by the current during floods. In some parts the spacing is much greater.

The low-water discharge, measured at New Orleans, 123 mi. from the mouth of the Southwest pass, has been as low as 49,200 cu.ft. per second; this, however, was affected by tide. The lowest discharge of record at Red River Landing, La., was 75,000 cu.ft. per second. At Vicksburg, Miss., a discharge of 1,806,000 sec.-ft. was recorded in 1927 (estimated 2,278,000 sec.-ft. if flood had been confined to leveed river), which compares with the minimum of record of 93,800 sec.-ft. at that place. The levees had not been adequate during certain floods to withstand the water pressure which had (before the record flood of 1927) a maximum rise at Vicksburg of 61.65 ft. above 1940 low water at that point. In 1927 the river at Vicksburg rose 3.55 ft. higher and 6j.2 ft. above the low stage of 1940. The floods tend to increase in height due to the confinement of the river between levees. Breaches, or crevasses as they are termed in the United States, have occurred during extraordinary flood, but no crevasses occurred after 1928 in the lower Mississippi river valley. They produce a sudden rush of the floodwaters through the opening which is damaging to the land in the immediate vicinity of the breach, but the general inundation is gradual and benefits the lands with a fertilizing deposit. The velocity of the outflouing water is rapid only immediately in front of a crevasse and the water creeps over the delta lands generally, aided by the sloping down of the land on the alluvial plains for some distance away from the river.

The great floods of the Mississippi and its tributary rivers in April–June 1927 were particularly serious. They were due to the extraordinary coincidence of flood conditions in all the chief tributaries of the river. Normally the eastern floods usually culminate between January and April, while the crests of the Missouri river

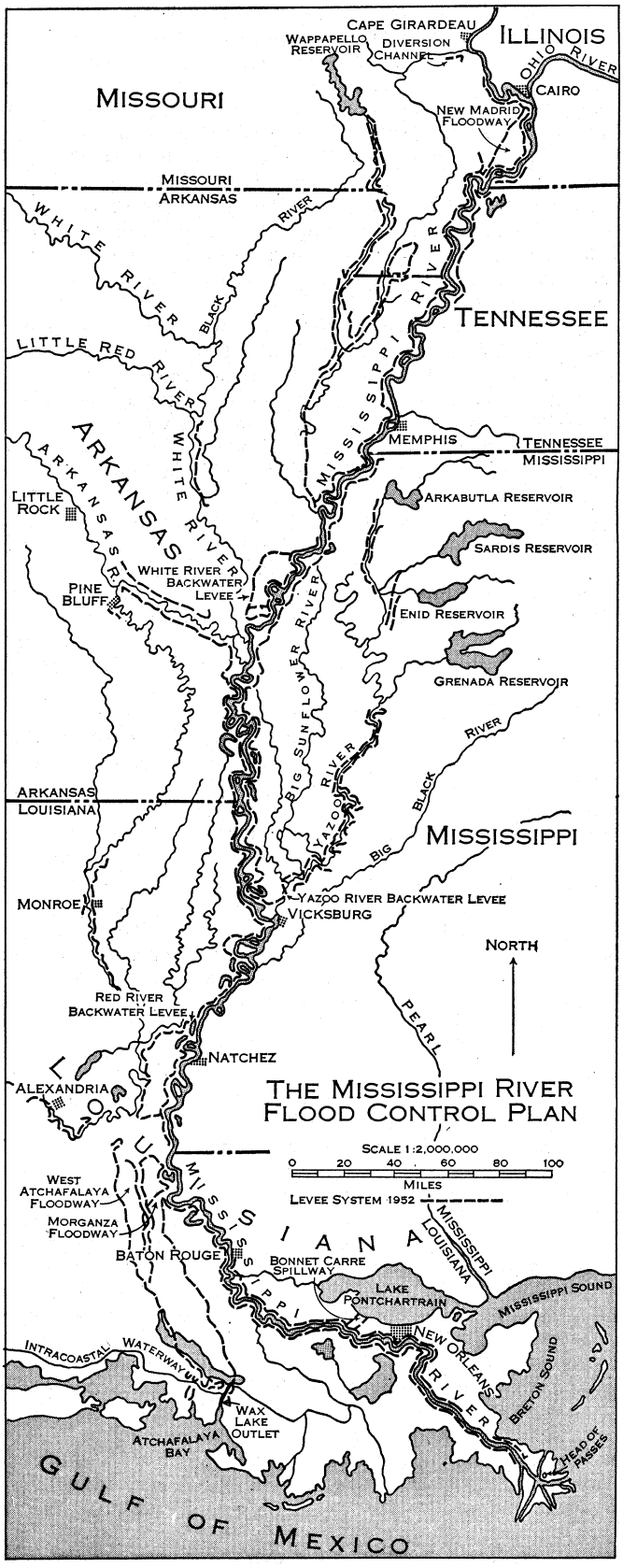

FIG. 4 — MAP OF MISSISSIPPI RIVER SHOWING AREAS SUBJECT TO OVERFLOW AND REQUIRING PROTECTIVE ENGINEERING

floods usually enter the Mississippi in June. In 1927 the levees were breached in many places and the floodwaters overflowed throughout the alluvial valley. An area of more than 23,000 sq.mi. was inundated and 700,000 people were driven from their homes, Apprehension was averted at the city of New Orleans by cutting a gap in the levees at Poydras, a few miles below the city, thus permitting a part of the floodwaters to take a short course of about 5 mi. to an arm of the sea instead of following the normal course of the river through the delta.

In Jan.–Feb. 1937, while the greatest flood of record was developing in the Ohio river, the conditions in the Mississippi river were favourable for receiving and disposing of this unprecedented discharge. The lower Mississippi was called on to carry a flood of more than 2,000,000 sec.-ft. The improved levee system successfully held the water within bounds, except in backwater areas of the tributaries, which were not protected. The Bonnet Carre spillway, 23 mi. above New Orleans, was put into operation late in January when it became apparent that the oncoming floodwaters would raise the stage at New Orleans above 20 ft. The floodway diverted a maximum of about 200,000 sec.-ft. into Lake Pontchartrain and held the crest at New Orleans to 19.3 ft. Without the relief afforded by the spillway, it is estimated that the stage at New Orleans would have been about 3 ft. higher. The Bonnet Carre floodway was also operated successfully in 1945 and in 1950. The 1950 flood, which produced the third highest stage of record at Cairo, Ill., was safely carried to the Gulf of Mexico within the levee system and control works.

In the early 1930s a system of channel cutoffs was inaugurated on the lower Mississippi river. By 1941 they had demonstrated their worth by lowering river stages more than 12 ft. at Arkansas City. Ark.. and 6 ft. at Vicksburg. Sixteen such cutoffs, combined with other channel shortenings, reduced the river distance from Memphis, Tenn., to Baton Rouge by 170 mi.

Local Protection Projects. — The above discussions are pertinent to the protection of extended continuous areas along such a river as the Mississippi. Levees and flood walls are also utilized for localized protection of municipal areas. After 1930 the United States especially developed many local protection projects of the latter type, designed to provide a higher degree of protection for highly developed industrial and residential areas than had been customary for the continuous embankment type of protection. A good example of a local protection project is that for the protection of Kansas City, Kan.. and Kansas City, Mo., located at the junction of the Missouri and the Kansas rivers, which provides for construction of a combination levee and flood wall; construction of pumping plants; construction of a river cutoff and a highway bridge across the cutoff; and alteration of 14 bridges across the Kansas river and 2 across the Missouri river.

REGULATION OF THE NONTIDAL PORTIONS OF RIVERS FOR NAVIGATION

The importance of rivers as means of communication can scarcely be overestimated. Works are, however, required in order to increase as far as practicable the navigable depth of the channel, and thus permit larger craft to navigate the river.

Since, because of its winding alignment, a naturally built river channel constitutes a succession of deeps and shoals, the removal or at least the improvement of the latter is obviously the main problem of regulation works as carried out on navigable rivers. On some rivers it is practicable to concentrate flow and fix the low-water channel by closing subsidiary low-water channels with dikes across them and narrowing the channel at the low stage by low-dipping cross dikes extended from the riverbanks down the slope, sometimes pointing slightly upstream so as to direct the water flowing over them into a central channel.

Removal of Shoals. — There are two schools of thought in connection with this problem. The first, traditional school maintains that since the flow lines in a river are generally parallel to its banks, it suffices to constrict its channel by training works in order to cause the velocity to increase and thus wash away the sand and silt forming the shoals. The second school questions these too obvious assumptions, and postulates that the nonparallelity of the flow is the main cause of the formation of shoals which. as such, can by no means be disregarded in carrying out the works intended for their removal. J. L. Van Ornum describes this second approach as the "directing control of the current of the river." Imagine a portion of a meandering river consisting of two curves with the

point of inflection, *A*, at their junction, as shown in fig. 5. The general pattern of a meandering river may be visualized as a succession of such S-shaped elements; and therefore what occurs with one of them may very well be taken as valid for the entire river.

According to Fargue's correlation law, between curvature and depth of channel the depth of water within the limits of the curved parts of the river is usually ample for the requirements of navigation. But *A*, the point of inflection, constitutes a technical design problem, for the curvature of the streamlines drops here suddenly to zero, and the water depth may be expected to be, therefore. a minimum. This, indeed. is found to be frequently the case in nature, and explains the succession of deeps and shoals; for the deeps, or pools. correspond to curves, while the shallows, or shoals. coincide with the inflection points. In this correlation between depth and curvature lies, consequently, the three-dimensional principle of alluvial river channels.

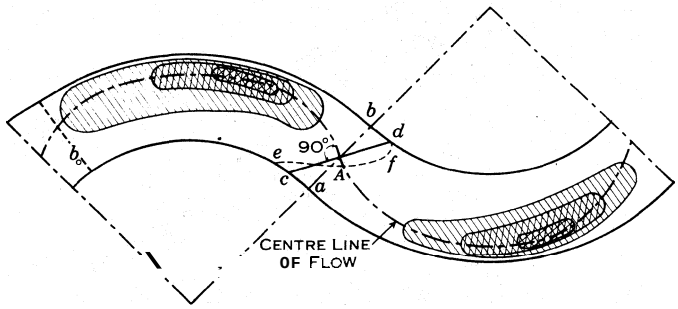

FIG. 5.— DIAGRAM OF TYPICAL MEANDER COIL. 'DEMONSTRATING THE INCONSISTENCY OF THE TRADITIONAL METHOD OF RIVER TRAINING BY CHANNEL CONTRACTION

Since the main objective in training a river is to permit larger, deeper-draft craft to ply on it, and since, in this case, the weakest link fixes the strength of the entire chain, it was only natural that the attention of training-works designers should have been concentrated on the improvement of the channel at the inflection points as the main task confronting the engineer. This point of training-works design is among the several problems, on the solution of which the parallelist and nonparallelist principles are particularly in disaccord; in fact, so long as the flow is assumed to be parallel to the banks, nature's choice of the inflection point as a locus for silting and a centre for sand deposits appears rather arbitrary. On the other hand, the physical reason of these deposits becomes quite clear if it is realized that at the inflection point the nonparallelism between flow and banks is particularly pronounced, for the main current crosses here from one concave bank to the other, and the area of waterways measured at right angles to the flow lines is not *ab (see* fig. *j),* as the parallelist school would have it, but cd (or even, as the curve *ef,* according to some observations carried out on large rivers). Since the area of waterways measured in this manner is much larger than *ab,* it follows that the velocity at the inflection point is far less than in the curve, and this explains the reason for the formation of the shoal, for as the velocity drops the sediment carried in suspension by the current is forthwith deposited. The solution advocated by the nonparallelist school consists, therefore, in dealing individually with each shoal by means of a long dike or spur protruding far into the channel of the river like a sabre in such a manner as to create a convergent, *i.e.,* scouring, type of current at the spot where it is most needed, at the inflection point. This method is recommended to replace the traditional layout of training works, consisting of a very large number of dikes and banks spread throughout the entire length of the regulated reach of the river, *i.e.,* inflection points and curves alike, as shown, for instance: in fig. 6.

Evidence on the practical results obtained by applying these two theories for the design of training works may possibly appear conflicting. But on further analysis it seems that while the traditional principle has frequently resulted in moderate general improvements of the navigation conditions. it often caused much disappointment because new shoals developed beyond the limits of the reaches trained in this manner—or even within these limits. Such local troubles could then be remedied by application of the second method. The main objection, however, against the traditional method is the very large expenditure on training works located at the spots where they are altogether unnecessary, *i.e.,* in the curves, where the natural depth of the channel is already ample for navigation.

A well-known instance of successful results obtained by this method is the regulation of the Waal river in the Netherlands, which is shown in fig. 6.

The improvement of this river was commenced about the middle of the 19th century, but the works carried out in it between 1909 and 1919 afford a most interesting example of successful results obtained by the first method, although, of course, there is nothing to prove that as good results might not have been obtained by the second method at much lower cost. The channel was deepened, throughout its length of 53 mi, from $7\frac{1}{2}$ ft. to $11\frac{1}{2}$ ft., almost entirely by training works. although no information is available on the behaviour of the river above and below the limits of this reach.

Where flood levels are a danger, training works might be objectionable because they create new obstructions to the flow and thus make this danger still greater. Such considerations lead to the development of a particular type of training works which are relatively low, as compared with the usual type, and therefore leave an almost free channel for the passage of the flood. The result of application of this type was rather indifferent on the Rhône, somewhat better on the Rhine and still better on the Mississippi above Cairo, Ill.

Much attention was devoted, at different times, to the question which of the two, training works or dredging, was the better solution for dealing with shoals. The combination of both methods seems to be the ideal solution *(see* DREDGES AND DREDGING).

On the Rhône below Lyons with its rapid current, the dikes are constructed of rubble, consolidated above low water with concrete. The dikes on the Rhine consist for the most part of earthwork mounds protected by a layer of rubble or pitching on the face, with a rubble mound forming the toe exposed to the current; but occasionally fascines are employed in conjunction with the stone or simple rubble mounds. On the Waal the newer cross dikes have a core of sand protected by a mattress weighted with stone. The dams closing subsidiary channels on the Mississippi are almost always constructed of fascine mattresses weighted with stone; but whereas the regulating dikes on the upper river are usually similar in construction, a common form for dikes in the United States consists of two parallel rows of piles filled in between with brushwood or other materials not affected by water, and protected at the sides from scour by an apron of fascines and stone.

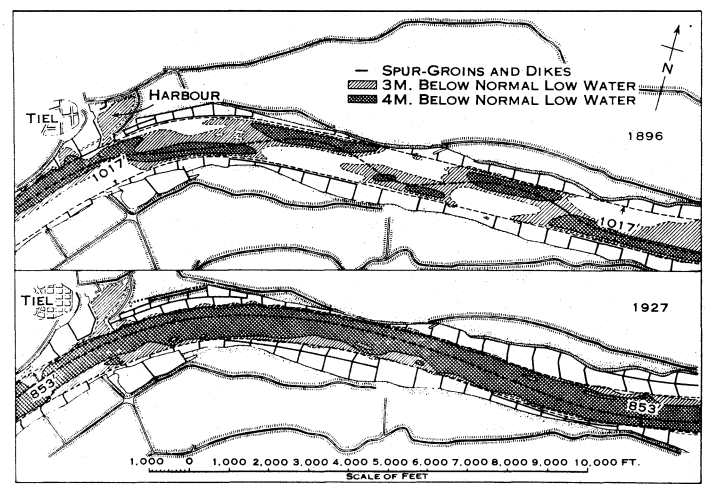

FIG. 6.— WAAL RIVER AT TIEL, NETH.. SHOWING THE CONDITION OF THE TIEL REACH IN 1896 AND 1927
The regulation works completed in this reach in 1911 effected a permanent deepening of the channel and no dredging was necessary thereafter

Protection of Vessels During Floods.—On large rivers, where vessels during high floods are exposed to injury from float-

ing debris and ice floes, shelter can be provided for them in refuge ports, formed in a recess at the side under the protection of a solid jetty or embankment constructed in the river parallel to the bank These ports are closed against floods at their upper end and have their entrance at the lower end facing downstream. There are numerous examples of such river harbours on the Danube. the Rhine and other European rivers and in the rivers of North America. Many of them. made in the vicinity of towns, as at Dusseldorf. Ger., are inland ports of considerable size.

This problem takes a particularly acute form in connection with the works carried out. after 1950, on the Don and Volga rivers in the U.S S.R.. nhere 200 mi long and 20 mi. wide internal seas have been created by building huge dams across the channels and valleys of the rivers. (See WATERWAYS, INLAND.)

SMALL RIVER OUTLETS EXPOSED TO LITTORAL DRIFT

Rivers with a small 'discharge flowing into the sea on an exposed coast are more or less obstructed at their outlet by drift of shingle or sand along the coast. When the flow falls very low in dry weather. the outlet of a river is sometimes completely closed by a continuous line of beach, any inland or tidal waters merely trickling through the obstruction; and it is only on the descent of floods that the outlet is opened out. In rivers which always have a fair fresh-water discharge, or a small fresh-water flow combined with a tidal flow and ebb, the channel sometimes has its direct outlet closed, and is deflected parallel to the shore till it reaches a weak place in the line of beach. through which a new outlet is formed; or, where the current keeps the outlet open, a bar is formed across the entrance by the littoral drift, reducing the navigable depth. (See HARBOURS; JETTY.)

Jetties at River Outlets. — The bar formed across the outlet of a river not heavily charged with sediment and flowing into a tideless sea can be lowered by carrying out solid jetties on each side of the outlet across the foreshore, so as to scour the bar by concentrating the issuing current over it. Thus by means of jetties slightly curved in plan. aided by dredging. the depth at the entrance to the Swinemunde of the Oder was increased from 7 ft. to 27 ft.. the approach channels to the Pernau river and other rivers flowing into the Baltic were deepened by jetties and the outlet channels of some of the rivers flowing into the Great Lakes of North America were improved by permanent jetties and dredging.

Where the littoral drift is powerful enough to divert the outlet of a river (as in the case of the Yare river, which at one time was driven to an outlet 4 mi. S. of its direct course into the sea at Yarmouth. Eng.. and the Adour river in France, whose outlet. because of the violent storms of the Bay of Biscay. was liable to be shifted 18 mi. from its proper position), it proved practicable to fix as well as to deepen the outlet by means of jetties. In such cases. however. where the rivers flow into tidal seas, it is important to place the jetties sufficiently apart to avoid any loss of tidal influx, since the tidal flow assists the fresh-water discharge in keeping the outlet open; whereas. with rivers flowing into tideless seas. a moderate restriction of the width between the jetties increases the scour. The tortuous and somewhat shifting outlet channel of the Scheur branch of the Maas (Meuse) river emerging onto a sandy coast where the rise of tide is small. and obstructed at its mouth by a bar, was replaced by a straight cut across the Hook of Holland. The outlet across the foreshore is fixed in position by fascine-mattress jetties (*see* JETTY). the maintenance of the depth at the mouth by the tidal and fresh waters being aided by frequent dredging (fig. 7).

DELTAIC OUTLETS OF TIDELESS RIVERS

Large rivers heavily charged with sand and silt. when their current is gradually arrested on entering a tideless or nearly tideless sea! deposit these materials as a constantly advancing fan-shaped delta through comparatively shallow diverging channels which convey the fresh-water and sediment discharge into the sea. These deltaic channels deposit their burden of sediment in front of their outlets. forming bars which advance with the delta and whose rate of progress seaward and distance in front of each outlet are proportionate to the sediment load and discharge of the several channels. A channel dredged on the bar in front of an unimproved outlet of a deltaic river retains its depth for only a moderate period

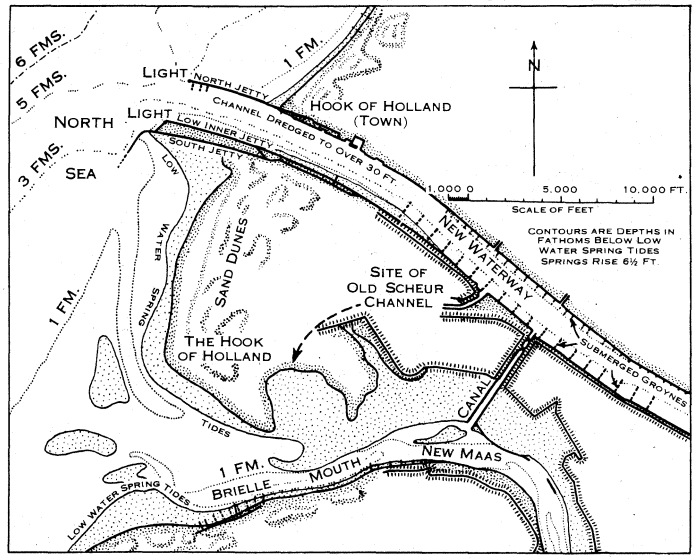

FIG 7 — JETTY OUTLET OF THE MAAS RIVER INTO THE NORTH SEA. THE ARTIFICIAL CUT FOR THE MAAS RIVER THROUGH THE HOOK OF HOLLAND WAS BEGUN IN 1864

on account of the deposit continually accumulating at the outlet.

Parallel Jetties at Delta Outlets. — The construction of parallel jetties, prolonging seaward the banks of an outlet channel, concentrates the scour of the issuing current on the bar at the outlet and under favourable conditions will procure and maintain an adequate depth for navigation. The requisite conditions for the success of this system of improvement are (1) a sufficient depth in the sea beyond the bar to allow for a considerable deposit of alluvium before the increased depth is interfered with; and (2) a littoral current carrying a portion of the alluvium away from the outlet. Both of these conditions retard the progression of the delta in front of the outlet and the inevitable eventual formation of a new bar farther out. Thus the rate of advance of the delta in front of an outlet is proportionate to the size of the channel. and the length of the jetties required is proportionate to the discharge of the channel.

The Delta of the Danube. — The Danube traverses its delta in three branches. the northern one of which. though conveying nearly two-thirds of the discharge of the river. is unsuitable for improvement due to its splitting up along portions of its course into several channels and eventually flowing into the sea through 12 mouths of a small independent delta advancing about 250 ft. annually across a shallow foreshore. The central Sulina branch was selected for improvement in 1858 in preference to the southern St. George's branch. which had a more favourable outlet and a better channel through the delta. The distance of the Sulina bar from the shore was only half that of the St. George's bar due to the much smaller discharge of. the Sulina branch. The jetties, begun provisionally in 1858 and subsequently consolidated and somewhat extended. were completed in 1877. They increased the depth over the bar from an average of about 9 ft. before 1858 up to 20½ ft. in 1873 which depth was maintained for many years. In 1894, however, the increasing draft of vessels rendered a greater depth necessary; the wide inshore portion of the jetty channel was therefore narrowed by inner parallel jetties. and a powerful suction dredger was set to work in the jetty channel and outside, whereby the depth was increased to 24 ft. in 1897 and was fairly maintained up to 1907, when a second dredger became necessary to cope with the shoaling. The depth contours gradually advanced seaward while the deepest channel was deflected northward by the action of current and waves. During World War I the decrease in depth, accelerated by the interference with dredging which occurred, was so rapid that the navigable depth was reduced at one time to 18 ft. In 1922 the seaward extension of

the jetties was commenced. leaving temporary gaps between the old heads and the new works, which mere closed after the new channel had been opened for traffic (fig. 8). This extension of the jetties for about 6.000 ft. and dredging operations restored for the time being the ruling depth of 24 ft. in the direct channel. A further extension of 2,000 ft. was made. The new jetties, like the original ones, are formed of fascine mattresses covered with stone rubble.

The Mississippi Delta.— The selection of the outlet of the

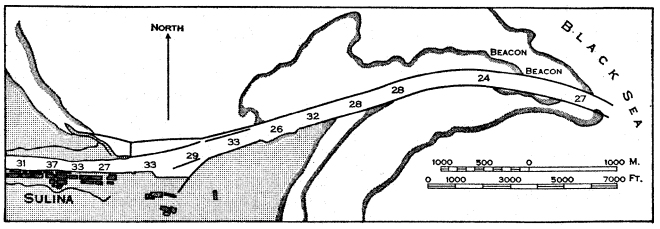

FIG. 8.— THE SULINA MOUTH OF THE DANUBE (1946)

South pass of the Mississippi delta for improvement by parallel jetties in 1876–79, in spite of the Southwest pass possessing a larger channel and a better depth over its bar, was due. as at the Danube, to motives of economy, as the bar of the Southwest pass was twice as far off from the shore as that of the South pass (fig. 9). Fascine-mattress jetties, $2\frac{1}{4}$ mi. and $1\frac{1}{2}$ mi. long, weighted with limestone, and with large concrete blocks at their exposed ends, were constructed. The jetties, which were curved slightly southward at their outer ends to direct the sediment-bearing current more directly at right angles to the westerly littoral current, increased the depth of 8 ft. over the bar in 1875 up to 31 ft. between the jetties and out to deep water. The prolonged flow of the river produced by the jetties, as at the Sulina outlet, carried the main portion of the heavier sediment into fairly deep water, so that the greatest advance of the foreshore in front of the South pass occurred in the 70-ft. line of soundings, though the shallower soundings also advanced. The shoaling, however, in the jetty channel necessitated its reduction in width by mattresses and spurs from 1.000 ft. to 600 ft., and eventually the jetties were rebuilt on lines reducing the channel width to about 6jo ft. Dredging was also required to maintain the stipulated central

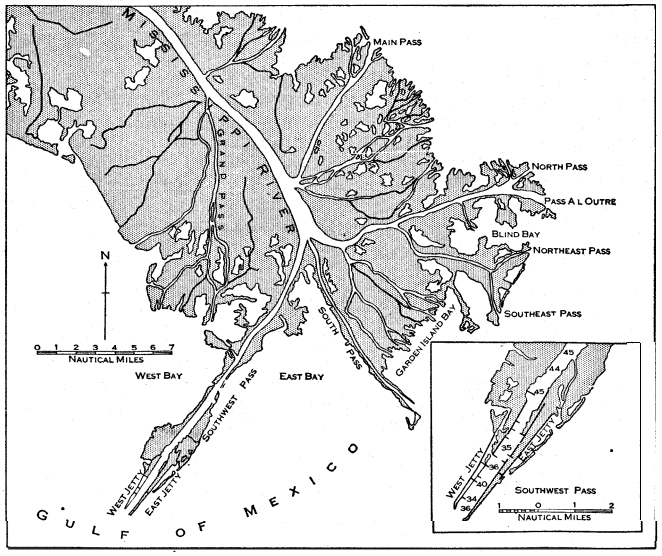

FIG. 9.— THE MISSISSIPPI DELTA (1946) SHOWING (INSET) PLAN OF SOUTHWEST PASS JETTIES

depth of 30 ft.. and 26-ft. depth for a width of 200 ft. out to deep water, while the outer channel was deflected to the east and narrowed by the alluvium carried westward by the littoral current and also deposited in front of the jetty outlet. After 1901 dredging and the increased discharge at the South pass widened the channel across the bar to about 600 ft., and gave it a minimum depth of 30 ft.

In order to provide for the increasing requirements of seagoing vessels, the formation of a channel 35 ft. deep and 1,000 ft. wide through the larger Southwest pass and its 9-ft. bar to deep water in the gulf was begun at the end of 1903. The discharge through this pass is rather more than three times that through the South pass and the bar was double the distance seaward of the outlet. Converging jetties, about 5,600 ft. apart at their land ends and about 3,000 ft. apart at the seaward outlet, were substituted for the parallel jetties constructed at the South pass, and suction dredging was relied upon to maintain the channel between the jetties and across the sea bar. The channel dredging was soon found to be excessive in quantity and in 1916 the project was modified by limiting the channel to a width of 2,400 ft between two parallel interior bulkheads and the extension of the jetties to the go-ft. contour beyond the bar. In 1923 the width was still further restricted to 1,750 ft. by building spur-dikes or groins, and by 1924 a depth of 35 ft. was secured by dredging aided by the scour of the current. The jetties are formed of fascine mattresses weighted with stone and capped with rubble and concrete (see JETTY). They were extended seaward from time to time and in 1956 the east jetty was about $4\frac{3}{4}$ mi. in length from the shore. The west jetty had a length of about $3\frac{3}{4}$ mi. The amount of dredging required to maintain the 35-ft.-deep channel through the pass and over the bar was reduced after the contraction of the width was effected. The artificial improvement and simultaneous maintenance of two entrance channels to the Mississippi river is essential to ensure the uninterrupted passage of vessels. The project was modified so that the following channel dimensions were prescribed: Southwest pass from Head of Passes to the outer end of the jetties, 40 ft. deep by 800 ft. wide; Southwest pass bar, 40 ft. deep by 600 ft. wide; South pass from Head of Passes to the outer end of the jetties, 30 ft deep by 450 ft. wide; and South pass bar, 30 ft. deep by 600 it wide. A dependable navigation channel 35 it deep is maintained via the Southwest pass. **A** study and a hydraulic model experiment were under way in the mid-1950s for the purpose of determining thc morks necessary to provide a dependable 40-ft channel.

The US congress through the River and Harbor act of Jan 21, 1927, assigned to the secretary of the army and to the chief of engineers, U.S army, the duty oi making surveys, with a view to the formulation of general plans for the most effective improvement of the U.S navigable streams and their tributaries. The Flood Control act of Mav 1j, 1928, amplified this duty with respect to the trihutaries of the Mississippi river The River and Harbor act of Aug 30, 1935, authorized the chief of engineers to make such supplemental studies as might be warranted Under these authorizations and subsequent acts of congress the corps of engineers investigated and reported on practically every river of any importance in the United States. Many of these surveys were published as congressional documents.

IMPROVEMENT OF TIDAL RIVERS FOR NAVIGATION

Whereas the size of tideless rivers depends wholly on their freshwater discharge, the condition of tidal rivers is due to the configuration of their outlets, the rise of tide at their mouths, the distance the tide can penetrate inland and the space available ior its reception. Accordingly. tidal rivers sometimes, even when possessing a comparatively small iresh-water discharge, have much better natural navigable channels at high tide than the largest deltaic rivers, as shown by a comparison of the Thames, the Humber and the Elbe with the Danube. the Nile and the Mississippi. Tidal water is, indeed. unlimited in volume; but, unlike the drainage waters, which must be discharged into the sea, it only flows up rivers where there is a channel and space available for its reception Consequently, works which exclude the tide irom a river may have injurious effects on the channel, as did the sluices which were erected long ago across the fen rivers of eastern Anglia to secure the low-lying lands irom the inroads oi the sea The tidal influx is also liable to be reduced by the accretion which may result in an estuary irom the construction of training morks. The aims of all tidal river improvement should be to facilitate to the utmost the flow of the flood tide up a river, to remove all obstructions from the channel so as to increase the scouring efficiency of the flood and ebb tides and to reduce to a minimum the period of slack tide when deposit takes place.

Tidal Flow in a River.—-The progress of the flood tide up a river and the corresponding ebb are clearly shown by a diagram giving a series oi tidal lines obtained from simultaneous observations of the height of the river. The steep form assumed by the ioremost part of the flood-tide lines on some rivers indicates the existence of a bore. This is caused by the sandbanks in the channel obstructing the advance of the flood tide, till it has risen sufficiently in height to rush up the river as a steep, breaking wave, overcoming all obstacles and producing a sudden reversal of the flow and abrupt rise of the water level. Such

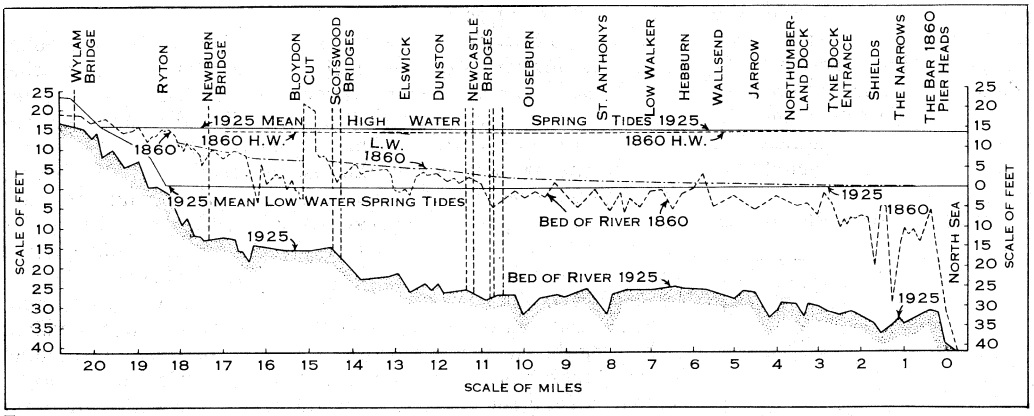

FIG. 10.—TYNE RIVER FROM THE SEA TO WYLAM: LONGITUDINAL SECTION OF THE CENTRE LINE OF THE RIVER SHOWING THE DEEPENING OF THE CHANNEL AND ALTERATION IN WATER LEVELS BETWEEN 1860 AND 1925

phenomena are observed on the Severn, the Seine, the Amazon and other rivers. A bore indicates defects in the tidal channel, which can be reduced only by lowering the obstructions and by the regulation of the river. No tidal river of even moderate length is ever completely filled by tidal water; for the tide begins to iall at its mouth before the flood tide has produced high water at the tidal limit. Every improvement of the channel, however, expedites and increases the filling of the river, while the volume of water admitted at each tide is further augmented by the additional capacity provided by the greater efflux of the ebb, as indicated by the lowering of the lorn-\eater line.

Deepening Tidal Rivers by Dredging.— The improvement of tidal rivers mainly by dredging is specially applicable to small rivers which possess a width sufficient ior navigation like the Clyde and the Tyne; for such rivers can be considerably deepened by an amount of dredging which would be quite inadequate for producing a similar increase in depth in a large, wide river with shifting channels. Both the Clyde below Glasgom and the Tyne below Newcastle were originally insignificant rivers, almost dry in places at low water of spring tides; and the earliest works on both rivers consisted mainly in regulating their flow and increasing their scour by jetties and traimng works. They were improved, after 1840 on the Clyde and after 1861 on the Tyne, by continuous systematic dredging. The Clyde was given a minimum depth of 27 ft. in the channel at low water of spring tides up to Port Glasgow; 25 ft. up to Rothesay dock and 24 ft. up to Glasgow harbour. A depth of 32 ft. at low water was provided alongside some of the quays. The Tyne was progressively deepened (fig. 10) until in 1929 the channel from the sea to the Northumberland dock (3½ mi.) had a minimum depth at low water spring tides of 30 ft.; from there to Derwenthaugh, above Newcastle, 25 ft.; and about 12 ft. on to Newburn, the rise of tide at springs increasing these depths by 15 ft.

The minimum low-water depth in the Thames river below Thames Haven in its natural state mas about 27 ft. (*see* HARBOURS). A channel at least 30 ft. deep at low water spring tides extends from the sea to King George V dock, 37 mi. above the Nore and Shoeburyness (fig. 11). Shallow portions of the channel between Shoeburyness and Purfleet were dredged and above Purfleet the river was considerably deepened throughout its course to secure this depth. Above the King George V dock the river was dredged to lesser depths at low water, decreasing to 14 ft. at London bridge.

Regulation and Dredging of Tidal Rivers.— Considerable improvements in the navigable condition of tidal rivers above their outlets or estuaries can often be effected by regulation works aided by dredging Esamples are the Kervion between Bilbao and its mouth, the Weser from Bremen to Bremerhaven at the head of its estuarv and the Whangpoo from Shanghai to Woosung uhere it enters the Yangtze estuarv These works resemble in principle the regulation works on large rivers with onlv a fresh-water discharge: hut on tidal rivers the channel should be trained with an enlarging width seaward to facilitate the tidal influx

To secure a good and fairly uniform depth on a tidal river, it is essential that the flood and ebb tides should follow the same course in order to combine their scouring efficiency and form a single, continuous, deep channel In wide, winding leaches. however, the flood tide in ascending a river follows as direct a course as practicable; and on reaching a bend, the main flood-tide current, in being deflected from its straight course, hugs the concave bank and, keeping close alongside the same bank beyond the bend, cuts into the shoal projecting irom the convex bend of the bank higher up, forming a blind shoaling channel as clearly indicated near Brul point in fig. 12. This effect is due to the flood tide losing its guidance, and consequently its concentration, at the change of curvature beyond the termination of the concave bank, where it spreads out and passes gradually over, in its direct course, to the next concave bend above along the opposite bank. The ebb tide, on the contrary, descending the river, follows the general course of the fresh-water discharge in all rivers. its main current keeping close along the concave bank and crossing over opposite Brul point to the next concave bank below. The main currents, accordingly, of the flood and ebb tides in such reaches act quite independently between the bends, forming channels on the opposite sides of the river and leaving a central intervening shoal or bar crossing.

In tidal rivers the main ebb current, being reinforced by the fresh-water discharge, generally forms the navigable channel, which is scoured out during floods. Narrowing the river between the bends to bring the two channels together would in certain cases unduly restrict the tidal flow; and in a river such as the Hooghly, dependent on the tidal flow for the maintenance oi its depth for two-thirds of the year, with channels changing with the met and dry seasons and even shifting their position from day to day, deepening by dredging can never be permanent. Hitherto, frequent redredging was relied on for maintaining the requisite depths at the bar crossings in the Hooghly.

The training and dredging works carried out in the Whangpoo after 1906 were successful in deepening the alluvial channel of the river to about 30 ft. at low water up to Shanghai including the bar crossing in a wide reach between Gough Island and Woosung where formerly the low-water depth was no more than 13 ft. to 1j ft. The problem which had to be faced differed from that of the Hooghly in that the volume of the land-water runoff is relatively small. Moreover the concave bank of the river above the crossing mas being rapidly eroded, accentuating a sharp bend below it. The condition of the lower part of the river is shown in fig. 13.

The erosion of the Taylor's bank, forming the concave side of the main sea channel oi the Mersey river: which threatened to intensify the bend to a dangerous degree. was countered by the revetting with stone of the concave face of the bank below low water (see HARBOURS).

The average rate of enlargement (of width) adopted for the trained channel of the Nervion, in proportion to its length, is 1 in 75 between Bilbao and its mouth; 1 in 71 for the Weser from Rremen to Bremerhaven; and about 1 in 73 for the Whangpoo from Shanghai to its outlet; and these ratios correspond very nearly to the enlargement of the regulated channel of the Clyde irom Glasgow to Dumbarton of 1 in 83, and of the Tyne irom Kewcastle to its mouth of 1 in 75. Accordingly a divergence comprised between 1 in 70 and 1 in 80 for the regulated or trained channel of the lower portion of a tidal river with a fairly level bed may be expected to give satisfactory results. The divergence as originally laid down for the Seine training works, 1 in 200, was found to be too small. (*See* fig. 14.) In rivers in which the channels are

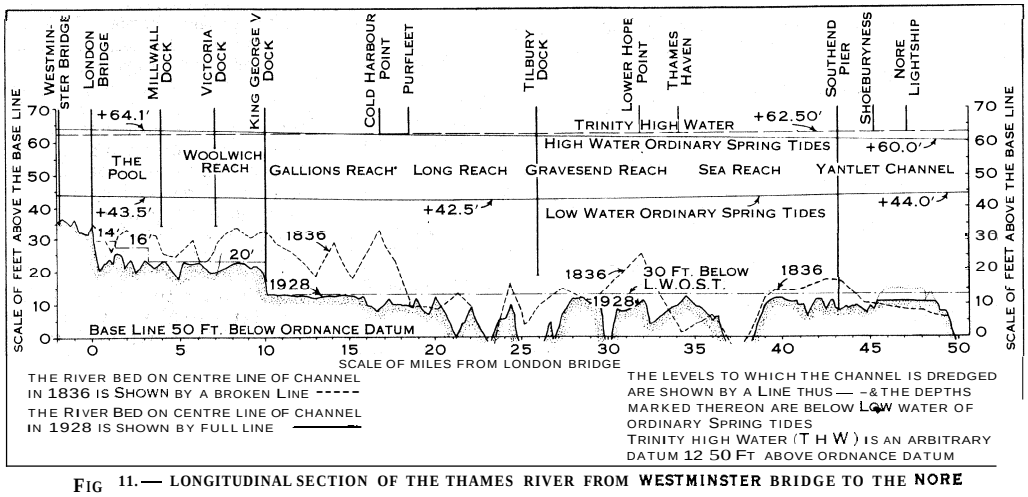

FIG 11.— LONGITUDINAL SECTION OF THE THAMES RIVER FROM WESTMINSTER BRIDGE TO THE NORE

more or less in natural condition, such as the Thames, the Humber and the Scheldt, the divergence is nearly 1 in 50.

Effect of River Deepening on Tidal Levels.—The general effect of deepening and regulating the tidal section of a river by dredging and the removal of obstructions is to facilitate the propagation of the flood tide up the channel and the efflux of the ebb. Consequently such works often result in the lowering of the low-water level and the raising of the high-water level in the upper part of the improved channel and sometimes above it. Thus the deepening of the Tyne river raised the level of mean high water spring tides at Newcastle about 1 ft. and lowered the water level by 2 ft. at Newcastle quay. In the Tyne river, the highest high water on record since 1880, 4 ft. 3 in. above high water ordinary spring tide, occurred in Dec. 1921 and again in Feb. 1943. The lowest low water recorded on the Tyne since 1880, 3 ft. 8 in. below low water ordinary spring tide, occurred March 13, 1914. The average low-water level at Glasgow fell 2 ft. after 1873 and the rise in spring tides increased by 1 ft. 8 in.

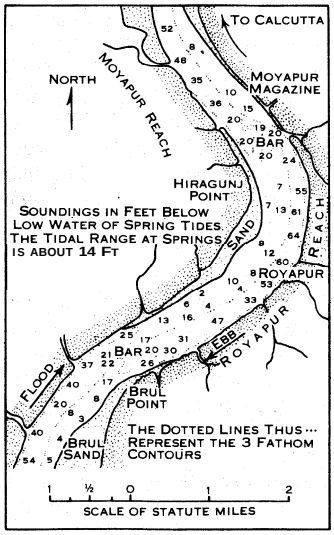

FIG. 12.—HOOGHLY RIVER SHOWING THE MOYAPUR AND ROYAPUR BAR CROSSINGS (1946)

The average high-water level in the Thames at Chelsea increased 8 in. between 1890 and 1927, a period which corresponds with the dredging carried out on a large scale in the lower reaches of the river. The maximum flood levels also increased steadily after 1874 when a tide rose 16 ft. 10 in. above ordnance datum (O.D.) at Westminster, considerably higher than any previous record. This height was exceeded on several later occasions, the highest recorded at Westminster up to the end of 1927 being 17 ft. 6 in. in 1881, the same level being reached again in 1882. These high levels were, however, far surpassed by the disastrous tidal flood of Jan. 6–7, 1928 (see *Report: Floods From the River Thames,* Cmd. 3045, 1928), when 18 ft. 3 in. above O.D. was reached at London bridge (equivalent to about 18 ft. 5 in. at Westminster).

Works at the Outlet of Tidal Rivers.—Tidal rivers flowing straight into the sea, without expanding into an estuary, are subject to the obstruction of a bar formed by the heaping-up action of the waves and drift along the coast, especially when the fresh-water discharge is small. The scour of the currents is often in such cases concentrated and extended across the beach by parallel jetties for lowering the bar, as at the outlets of the Maas and the Nervion rivers. (*See* HARBOURS; JETTY.)

Training Works Through Estuaries.—Many tidal rivers flow through bays, estuaries or arms of the sea before reaching the open sea, as, for instance, the Mersey through Liverpool bay, the Tees through its enclosed bay, the Liffey through Dublin bay, the Thames, the Ribble, the Dee, the Shannon, the Seine, the Scheldt, the Weser, the Elbe and the Yangtze through their respective estuaries, the Yorkshire Ouse and Trent through the Humber estuary, the Garonne and Dordogne through the Gironde estuary and the Clyde, the Tay, the Severn and the St. Lawrence through firths or arms of the sea. These estuaries vary greatly in their tidal range, the distance inland of the ports to which they give access and the facilities they offer for navigation Some possess a very ample depth in their outer portion, though they generally become shallow toward their upper end; but dredging often suffices to remedy their deficiencies and to extend their deepwater channel. Thus the St. Lawrence, which possesses an ample depth from the Atlantic up to Quebec, was rendered accessible for large seagoing vessels up to Montreal by a moderate amount of dredging, while dredging was resorted to in parts of the Thames and Humber estuaries and on the Elbe below Hamburg to provide for the increasing draft of vessels; and the Mersey bar in Liverpool bay, about 11 mi. seaward of the actual mouth of the river, was lowered by suction dredging from a depth of about 9 ft. down to about 26 ft. below low water of equinoctial spring tides.

A remarkable improvement was effected in the navigable condition of the upper portion of the Seine estuary by training works, begun in 1848; for in place of a shallow, intricate channel through shifting sandbanks, whose dangers were at times intensified by a bore, a stable channel was provided down to St. Sauveur, rendering access easy as far up the river as Rouen for vessels drawing up to 23 ft. at high-water neaps and up to 27 ft. at high water of spring tides. The channel itself, however, was originally made too narrow between Aizier and Berville and was subsequently enlarged, and large tracts of land were reclaimed in the upper estuary. The reduction in tidal capacity due to the reclamations, together with the fixing and undue restriction in width of the channel, occasioned large accretions at the back of the lower portions of the training walls and at the sides of the estuary beyond them, and an extension of the sandbanks seaward.

Experience proved that training works through sandy estuaries, by stopping the wanderings of the navigable channel, produce an increase in its depth and, consequently, in the tidal scour for maintaining it. This scour, however, being concentrated in the trained channel, is withdrawn from the sides of the estuary, which in its natural condition is stirred up periodically by the wandering channel and, therefore, accretion takes place in the parts of the estuary from which the tidal scour and fresh-water discharge have been permanently diverted.

This accretion reduces the tidal capacity of the estuary and, producing a diminution in the tidal volume passing through the outlet, should not be raised more above low-water level than absolutely necessary to fix the channel. Experiments with a model, molded to the configuration of the estuary under consideration and reproducing in miniature the tidal ebb and flow and fresh-water discharge over a bed of very fine sand, in which various lines of training walls can be successively inserted, are capable in some cases of furnishing valuable indications of the respective effects and comparative merits of the different schemes proposed for works which often have evoked very conflicting opinions.

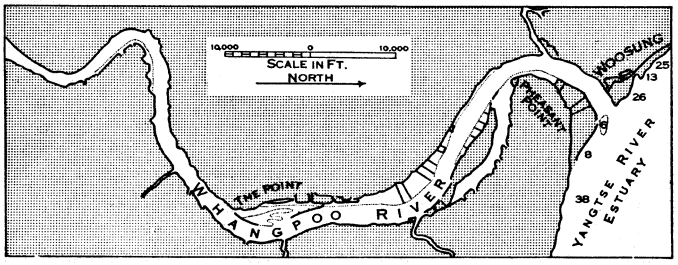

FIG. 13.—LOWER PART OF THE WHANGPOO RIVER (1946). AFTER 1907 THE CHANNEL OF THE RIVER WAS REGULATED BY BUILDING TRAINING WALLS AND GROINS

Gravity Flow.—Much attention is devoted in modern literature on river hydraulics to the phenomena known as gravity currents, which are currents of heavier liquids in currents of lighter liquids. Examples are heavily silt-laden currents in clear water lakes, and salt water currents at the estuaries of rivers moving upstream beneath the sweet water current moving downstream, as for instance in some Scottish lochs and, very probably, in the Nile.

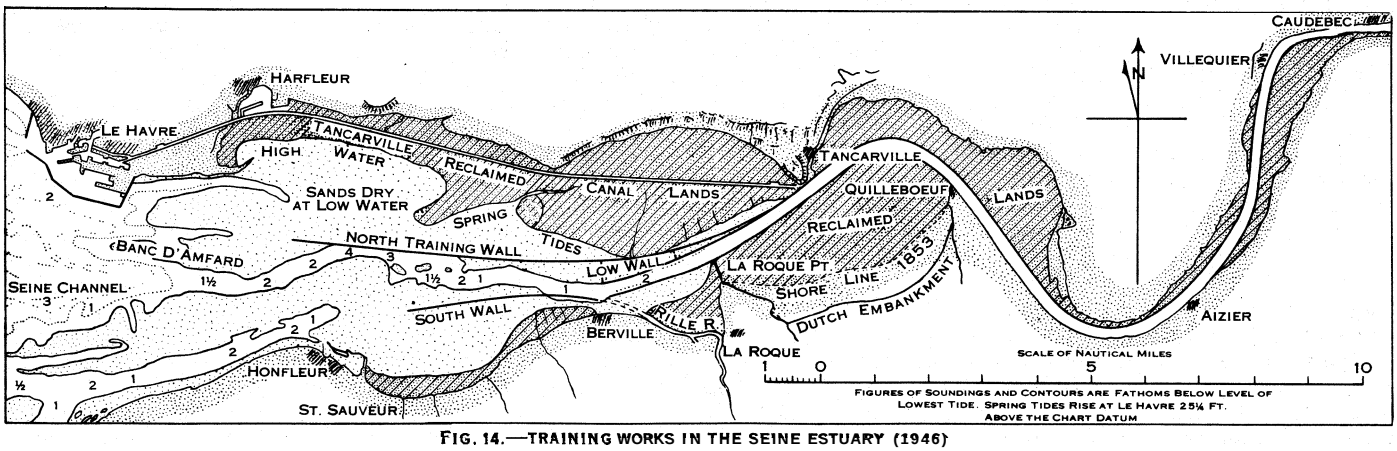

FIG. 14.—TRAINING WORKS IN THE SEINE ESTUARY (1946)

BIBLIOGRAPHY.—See the list at the end of the article WATERWAYS, INLAND. The works by L. F. V. Harcourt, D. Stevenson and B. F. Thomas and D. A. Watt mentioned therein are important. *See* also S. Leliavsky, *An Introduction to Fluvial Hydraulics* (London, New York, 1955); Hunter Rouse, *Engineering Hydraulics* (New York, 1950; London, 1951); W. H. Hunter, *Rivers and Estuaries* (1913); J. L. Van Ornum, *The Regulation oj Rivers* (1914), an excellent and comprehensive work dealing mainly with nontidal rivers; C. M. Townsend, *Hydraulic Principles of River and Harbour Construction* (1922), with bibliography; *Encyclopédie de ge'nie civil,* two volumes by Vidal deal with rivers (1921–22); and L. Fargue, *La Forme du lit des rivières* (1908). *See* River and Harbor Act, 1945 (public law 14, 79th U.S. Congress). The *Proceedings* of the Institute of Civil Engineers. *Transactions* of the American Society of Civil Engineers and the International Navigation Congress publications contain valuable papers. The bibliographies issued by the I.N.C. bureau (Brussels) are exhaustive.

(L. F. V.-H.; N. G. G.; S. N. L.)

RIVER BRETHREN: *see* BRETHREN IN CHRIST.

RIVER HOG, a name for the African wild pig. It constitutes a genus. *Potamochoerus,* allied to the typical pigs of the genus *Sus (see* SWINE). from which they are distinguishable by the presence in the males of a long horny ridge below the eye, by their thick coat of bristly and often brightly coloured hair and by tufts at the tips of the elongated ears. The red river hog. P. *porcus,* is found in typical form in west Africa. The ear tufts are especially long and the prevailing colour is brownish red; the face and legs are marked with black. while the cheeks, a ring around the eyes, the edges of the ears, the tip of the tufts and the mane are white. It inhabits the dense tropical forests. Through a number of intergrading forms this type is connected with the brownish gray brush pig of South Africa. P. *p. koiropotamus. A* small yellowish-haired representative of the genus (P. *larvatus*) occurs in Madagascar, to which island it must have come from the mainland.

RIVERINA, a district occupying the central south portion of New South Wales, Austr., bounded on the south by the Murray river and on the north by the Lachlan-Murrumbidgee from about Hillston down to the Murray confluence. The eastern boundary runs from the Lachlan above Hillston to Corowa on the Murray, but the lower slopes of the southern tableland are sometimes included in the Riverina region. Except in the east: the whole area is flat. with the rivers falling from ten inches a mile in the east to four to five inches in the west of the area. The rivers meander across vast alluvial plains, periodically flooding and forming distributaries and billabongs (lagoons); in their upper reaches in the east they offer many sites for dams. The soil is prevailingly rich.

The eastern valleys have in the past yielded considerable quantities of gold. both alluvial and reef, especially at Xdelong and Gundagai. but production is now negligible. In 1915 soft black subbituminous coal was discovered near Oaklands.

The greater part of the Riverina provides good natural fodder for sheep grazing and was originally a pastoral area, but improvements in farming (particularly in wheat breeds and in dry farming) and the development of water conservation projects led to great increases in cultivation. Along the southeastern slopes. with their cooler temperature and more reliable rain, much arable farming is carried on, with fruit growing and some dairying. Farther west mixed wheat and sheep farming is characteristic. The great wealth of the Riverina, however. lies in its irrigation farming, the bulk of irrigated land being along the Murray and Murrumbidgee. with a smaller area on the Lachlan. The Murrumbidgee irrigation area consists of 403.256 ac. served with water from Burrinjuck dam and Berembed weir, from which the irrigation channels lead. Leeton (pop. 5,148 in 1954) and Griffith (6,608), about 2.000 irrigation farms and a total population of about 26,000 people are now established in a once sparsely inhabited pastoral area. The farms are either horticultural (principal products: citrus fruits, apricots, peaches. wine grapes and vegetables) or mixed (rice, wheat, oats, meat and wool); the industry of the area is restricted to processing local products: there are wineries, canneries (including the largest in Australia), rice mills-and fruit packing houses. Smaller irrigation areas are at Hay on the Murrumbidgee (6.806 ac.) and Tullakool on the Murray (16,305 ac.); while larger areas on the Murray (Berriquin, 654,050 ac., Wakool, 486,192 ac., Denimein, 156,830 ac. and Denibooth, 303,064 ac.) and on the Murrumbidgee (Waa Waa, 583,111 ac.; Tabbita, 5.980 ac.) are farmed less intensively, water being allotted on the basis that only a portion of each holding will be irrigated. The Snowy Mountains hydroelectric scheme was begun in 1949 to make available a much larger volume of water for irrigation.

The area of the Riverina is 26,533 sq.mi., with a population in 1954 of 88,661. The chief towns are Albury (16.726). Wagga Wagga (19,235), Junee (4,064), Narrandera (4,418). Hay (3.009) and Leeton and Griffith. There were 6,787 holdings, totaling 15,-971,000 ac., with, in 1954–55. 1,003,172 ac. under cultivation (main crops: wheat. wheat hay, oats, barley, rice, lucerne, vegetables, vineyards, orchards, green fodder, grass seed, other hay pastures. sorghum, rye, maize) and over 1.000,000 ac. of sown pastures. Sheep and beef cattle are also raised. (R. M. HL.)

RIVER ROUGE, a city of Michigan, U.S., in Wayne county, bordering Detroit on the southwest, is located on the Detroit and Rouge rivers. The available rail and water transport encouraged industrialization, and manufactures include paper, ships, gypsum products and steel. Most of the residents are employed by local firms. Zug Island, a highly industrialized 400-ac. site formed by a canal dredged between the Rouge and Detroit rivers, is located in the northeast corner of the city The concentration of industry results in favourable tax rates for homeowners and, during normal periods, a solvent municipal economy. Although a site of early French settlement, the nucleus of a town did not appear until 1817 nhen a toll bridge was erected over the Rouge river at River road (Jefferson avenue). With the advent of industrialization. River Rouge was incorporated as a village in 1899. During World War I, mainly because of the construction of the Ford Motor company's River Rouge plant nearby, a population influx occurred uhich, in 1921, resulted in the incorporation of River Rouge as a city. For comparative population figures *see* table in MICHIGAN: *Population.* (E. K. R.)

RIVERS, ANTHONY WOODVILLE, or WYDEVILLE, 2ND EARL (c. 1442–1483), statesman and patron of literature, and author of the first book printed on English soil, was born probably in 1442. He was the son of Richard de Wydeville and his wife, Jacquetta de Luxemburg, duchess of Bedford. His father was raised to the peerage in his son's infancy, and was made earl of Rivers in 1466. Anthony, who was knighted before he became of age, and fought at Towton in 1461, married the daughter of Lord Scales, and became a peer *jure uxoris* in 1462, two years after the death of that nobleman. Being lord of the Isle of Wight at the time, he was in 1467 appointed one of the ambassadors to treat with the duke of Burgundy, and he exalted his office by challenging Anthony, comte de la Roche, the bastard of Burgundy, to single fight in what was one of the most famous tournaments of the age. (*See* Bentley's *Excerpta Historica,* 176–182.) In 1469 Anthony was promoted to be lieutenant of Calais and captain of the king's armada, while holding other honorary posts. His father and brother were beheaded after the battle of Edgecot, and he succeeded in August of that year to the earldom. He accompanied Edward in his temporary flight to the Continent, and on his return to England had a share in the victory of Barnet and Tewkesbury and defended London from the Lancastrians. In 1473 he became guardian and governor to the young prince of Wales. In 1475 and 1476 he went on pilgrimage to the holy places of Italy.

Caxton had in 1476 rented a shop in the Sanctuary at Westminster, and here had set up a printing-press. The first book which he undertook in London was one sent to him by "the noble and puissant lord, Lord Antone, Erle of Ryvyers," consisting of a translation "into right good and fayr Englyssh" of Jean de Teonville's French version of a Latin work, "a glorious fair mirror to all good Christian people." In 1477 Caxton brought out this book, as *Dictes and Sayengis of the Philosophers.* (*See* CAXTON, WILLIAM.) To this succeeded the *Moral Proverbs* of Christine de Pisan, in verse, in 1478, and a *Cordial,* in prose, in 1479. The original productions of Lord Rivers, and, in particular, his *Balades agaznst the Seven Deadly Sins,* are lost.

In 1478 a marriage was arranged between him and Margaret, sister of King James III of Scotland, but it was mysteriously

broken off. He was beheaded by order of Richard III at Pontefract on June 25, 1483. His protection and encouragement of Caxton were of inestimable value to English literature, and in the preface to the Dictes the printer gives an account of his own relations with the statesman which illustrates the dignity and modesty of Lord Rivers in a very agreeable way. Rivers was one of the purest writers of English prose of his time.

"Memoirs of Anthony, Earl Rivers" are comprised in the *Historical Illustrations of the Reign of Edward the Fourth* (ed. W. H. B[lack]).

RIVERS, RICHARD WOODVILLE or **WYDEVILLE,** EARL (d. 1469), served under the duke of Bedford in France, and after his master's death married his widow Jacquetta of Luxembourg. Henry VI created him Baron Rivers in 1448. His associations made him a strong Lancastrian. For some years he was lieutenant of Calais in Henry's interests. In 1459 he was taken prisoner and was sent with his son Anthony to the earl of Warwick at Calais. He was, however, released in time to fight for Henry VI at Towton. Early in the reign of Edward IV Rivers recognized that the Lancastrian cause was lost and made his peace with the new king. The marriage of his eldest daughter, Elizabeth, widow of Sir John Grey of Groby, to Edward on May 1, 1464, secured the fortunes of his family.

Rivers was appointed treasurer in 1466 and a little later was created earl. Elizabeth found great alliances for her younger brothers and sisters, and the Woodville influence became all-powerful at court. The power of this new family was very distasteful to the old baronial party, and especially so to Warwick. Early in 1468 Rivers's estates were plundered by Warwick's partisans, and the open war of the following year was aimed to destroy the Woodvilles. After the king's defeat at Edgecot, Rivers and his second son, John, were taken prisoners at Chepstow and executed at Kenilworth on Aug. 12, 1469. Rivers had a large family. His third son, Lionel (d. 1484), was bishop of Salisbury. All his daughters made great marriages: Catherine, the sixth, was wife of Henry Stafford, 2nd duke of Buckingham (*q.v.*).

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RIVERS, WILLIAM HALSE RIVERS (1864–1922), English psychologist, physiologist and anthropologist, who specialized in experimental and medical psychology, was born on March 12, 1864, at Luton, near Chatham, Kent. Completing his medical training at St. Bartholomew's hospital, London, he then devoted his attention to problems of physiological psychology—notably the nature of colour vision; and his work in this field and, later, on the influence of drugs (particularly alcohol) and on mental fatigue quickly established his reputation. In 1897 he became director of the first British laboratory for experimental psychology (opened by J. Sully at University college, London); and in the same year he was appointed lecturer on the special senses at Cambridge, where, with C. S. Myers, he was the effective founder of experimental psychology in that university.

Toward the close of 1898 he joined the Cambridge expedition to the Torres strait with A. C. Haddon, C. S. Myers and W. McDougall. With them he administered a number of tests of sensory capacity to the Melanesians, and became keenly interested in anthropological field work. In 1901–02 he made a firsthand study of the Todas, a polyandrous group in southern India, and later paid several visits to Melanesia. In 1908 he was elected fellow of the Royal society.

His two main anthropological publications—The Todas (1908) and his monumental History of *Melanesian* Society (2 vol., 1914)—are of permanent interest. His main contribution was his demonstration of the relation between kinship names and social organization. On the outbreak of World War I he became neurological consultant to the British army, and for the remainder of his life he devoted himself to medical psychology. His critical discussion of Freudian theories in his Instinct and the Unconscious (1920) did much to encourage a more sympathetic attitude toward the new psychoanalytic doctrines. But his main influence was exerted more through personality and his critical contributions at conferences and congresses than by his published writings, and in this way he perhaps did more than any other psychologist of his day toward setting up high standards of scientific rigour in the study of human behaviour. He died on June 4, 1922.

See for a biographical review *The Eagle,* vol. xliii, pp. 2–14 (1924). (CY. B.)

RIVERSIDE, a city of southern California, U.S., is situated on the Santa Ana river at the base of the San Bernardino range, about 55 mi. S.E. of Los Angeles; the seat of Riverside county. Riverside (1960 pop. 84,332) is part of the San Bernardino-Riverside-Ontario standard metropolitan statistical area (1960 pop. 809,782).

Despite nearness to Los Angeles, the city has a strongly individual character, marked by extensive planting of palm, pepper and orange trees. In the 1960s housebuilding was diminishing the orange groves, but these were still extensive.

Settlement in the area began in the 1870s, sponsored by Judge John W. North of Tennessee. Street names (Victoria, Prince Albert, Dufferin) commemorate the largely British and Canadian character of early immigration. The original idea of a silk-cultivating colony was replaced in 1878 by the successful propagation of the Washington navel orange tree; the parent tree still survives. Riverside was incorporated in 1383 and adopted the city-manager form of government in 1953.

The city is the location of a general campus of the University of California, including the citrus experiment station (founded 1907). a college of letters and science (1954) and a graduate school (1960). Other educational institutions include Riverside City college (Jr.) (1916), California Baptist college (1955) and Sherman institute (1901), a school for Indians. Its unique hotel, the Mission inn, is a show place of Spanish-style architecture.

Riverside's climate is dry and warm. Its economy, formerly based almost entirely on oranges, is diversified and includes the manufacture of aircraft motors, precision instruments, air-conditioning equipment, paints and building materials. It remains, however, an important food distribution centre with extensive citrus-fruit and vegetable packing. (A. C. TR.)

RIVES, AMÉLIE: see TROUBETZKOY, AMÉLIE.

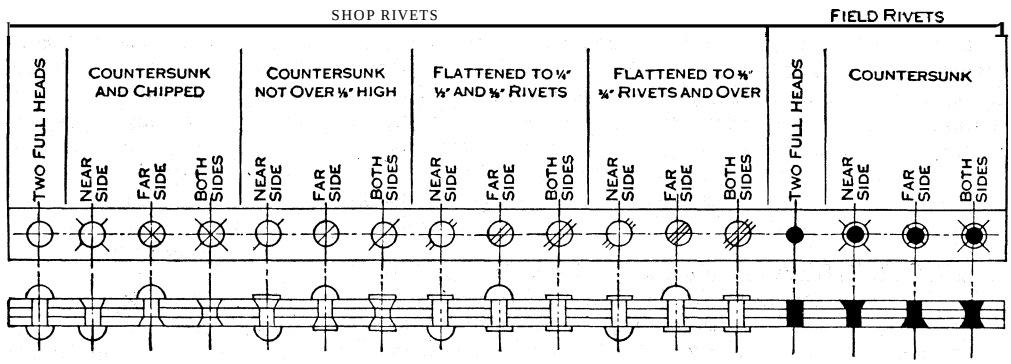
RIVES, WILLIAM CABELL (1793–1868), U.S. political leader and diplomat, was born in Nelson county, Va., on May 4, 1793. He attended Hampden-Sydney college, Hampden Sydney, Va., and the College of William and Mary, Williamsburg, Va., was admitted to the bar and practised in Nelson and Albemarle counties. A Democrat. he served in the state constitutional convention, in the Virginia house of delegates and in the federal house of representatives. From 1820 to 1832 he was minister to France; in 1833 he entered the United States senate but resigned in the following year. From 1836 to 1845 he again served in the senate, and in 1849–53 was again minister to France. In Feb. 1861 he was a delegate to the peace conference in Washington; he opposed secession but was loyal to his state when it seceded, and was a representative in the Confederate congress during the Civil War. He died at the country estate of Castle Hill, Albemarle county, Va., on April 25, 1868. Rives was the author of Life and Times of James Madison (3 vol., 1859–68), the completion of which was prevented by his death. He was the father of ALFRED LANDON RIVES (1830–1903), an engineer of some prominence, whose daughter AMÉLIE RIVES (Princess Troubetzkoy) (1863–1945) became well known as a novelist.

RIVET is a headed pin or bolt used as a permanent fastening in metal work by forming a head on the plain end by the process of hammering or by direct pressure. Cold riveting is practicable for small sizes in copper, brass, aluminum, iron and steel, but the larger sizes have to be heated, in the cases of iron and steel, in order to secure rapid and easy closing.

Machine riveting in small sizes is done either in a power press, the ram of which works a snap and closes the tail with a blow,

or with a rotary rivet spinning machine, with hard steel rollers which spin the tail quickly and noiselessly into shape. In engineering structures, machine riveting is employed whenever practicable, portable pneumatic hammers, or fixed or portable hydraulic riveters being used.

The various shapes of rivet-heads or tails include the countersunk, beaten flush into a conical recess in the plate, the cup- or roundhead, the panhead, which has sloping sides and flat top, the conical with sloped sides ending in a point, and the thin flathead coopers' or tinmen's rivets. Bifurcated rivets for belting and harness have thin heads, but the tails are split and opened like a paper fastener. A great deal of gas or electric welding has been substituted for riveting in the case of hollowware and other sorts of sheet metal product. Electric welding is an alternate method for the connection of structural members, such as columns and beams, in building construction. See also PNEUMATIC TOOLS.



BY COURTESY, AMERICAN INSTITUTE OF STEEL CONSTRUCTION

CONVENTIONAL SIGNS FOR RIVETING SHOWING HOW THE DRAFTSMAN DRAWS RIVETS IN PLAN AND ELEVATION ON ALL STRUCTURAL DRAWINGS

RIVIERA, the narrow coastland between the mountains and the sea around the Gulf of Genoa in the north of Italy, and in France from Nice on the west to Spezia on the east. The name is derived from riva (Lat. *ripa*) meaning "bank." It is usually spoken of as Riviera di Ponente ("the coast of the setting sun," the portion between Nice and Genoa), and as Riviera di Levante ("the coast of the rising sun," the portion from Genoa to Spezia). All this district, being open to the south and sheltered from the north and east winds, enjoys a remarkably mild climate (winter mean, about 49° F.); the vegetation in many places is of a subtropical character (*e.g.*, the pomegranate. agave, prickly pear, date, palm and banana). Large numbers of flowers. especially roses, violets, hyacinths, etc., are grown near Nice, Mentone, Bordighera and other towns for the London and Paris markets. The uncommon mildness of the climate, conjoined with the natural beauty of the coast scenery — the steep sea-crags, the ruined towers and the range of the Maritime Alps — attracts thousands of invalids and convalescents to spend the winter there. and these resorts are frequented for sea bathing in summer. Proceeding from west to east, the following are the places to which visitors principally resort: Nice, Monaco (an independent principality), Monte Carlo, Mentone (the last town on the French Riviera), Bordighera, Ospedaletti, San Remo, Alassio, Nervi, Santa Margherita, Rapallo, Sestri Levante, Levanto. The railway which runs close through the Riviera burrows through the many projecting headlands by means of more than 80 tunnels.

RIVIÈRE, JACQUES (1886–1925), French essayist, whose delicacy of perception and acute sense of responsibility had a profound influence on the writers associated with the *Nouvelle* Revue *française* (*N.R.F.*), was born in Bordeaux on July 1j 1886. He was secretary of the N.R.F. immediately before World War I and became editor in 1919. Among his friends were André Gide, Paul Claudel. Charles Peguy and Jacques Copeau, and he was an early admirer of Marcel Proust. He himself aspired to write an analytical novel (*Aimée,* 1922; and the unfinished Florence, published posthumously, 1935). His persona1 anxieties and aspirations are best reflected in his letters to Alain-Fournier (his brother-in-law), in his correspondence with Claudel, published after his death, and in his essay A la trace de Dieu (1925). He was brought up a Catholic, but later an oppressive awareness of "the reality of nonbeing" prevented him from accepting the Christian faith, much as he would have liked to do so. He died in Paris, on Feb. 14, 1925, before the promise of his work had been fulfilled. His other writings include *L'Allemand* (1918), *Carnet* de guerre (1929), *Études* (1912) and Nouvelles Etudes (published posthumously, 1947).

See the commemorative number of the *Nouvelle* Revue *française,* vol. 24 (1925). (A. PE.)

RIYADH, the capital of Saudi Arabia. lies 535 mi. N.E. of Jidda on the Red sea, and 250 mi. S.W. of Dammam on the Persian gulf. with which, after 1951, it was connected by a railway (350 mi long). In the mid-1950s it was planned to extend this line. via Buraida and Madina (Medina), to Jidda and Mecca (about 1,000 mi.). From Madina it was to be connected to Damascus by the Hijaz railway when repaired. Meanwhile Riyadh is linked with all parts of the kingdom and the neighbouring Arab countries by an extensive network of rough but passable roads and some lengths of macadamized road. Since soon after World War II the Saudi capital has been linked with the outside world by air services operating from Riyadh itself, Dhahran and Jidda, and by a system of wireless stations equipped uith telephones. After the 1930s the camel was discarded as the normal carrier of news, passengers and goods

The discovery of oil and the resulting institution of modern means of communication have revolutionized the life of the desert kingdom; the general tendency has been toward the development of large urban communities at the expense of what was a village and tribal economy. Riyadh best illustrates this process. The old walled town of approximately 30.000 inhabitants remained intact until the end of World War II, though a few palaces and villas made their appearance outside the perimeter toward the end of this period. It formed an irregular square of 600 yd. each way. By 1951 various minor expansions had raised the population to about 60,000. Since then the walls have gone, and most of the old houses have been destroyed to make room for modern buildings and boulevards, while the town has expanded in every direction over the uprooted palm groves into the desert. The town has become a city, covering an area of 100 sq.mi. and containing a population of more than 300,000, though exact figures are not available as no census has ever been taken. Also the character of the population, once exclusively Najdi, has changed beyond recognition; at least half of the increase must be credited to immigrants from the neighbouring Arab countries in search of employment and commercial opportunity. Most of them came from Syria. Lebanon, Egypt, the Yaman (Yemen) and the Hijaz (Hejaz). Needless to say, the old puritan way of life, the outstanding feature of the old town, became submerged by the influx of these elements.

In the centre of the old town the royal palace, which once represented "all that is best in modern Arabian architecture." has made way for a great concrete structure of cubist affinities, serving as the headquarters of the local provincial government. Opposite it. the old Wahhabi cathedral with its low minaret has disappeared in favour of a large concrete building. 200 yd. long and wide, with tao tall minarets tapering by stages to a ball point and equipped with loud speakers to relay the calls to prayer and the services. The old and famous fort df Mismak is virtually the only building of former times which survives intact; it serves as it has long done, as the local prison. The palace square is a busy crossroads from which broad Tarmac streets, lined with modern shops, run east, west, south and north into the modern suburbs of greater Riyadh. The north road, leading to the airport, is lined with palatial buildings, constructed to house the

various ministries of the central government. Beyond them are the barracks of the royal guard. the royal military college for the training of officers, with villas to house them and their families, and the military hospitals. The road ends at the government workshops and the airport. The east road. continuing ultimately to the Kharj province, the principal military centre of the country, leads to the railway station. The south road goes for a considerable distance through the old town, greatly expanded, and passes through new residential suburbs to the valley of Wadi Hanifa and the king's country palace. Finally, westward, a broad double roadway, divided in the middle by gay flower beds, as is the airport road, leads through rows of palatial mansions to the royal palace of Nasiriya, standing in its own vast grounds. The main buildings are of pink-tinted concrete in a mixture of styles ranging from pseudo-Moorish to modern European, a showy and on the whole pleasing group of buildings containing a population slightly larger than that of the Vatican City. Besides these. in the palace enclave, there are a large mosque with tall minaret; a museum still under construction in the mid-1950s; a college for the royal children (male) and the sons of courtiers; barrack accommodations for the royal guard; a zoo containing lions, rhinoceroses, elephants. baboons, bears, ostriches. oryxes and gazelles. etc.; and two imposing gates at the eastern and western extremities. with ornamental avenues and double roadways connecting them with all parts of the palace complex. The general impression is one of luxury and modernity, an epitome of the aspirations of modern Arabia.

Finally. the whole city is lavishly equipped with electric power for all purposes, and makes a brilliant display by night, as seen from the air. An ample water supply is assured to the large and ever-growing population by the harnessing of two groups of wells in Wadi Hanifa, north and south of the city, to a network of pipes circulating to every part thereof. This supply was reinforced by a deep artesian well. drilled by French experts, which raised the potential capacity of the area to about 10,000 000 gal. a day. Much of this goes to the beautification of the city with gardens and green spaces, while traffic lights and roundabouts (one-way circular systems) regulate the immense amount of motor traffic. Riyadh is in every sense a modern city. fully equipped with all the amenities of life. (H. ST. J. B. P.)

RIZAL, JOSÉ (1861–1896), Filipino patriot and inspirer of Philippine nationalism, sought to prove throughout his career that Filipinos were the intellectual and moral equals of their Spanish masters; he also worked for fundamental political and social reforms. These aims pervaded his writing, most of which was done in Europe, where, with one brief interruption. he resided betneen 1882 and 1892. His education, centring in medicine but extending to many fields, was acquired in the Philippines and Europe. His two novels. Noli Me *Tangere* (1887) and El *Filibusterismo* (1891), vividly pictured the evils of Spanish rule in the Philippines. In 1890 he published an annotated edition of Morga's Sucesos de las Islas *Filipinas,* hoping to show that the Philippines had its own history before Spanish rule. He also wrote articles for La Solidaridad, a Filipino reformist periodical published in Spain.

Rizal returned to Manila in 1892 and founded a nationalist reformist society (Liga Filipina), with the result that the Spanish exiled him to Dapitan on northwest Mindanao (1892–96). When the Philippine revolution of 1896 began, Rizal, who was on his way (via Spain) to Cuba for medical service with the Spanish army, did not take any direct part. He was, nevertheless. arrested aboard ship and brought back to Manila to stand trial for complicity in the insurrection. A military court found him guilty, and he was shot Dec. 30, 1896. His death enhanced his already great prestige among Filipinos and stimulated national sentiment.

See Rafael Palma, *The Pride* of *the Malay Race,* trans. *by* Roman Ozaeta (New York, 1949); Frank C. Laubach, *Rizal: Man and Martyr* (Manila, *1936);* W. Retana, *Vida* y *Escritos del Doctor Jose' Rizal* (Madrid, *1907).* (E. C. CN.)

RIZA SHAH PAHLAVI (1877–1944), shah of Persia (Iran) from 1925 to 1941, was born in Mazandaran, the son of an army officer. Entering the army at an early age, he showed such aptitude that promotion was rapid, and he rose at length to the command of the Cossack division. In 1921, in conjunction with Zia ad-Din, he marched on Tehran with about 4,000 men and compelled the government to resign. Zia became prime minister, while Riza Khan (as he was then known) took over the ministry of war and the command of the army. In 1923 he became prime minister and virtual ruler. Two years later, after Ahmad Shah Qajar had left the country. Riza Khan was made shah and the sovereignty was vested in the Pahlavi dynasty. Riza Shah proceeded to carry out reforms on western lines, largely on the model of Kemal Atatiirk in Turkey. He broke the power of the tribes, put down brigandage and restored the authority of the central government. His greatest achievement was the construction of the Trans-Persian railn ay, completed in 1938.

Riza Shah, who had employed many Germans in his industrialization program. rejected a joint request by Britain and the U.S.S.R. in 1941 for the expulsion of the Germans, and troops were sent into Iran to prevent Germany from seizing control. Riza Shah thereupon abdicated in favour of his son, Mohammed Riza Pahlavi, and was sent first to Mauritius and then to South Africa. He died in Johannesburg on July 26, 1944. (L. Lo.)

RIZZIO or RICCIO, **DAVID** (*c.* 1533–1566), secretary of Mary (*q.v*), queen of Scots, mas a native of Turin and went to Scotland in 1561 in the train of the Piedmontese ambassador. The queen wanted a bass singer, and he entered her service as a musician, becoming also her valet de *chambre,* and in 1564 private foreign secretary. After her marriage to Darnley in 1565 his influence with Mary became paramount. His elevation aroused the active hostility of Darnley and the other nobles, and he was suspected of being the queen's lover. On March 9, 1566, the earls of Morton and Lindsay. with armed followers. entered Mary's supper chamber at Holyrood. seized Rizzio. hacked him to death with daggers, and threw his body into the courtyard.

ROACH, JOHN (1813–1887), **U.S.** shipbuilder, who has been called "the father of iron shipbuilding in America," was born in County Cork. Ire., on Dec. 25, 1813 He emigrated to the United States at an early age, and worked at the Howell (N.J.) ironworks where he was taught the trade of iron molding Later, with other artisans he established an ironmorks in New York city. He acquired a number of marine-engine plants and in 1868 the Morgan ironnorks in New York city. After purchasing shipyards in Chester, Pa, he built many iron ships for the government and private companies. Although he was not the first to build such ships. he became a leading authority and builder. He was also a vigorous advocate of a strong U.S. merchant marine. He voluntarily closed his aorks in 1885 when the secretary of the navy, overruling the naval advisory board, rejected the "Dolphin," a dispatch boat built by Roach, and also canceled Roach's contract to build for the navy three cruisers—the "Atlanta," "Boston" and "Chicago"; construction of the cruisers had begun in 1883. Roach died on Jan. 10, 1887. at New York city.

ROACH (*Rutilus rutilus*), a cyprinid fish of England. Europe and Siberia. It is a moderately deep, silvery fish. Specimens of more than three pounds are rare. In the United States the term has been applied to various members of the carp family, and the "golden shiner" minnow has been sometimes called a roach.

ROAD RUNNER (Geococcyx *californianus*), a bird characteristic of the deserts of northnest South America, Mexico and southern U.S. It runs with head lowered and tail horizontal, stopping from time to time. when the tail assumes an almost vertical position. The road runner belongs to the cuckoo family (Cuculidae).

ROADS AND STREETS. A road system implies central government over a wide area with power to command labour and with technical experts to supervise the work The first known example of an empire larger than could be served by a single river for transport was that of Sargon, about 2600 B.C.. whose rule extended from Babylonia to the Mediterranean. About this time, or even earlier, there must have been lengthy trade routes. since tombs in this area dating back to 3000 B C. contain the blue gem lapis lazuli, mined in Afghanistan.

Any dates earlier than about 800 B.C. are usually conjectural, but there is a record of that date which claims to detail the main roads of Sargon's empire. In 800 B.C. there were in Assyria traces

of a highway system of roads, built on low embankments in the valleys and with the gradients on hills eased with cuttings. Tradition assigns all such engineering feats to the reign of Semiramis, the great Assyrian princess; all that is really known is that these roads were already of great antiquity in 800 B.C. In 1928 workers for the Field Museum of Natural History. Chicago, discovered a wheeled chariot at Kish. which they dated at about 3200 B.C. There were highly skilled stonemasons at that time. so it may well be that streets in towns began to be paved with flat stones about the time that chariots came into general use, since rammed earth is too weak to carry much wheeled traffic. There is a record, dated about 2200 B.C.. of Babylonian stonemasons laying two parallel rows of worked stones to take oxcarts whose wheels were about five feet apart, and remains of paved roads have been found in Crete which are believed to date back to 1500 B.C.

By 500 B.C there were two great roads connecting the Mediterranean with the top of the Persian gulf. One began at Sardis, near Smyrna, and passed through Ankara (Angora) eastward to Nineveh (near Mosul), crossing the Euphrates, the Tigris and the Great and Little Zab to end at Susa. Herodotus, the Greek historian (484–425 B C), travelled this road (the ancient royal road) and describes its relay stations, fortified hostels, garrisons and toll gates. The other road ran roughly parallel to it but farther south, to reach the Mediterranean near Alexandretta. There was also a road connecting Babylon with Egypt; this was built by Cyrus after his conquest of Babylon in 539 B.C. and is the "highway" mentioned in the prophetic books of the Bible (*e.g.*, Isaiah xl, 3–5).

By about A.D. 200 there were caravan routes linking the Roman empire with China for the importation of silks and jade and other articles of luxury. One route started at Chungking and passed through Burma and northern India to Delhi and thence to Tehran and Baghdad, or farther north to Samarkand and then west across the Caspian sea and through Tiflis to the Black sea. There are believed to have been at least two more northerly routes through Russia, since articles of jade are found in ancient barrows or tombs (dated 100 B.C. to A.D. 100) in the Crimea and in southern Siberia. These caravan routes were never safe and when navigators were skilled enough to cross the Indian ocean they were largely abandoned.

The growth in power of the Roman empire at this period led to the construction of an elaborate system of paved roads in western Europe. There was first the Via Appia from Rome to Brindisi, from which troops were shipped to Africa and the east. Then in the 2nd century B.C. the Via Egnatia was built from Durazzo. through northern Greece to Salonika, and later the Via Domitia was built across southern France and into Spain. Augustus (63 B.C. to A.D. 14) improved this road and drove it as far as Cadiz and also built two roads across the Alps. The first corresponds to the modern Petit St. Bernard and was suitable for wheeled vehicles; the second was a track for pack animals through Briançon. These two roads converged on Lyons, which was the centre of the Roman road system in France. From Lyons four main roads led respectively to the Baltic and the camps on the Rhine, the channel ports, Bordeaux and the Mediterranean sea. These and other main roads were planned for the imperial courier service and for the rapid movement of troops; they were furnished with posting stations with relays of horses about every 10 mi. and with lodging places (mansiones) about every 25 mi. These roads were the viae publicae regales. Where possible they took the direct line between towns, marshy ground being crossed by using piles and embankments, and cuttings and even tunnels being constructed in hilly country. A network of smaller roads (viae *vicinales*) linked up the smaller towns and there were also recognized earth tracks (viae terrenae). Drusus, the stepson of Augustus, began the building of a highway across the Alps to provide a direct route from the Adriatic to Augsburg and the Danube; it passed by Trento and over the Brenner and Reschen Scheideck passes. This road was finished by his son, the emperor Claudius, who also constructed a route over the Alps by the Great St. Bernard pass to Augst, near Basle, and from there to the permanent camps on the Rhine.

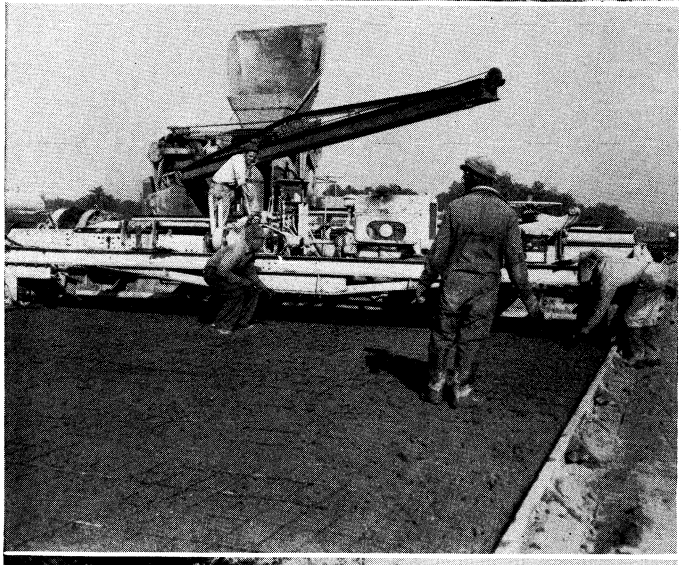
By A.D. 100 the danger of invasion from the north and east had become obvious; to meet it Trajan constructed a highway from the Rhine to the Black sea, and he and his successors built many bridges. All this was to no avail; the slow collapse of the Roman empire ushered in a thousand years of chaos and petty kingdoms whose resources were far too small for the upkeep of such roads: where dressed stone had been used in their construction they were dug up and the stones used for building. Brigandage and lawlessness prevented people from travelling, and roads and bridges fell into ruin.

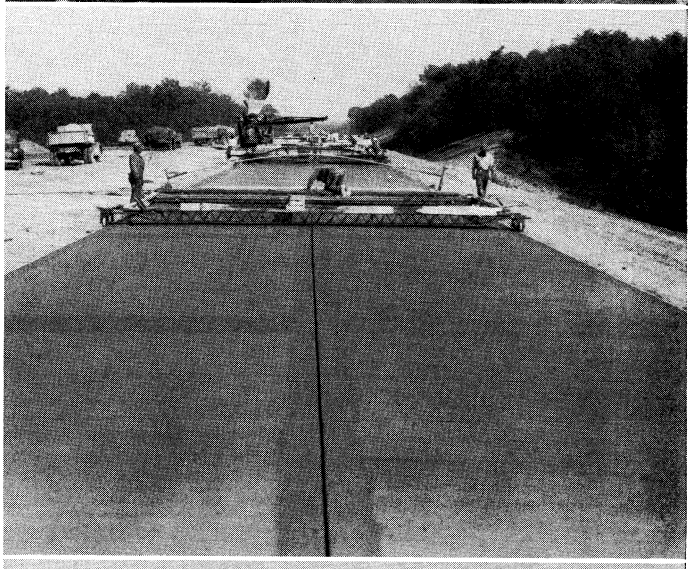
Britain was a Roman colony for about 350 years (A.D. 43 to A.D. 410) and the road system was laid out to meet the strategy of the conquest, which was in stages. Thus the Fosse way running from Exeter to Lincoln through Ilchester, Bath, Cirencester and Leicester ran just behind the front line, which separated a lowland area that had been conquered and organized under a civil administration from a highland area still the scene of military operations. This line was fed by a series of roads radiating from the Roman base at London. The last of these front lines was the great wall between Carlisle and Newcastle. The principal road between London and the wall was Ermine street, via Lincoln and York. This stretched to the Tay river, but Scotland was never conquered. After A.D. 121 the wall with its mile-castles and forts was the northern boundary of the Roman occupation. Wales was also a turbulent military area with the occupation troops in forts. This area was served by Watling street, which ran through St. Albans to Towcester and thence to Wroxeter where it joined a road running from the Bristol channel through Kenchester to Chester. Other roads linked Manchester with Chester and with the Fosse way near Leicester.

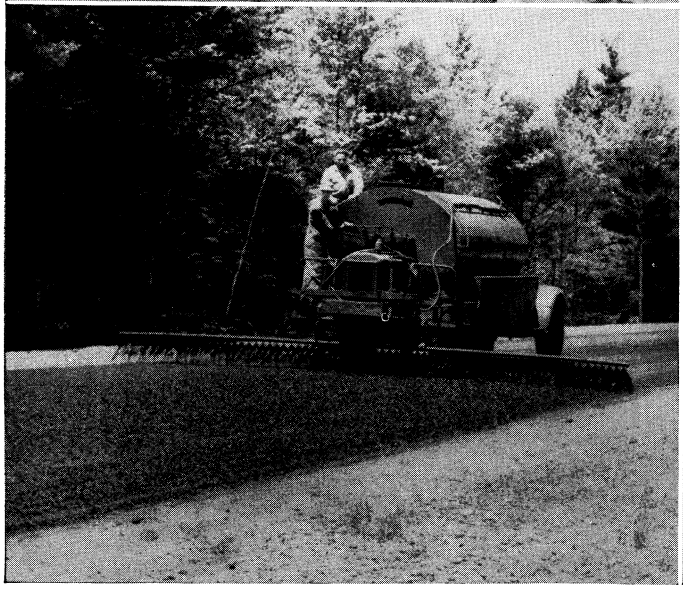
In building their roads the Romans used any hard materials near at hand. Thus the Via Appia had for the most part a wearing surface of six inches or so of hard lava on a bed of gravel, which replaced the loose topsoil on the site of the road; on the outskirts of Rome it was paved with worked stone blocks. Stane street, from London to Chichester, was composed of a thickness of 12 in. or so of gravel, flints and pebbles, the larger aggregates at the bottom. Such roads were cambered; they had drainage ditches on either side and were about 15 ft. wide. The aggregates were sometimes mixed with lime mortar or with a lime-trass mortar to form concrete, the trass coming from Pozzuoli in Italy. The road was prevented from spreading by raised stone curbs and by wooden pegs driven into the bed at intervals. Where stone was plentiful, as on the Yorkshire moors, the roads were surfaced with stone slabs. Over marshy ground at Hartshill, Watling street consisted of a layer of oak logs laid diagonally and covered with moss and holly twigs. This raft carried 9 to 12 in. of sandstone with a covering layer of 6 in. of a black concrete. The "Iron way" between New Cross and Lewes, discovered in 1929 by air photography, is composed of iron slag and iron under concrete in the neighbourhood of the Roman iron mines in Sussex, but of flint pebbles and rammed chalk near the downs. In flat land liable to flooding the Roman road was carried on an embankment.

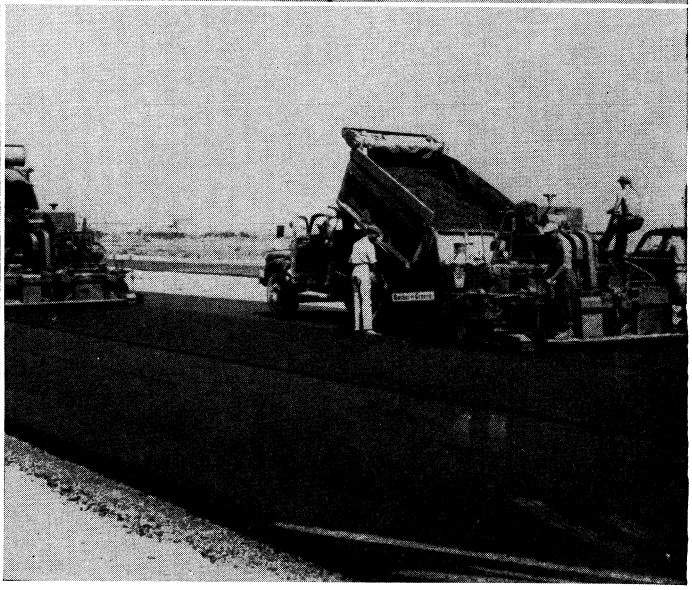
After the fall of the Roman empire there was no road or bridge-building until the custom grew up of making pilgrimages to Rome and later to the shrine of St. James of Compostella (Santiago in Spain) and to Assisi. The feudal barons levied tolls of passage on the pilgrims and some of them spent a little of this on road repairs and bridgebuilding. About 1,700 bridges were constructed in France alone between the 12th and the 16th centuries, some by bridgebuilding monks, *Frères* Pontifes, whose patron saint, St. Bénazet, according to tradition, built the bridge at Avignon in 1178–88. Road repairing and bridgebuilding were also works of piety in the middle ages.

With the beginning of the Industrial Revolution the state of the roads in the various countries of Europe was an indication of the strength of the central government. The roads were maintained largely by the forced labour of the householders, cottagers or other occupiers of land, who were required in England to give four days' labour every year and to provide carts and horses where they had them. By a rigorous application of forced labour Jean Baptiste Colbert greatly improved the roads in France in the reign of Louis XIV, but himself earned thereby almost universal detes-









BY COURTESY OF (TOP LEFT) U.S. BUREAU OF PUBLIC ROADS AND CATERPILLAR TRACTOR CO., (TOP RIGHT) PORTLAND CEMENT ASSN., (CENTRE LEFT, CENTRE RIGHT, BOTTOM RIGHT) BUREAU OF PUBLIC ROADS, (BOTTOM LEFT) NEW HAMPSHIRE DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

ROAD-BUILDING MACHINERY AT WORK ON GRADING AND SURFACING

Top *left:* Grading with a bulldozer
Top right: Portland cement concrete paving operations
Centre left: Steel reinforcing being laid, to be followed by more concrete
Centre right: Joints being cut and finished by hand from a moving bridge
Bottom left: Distributor applying bitumen through 24-ft. spray bars
Bottom right: Bituminous paver laying asphalt

tation. In other countries such work was scamped or dodged; at that time the roads in Great Britain were among the worst in Europe. In 1716 a central administration for the upkeep of roads and bridges was formed in France and a training school for young engineers was attached to it in 1747. This was one of the beginnings of the study of the science of road construction.

In Great Britain the Jacobite rebellion had collapsed in 1715, but a nervous parliament commissioned Gen. George Wade (*q.v.*) to build a series of strategic roads in Scotland for the movement of troops. From 1726 to 1737 he built 250 mi. of road and about 40 bridges. Another pioneer in road building was John ("Blind Jack") Metcalf of Knaresborough; between 1767 and 1792 he built about 180 mi. of road which were outstandingly good. This period was the beginning of the Industrial Revolution; the need to carry goods caused many canals to be built, but the large-scale building and repairing of roads came somewhat later. This was put in hand by turnpike trusts, private companies who secured acts of parliament permitting them to close a main road with gates and charge a toll to all users, part of the money being used to repair the road; at one time there were nearly 8,000 tollgates in Great Britain. These trusts employed two great engineers. The first, Thomas Telford, was apprenticed to a stonemason. The base of his roads was formed of large blocks of stone wedged together with stone chips, giving a cambered layer 9 in. thick at the edges and 15 in. thick in the middle. This was covered with 6 in. of small broken stones followed by a wearing surface of 3 in. of gravel. Between 1802 and 1834 he built many roads, the best known being between Shrewsbury and Holyhead and between Carlisle and Glasgow. The other great engineer was John Loudon MacAdam. He made the subsoil of his roads very firm and shaped to the finished camber; side ditches were also dug for draining the road bed. His road then consisted of a layer one foot thick of small broken stones as cubical as possible. able to pass through a ring $2\frac{1}{2}$ in. in diameter but not passing a 2-in. ring. No large stones, loose earth or other binding material was allowed. The wheels of the coaches ground the stones together and the dust so made filled the interstices. Most of the minor roads in Great Britain are built on this principle. They are kept in good condition by periodic surface dressings of tar or bitumen and chippings. Such roads form 58% of the total mileage of roads in Great Britain.

The delays caused by turnpikes and the burden of the tolls on merchants and travellers became so great that a mass rebellion against them broke out in Wales in 1842–43. Gates were smashed and tollhouses levelled to the ground at night by men dressed in women's nightgowns and known as Rebecca's sisters (Genesis xxiv, 60). Juries refused to convict any rioters caught and. at last, in 1864 parliament bowed to public opinion and formed a Turnpike committee to cut down the number of toll roads and bridges. A few still remain. The invention of the internal-combustion engine and the repeal of the "Red Flag" act in 1896 ushered in the modern age. (T. L.)

ADMINISTRATION: GREAT BRITAIN

Before the Highway act, 1835, responsibility for the repair of highways in England and Wales normally rested on the inhabitants of the parish in which the highway was situated. It was performed, under the supervision of the justices in special highways sessions, through the two highway surveyors appointed annually for each parish. There were two important exceptions to parochial responsibility: certain streets in towns might be the responsibility of paving commissioners under local acts; and turnpike roads were repairable by the turnpike trustees under their private acts. The act of 1835 permitted the constitution of two other bodies which might become the authority for parochial highways, namely elective highway boards and highway districts comprising two or more parishes. The act also provided that roads thereafter laid out should not become repairable by the inhabitants unless the procedure for their acceptance was complied with. This is the origin of the "private street."

The Highways and Locomotives (Amendment) act, 1878, created a new class of road called the main road. which included all roads which were no longer turnpikes after 1870 and other roads so declared by county quarter sessions, and the county was made responsible for one-half of the cost of maintaining these roads. Under the Local Government acts of 1888 and 1894, county councils became responsible for main roads and district councils for other roads. County borough councils became sole highway authorities in their respective areas. During the 20th century the central government assumed responsibility for certain roads which are main arteries of communication, known as trunk roads, and the Local Government act, 1929, reallocated certain functions between local authorities. The highway authorities in 1955 were: (1) the minister of transport and civil aviation for trunk roads; (2) county borough councils for all roads in their areas other than trunk roads; (3) county councils for main roads. all roads in rural districts and classified roads in noncounty boroughs and urban districts; (4) noncounty borough and urban district councils for unclassified roads in their areas. The council of a noncounty borough or urban district having a population exceeding 20,000 was empowered to claim to exercise the functions of repair and maintenance of any county road in its area. The minister could arrange with a highway authority to act as his agent in relation to any trunk road. (E. J. O. G.)

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ROADS AND ROAD CONSTRUCTION IN THE UNITED STATES

In the mid-1950s there were approximately 3,000,000 mi. of rural roads and 350,000 mi. of municipal roads in the United States. Approximately 1,780,000 mi. or 60% of the rural mileage was surfaced and 595,000 mi. were graded and drained. Of the rural surfaced mileage about 65% was improved with low-type surfaces such as slag, sand clay, stone and gravel; 20% was improved with intermediate types of bituminous-treated or mixed-bituminous surfaces; and 15% was improved with high-type surfaces of bituminous pavements, portland cement concrete and brick or block surfaces. Highway construction, which was practically stopped during World War II, increased after the war to a rate of completion of about 60.000 mi. per year. Only a small portion of this construction resulted in an increase in highway mileage because most highway work consisted of rebuilding and modernizing existing roads. Roads are divided into three main classes—federal-aid roads, constructed with federal-aid funds and state funds under supervision of the state highway departments and the federal bureau of public roads; state roads, built with state funds under the supervision of the state highway departments; county and local roads constructed largely with county and local funds by county and local authorities.

In the various federal-aid systems there were in the mid-1950s about 665,000 mi. of road that were almost all surfaced. but additions were being made yearly. Many sections, built for a lesser and slower moving traffic, were in need of widening, straightening, resurfacing and other improvements.

The Federal-Aid Highway System.—The federal-aid highway system was designated co-operatively by the secretary of agriculture, acting through the bureau of public roads, and the officials of the several state highway departments in accordance with the Federal Highway act passed by congress, 1921. The system thus designated comprises the main interstate roads and reaches directly nearly every city of 5,000 population or greater, and the roads are so chosen that if a zone ten miles wide mere marked off on each side of them, these zones would include the homes of 90% of the population.

For improvement of the federal-aid system special appropriations were made by congress for each fiscal year from 1917, with exception of the years 1934, 1935, 1944, 1945 and 1949. These funds are required generally to be matched by the states in at least equal amount. Formerly limited to $10,000 per mile and to ex-

penditure on roads outside of cities, the federal funds may be expended without arbitrary limitation per mile and upon sections of the federal-aid system within as well as without city limits. The federal funds are appropriated from any funds in the U.S. treasury, there being no special federal tax for road construction. In addition to improvements financed with joint federal and state contributions, other improvements are made on the federal-aid system but with state funds exclusively, and the mileage improved in this way approximates that improved with federal participation.

In addition to its contribution to federal-aid roads, the federal government also assumes as a rightful obligation the duty of building those sections of the major national system which lie in the national forests and parks and other parts of the public domain. In the forest highway system in the mid-1950s were more than 75,000 mi. of road of which more than 18,000 mi. had been improved.

During the period of the depression large additional federal appropriations were made for the purpose of promoting road construction as a measure for the relief of unemployment. These appropriations were expendable upon secondary and upon feeder roads as well as upon routes of the federal-aid system, and represented the first departure by the federal government from the long-established policy of participating exclusively in the improvement of main interstate highways. Special funds were also provided for elimination of highway-railroad grade crossings. These appropriations, unlike the earlier federal grants, were not matched with state funds.

Improvement of secondary or farm-to-market roads, special urban routes and interstate highways were continued as parts of the federal-aid program. The federal government generally pays half the cost of the highway work.

State Highway Systems.—There were approximately 370,000 mi. of roads in the rural primary state highway systems in the mid-1950s. These systems include, in most states, all the roads of the federal-aid system and a number of others of important state significance. In some states the selected roads have been designated by name and description in the la s of the state; in others the designation has been left to the state highway departments.

State highway systems are constructed with state funds only and with state and county or other local funds.

Of the total state highway mileage in 1952, there were 576,918 mi. surfaced. Of the surfaced mileage, 39,131 were soil surfaced; 92,815 were of slag, gravel or stone; 150,095 were bituminous surface treated; 41,612 were of mixed bituminous (nonrigid base); 64,214 were of mixed bituminous (rigid base); 7,143 were of bituminous penetration (nonrigid base); 29,208 were of bituminous penetration (rigid base); 66,627 were of bituminous concrete and sheet asphalt; 84,093 were of portland cement concrete; 1,800 were of vitrified brick; and 180 mi. of asphalt block, wood block, stone block and miscellaneous types. The unsurfaced mileage of 59,470 included 29,974 mi. of primitive or unimproved roads and 29,496 mi. of improved roads which had been drained and had an established grade.

County and Local Roads.—There were approximately 2,320,000 mi. of county and local rural roads in the county and local road systems in the mid-1950s. All roads not included in the federal-aid and state highway systems are classified as county and local rural roads. With the exception of about 125,000 mi. transferred for administration as secondary roads by the state highway departments of six states, all local roads are built by local officials with local funds.

By far the larger part of the unimproved mileage of the country is in the county and local rodd system. There are hundreds of thousands of miles on which the traffic is so small that improvement is not justified. Of the local road mileage approximately 1,223,881 were surfaced; in large part these surfaces were of such low types as sand clay, topsoil, gravel and water-bound macadam. Great improvements have been made in methods of combining asphalt and tar with materials of a sandy or gravelly nature to make low-cost dustless surfaces. Such surfaces are particularly suited to secondary roads and a considerable mileage has been constructed.

Administration of Federal-Aid Road Construction.—Federal-aid roads are constructed under the immediate supervision of the several state highway departments subject to the approval of the department of commerce, which department delegates the details of administration to the commissioner, bureau of public roads. The bureau has established nine divisions throughout the United States, which groups act in consulting and advisory capacities on state highway programs and systems. Under these nine divisions are grouped all the states, each in charge of a district engineer representing the bureau of public roads.

When a state highway department desires federal aid in financing systems, it submits a complete program to the district engineer in its state. The district engineer examines the road and the plans proposed for its improvement and if he approves the state's proposal, he submits the program to Washington through his division office.

A formal agreement is made between the state and the federal government. Construction then proceeds with full authority of the government under the immediate supervision of the state highway engineers and subject to frequent inspection by federal engineers. The federal government has no official relations with city, county and local officials.

Administration of State Highways.—Control over the state roads is vested in the state highway departments. The highway department determines the order in which the roads of the state system are to be improved, prepares the plans for the improvement, supervises the construction and pays for it with state funds entirely under its own control and, after completion, maintains the roads also with state funds under its own control. The federal-aid system coincides with the more extensive state systems and, therefore, a considerable portion of state highway improvement is done with federal aid.

In four states in the mid-1950s the state highway department had full control over the construction and maintenance of all or most of the local roads. Until about 1930 the work of state highway departments extended only to city limits. Thereafter there was a strong trend toward state improvement of extensions of main routes into and through cities and by the mid-1950s every state highway department made expenditures on such sections of highway.

Early American Roads.—The first American roads were the narrow Indian foot trails which crisscrossed the wilderness. Many of these trails followed the well-worn paths originally formed by the movements of deer, elk or buffalo. The early American explorers and colonists used water routes whenever possible. In many cases, however, the narrow winding Indian trails offered the only course. These trails sought the high ground which offered a dry route generally kept free of leaves and snow by the wind. Among the more important Indian trails were the Old Connecticut path, which travelled from the upper Hudson valley near Albany to Boston; the Iroquois trail, which followed the Mohawk valley and terminated near Niagara falls after crossing the area south of Lake Ontario; Nemacolin's path, which was named after a Delaware chief and led northwest from the upper Potomac to Pittsburgh; and the Warrior's path, through the Cumberland gap and Kentucky to the falls of the Ohio river. In 1775 Daniel Boone widened the Warrior's path into the Wilderness road and as the colonists moved westward they followed the maps prepared by Lewis and Clark, Mackenzie, Frémont, Thompson and others who used the Indian trails as paths to open the west.

Virginia's first highway law was passed in 1632, and in 1639 the general court of Massachusetts passed a comprehensive act which ordered each town to appoint two or three men who would be responsible for building highways "where they may be most convenient." The early roads and streets were relatively local in character and were often seas of mud or clouds of dust, depending on what the previous day's weather had been. The Conestoga wagon was probably the most famous vehicle of this period. This wagon, later models of which became known as the western prairie schooner, was responsible for causing American traffic to move on the right. The early colonists introduced the English custom of keeping to the left and carriages and wagons were driven from the

right side. The Conestoga wagon had to be guided from the left side and the drivers, in order to get a clear view of the road ahead,. began to keep their vehicles to the right. Because it was much easier to follow the deep ruts formed by these heavy freight carriers, other drivers soon moved to the right, and in 1813the state of New Jersey ordered all vehicles to keep to the right.

Toward the end of the 18th century the increased demand for better roads caused many routes to be built with private capital as turnpikes. The first United States turnpike utilized existing roads to connect settlements in the Blue Ridge mountains with Alexandria, Va. The first American macadamized road was known as the Lancaster turnpike and was initiated in 1792. It was located between Lancaster. Pa., and Philadelphia.

The federal government entered the highway construction field for the first time when it appropriated funds for the completion of a road to connect the Ohio valley with the eastern seaboard. This road, known as the Cumberland road or Sational road, was originally a free road. When congressional interest lagged and no additional federal funds were appropriated, the roads reverted to the states and tolls were charged. This marked the end of federal expenditures for highways until the first Federal Aid Road act was passed in 1916. In the early 1880s road-building programs declined with the expansion of the railroads. Interest in highway, road and street construction was reborn with the development of the bicycle in about 18jo and was accelerated by the development and adoption of the automobile early in the 20th century.

STATE PARTICIPATION

Development of State Highway Departments. — In 1891 New Jersey passed a law providing for a certain measure of state participation in road building. With one exception. it mas the first instance in which any stste had undertaken to participate directly in the construction of roads. The exception nas Kentucky. which had a state highway department and a well-defined road policy from 1821 to 1837, and had completed about 340 mi of roads.

Following New Jersey's example, laws providing for establishment of state highway departments and for granting of state aid were passed in hlassachusetts in 1892, in California and Connecticut in 1895 and in Maryland, New York and Vermont in 1898.

Between 1900 and 1915, 38 other states had established highway departments and empowered them with some degree of authority. Several of these previously established departments were materially strengthened and similar agencies were created in the three remaining states uhen, in 1916, the Federal Aid Road act required the establishment of adequate state agencies as a condition of the granting of federal aid. The establishment of adequate state highway departments by all states was the most important immediate effect of the federal aid law. The first administrative act of the bureau of public roads under the federal aid law was to request all states to submit a five-year program map showing the system of roads upon which the state highway departments would request federal aid. The rapid and consistent improvement of the main highways of the United States is the result of concentration of authority in the state highway departments, the engineering control thus established and especially the correlating influence of the federal government. The several state systems were substantially welded into a national network by the designation in 1921 of the federal-aid highway system.

The purpose of the New Jersey lam was to establish a state department, employing skilled engineers, which would act in an advisory capacity to county officials for improvement of road construction The highway department developed plans and specifications. inspected and supervised the construction, but contracts nere let by the counties and the roads were to remain county roads subject to maintenance by the county. As an inducement for counties to seek state aid. funds were appropriated by the state legislature to pay one-third of the cost of road construction.

With minor modifications. the New Jersey principle of state aid was subsequently adopted by many other states. In some states joint participation of the state and county in construction of the most important roads was made mandatory. Other variations differentiated the systems as adopted by the several states.

Organization of State Highway Departments. — In most of the states the highway departments are called state highway commissions, consisting of three to five members, appointed by the governor. with the consent of the senate in some states, for a period of from two to six years. In the majority of states the executive officer of the commission is the state highway engineer, appointed by the commission. In some states the governor serves as chairman of the commission. In some. the highway departments are bureaus or divisions of highways which are part of the department of public works. The executive officer may have the title of state highway engineer. director of highways or commissioner of highways. In other states the chief executive of the highway department is a state highway commissioner, appointed by the governor, except in one state — Michigan — where he is elected by popular vote.

Construction of practically all roads of the federal-aid and state highway systems is by contract let by the state highway departments to the lowest responsible bidder. All work is advertised. Each state highway department makes its own tests of materials either in its own laboratory or in a nearby commercial laboratory. It likewise conducts its own inspections of construction work. Federal-aid highways are subject also to federal inspection.

FINANCE

Administration of Local Roads. — County roads, in general, are built and maintained by county officials with funds raised, as a rule, by taxation of real and personal property within the county. In the mid-1950s such funds were supplemented by approximately $500,000,000 from gasoline taxes and other imposts on highway users and assigned for local road improvement. The more advanced counties employ a county engineer or an engineering organization to supervise the technical details of construction, the county governing body acting only as an administrative body. In some states the lesser roads in each county are administered, constructed and maintained by a host of township and district officials, each of whom may have charge of only a few miles of road.

Sources of Highway Revenue. — For many years the property tax and poll tax were the only sources of road revenues. They were collected and expended by the local governments. Commutation of the poll tax was permitted. As an indirect source of revenue, prison labour, while not a large factor, has been used, mainly to give employment to prisoners.

The first motor vehicle fees levied by the states were nominal and were designed merely to cover cost of registration. The rapid growth in motor vehicle registration increased the demand for improved roads with the resulting issuance of state and county bonds to secure funds to speed the improvements beyond the rate possible with limited current revenues. With improved roads, special benefits resulted to operators of motor vehicles and the motor vehicle taxes have been increased in recognition of this fact.

After 1929 all states levied a gasoline tax as a source of additional revenue. The tax had been first levied in 1919 by four states: Colorado (1 cent per gallon); New Mexico (2 cents); North Dakota ($\frac{1}{4}$ cent); and Oregon(1 cent). In 1920 Kentucky joined the four and levied a gas tax of 1 cent per gallon. In 1921, 15 states levied taxes from $\frac{1}{4}$ cent to 2 cents per gallon. In 1922, four additional states levied taxes. By 1923, 35 states levied a gasoline tax. The tax rate in the mid-1950s varied from 3 cents to 7 cents per gallon in different states. In 1952 the total state motor-fuel tax earnings, inspection fees and similar receipts amounted to $1,958,182,000 and the consumption of taxed gasoline was 40,584,530,000 gal. In that year highway users also paid $1,072,501,000 for registration of vehicles and $63,367,000 as motor carrier taxes. The total contribution of highway users was $3,094,050,000. Of the amount distributed 3% went for collection costs. 71% for state highway purposes, 21% for local roads and 5% went for nonhighway purposes.

The total income to state highway departments in 1952 was $4,651,306,000, and balances on hand brought the total funds available to $6,237,700,000. The current income from state sources was $3,278,756,000, of which motor vehicle users supplied

more than **94%.** Taxes on property no longer supplied significant amounts to state highway funds. The net amount of funds received from federal sources was $485,273,000. Income from sale of bonds, transfers from local units and from miscellaneous sources brought the total income from other than current state revenue sources to $1,372,550,000.

Expenditures for state-administered highways in 1952 amounted to $2,577,363,000. The states spent $1,757,349,000 for construction of highways and $563,135,000 for maintenance. These expenditures were divided as follows: $1,650,288,000 on primary state highways, **$284,391,000** on secondary roads in **17** states, $358,820,000 on urban extensions of state highways and $26,985,000 on other state roads. The outlay for administration, equipment, highway police. safety and bond interest amounted to **$256,879,000.** In addition $103,203,000 was used for retirement of debt. The total expenditure for all purposes was $2,680,566,000. During the period 1916–52 a total of $9,010,000,000 in federal-aid funds was authorized by the federal government to aid the states in highway improvements through the fiscal year 1957. For the fiscal years **1956** and 1957 the federal-aid authorization was $315,000,000 for primary roads, **$210,000,000** for secondary roads, $175,000,000 for urban roads and $175,000,000 for interstate roads.

MODERN ROAD PRACTICE

Types of Road.—Prior to 1904 the major types of surfacing were gravel and macadam, which gave entire satisfaction under the normal traffic of relatively light horse-drawn. steel-tired vehicles, with a bicycle traffic near the cities. The outpouring of motor vehicles from the cities which began about 1904 caused the macadam roads to "ravel," and maintenance under such traffic was impossible. Tars and asphalts were substituted for the weaker binders; first as dust layers and protective surface coatings, then as binders introduced into roads of the macadam type by penetration, and finally as hot admixtures according to the bituminous concrete principle. These types were entirely satisfactory for automobile traffic.

The period from 1904 to 1914 was one of bituminous construction. In 1904 there were in the entire country only **18** mi. of bituminous rural roads, all in Massachusetts and Ohio. By 1914 there were 10,500 mi.. a mileage which was nearly three-quarters of the aggregate length of all roads of higher type than macadam. The decline in the surface-treated and penetration types of macadam began when motor trucks in considerable numbers began to appear on the rural highways. They brought a demand for rigid pavements of concrete and brick and bituminous concrete on a concrete base.

Although the first concrete road had been built in **1893,** in Bellefontaine, O., there were no more than five miles of that type on rural highways in the entire country in 1909. The first big increase occurred in **1912** when more than **250** mi. of rural highways were paved, to be followed in 1913 with 500 mi., and in 1914 with more than 1,500 mi. At the close of 1914 there were in the entire country **2,348** mi. of concrete roads. Ten years later the mileage had increased to **31,186** and construction was proceeding at the rate of more than 6,000 mi. a year, a rate approached by no other type better than gravel.

The increase of motor trucks on the highways also caused a more extensive use of brick and the bituminous pavements of the mixed type on concrete bases. In 1914 there were approximately **1,600** mi. of brick pavement; in 1924 there were 4,319 mi. In 1914 the bituminous concrete or sheet asphalt mileage on rural highways was negligible; in 1924 there were more than 9,700 mi. of these types.

Main highways thereafter were improved with high-type surfaces such as concrete and bituminous mixtures. For moderate and light traffic water-bound macadam, gravel, sand clay, selected soil mixtures and low-cost bituminous mixtures were used. Practically all surfaces that tend to become dusty in dry weather were made dustless by applying a bituminous or chemical treatment during construction or soon thereafter. Great progress was made in learning how to combine granular materials such as sand and gravel with clay and bituminous binders to form durable surfaces that are moderate in cost.

Because the type of soil below a road surface greatly influences the ability of the pavement to carry traffic loads, the data obtained from extensive soil surveys play an important part in modern highway construction. These surveys include the use of test pits, auger borings, core drillings, resistivity methods and seismic methods to obtain samples or other information for the determination of the engineering characteristics of the materials in the various horizons or layers of the soil profile. Agriculture soil survey maps, certain types of geologic maps and aerial photographs also are utilized to obtain this type of information.

The variations in designs of pavements in use in the early 1950s on some of the several turnpikes in the United States are noteworthy from the standpoint of indicating modem trends. However, some of these designs also reflect the local influence of: (1) availability of materials of construction at very low cost; **(2)** prevailing soils of a granular texture; **(3)** low rainfall; and **(4)** absence of serious frost action. The highest types of highway design can be found in the multilane freeways, expressways and toll roads being built. Rigid pavements, built of portland cement concrete, are commonly eight to ten inches thick and are placed on a granular layer a few inches thick, which in turn is placed on a well compacted earth subgrade. The original sections of the Pennsylvania turnpike were constructed with a nine-inch reinforced concrete slab which was placed directly on the subgrade without a base or subbase.

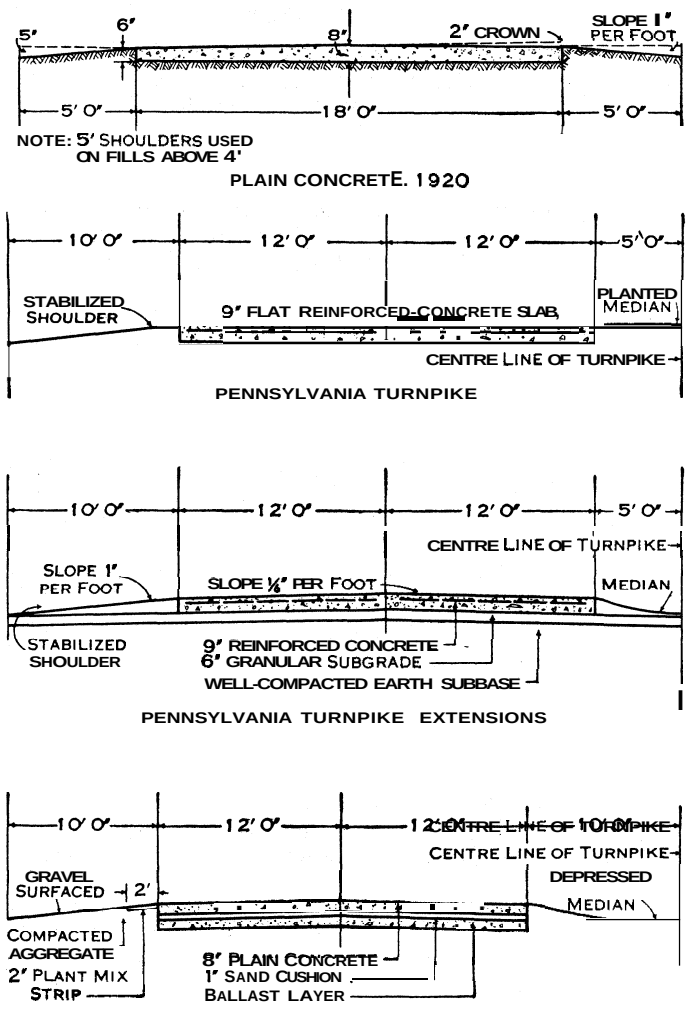

FIG. 1—CONCRETE PAVEMENTS IN THE UNITED STATES

Later extensions to the Pennsylvania turnpike had nine inches of reinforced concrete placed on a six-inch granular subbase while the Denver-Boulder (Colorado) turnpike, built in a dryer climate,

employed eight inches of plain concrete. Construction joints and longitudinal joints are generally used but expansion joints are no longer used extensively for rigid pavements for highways. Flexible or bituminous pavements consist of several layers of different materials which serve to spread the concentrated load, imposed by the wheel on the surface, over a large area of the subgrade. The New Jersey turnpike used layers of the following materials: 4.5 in. asphaltic concrete; 7.5 in. macadam base; 6.5 in. gravel subbase; and 18 in. selected subgrade material. In the drier area

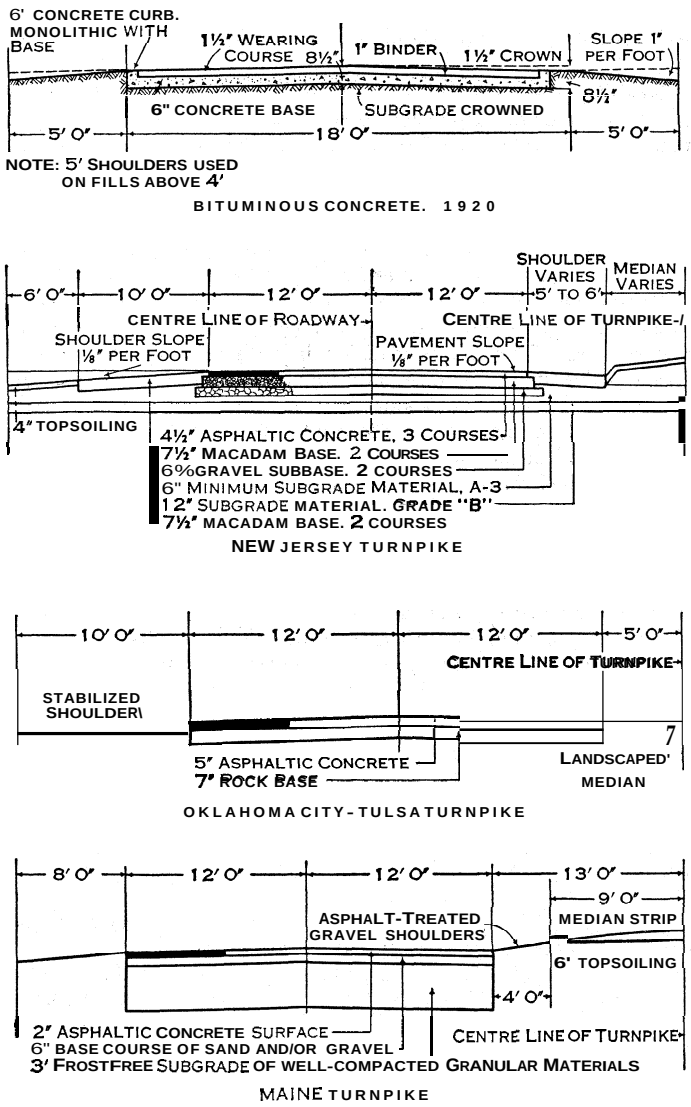

FIG. 2.—EXAMPLES OF BITUMINOUS PAVEMENTS IN THE UNITED STATES

crossed by the Oklahoma City-Tulsa turnpike, a five-inch layer of asphaltic concrete was placed on seven inches of rock base. Meanwhile in Maine, where frost is an important problem but where gravel is economically available in abundance, the Maine turnpike has a 2-in. asphaltic concrete surface and a 6-in. base course of sand or gravel placed on a 36-in. layer of frost-free, well-compacted granular material.

Until about 1930 road-building efforts were directed largely toward the extension of surfaced mileage. This early objective was reached, but the amount of needed highway improvements remained greater than ever before. The great increase in volume and speed of traffic made obsolete the highways built years before when conditions were different. Existing highways were modernized by placing better and wider surfaces, eliminating sharp curves and steep grades, eliminating railroad grade crossings and placing warning and danger signs and marks.

A great many two-lane highways mere built 20 or 22 ft. wide but soon there was a trend toward greater width. Provision of a third lane was resorted to where two lanes were not sufficient but because of the danger of using the middle lane it was not a satisfactory solution. Where two lanes were not sufficient, four lanes were provided. For great volumes of traffic the multiple-lane highway became the only satisfactory solution. Experience with four-lane highways showed that traffic flowing in opposite directions must be separated by a dividing strip if a heavy accident toll is to be avoided.

The need for express routes into and through the centres of big cities resulted in extensive construction of such routes. On these routes no roads intersect at grade and parallel roads are necessary to serve abutting property. Lanes for each direction are separated from each other by some type of dividing strip. These roads, commonly called expressways or freeways, were also built to carry heavy volumes of traffic in rural areas.

Development of the interstate system, consisting of about 40,000 mi. of the most used primary federal-aid highways, was one of the features of the highway program in the mid-1950s.

Toll Roads.—Although many early American roads were built with private funds as toll roads, they soon gave way to roads constructed and maintained by public funds. The Pennsylvania turnpike, opened in 1940, began a modern era of toll-road construction. As of Oct. 1954 there were 1,335.5 mi. open to traffic in 10 states, 1,256.3 mi. under construction in 11 states, 3,708 mi. authorized in 16 states and 2,640 mi. proposed in 9 states. A total of 28 states were active in various phases of toll-road development. The cost of the mileage in operation was in excess of $1,516,403,000.

CO-OPERATION OF INTERESTS

The United States Highway System.—Through the co-operation of all states and the federal government, effected initially through the agency of the Joint Board on Interstate Highways and continued by the American Association of State Highway Officials, a system of main transcontinental highways, known as the U.S. highway system, was designated in 1926. The standard signs adopted for this system are of two general classes. One group, the danger and caution signs, are of four different shapes representing as many degrees of danger. These have a red or yellow background with black letters and symbols. The other group includes the standard route marker in the form of a U.S. shield which contains the route number and directional and informational signs with white backgrounds and black letters.

Highway Research.—As a result of the co-operation of the bureau of public roads with state highway departments and universities in scientific research looking to the development of types of construction and methods of administration and finance adequate to meet the demands of the fast-growing traffic, there is being built up a new science of highway engineering.

The investigations conducted include studies of the characteristics of materials; determination of the forces applied to road surfaces by standing and moving vehicles; of stresses developed in the structure of roads and bridges by live loads and by temperature and other natural causes; analyses of subgrade soils and tests of methods designed for their improvement; studies of the flow of water through drainage structures; of the runoff from drainage areas; of the effect of moisture and frost on soils; analysis of human behavior as related to driver and pedestrian action; development of methods for predicting future traffic volumes; improvement of techniques to measure the adequacy of service provided by roads; and others of fundamental importance and value.

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ROANNE, a town of east-central France, capital of an *arrondissement* in the *département* of Loire, on the left bank of the Loire, 54 mi. N.W. of Lyons. Pop. (1954) 45,262.

Roanne (*Rodomna* or *Roidomna)* was an ancient city of the

Segusiani and a station on the Roman road from Lyons to the sea. In 1447 the lordship of Roannais became the property of the banker Jacques Coeur, from whom it passed to the family of Gouffier. The title was raised to the rank of marquisate and in 1566 to the rank of duchy; it became extinct in the 18th century.

The industrial suburb of Le Côteau is on the right bank of the river. It is the terminus of the Roanne-Digoin canal.

ROANOKE, a city of western Virginia, U.S., on the Roanoke river, 166 mi. W.S.W. of Richmond. It was settled in 1740 but did not become important until 1882 despite its favourable location in a fertile bowl between the Blue Ridge and Allegheny mountains, easily accessible from the north, east and west. It was first called Big Lick because of its salt deposits. In 1852 it became a way station of the railroad extending across southern Virginia but in 1880 it had only 669 inhabitants. Its growth started in 1882 when a railroad from the north made a junction there with the line across southern Virginia, offering an outlet for the coal deposits of the Virginias; the town acquired huge railroad shops and offices,and in that year was renamed Roanoke. In 1884 it was chartered as a city, its population at that time being 5.000. Railroads were supplemented by various industrial activities including fabricated steel. The city grew to 21.495 by 1900. Further growth was assured by the coming of the Virginian railroad in 1908 and of a large rayon plant in 1917. Roanoke suffered a labour depression after 1957 when the Norfolk and Western Railway shifted from steam to diesel locomotives and the rayon works closed because its product was outmoded. But the city's industry was too extensive for its prosperity to be halted permanently. Its truck lines expanded and hotel accommodations were provided for tourists from the Sky Line drive and the Blue Ridge parkway. The population of the city in 1960 was 97,110; that of the standard metropolitan statistical area (Roanoke City and Roanoke county) was 158,803. (For comparative population figures *see* table in VIRGINIA: *Population.)* Roanoke has a council-manager form of government, in effect since 1918. A few miles west of the city is Salem, the county seat and home of Roanoke college (Lutheran, founded 1842), and 6 mi. N. is Hollins, a private college for women. established in 1842. (F. B. S.)

ROANOKE ISLAND, in Dare county, off the coast of North Carolina. U.S., is south of Albemarle sound between the Outer Banks and the mainland. The island, which is 12 mi. long with an average width of about 3 mi., is the site of the first attempted English settlement in America and the birthplace of the first child of English parents born in the new world (Virginia Dare, Aug. 18. 1587). In 1584 captains Philip Amadas, or Amidas, and Arthur Barlowe there claimed the North American continent for Sir Walter Raleigh under his patent from Elizabeth I. After two months exploration they returned to England with the Indians, Manteo and Wanchese. and with samples of tobacco and potatoes. Next year Sir Richard Grenville (*q.v.*) transported 108 settlers under Ralph Lane, but the whole group returned to England with Sir Francis Drake in 1586. Two weeks later Grenville arrived with supplies, leaving 15 men to hold England's claim.

In 1587 John White, artist of the Lane colony (whose 75 Indian drawings are in the British museum) and grandfather of Virginia Dare, arrived at Roanoke Island but the 15 men had vanished. He planted a new colony comprising more than 100 settlers. Later he returned to England for supplies. Upon White's return on Aug. 15, 1591, the only trace of this lost colony was the word "Croatoan" carved on one tree and "Cro" on another tree. Numerous and romantic are the conjectures as to the colony's fate. From 1937 its gallant story has been portrayed locally each summer by the outdoor drama, *The Lost Colony,* by Paul Green. The Fort Raleigh National Historic site was established in 1941 to restore this first English implantation, based on original excavations and employing authentic restorations.

Roanoke was the scene of a Civil War action in Dec. 1862 when Federal troops under Gen. Ambrose Everett Burnside took the island from the Confederates under Col. Henry M. Shaw.

Manteo, the county seat, and Wanchese, a fishing village, are added tourist attractions. (B. P. R.)

ROANOKE RIVER, of southeastern United States, rises in the Appalachian valley in southwestern Virginia and flows southeasterly in a 410-mi. long course into Albemarle sound, on the Atlantic coast of North Carolina. It drains an area of 9,580 sq.mi.

Shortly before crossing the Virginia-North Carolina state line it is joined by the Dan river, its principal tributary. The Roanoke is navigable for small craft for 112 mi. from its mouth to Weldon, N.C., which lies just below the fall line.

Ships with a draft of up to 12 ft. can reach Plymouth, N.C., 6 mi. above the mouth. In 1829 the Weldon canal, 12 mi. long, was opened to afford a passage around the falls, but it was abandoned in 1850. (F. O. A.)

ROARING FORTIES. Moderate to strong winds, unmodified by large land masses, accompany the migratory pressure systems in the middle latitudes of the southern hemisphere. Early sailors recognized this wind regime and found that, unlike the condition in the northern hemisphere, the strong westerly winds were common in summer as well as in winter. They termed the region from latitude 40° to 50° S. the "roaring forties."

See also WIND: *The Westerlies.* (J. M. AN.)

ROBBER FLY, the name given to predaceous flies of the family Asilidae of the order Diptera (*q.v.*); they are also called assassin flies. They are predaceous in both the adult and larval stages. The various groups are found in a particular type of habitat. Some occur in woods, on tree trunks and foliage, some on grass and low plants or on the tips of dead twigs, some on sand or gravel and on beaches. The head is hollowed above between the eyes, which have an area of enlarged facets that give them keen sight.

A few kinds, particularly species of *Promachus,* may be serious pests of apiaries; they feed on many kinds of bees, as well as upon almost all kinds of flying insects. Their legs are long and adapted for capturing prey in flight and holding it while it is eaten. They inject a fluid into their victims which breaks down the muscular tissues so that only the skeleton remains. There are more than 4.000 species distributed through the world, most of them rather dull coloured but some metallic. They vary in length from $\frac{1}{4}$ in. to $1\frac{1}{2}$ in. (C. H. CN.)

ROBBER SYNOD, the name given to an irregular ecclesiastical council held at Ephesus in A.D. 449. See COUNCIL.

ROBBERY, in law, is the unlawful and forcible taking of goods or money from the person of another by violence or threatened violence. Robbery is larceny (*q.v.*) with violence. *See* also CRIME: CRIMINAL LAW.

ROBBIA, DELLA, the name of a celebrated family of Florentine sculptors, mainly associated with the production of works in enameled terra cotta. The principal members of this family were LUCA DELLA ROBBIA (*c.* 1399–1482), his nephew ANDREA (1435–1525) and two of Andrea's five sons, GIOVANNI (1469–1529?) and GIROLAMO (1488–1566).

LUCA, son of Simone di Marco della Robbia, matriculated in the guild of sculptors in 1432. He is mentioned in the preface to L. B. Alberti's *Della Piftura,* along with Filippo Brunelleschi, Masaccio. Donatello and Lorenzo Ghiberti, as one of the pioneers of Florentine Renaissance style, and he must have been an established artist by 1431, when his most important work was commissioned, the *cantoria,* or "singing gallery," over the door of the north sacristy of the *duomo* ("cathedral"), on which he was engaged until 1438. The balance of evidence is that at this time he practised solely as a marble sculptor. In style Luca's marble sculptures recall the work of Nanni di Banco, to whom his early training may have been due. The *cantoria* (taken down in 1688 and now reassembled in the Museo dell'Opera del Duomo) consists of ten figurated reliefs, two at the ends of the gallery, four on the front and four beneath placed between the supporting consoles. The panels illustrate Psalm cl and show two groups of singing boys, trumpeters, choral dancers and children playing on the psaltery, cithara, organ and harp, tambourine and cymbals. Two bronze *putti* from the upper corners of the gallery are in the Musée Jacquemart-André, Paris. The architectural forms throughout are strongly influenced by Brunelleschi and the handling of the figures reveals a close study of classical originals. The panels owe their

ALINARI

PANEL OF THE "SINGING GALLERY." A BAS-RELIEF BY LUCA DELLA ROBBIA FOR THE FLORENCE CATHEDRAL, 15TH CENTURY. IN THE MUSEO DEL DUOMO. FLORENCE

great popularity to the innocence and lack of artifice with which the children in them are portrayed.

Shortly before the completion of the *cantoria,* Luca received the commission (1437) for five reliefs of the arts and sciences for the campanile of the cathedral, in completion of the cycle begun by Andrea Pisano a century before, and in 1439 undertook work on the altars in the chapels of St. Peter and St. Paul in the cathedral. Two marble reliefs from the predella of the St. Peter altar survive in the Bargello. The most important of Luca's other works in marble are a tabernacle at Peretola. near Florence (carved for Sta. Maria Nuova in Florence in 1441–43), and the tomb of Benozzo Federighi. bishop of Fiesole (d. 1450), completed in 1459 In all these works Luca appears as an artist of strongly classical stamp, with a predilection for static figures and rectilinear compositions which stand in marked contrast to the works of Donatello in the same period.

Both in the campanile reliefs (designed to blend with those of Andrea Pisano) and in the figures of the dead Christ, Virgin and St. John behind the Federighi monument, Luca's style represents a conscious reversion to the practice of the 14th century. The Federighi monument is surrounded by a strip of flat foliated decoration in enameled terra cotta. Intimately connected with these works is the bronze door of the north sacristy of the cathedral (1446–63). Undertaken in its early stages in collaboration with Michelozzo and the bronze sculptor Maso di Bartolommeo. the door consists of two wings, with heads of prophets in the frames and ten reliefs of the Virgin and Child, St. John the Baptist and the evangelists and doctors of the church. Though features of the design may be due to Michelozzo, it is likely that the whole figurated area is the work of Luca della Robbia.

The medium of polychrome enameled terra cotta appears for the first time in a dated work in the Peretola tabernacle, where it is used to set off the marble sculpture. The earliest documented work wholly executed in this medium is a lunette of the Resurrection over the door of the north sacristy of the cathedral (1442–45). According to Giorgio Vasari, the glaze with which Luca covered his terra-cotta sculptures consisted of a mixture of tin, litharge antimony and other minerals. Precedents are found in pottery and there is evidence that in the studio of Ghiberti experiments were made in carving terra-cotta sculptures with transparent glaze as a basis for gilding. In relation to sculpture, however, the technique adopted by Luca and developed by the later members of the Della Robbia workshop was a novel one. In the late 15th and 16th centuries works in this medium seem to have been regarded as an inexpensive substitute for marble sculpture, but analysis of the early commissions suggests that initially the medium was employed only in architectural contexts where marble sculpture would have been inapposite and that the function of the glaze was colouristic and not preservative. The resurrection lunette in the *duomo* was followed (1446–51) by a corresponding relief of the Ascension over the south sacristy door, in which a wider range of colour is employed. Of the many decorative schemes for which enameled terra cotta was employed by Luca della Robbia. the most important are the roundels of Apostles in Brunelleschi's Pazzi chapel (soon after 1443); the roof of Michelozzo's chapel of the Crucifix in S. Miniato al Monte, Florence (1447–48); a lunette over the entrance of S. Domenico at Urbino (1450); two altars at Impruneta; and the ceiling of the chapel of the Cardinal of Portugal in S. Miniato al Monte (1461–66). Luca's last major work in this medium is an altarpiece in the Palazzo Vescovile at Pescia (after 1472). Many notable works by Luca della Robbia are found outside Italy. Among these are the colossal stemma of René of Anjou and 12 roundels with the labours of the months from the Palazzo Medici in the Victoria and Albert museum, London, and the Altman and Demidoff Madonnas, respectively, in the Metropolitan museum, New York city. and the Museum of Art, Toledo. O.

After Luca's death at Florence on Feb. 20, 1482, his nephew ANDREA, who had been for many years an active member of his studio, assumed control of the Della Robbia workshop. Born on Oct. 20, 1435, Andrea appears, like his uncle. to have been trained as a marble sculptor. Neither in this medium nor in enameled terra cotta, however, was he an artist of Luca's calibre, and by the supremely high standard of Luca his work is trivial in form and deficient in sculptural quality. His best-known works are ten roundels of foundlings in swaddling clothes on the façade of the Ospedale degli Innocenti in Florence (about 1480). Andrea's interest in narrative sculpture led him to develop from the reliefs of Luca a class of large polychrome reliefs of which characteristic examples exist in Sta. Maria degli Angeli at Assisi. Sta. Maria degli Angeli at La Verna, S. Bernardino at Aquila. Sta. Chiara at Borgo San Seppolcro and Sta Croce in Florence, as well as in many museums outside Italy. Between 1475 and 1522 the development of Andrea's style can be follo ed through a sequence of dated or documented works. Many of Andrea's smaller reliefs exist in a quantity of versions turned out from the Della Robbia studio.

Andrea della Robbia died at the age of 90 on Aug. 4, 1525, and control of the workshop passed to his son GIOVANNI (b. May 19, 1469). Giovanni's early works, of which the most remarkable are a lavabo in Sta. Maria Novella, Florence (1497), and the medallions in the Loggia di S. Paolo (1490–95), were executed in collaboration with or under the strong influence of his father, but as with age Andrea's grasp relaxed, Giovanni della Robbia evolved a coarser, more pictorial style in which the poverty of modeling and composition is accompanied by vivid. often vulgar polychromy. His most ambitious work is a frieze with representations of the works of mercy on the Ospedale del Ceppo at Pistoia (1525–29), in which he was assisted by his pupils Benedetto Buglioni (1461–1521) and Santi Buglioni (b. 1494).

Giovanni's younger brother GIROLAMO (b. March 9. 1488) was trained in Andrea's studio and collaborated with his father and brother until (about 1527–28) he moved to France. where he was employed on the terra-cotta decoration of the demolished Chdteau de Madrid. After the death of Francis I (1547) Girolamo returned to Florence. but later (1559), on the appointment of F. Primaticcio as superintendent of the royal buildings. he resumed his work at the Chdteau de Madrid and at Fontainebleau and was also employed on the monuments of François II and Catherine de Médicis at St. Denis. Girolamo della Robbia died in France on Aug. 4, 1566.

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ROBBINS, FREDERICK CHAPMAN (1916–), U.S. pediatrician, shared with J. F. Enders and T. H. Weller (*qq.v.*) the Nobel prize in physiology and medicine in 1954 for cultivation of the poliomyelitis viruses in tissue culture. Robbins was born on Aug. 25, 1916, in Auburn. Ala., and attended the University of Missouri and Harvard medical school (M.D., 1940). After two years at the Children's hospital, Boston, Mass., he entered the army and became chief of the virus and rickettsial section, 1 jth medical general laboratory, stationed in the Mediterranean theatre, where he investigated epidemics of infectious hepatitis, typhus and Q fever. Following the war, Robbins completed his hospital training in pediatrics and joined Enders and Weller in 1948 in the research laboratory of the Children's hospital. Boston. There they devised techniques for cultivating the viruses of poliomyelitis in tissue culture which made possible the development of poliomyelitis vaccine, new diagnostic methods and the isolation of many new viruses. In 1952 Robbins became director of the department of pediatrics and contagious diseases, Cuyahoga County hospital, and professor of pediatrics at Western Reserve university school of medicine, Cleveland, O.

(J. H. DE.)

ROBBINS, JEROME (1918–), U.S. dancer and choreographer, noted for the imaginative and original use of contemporary American themes in his ballets and for the excellent dances he devised for Broadway shows. A character dancer of distinction, Robbins appeared at the Gluck Sandor-Felicia Sorel dance centre, danced in musicals and toured with Ballet Theatre before staging his first ballet, *Fancy Free,* in 1943. His ballets include *Interplay, Pied Piper* and *Fanfare* and dances for the musicals *On the Town, The King and I* and *West Side Story.*

Robbins is associate artistic director of the New York City Ballet. (LN. ME)

ROBERT I (c. 865–923), king of France, or king of the Franks, was the younger son of Robert the Strong, count of Anjou, and the brother of Odo, or Eudes, who became king of the western Franks in 888. He did not claim the crown of France when his brother died in 898; but recognizing the supremacy of the Carolingian king, Charles III, the Simple. he continued to defend northern France from the attacks of the Normans as "duke of the Franks." About 921 Robert, supported by many of the clergy and by some of the most powerful of the Frankish nobles, took up arms, drove Charles into Lorraine, and was himself crowned king of the Franks at Reims on June 29, 922. Collecting an army, Charles marched against the usurper, and on June 1j, 923, in a stubborn and sanguinary battle near Soissons, Robert was killed, according to one tradition, in single combat with his rival. Robert left a son, Hugh the Great, duke of the Franks, and his grandson was Hugh Capet, king of France.

See F. Lot, *Les Derniers Carolingiens (1891);* and *E.* Lavisse, *Histoire de France,* tome ii. (1903).

ROBERT II. (c. 970–1031), king of France, was a son of Hugh Capet, and was born at Orleans. He was educated at Reims under Gerbert, afterwards Pope Silvester II. As the ideal of mediaeval Christianity he won his surname of "Pious" by his humility and charity, but he also possessed some of the qualities of a soldier and a statesman. His father associated him with himself in the government of France, and he was crowned in December 987, becoming sole king on Hugh's death in October 996. In 988 he had married Rosala, or Susanna, widow of Arnold II., count of Flanders. He repudiated her in 989, fixing his ,affections upon Bertha, daughter of Conrad the Peaceful, king of Burgundy, or Arles, and wife of Eudes I., count of Blois; and although the pair were related, and the king had been godfather to one of Bertha's children, they were married in 996, a year after the death of Eudes. Pope Gregory V. excommunicated the king, and a council at Rome imposed a seven years' penance upon him. For five years the king braved all anathemas, but about 1002 he gave up Bertha and married Constance, daughter of a certain Count William. Still attached to Bertha, Robert took this lady with him to Rome in 1010, but the pope refused to recognize their marriage, and the king was forced to return to Constance. By this wife Robert had four sons, and in 1017, the eldest of these, Hugh, (1007–102j), was crowned as his father's colleague and successor. After Hugh's death Robert's concluding days were troubled by a rising on the part of his younger sons, and after a short war, in which he was worsted, the king died at Melun on July 20, 1031.

His life was written by his chaplain, Helgaud, and this panegyric, *Epitoma vitae Roberti regis,* is published by J. P. Migne in the *Patrologia Latina,* tome cxli. (Paris, 1844). *See* also C. Pfister, *Études sur le rigne de Robert le Pieux* (1885); and E. Lavisse, *Histoire de France,* tome ii. (1901).

ROBERT (1275–1343), king of Naples, was the son of Charles II., duke of Anjou and king of Naples. On the death of Charles in 1309 Robert succeeded to the throne, although his nephew Caroberto (Carlo Roberto), son of his elder brother Charles Martel, who had died before his father, had a prior claim. He was crowned by Pope Clement V. at Avignon, and on the descent into Italy of the emperor Henry VII. was appointed papal vicar in Romagna to resist the imperialists; thenceforth he became the recognized leader of the Guelphs or papal faction in Italy and took part in all the wars against the Ghibellines. On various occasions he obtained for himself or his sons the suzerainty over Rome, Florence and other cities, and was regarded as the most powerful Italian prince of his day. Pope John XXII. created him papal vicar in Italy against the emperor Louis the Bavarian. In 1320 Robert summoned his kinsman Philip V. of France to Italy, and he waged war against Sicily once more from 1325 to 1341, but failed to drive out the Aragonese. He died in 1343, just as he was about to lead another expedition to the island. Robert was a man of learning, devoted to literature, and a generous patron of literary men: he befriended Petrarch. Dante described Robert as a *re da sermone* (word king).

See G. Villani, *Cronache;* M. Murena, *Vita di Roberto d'Angiò, re di Napoli* (Naples, 1770); and *Archivio storico Siciliano (1884,* viii. 511 *seq.*)

ROBERT I., "THE BRUCE" (1274–1329), king of Scotland, the son of Robert de Bruce VII., earl of Carrick by right of his wife Marjorie, was a direct descendant of a Norman baron who accompanied William I. to England. He was probably born at Turnberry, Ayrshire, on July 11, 1274, and is said to have spent his youth at the court of Edward I., where he must have watched the progress of the suit for the crown of Scotland. After the death of Margaret, the "maid of Norway," Bruce's grandfather claimed the crown by right of his descent from David I.; but John de Balliol, grandson of Margaret, being preferred by the commissioners of Edward I., he resigned his estates to Bruce's father, who assumed the title of Lord of Annandale (1295). In 1292, Bruce became earl of Carrick, by which title he is often known. Some four years later Bruce and his father swore fealty to Edward I., but when Sir William Wallace raised his standard, Bruce followed the popular leader and harried the forces of John' de Warenne, Edward's general. In July, 1297, however, he was forced to sign the capitulation of Irvine, whereby the Scottish lords were pardoned in return for their allegiance.

Bruce thus took no part in the momentary triumph and final defeat of Wallace, who continued the struggle almost unaided. Soon after Bruce again appears to have sided with his countrymen, but he was not yet regarded as an open enemy of the English, for his estates were left intact, and in 1299 he was appointed co-regent of Scotland, together with William Lamberton, bishop of St. Andrews, and John Comyn the younger. For the next four years he remained passive, and in 1304 even supported Edward I. in the capture of Stirling, but secretly he entered into a bond with Lamberton which bound him to the patriotic cause.

The second period of his life, which was occupied by the contest for the kingdom, now began. After the execution of Wallace in 1305, Edward sought to conciliate the Scottish nobles by granting a liberal constitution to Scotland. Bruce is reputed to have been one of the advisers, but his fidelity was already suspected and in 1306 he returned to Scotland secretly. In the same year he murdered his old enemy Comyn, and was thenceforward definitely committed to the Scottish cause. Collecting his adherents, Bruce marched to Scone where he was crowned on March 27, 1306, and a few days later was placed on the throne according to an ancient

Celtic ceremony, by the Macduffs, earls of Fife. He then set out to win his kingdom, but after being defeated at Methven and at Dalry in Strathfillan, he fled almost alone to the island of Rathlin. Proclaimed an outlaw, excommunicated by the pope, his wife and daughter in the hands of the English, and his brother executed, Bruce's cause seemed hopeless, but on July 7, 1307, Edward I. died, and Bruce was opposed only by his incompetent son Edward II. In the winter of 1307 and in 1308, hurrying to Aberdeenshire, he harried the lands of the earl of Buchan, whom he defeated near Inverurie on May 22, 1308, while his brother Edward reduced Galloway. He then crossed to Argyllshire, took the pass of Brander (1309), captured Dunstaffnage, and in March held his first parliament at St. Andrews.

A truce having been effected by Pope Clement V. in 1309, Bruce was recognized as king by the clergy of Scotland in Feb. 1310, in spite of his excommunication; and with this backing he set out to reduce the strongholds still held by the English. Linlithgow fell towards the end of 1310, Dumbarton in Oct. 1311, Perth in Jan. 1312, two raids into the north of England were also successful in March 1313, Roxburgh and Edinburgh were captured and in May the Isle of Man was subdued. By the end of 1313, Stirling, Bothwell and Berwick alone remained English and these Edward II. made a determined effort to save. He reached Falkirk on June 22, 1314, and two days later the battle of Bannockburn was fought, in which the defeat of the English determined the independence of Scotland and confirmed the title of Bruce. On April 26, 1315, at the parliament of Ayr, the succession was unanimously settled on Bruce and his heirs.

The last part of Bruce's life, from 1315 to 1329, began with the rising of the whole Celtic race against the English. Robert Bruce declined the offer of the Irish crown, but in 1315, Edward Bruce crossed to Ireland at the invitation of the natives, and in 1317 he was joined by Robert, who defeated the English at Slane in Louth. But although they enjoyed a temporary success, Edward was finally killed at Dundalk in Oct. 1318, having previously been proclaimed king of Ireland. In 1317, Robert Bruce had been obliged to return to protect his own borders, and in 1318 he laid siege to Berwick. Refusing all offers of mediation on the part of the pope, unless his title were recognized, Bruce continued his struggle and after the capitulation of Berwick, laid waste to the English border. In Dec. 1318, he held a parliament at Scone, where the succession was settled, and legislation for the defence and administration of the kingdom was initiated.

The king's position was now so strong that foreign countries began to recognize him, and in 1323 his title was confirmed by the pope. Hostilities against England continued, however, and on May 30, 1323, Edward was forced to make a truce of 13 years. On the accession of Edward III, 1327, the treaty of York was signed, whereby "Scotland according to its ancient bounds in the days of Alexander III, should remain to Robert, king of Scots, and his heirs free and divided from England, without any subjection, servitude, claim or demand whatsoever." This was ratified by the marriage of Edward's sister, Joanna, to David, Bruce's infant son (July 12, 1328). The chief author of Scottish independence barely survived his work. In 1327 he conducted an expedition into Ireland, but on his return, he spent his remaining years at Cardross, on the Clyde, where he died from leprosy on June 7, 1329. His body was buried at Dunfermline, his heart at Melrose.

BIBLIOGRAPHY.—The chief contemporary authorities for the life of Bruce are coloured to some extent by the nationality of the writers. On the Scottish side, *The Brus*, a poem by John Barbour, ed. by W. W. Skeat (Edinburgh, 1894), and the *Chronica gentis Scotorum* of John of Fordun, ed. by W. F. Skene (Edinburgh, 1871–72), are perhaps the most valuable. The *Chronicon de Lanercost*, ed. by J. Stevenson (Edinburgh, 1839), is also important. The English chronicles which may be consulted with advantage are those of Walter of Hemingford, ed. by H. C. Hamilton (1848–49) and of Peter Langtoft, ed. by T. Wright (1866–68), and the *Scalacronica* of Thomas Gray, ed. by J. Stevenson (Edinburgh, 1836). For the documents of the time reference should be made to the *Calendar of Documents relating to Scotland*, ed. by J. Bain (Edinburgh, 1881–88), *Documents and Records Illustrating the History of Scotland*, vol. i., ed. by F. Palgrave (1837); the *Rotuli Scotiae* (1814–19), and the *Foedera* of T. Rymer, vol. i. (1704). *See* also Sir H. Maxwell, *Robert the Bruce* (1897); A. M. Mackenzie, *Robert Bruce, King of Scots* (London, 1934).

ROBERT II. (1316–1390), called "the Steward," king of Scotland, a son of Walter, the steward of Scotland (d. 1326), and Marjorie (d. 1316), daughter of King Robert the Bruce, was born on March 2, 1316. In 1318 the Scottish parliament decreed that if King Robert died without sons the crown should pass to his grandson; but the birth of a son, afterwards King David II., to Bruce in 1324 postponed the accession of Robert for nearly 42 years. Soon after the infant David became king in 1329, the Steward began to take a prominent part in the affairs of Scotland. He was one of the leaders of the Scottish army at the battle of Halidon Hill in July 1333; and together with John Randolph, 3rd earl of Moray (d. 1346), was chosen co-regent of Scotland, while David sought safety in France. The colleagues soon quarrelled; Randolph fell into the hands of the English, and Robert became sole regent until the return of David in 1341. The Steward escaped from the battle of Neville's Cross in 1346, and was again regent while the king was a captive in England.

Soon after this event some friction arose between Robert and his royal uncle. Accused, probably without truth, of desertion at Neville's Cross, the Steward as heir-apparent was chagrined by David's recognition of Edward III. as his successor.

In 1363 he rose in rebellion, and after having made his submission was seized and imprisoned together with his three sons, being only released a short time before David's death in February 1371. By the terms of the decree of 1318 Robert now succeeded to the throne, and was crowned at Scone in March 1371. His reign was unimportant; for relations with England and France see SCOTLAND: *History*. The king died at Dundonald on May 13, 1390, and was buried at Scone.

See Andrew of Wyntoun, *The Orygynale Cronykil of Scotland*, edited by *D.* Laing (Edinburgh, 1872–79); John of Fordun, *Scotichronicon*, continued by Walter Bower, ed. T. Hearne (Oxford, 1722); John Major, *Hzstória maioris Britanntae* translated by *A.* Constable (Edinburgh, 1892); and P. F. Tytler, *History of Scotland* (Edinburgh, 1841–43).

ROBERT III. (*c.* 1340–1406), king of Scotland, was the eldest son of King Robert II. by his mistress, Elizabeth Mure, and was legitimatized when his parents were married about 1349. In 1368 he was created earl of Carrick, and he took some part in the government of the kingdom until about 1387, when he was disabled by the kick of a horse. It was probably in consequence of this accident that his brother Robert, earl of Fife, and not the crown prince himself, was made guardian of the kingdom in 1389; but the latter succeeded to the throne on his father's death in May 1390. At this time he changed his baptismal name of John, which was unpopular owing to its connection with John de Baliol, for that of Robert, being crowned at Scone in August 1390 as King Robert III. The new king was only the nominal ruler of Scotland, the real power being in the hands of his brother, the earl of Fife. In 1399, his elder son, David, duke of Rothesay, was appointed lieutenant of the kingdom; but this event was followed by an English invasion of Scotland, by serious differences between Rothesay and his uncle, Robert, now duke of Albany, and finally in March 1402 by Rothesay's mysterious death at Falkland. Early in 1406 the king's only surviving son, afterwards King James I., was captured by the English; and on April 4, 1406, Robert died, probably at Rothesay, and was buried at Paisley.

ROBERT, the name of two dukes of Normandy.

ROBERT I. (d. 1035), called Robert the Devil, was the younger son of Richard II., duke of Normandy (d. 1026), and father of William the Conqueror. In 1028 he succeeded his brother, Richard III., whom he was accused of poisoning, as duke of Normandy. Robert sheltered the exiled English princes, Edward, afterwards King Edward the Confessor, and his brother Alfred, and fitted out a fleet for the purpose of restoring them to their inheritance, but this was scattered by a storm. When returning from a pilgrimage to Jerusalem, he died at Nicaea on July 22, 1035. Robert is the subject of several poems and romances. (*See* ROBERT THE DEVIL.)

ROBERT II. (c. 1054–1134), called Robert Curthose, was the eldest son of William the Conquerer. Although recognized in boyhood as his father's successor in Normandy, he twice revolted

against his father. (*See* WILLIAM I.) When the Conqueror died in Sept. 1087, Robert became duke of Normandy, but not king of England; although he received offers of help, he took no serious steps to displace his younger brother, King William II. In Normandy his rule was weak and irresolute. In 1089 his duchy was invaded by William II, who soon made peace with Robert, the two agreeing to dispossess their brother Henry of his lands in Normandy. This peace lasted until 1094, when occasions of difference again arose and another struggle began, Robert being aided by King Philip I of France.

This warfare ended in 1096, when Robert set out on the first crusade. He returned to Normandy in Sept. 1100.

William Rufus died while Robert was on his homeward way, and in Italy the Norman duke was greeted as king of England; but when he reached Normandy he learned that the English throne was already in the possession of Henry I. In July 1101 he crossed over to England, intending to contest his brother's title, but Henry met him near Alton, in Hampshire, and an amicable arrangement was made between them. But there was no lasting peace. In 1106 the English king crossed over to Normandy, and at the battle of Tinchebrai (Sept. 28, 1106), Henry took his brother prisoner and carried him to England. For 28 years Robert was a captive. He died Feb. 10, 1134.

ROBERT OF AUXERRE (*c.* 1156–1212), French chronicler, was an inmate of the monastery of St. Marien at Auxerre. At the request of Milo de Trainel (1155–1202), abbot of this house, he wrote a *Chronicon* or universal history, which covers the period between the creation of the world and 1211. Robert is an original authority for the period from 1181 to 1211. Two continuators took the work down to 1228 and it was extensively used by later chroniclers.

ROBERT OF COURTENAY (d. 1228), emperor of Rumania or Constantinople, was a younger son of the emperor Peter of Courtenay. When it became known in France that Peter of Courtenay was dead, his eldest son, Philip, renounced the succession in favour of his brother Robert, who set out to take possession of his distracted inheritance. Crowned emperor on March 25, 1221, Robert appealed for help to the pope and to the king of France; but meanwhile his lands were falling into the hands of the Greeks. Some little aid was sent from western Europe, but soon Robert was compelled to make peace with his chief foe, John Ducas Vatatzes, emperor of Nicaea, who was confirmed in all his conquests. Robert died in Achaia in 1228.

ROBERT THE DEVIL, legendary son of a duke of Normandy, who, at 20, uses his immense strength only for outrage and crime. His mother informs him, in explanation of his evil impulses, that he was born in answer to prayers addressed to the devil; and a hermit, to whom the pope directs him, requires him as a penance to maintain absolute silence, feign madness, take his food from the mouth of a dog and provoke ill-treatment from the common people without retaliating. Later, while the emperor's court fool, he appears as an unknown knight at the bidding of a celestial messenger and delivers Rome from Saracen attacks in three successive years; his disguise is pierced by the emperor's dumb daughter, who recovers speech to identify him, but he refuses her hand and withdraws to end his days with the hermit.

This legend is found in a late 12th-century romance, *Robert Le Diable,* ed. by E. Löseth for the Société des Anciens Textes Français (1903). Another version, in which Robert is a bandit who, in penitence, kills his accomplices, feigns madness, is recognized as son of the duke of Normandy and is married by the pope to the emperor's daughter, forms the subject of the 14th-century *Mystère de Robert le Diable* ed. by E. Fournier, 1879. For another 14th-century version, in alexandrine quatrains, *see* K. Breul, *Le dit de Robert le Diable,* in *Abhandlungen Prof. A. Tobler dargebracht* (1895). The legend, distorted, also provides the Eugène Scribe libretto for Meyerbeer's opera, *Robert le Diable* (1831).

ROBERT OF GLOUCESTER (fl. 1260–1300), English chronicler known only through his connection with the work which bears his name, probably written *c.* 1300. This is a vernacular history of England, from the days of the legendary Brut to the year 1270, written in rhymed couplets. The lines are of 14 syllables, with a break after the eighth syllable. In some manuscripts the early part (up to 1135) is followed by a brief continuation by an anonymous versifier, and in these slight deviations from the version generally accepted as Robert's are also discernible. The authorities employed for the earlier part were Geoffrey of Monmouth, Henry of Huntingdon, William of Malmesbury, the English chronicles and some minor sources; Robert, in making his recension of it, also used the *Brut* of Layamon. From 1135 to 1236 Robert is still a compiler, although references to oral tradition become more frequent as he approaches his own time. From 1256 to 1270 he has the value of a contemporary authority, but he is more important to the philologist than to the historian.

Robert's chronicle was first edited by T. Hearne, 2 vol. (1724), but this text was superseded by that of W. Aldis Wright, 2 vol., Rolls series (1887). Extracts (1192–1270) were edited by F. Liebermann in *Monumenta Germaniae Historica, Scriptores,* xxviii, pp. 663–669 (1888).

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(X.; D. WK.)

ROBERT OF JUMIÈGES (d. *c.* 1055), archbishop of Canterbury, was a Norman monk who became prior of St. Ouen and in 1037 abbot of the Benedictine abbey of Jumièges, near Rouen. He was taken to England by his friend Edward the Confessor in 1042 and made bishop of London in 1044. He became Edward's leading adviser and head of the Norman party, and was appointed archbishop of Canterbury in 1051. Although Robert was instrumental in bringing about the exile of Earl Godwine in 1051, on the native leader's return in 1052 the archbishop himself was forced to flee to the continent. Deposed and outlawed by the Witenagemot, Robert died at Jumièges, possibly in 1055. The uncanonical usurpation of the primatial see by Stigand enabled William of Normandy to champion the ecclesiastical cause and obtain papal support for his invasion of 1066. (D. D. McG.)

ROBERT THE STRONG (LE FORT) (d. 866), count of Anjou and of Blois, appears as rector of the abbey of Marmoutier in 852, and as one of Charles the Bald's *missi dominici,* in 853; but soon afterward he was among those who rebelled against Charles, and invited the king's half-brother, Louis the German, to invade West Francia.

In 860 Robert came to terms with Charles, who made him count of Anjou and of Blois and entrusted him with the defense of that part of his kingdom which lay between the Seine and the Loire, a district which had suffered greatly from the ravages of the Normans and the Bretons. He was killed in battle at Brissarthe in Oct. 866, leaving two sons, Odo or Eudes and Robert, both of whom became kings of the Franks. Robert was the ancestor of the Capetian kings of France.

See K. von Kalekstein, *Robert der Tapfere* (1871); E. Favre, *Eudes, comte de Paris et roi de France* (1893).

ROBERT OF TORIGNI (*c.* 1110–1186), medieval chronicler, was prior of Bec in 1149, and in 1154 became abbot of Mont St. Michel, whence he is also sometimes called Robertus de Monte. He died, according to Potthast, on May 29, 1186.

Robert wrote additions and appendices to the chronicle of Sigebert of Gembloux, covering the period A.D. 385–1100, and a chronicle in continuation of Sigebert, extending from 1100 to 1186, of great value for Anglo-Norman history. It is for continental affairs between 1154 and 1170 that his information is valuable.

ROBERT, HUBERT (1733–1808), French painter, sometimes called "Robert des Ruines" because of his paintings of Roman ruins, was born in Paris on May 22, 1733. His first teacher was the sculptor Michel Ange Slodtz. He went to Rome in 1754, where he had to pay a small fee for his keep at the French academy before receiving a formal appointment. French travelers to Italy began to purchase his views of Rome. In 1759 the abbé de Saint-Non and the painter Jean Honoré Fragonard, his elder, joined him

and they traveled to Tivoli and Naples. Living at the Villa d'Este, they produced a quantity of drawings in red chalk of ancient buildings in ruined parks, animated with small figures. After his 11-year stay in Italy, Robert left the country in 1765, and became a member of the Paris academy the next year.

Robert was a born decorator and his paintings looked well on the gray wainscoting then much used. His popularity was enhanced by exhibitions at the Salons from 1767 on. In addition to his Italian landscapes, he painted scenes of Ermenonville, Marly and Versailles, near Paris, and of the south of France, with ruined monuments of the Roman era. During the Revolution he was imprisoned but continued his work; the fall of Robespierre saved him from the guillotine. He worked with Fragonard on a commission for the Musée Français, then a national museum in the old palace of the Louvre. He died in Paris on April 1j, 1808, entirely forgotten. He is represented by works at the Louvre, Paris, the Versailles palace and many French museums, the Metropolitan museum, New York city, the Institute of Fine Arts, Detroit, Mich., and the Art Institute of Chicago.

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ROBERT GUISCARD (*i.e.*, "the resourceful") (*c.* 1015–108j), the most remarkable of the Norman adventurers who conquered southern Italy. Those who first came in 1016 to seek their fortune in Apulia and Calabria seem to have had no political ambitions. They arrived in small groups and lacked organization and experienced leadership. They were prepared to live as mercenaries in the service of Greeks or of Lombards. It was not until 1030 that Sergius of Naples, by installing the leader Rainulf in the fortress of Aversa, gave them their first *pied-à-terre* and that they began an organized conquest of the land. Foremost in this work were the sons of Tancred de Hauteville, whose lands near Coutances were too modest to support his large family. William "Iron Arm" and Drogo were successively leaders of those Normans who from 1040 were extending their possessions in Apulia and Calabria, and among their brothers who joined them were Humphrey in 1044 and Robert Guiscard in 1046. At first, Robert was not made welcome and was forced, as were many of his compatriots, to live like a brigand, terrorizing and laying waste the countrvside. Because of the distress so caused. Leo IX attempted to-subdue the Normans by force; but their principal leaders, among them Robert, combined in 1053 to defeat the pope at Civitate. Thereafter Robert prospered. In 1057 he succeeded Humphrey as recognized leader of the Normans in Apulia. In 1059 Pope Nicholas II, seeking independence from the German king Henry IV and the Roman nobility, turned to the Normans as allies. On Aug. 23, 1059, Robert became a vassal of the pope, promising tribute and help when needed. In return he became "by grace of God and St. Peter duke of Calabria and Apulia and future lord of Sicily." It was a master stroke. Robert's dominion was legitimized by solemn papal investiture.

In the next 20 years Guiscard made an amazing series of conquests at the expense of Moslems, Greeks and Lombards. Invading Sicily with his brother Roger, he captured Messina (1061) and Palermo (1072). Bari was reduced (April 1071) and the Greeks were finally ousted from southern Italy. The territory of Salerno was already Robert's; in Dec. 1076 he took the city, expelling its Lombard prince Gisulf, whose sister Sicelgaeta he had married.

The Norman attacks on Benevento, a papal fief, alarmed Gregory VII but, pressed by Henry IV, he turned again to the Normans and at Ceprano (June 1080) reinvested Robert, securing him also in the southern Abruzzi, but reserving Salerno. Guiscard's last enterprise was his attack on the eastern empire, a rallying ground for his rebel vassals. He contemplated seizing the imperial throne and took up the cause of Michael VII, who had been deposed in 1078 and to whose son his daughter had been betrothed. He sailed against the empire in May 1081 and had occupied Corfu and Durazzo by Feb. 1082. He was, however, recalled to the aid of Gregory VII, who was besieged in San Angelo by Henry IV (June 1083). Marching north, he entered Rome and forced Henry to retire, but an *émeute* of the citizens led to a three days' sack of the city (May 1084), after which Guiscard escorted the pope to Salerno. His son Bohemund (*q.v.*), for a time master of Thessaly, had now lost the Greek conquests. Robert, returning to restore them, occupied Corfu and Cephalonia, but died of fever on July 17, 1085. (E. CU.; R. C. SMA.)

ROBERTS, SIR CHARLES GEORGE DOUGLAS (1860–1943), Canadian poet and prose writer, is often referred to as the father of Canadian literature. He was the first poet to express the new national feeling aroused in Canada by the Confederation of 1867, and his example and counsel inspired a whole school of late 19th-century Canadian poets.

Roberts was born near Fredericton, N.B., Jan. 10, 1860. After graduation from the University of New Brunswick in 1879, he taught school. edited the influential Toronto magazine *The Week*, and was for ten years professor of English at King's college, Windsor, N.S. In 1897 he moved to New York city where he worked as a journalist, and in 1907 he went to London. Upon his return to Canada in 1925, he was enthusiastically received on a cross-Canada lecture tour and later settled in Toronto as the acknowledged dean of Canadian letters. He was knighted by King George V in 1935. He died in Toronto on Nov. 26. 1943. and was buried in Fredericton.

Roberts was almost equally adept at prose and poetry. His prose included a pioneer *History of Canada* (1897), several novels dealing with the past and present of the maritime provinces, and many volumes of the animal stories that were his chief source of fame as a prose writer. In such books as *Earth's Enigmas* (1896), *The Kindred of the Wild* (1902) and *Neighbours Unknown* (1911) he displayed his intimate knowledge of the woods and their animal inhabitants.

Later criticism, however, tended to value Roberts' poetry rather more highly than his prose. Beginning with *Orion* (1880), he published about 12 volumes of verse, of which the best were *In Divers Tones* (1887), *Songs of the Common Day* (1893), *The Vagrant of Time* (1927) and *The Iceberg and Other Poems* (1934). *Selected Poems*, edited by Desmond Pacey, was published in 1956. Roberts wrote of nature, love, nationalism and philosophy, but his best poems by general consent were his simple descriptive lyrics about the scenery and rural life of New Brunswick and Nova Scotia.

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ROBERTS, FREDERICK SLEIGH ROBERTS, 1ST EARL (1832–1914), British soldier, whose successful campaigns principally in India, Afghanistan and South Africa culminated in his appointment as commander in chief of the British army, was born at Cawnpore, India, Sept. 30, 1832. Educated at Eton, Sandhurst and Addiscombe, he obtained a commission in the Bengal artillery on Dec. 12, 1851. In 1852 he was posted to a field battery at Peshawar, where he also acted as aide-de-camp to his father, who commanded the Peshawar division. In 1856 Roberts was appointed to the quartermaster general's department of the staff. in which he remained for 22 years, passing from one grade to another until he became quartermaster general in India. On the outbreak of the mutiny in 1857, Roberts, at first, was staff officer to the movable column operating against the mutineers in the Punjab but, toward the end of June, he joined the Delhi field force and was deputy assistant quartermaster general with the artillery during the operations against Delhi. He served under Sir Colin Campbell at the second relief of Lucknow in November, at the battle of Cawnpore on Dec. 6 and the subsequent pursuit and defeat of the Gwalior contingent near Shinrajpur.

Roberts distinguished himself at the engagement of Khudaganj on Jan. 2, 1858. He was present at the reoccupation of Fatehgarh on Jan. 6, the storm of Mianganj in February, the siege and capture of Lucknow in March, and the action at Kursi on March 22, after which he went home on sick leave. On his return to India he was entrusted with'the organization of the viceroy's camps during the progresses through Oudh, the North-West Provinces, the Punjab and Central India, in 1860 and 1861. In Dec. 1863

he took part, under Maj. Gen. John Garvock, in the Ambela campaign against the Hindustani fanatics among the mountains to the north of Peshawar, and was present at the storm of Lalu, the capture of Ambela and the destruction of Malka.

In 1867 Roberts was appointed assistant quartermaster general to Sir Donald Stewart's Bengal brigade for Abyssinia. He arrived at Zula, Annesley Bay. in the Red Sea, the base of the expedition, on Feb. 3, 1868, and remained there as senior base staff officer during the four months' campaign. At its close he superintended the re-embarkation of the whole army. He returned to India the following year as first assistant quartermaster general. In the autumn of 1871 he made the arrangements for the expedition against the tribes of the Lushai hills, between southeast Bengal and Burma. On his return in March 1872, he became deputy quartermaster general in Bengal, and in 1875 quartermaster general and colonel. He settled the details of the great camp of exercise at Delhi on the occasion of the visit of the prince of Wales in Jan. 1876, and attended him at the maneuvers. He also superintended the arrangements for the great durbar (ceremonial gathering) at Delhi on Jan. 1, 1877, when Queen Victoria was proclaimed empress of India.

In 1878 Roberts was appointed to the command of the Frontier field force at Abbottabad, in Hazara; but in the autumn, on the repulse of Sir Neville Bowles Chamberlain's mission by the Afghans at Ali Masjid, and the formation of three columns to advance into Afghanistan by the Khyber, the Bolan and the Kurram passes, he was given command of the Kurram field force, with the rank of major general. Concentrating his column at Thal, he advanced to Kurram toward the end of November and, having formed an advanced base there, moved on to Habib Kila. Under cover of preparations for a front attack on the Peiwar Kotal, he reconnoitred that formidable position and, on the night of Dec. 1, moved part of his force to attack the Spingawi Kotal. in order to turn the Afghan left flank, leaving the remainder of the force to feign a front attack on the Peiwar and to guard the camp. After a very difficult night march the Spingawi Kotal was carried at daybreak on Dec. 2 and, later, the Afghans on the Peiwar Kotal, threatened in the rear, abandoned the position.

At the end of January he returned to Hagir Pir, in Kurram, where his force remained in occupation. In July Maj. Louis Cavagnari, the British envoy to the new amir, Yakub Khan, passed through Kurram on his way to Kabul, and, shortly afterward, Roberts left his Kurram command and went to Simla to take his seat on the army commission.

While Roberts was at Simla, news arrived on Sept. 5 of the murder of Cavagnari and his companions at Kabul. By Sept. 19 a brigade was entrenched on the Shutargardan and, as Roberts advanced. Amir Yakub Khan came into his camp. On Oct. 6 the enemy was severely defeated.

Yakub Khan abdicated on Oct. 12 and was eventually deported to India. The troops occupied the Sherpur cantonments; but in November a religious war was proclaimed by the Mullahs and, early in December, in order to prevent a threatening combination of Afghan tribes against him, Roberts moved out two columns to attack them in detail. After considerable fighting near Kabul, the numbers of the enemy became so great that he was forced to concentrate his troops again at Sherpur, the defenses of which had been greatly improved and strengthened. Sherpur was invested by the enemy, and early on Dec. 23, was attacked by over 100,000 Afghans. They were driven off with great loss and, on making a second attempt to storm the place, were met by Roberts, who moved out, attacked them in flank, and defeated them.

Roberts now recommended the political dismemberment of Afghanistan, and negotiations were carried on mith the northern tribes for the appointment of an amir for the Kabul district only. On May 5, Sir Donald Stewart arrived with his column from Kandahar and assumed the supreme command in Afghanistan. Roberts retained, under Stewart. the command of the two Kabul divisions, and organized an efficient transport corps under Col. R. Low, which was soon to be of inestimable value. On July 22, Abdur Rahman was proclaimed Amir of Kabul. Roberts was preparing to withdraw his troops to India by the Kurram route, when news arrived that a British brigade had been totally defeated at Maiwand on July 27, and that Lieut. Gen. James Primrose was besieged in Kandahar.

Roberts was ordered to proceed thither at once with a specially selected column of 10.000 troops and his ne transport corps. He started on his famous march on Aug. 9 and arrived at Kandahar on the morning of the 31st, having covered 313 miles in 22 days. The ease mith which Roberts effected his famous march is partly explained by the fact that Abdur Rahman wrote to the tribal chiefs between Kabul and Kandahar asking them not to contest the advance of the British forces. On the following day he fought the battle of Kandahar and gained a complete victory. Roberts was now created K.C.B., G.C.B. and a baronet, and was given the command of the Madras army.

Before proceeding to Madras, Roberts went home on furlough, and when the news of the disaster at Majuba Hill in South Africa arrived in London at the end of Feb. 1881, he was appointed governor of Natal and commander in chief in South Africa. He arrived at Cape Town to find that peace had been made with the Boers, and that instructions awaited him to return home. He returned to India in November. The following year he visited Burma with the viceroy, and in 1885 attended the meeting between Abdur Rahman and Lord Dufferin at Rawalpindi at the time of the Panjdeh incident. In July he succeeded Sir Donald Stewart as commander in chief in India. At the end of 1886, at the request of the viceroy, he took personal command for a time of the forces in Burma, and organized measures for the suppression of dacoity. In 1893 he left India for good.

After the disastrous actions in the Boer war in South Africa in Dec. 1899 at Magersfontein, Stormberg and Colenso, where his only son was killed, Lord Roberts was sent out as commander in chief. He arrived at Cape Town on Jan. 10, 1900, and, after organizing his force, advanced with sound strategy on Bloemfontein, the capital of the Orange Free State, and soon changed the aspect of affairs. The sieges of Kimberley and Ladysmith were raised, and the Boer general, Piet Cronje, fleeing toward the capital, was overtaken at Paardeberg and, after a fine defense, was compelled to surrender.

Roberts entered Bloemfontein on March 13 and, after six weeks' preparation, advanced on Pretoria, the capital of the Transvaal. Mafeking was relieved on May 17 and Pretoria occupied on June 5. The two Boer states were annexed and, the war gradually assuming a guerrilla character, Roberts handed over the command to Lord Kitchener and returned to England to fill the office of commander in chief of the army in succession to Lord Wolseley.

On the outbreak of World War I he was a frequent visitor at the war office, and shortly after the arrival of the two Indian divisions in France he crossed the channel to visit them in the trenches. He was attacked by pneumonia while at the front and died at St. Omeron Nov. 14, 1914.

BIBLIOGRAPHY.—Lord Roberts works included: *The Rise of Wellington* (1895); *Forty-one Years in India,* 2 vol. (1897); *Letters Written During the Indian Mutiny* (1924). *See* also H Hensman, *The Afghan War of* 1879–1880 (1881); *The Anglo-Ajghan War,* official account (1881); Sir T. E. Maurice and M. H. Grant, *History of the War in South Africa* 1899–1902 (1906–10); Sir G. W. Forrest, *The Life of Lord Roberts* (1914); David James, *Lord Roberts* (1954).

ROBERTS-AUSTEN, SIR WILLIAM CHANDLER *(1843–1902)*, English metallurgist noted for his researches into the physical properties of metals, was born in Kennington, Surrey, March 3, 1843. At the wish of his uncle, Maj. Nathaniel L. Austen, he later adopted the name commemorated in the term austenite, used for the solid solution of carbon in gamma-iron (see IRON AND STEEL: *Austenite*). Educated at the Royal School of Mines, he became private assistant to the master of the mint (1865) and chemist to the mint (1870), chemist and assayer (1882) and acting deputy master (1902). He also became professor of metallurgy at the School of Mines in 1880. An outstanding teacher, Roberts-Austen won renown for his work in the new field of physical metallurgy, much of which formed the basis of the alloys research reports of the Institution of Mechanical Engineers. He served on the treasury committee entrusted with the establishment of the National Physical laboratory (1897) and

was an original member of the war office explosives committee (1899). Among the many honours bestowed upon him was fellowship of the Royal society (1875). He died in London on Nov. 22, 1902. (C. W. D.)

ROBERTSON, FREDERICK WILLIAM (1816–1853), English clergyman, known as Robertson of Brighton, was born in London on Feb. 3, 1816. He studied at Edinburgh university, and at Brasenose college, Oxford. He had intended to go into the army, but Oxford changed the bent of his mind, and he was ordained in 1840, and served in curacies at Winchester and Cheltenham. He entered in 1847 on his famous ministry at Trinity chapel, Brighton, where his church was thronged with thoughtful men of all types.

Robertson was not a scientific theologian; but his insight into the principles of the spiritual life was unrivaled. As his biographer says, thousands found in his sermons "a living source of impulse, a practical direction of thought, a key to many of the problems of theology, and above all a path to spiritual freedom." His closing years were full of suffering, arising mainly from the opposition aroused by his sympathy with the revolutionary ideas of the 1848 epoch. He died on Aug. 15, 1853.

Robertson's works include five volumes of sermons, two volumes of expository lectures. on Genesis and on the epistles to the Corinthians, a volume of miscellaneous addresses, and an *Analysis of "In Memoriam."*

See Stopford *A.* Brooke, *Life and Letters* (1865).

ROBERTSON, THOMAS WILLIAM (1829–1871), English actor and dramatist, was born at Newark on Jan. 9, 1829. Robertson was familiar with the stage from his childhood; he was the eldest of a large family, the actress Margaret (Madge) Robertson (Mrs. Kendal) was the youngest. A farcical comedy by him, *A Night's Adventure,* was produced, without great success, at the Olympic, under Farren's management as early as 1851. He remained for some years longer in the provinces, varying his work as an actor with miscellaneous contributions to newspapers. In 1860 he went to London, and edited a mining journal. He was at one time prompter at the Olympic under the management of Charles Mathews. He wrote a farce entitled *A Cantab,* which was played at the Strand theatre in 1861. This brought him a reputation in a Bohemian clique, but so little practical assistance that he thought of abandoning the profession to become a tobacconist. Then, in 1864, came *David Garrick,* produced at the Haymarket with Edward Sothern in the principal character, which has kept the stage ever since.

But his name was made by the production of *Society* at the Prince of Wales theatre in 1865, under the management of Miss Marie Wilton, afterward Mrs. Bancroft. Playwriter and company were exactly suited one to another; the plays and the acting together—the small size of the playhouse being also in their favour—were at once recognized as a new thing. Although some critics sneered at the "cup-and-saucer comedy," voted it absurdly realistic, said there was nothing in it but commonplace life represented without a trace of Sheridanian wit and sparkle, all London flocked to the little house in Tottenham street, and the stage was at once inundated with imitations of the new style of acting and the new kind of play. All Robertson's best-known plays (except *David Garrick*) were written for the old Prince of Wales's under the Bancrofts, and that régime is now an historical incident in the progress of the English stage. *Ours* was produced in 1866, *Caste* in 1867. *Play* in 1868, *School* in 1869, *M.P.* in 1870. Robertson died in London on Feb. 3, 1871.

See *Principal Dramatic Works of Robertson; with Memoir by his son* (1889) ; and *T.* E. Pemberton, *Life and Writings of Robertson* (1893).

ROBERTSON, WILLIAM (1721–1793), Scottish historian and Presbyterian minister, whose writings were the earliest popular histories within their respective fields and were highly esteemed by his contemporaries. He was born at Borthwick, Midlothian, on Sept. 19, 1721. After being educated at Dalkeith grammar school and Edinburgh university, he was presented to the living of Gladsmuir, near Edinburgh, in 1743. A member of the General Assembly from 1746 he was elected moderator in 1762 and for many years his influence as leader of the "moderate" party was supreme. *(See* PRESBYTERIAN.)

Robertson's career as historian began with the publication of *History of Scotland during the Reigns of Queen Mary and of James VI until his Accession to the Crown of England,* 2 vol. (1759), which brought immediate fame and was eulogized by, among others, David Hume and Edward Gibbon. It also gained the favour of Lord Bute, who secured Robertson's appointment as principal of Edinburgh university in 1762 and revived the office of historiographer royal for him in 1763. Robertson's next work was *History of the Reign of the Emperor Charles the Fifth,* 3 vol. (1769). and this was followed by *History of America,* 3 vol. (5th ed , 1788). Robertson's reputation has not stood the test of time. His concern for the "dignity of history" often seems mere pomposity and his straightforward prose is often dull. He had the virtue of adhering closely to his sources, but. as a corollary, held that those early periods of history which were poorly documented deserved to be forgotten. Of his three major works, the *History of America* (in effect, Spanish America) was the most outstanding and for this Robertson would undoubtedly be more widely remembered were he not unfortunate in having been followed by W. H. Prescott.

See J B. Black, *The Art of History* (1926) ; *R.* A. Humphreys, *William Robertson and his "History of America"* (1954).

ROBERTSON, SIR WILLIAM ROBERT (1860–1933), British field marshal, was born at Welbourn, Lincs., on Sept. 14, 1860. He enlisted as a private in the 16th Lancers in 1877, and served in the ranks of that regiment until 1888, when he won a commission in the 3rd Dragoon Guards, then in India. He eagerly studied his profession in all its branches and he learned the native languages. He was railway staff officer in the Miranzai and Black Mountain operations of 1891, and in the following year joined the intelligence department at Simla; while on its staff he carried out a reconnaissance to the Pamirs, and in 1895 served with the Chitral Relief Force, being wounded and receiving the D.S.O. He passed through the Staff College in 1897–8—the first officer risen from the ranks to do so—and then, after a few months at the War Office, went out to South Africa on the Intelligence Staff; he accompanied Lord Roberts on his advance from Cape Colony into the Transvaal, and was promoted brevet lieutenant-colonel for his services. He spent the period from 1901 to 1907 at the War Office, being promoted colonel in 1903, and he then went to the staff at Aldershot, where he spent three years. In 1910 he was appointed commandant of the Staff College, was shortly afterwards promoted major-general and in 1913 became director of military training at the War Office.

On the mobilization of the army for the World War, Robertson became quartermaster-genera1 of the Expeditionary Force, and in Jan. 1915 chief of the general staff to Sir John French. In the following December he was brought back to the War Office as chief of the imperial general staff and immediately introduced great improvements in the office organization. Convinced that the Western Front represented the decisive theatre of war, and fully aware how mischievous was dispersion of force in principle, he saw to it that, where operations in distant regions were unavoidable, the commanders on the spot were furnished with what was deemed essential to achieve success—with the result that the position of affairs in Mesopotamia, on the Suez frontier and in East Africa was completely transformed within a very few months. His services were recognized by promotion to general in 1916 and by the G.C B. in 1917.

In the later months of 1917 he found it more and more difficult, in view of the disappointing results of Allied offensives in France and Flanders, to persuade the War Cabinet that diversion of fighting resources to other theatres of war endangered prospects of victory at the decisive point and might lead to disaster near home. His anxieties were increased by the manner in which the problem of man-power was treated. He moreover foresaw that the Supreme War Council, introduced towards the end of the year, would not provide effective means for combining the operations of the Allies. In Feb. 1918 he was transferred by the Government to the charge of the eastern command in England—just one month be-

fore the success that attended the great German offensive of March proved how correct had been his appreciation of the situation. Three months later he succeeded French as commander-in-chief in Great Britain. After the War he received a baronetcy, a grant of £10,000, and in 1919, the G.C.M.G. From April 1919 to March 1920 he commanded the British troops on the Rhine, and, after relinquishing that appointment on the force being reduced, was promoted field-marshal. Robertson received many English and foreign honours, including the G.C.V.O. (1931).

See his *From Private to Field-marshal* (1921); and *Soldiers and Statesmen 1914–1918* (1926).

ROBERVAL, GILLES PERSONNE (PERSONIER) **DE** (1602–1675), French mathematician, whose most important work was done on curves, was born at Roberval, near Beauvais, on Aug. 8. 1602. In 1632 he became professor of mathematics in the Collège de France and maintained this position until his death in Paris on Oct. 27, 1675.

Roberval studied the quadrature of surfaces and the cubature of solids, which he accomplished, in some of the simpler cases by an original method which he called the "method of indivisibles." He discovered a general method of drawing tangents, by considering a curve as described by a moving point whose motion is the resultant of several simpler motions.

He also discovered a method of deriving one curve from another. by means of which finite areas can be obtained equal to the areas between certain curves and their asymptotes. To these curves. which were also applied to effect some quadratures, Evangelista Torricelli gave the name of "Robervallian lines." Roberval was an irascible person who indulged in scientific feuds with several of his contemporaries, among them Descartes. He invented the balance which goes by his name.

His works were published in 1693 by the Abbé Gallois, in the *Recueil* of the *Mémoires* de *l'Académie* des Sciences.

See E. Walker, *a Study of the Traité des indivisibles of G. P, de Roberval* (1932). (O. OE)

ROBES, the name generally given to a class of official dress, especially as worn by certain persons or classes on occasions of particular solemnity. The word robe (toga) was earliest used, in the sense of a garment, of those given by popes and princes to the members of their household or their great officers. It would be going too far to assume that, for example, peers' robes were originally the king's livery, but in most early cases where robes are mentioned. if not of cloth of gold, etc., they are of scarlet, furred. A robe is properly a long garment (toga talaris), and the term "robes" is now applied only in those cases where a long garment forms part of the official dress, though in ordinary usage it is taken to include all the other articles of clothing proper to the full dress in question. The term "robes" moreover, connotes a certain degree of dignity or honour in the wearer. It is proper to speak of the sovereign's robes of state. of peers' robes, of the robes of the clergy. of academical robes, judicial robes, municipal or civic robes. In the case of the official dress of the clergy, too, a distinction must be drawn. The sacerdotal vestments are not spoken of as "robes"; a priest is not "robed" but "vested" for Mass; yet the rochet and chimere of an English bishop. even in church, are more properly referred to as robes than as vestments, and, while the cope he wears in church is a vestment rather than a robe, the scarlet habit which is part of his parliamentary full dress is a robe, not a vestment. This habit is a doctor's convocation robe (supertunica, "the sleveless cote" of the act of 24 Henry VIII, 1533, *caput* 13) and non-doctor bishops and suffragans should not wear it. It is faced and partly lined uith the silk of the doctorate held. The chimere (*supertunica*) of the Anglican prelate is of black corded ottoman silk: the scarlet chimere is a preaching, court and parliamentary robe. The bishop's rochet is not a liturgical vestment but is a kind of outdoor traveling shirt. But the priest's surplice is a liturgical vestment (*superpellicium*). The full-dress doctors' robes worn by bishops on non-ecclesiastical occasions are post-Reformation, lay and purely academical robes (sleeved tabards). authorized at the Hampton Court conference, 1603. The official.non-liturgical dress of the clergy is dealt with in the article VESTMENTS.

The coronation robes reflect the requirements of royal ceremonial and the sacerdotal significance of Christian kingship. The robes of the British sovereign consist of a crimson surcoat, parliamentary robe and cap of estate worn before the service. During the ceremony, the sovereign is invested with the *Colobium Sindonis,* a loose linen garment. the dalmatic or cloth of gold surcoat with girdle of the same, surmounted by the *Pallium* Regale or cloth of gold mantle and *armilla* or stole. Leaving Westminster abbey, the purple surcoat is worn under the purple robe of estate, with the imperial state crown. Queen Elizabeth II wore these traditional robes in 1953, omitting the crimson and purple surcoats for a coronation dress, and the cap of estate. The sovereign's coronation robes are described in "The King's Coronation Ornaments," by William H. St. John Hope, in The Ancestor, vols. i and ii (1902), also by L. Wickham Legg (ed.), English Coronation Records (1901).

All countries which boast an ancient civilization have some sort of official robes, and the modern tendency has been to multiply rather than to diminish their number. In the United States few save judges of the higher courts wear robes. The scarlet judicial robes were discarded at the Revolution. Those of black silk now worn are slightly modified academical gowns. John Jay, first chief justice of the supreme court (1789), set the fashion by sitting in the LL.D. robe granted him by Columbia university.

Peers' **Robes.**—As early as the end of the 14th century peers seem to have uorn at their creation some kind of robe of honour. An illumination on the foundation charter of King's college, Cambridge, represents the peers in 1446 wearing gowns, mantles and hoods of scarlet, furred with miniver, the mantle opening on the right shoulder and guarded with two, three or four bars of miniver. in the form of short stripes high up on the shoulder. The origin of these is as yet unknown, though it is highly probable that these scarlet and miniver (or ermine) robes approximate to those of the medieval doctors, after they had adopted scarlet about 1340: it is not certain precisely when the peers' velvet robe of estate was first used. During the reign of Henry VIII, references are found to the "parliament robes" of peers. By the time of James II's coronation, the baron and viscount had the velvet robes of estate. The colour of these seems to have been crimson at first, sometimes varying to purple. They consisted of a long gown or surcoat with girdle, a mantle lined with ermine, a hood and a cape of ermine, the rows being as follows: for a duke 4, a marquess $3\frac{1}{2}$, an earl 3, a viscount $2\frac{1}{2}$ and a baron 2.

Till late in the 18th century peers continued to attend the house of lords in parliamentary robes, with the stars and ribands of their orders, but robes now are worn only in the house of lords, *e.g.,* at the opening of parliament, on occasions when the sovereign gives his (or her) assent to bills by "royal commission" (when five or six peers on the government side appear in robes and the lord chancellor also wears his peer's robe of scarlet ermine) and at the introduction of a newly created peer or peeress, when the new peer or peeress and his or her two introducers wear their parliamentary robes (over morning dress) during the ceremony of introduction only. The mover and seconder of the Address no longer wear robes, but uniform. On all the above occasions, and when the peers as a body attend church or some other ceremony, the parliamentary robe of scarlet cloth is worn; in the present day it takes the form of a mantle opening on the right shoulder, with a collar of ermine, and guarded with rows of ermine and gold lace round the right shoulder, varying in number according to the rank of the wearer. The modern coronation robes consist of a crimson velvet surcoat and a mantle with a cape of ermine and with rows of ermine as in the parliamentary robes. The surcoat is no longer a gown, but a short sleeveless garment.

As regards peeresses' robes, the order of the earl-marshal for the regulation of these at the coronation of James II shows that by then all peeresses wore the robes of state of crimson velvet and minutely regulates all details, such as shape, powderings, length of train and width of the fur edging of the mantle. They have changed very little up to the present day. Peeresses created for life when introduced into the house of lords for the first time in October 1958 wore normal parliamentary robes with a hat of

tricorn pattern.

House of Commons.—The speaker of the house of commons wears on state occasions a black damask robe with gold lace and a full-bottomed wig; in the house itself he wears a black silk robe with train and a full-bottomed wig. The clerks at the table wear barristers' gowns and wigs.

Robes of the Orders of Knighthood.—The robes of the Garter mere originally of blue woollen stuff, the surcoat and hood being powdered with garters embroidered in silk and gold. The surcoat varied in colour from year to year; the hood was made of the same material as the surcoat and, when hats began to be worn. was carried hanging over the shoulder. Robes were sometimes granted to ladies in the early days. The last lady to receive the robes was Margaret, countess of Richmond, in 1488. At the present day the mantle is of dark blue velvet, of the same colour as the riband, lined with taffeta, and with the star embroidered on the left shoulder, the hood and surcoat of crimson velvet lined with white taffeta, and with these are worn a doublet and trunk-hose of white satin and a plumed hat.

The robes worn by the knights of the Bath created at the coronation of Henry IV were green with furred hoods and a white silk cord hanging from the left shoulder. The mantle in the present day is of crimson velvet lined with white over a white satin undercoat and trunk-hose, and a plumed hat and white boots with red tops are worn. The mantle of the Thistle is of dark green velvet over surcoat, etc., of cloth of silver; that of St. Patrick azure, with doublet and trunk-hose of white satin; that of St. Michael and St. George of Saxon blue satin lined with scarlet; and that of the Star of India of light blue satin lined with white.

Judicial and Forensic Robes.—It is frequently stated that judicial robes had their origin in the dress of ecclesiastics But though ecclesiastics in early days frequently acted as judges and though, as Sir John Fortescue says. the serjeant's long robe was "after the fashion of a priest," judicial robes more probably arose from the ordinary civilian dress of the early 14th century. The chief argument for the ecclesiastical origin has been found in the coif, a cap of white linen or silk, tied under the chin, and described by Fortescue as "the principal or chief insignment and habit wherewith serjeants-at-law at their creation are decked," which is said to have been used by ecclesiastics to hide the tonsure when in court. More probably the coif was a head-dress in common use in the 13th century, which survived as the distinguishing mark of men of law. The scarlet judicial robe trimmed with white fur (ermine or miniver) together with a hood of scarlet cloth lined with white fur undoubtedly represent the survival for specialized use of the robes of the pre-Reformation doctors in canon law (*decretorum* doctor). About 1340 the doctors in theology and in canon law adopted scarlet robes and hoods, lined nith miniver, and silk linings were adopted for summer use about a century later. An ecclesiastical origin is correct in as much as, prior to the Reformation, all the members of the two ancient universities were in holy orders, or at least were tonsured, belonging to one of the lower orders of the clericature.

About the time of Queen Elizabeth I the square cap (*pileus* quadratus). otherwise known as the cornered, black or sentence cap (the last from the fact of its being put on by the judge nhen pronouncing sentence of death), began to appear. Sometimes it nas norn over the coif only, sometimes over the coif and skullcap. Sometimes it had ear flaps, sometimes, as in its present form, it had not.

Toward the end of the 17th century the judges took to wearing wigs and they have continued to wear them ever since. The nearing of wigs naturally concealed the coif and velvet skullcap. so a device had to be invented by which they could still be displayed. The expedient aas hit upon of putting a round patch of nhite stuff, aith a black spot in the middle of it, on the crown of the wig of certain of the judges, to represent the coif and skullcap. Serjeants being appointed no longer, this round patch has now disappeared, the only trace of it left being the circular depression on the crown of the aig Minute details of court and levee dress, judicial and legal, of the present day, will be found in *Dress Worn* at Court (pp. 60–61), issued with the authority of the lord chamberlain—also details of mourning costume.

Municipal and Civic Robes.—The word "livery," the use of which is now practically confined to the official dress of the "livery companies." the dress of menservants, etc., originally meant an allowance of food or clothing granted to certain persons. It is still used of the allowances of food made to the fellows of certain colleges. As early as the 13th century, the citizens of London used to assume a uniform dress to do honour to some great occasion, as when 600 citizens rode out to meet Queen Margaret of France, second wife of Edward I, "in one livery of red and white, with the cognizances of their misteries embroidered upon their sleeves." By the 14th century there is evidence of the adoption of liveries by the trades and fraternities, and when the livery companies were incorporated they took care to have their liveries authorized by their charters. As to the dress of the mayor, alderman, sheriffs, etc., the scarlet, violet and black robes, still worn by them, were early in use. The provincial mayors and aldermen at quite an early date followed the fashion of London, wearing what are virtually sleeved tabards. An account of the robes of modern provincial mayors will be found in William H. St. John Hope (ed.), Covporation Plate . . . of the cities . . . of England and *Wales* (1895).

At the present day the lord mayor has several sets of robes: a special coronation robe, a crimson velvet robe of state like that of an earl, worn with the chain and jewel, *e.g.*, in the presence of the sovereign when in the city; a black robe of state trimmed with gold, which is worn with the chain and jewel, e g., at the Guildhall on lord mayor's day; the scarlet robes, which are worn, with or without the chain. on most public occasions, such as the service at St. Paul's on the first day of the Easter law term, audiences of the sovereign, the election of the lord mayor. the opening of the central criminal court, etc.; a violet gown, which is worn, *e.g.*, when the lord mayor elect is presented to the king, when he is sworn in, at the election of sheriffs. etc., and a black gown worn in church on Good Friday, etc. The aldermen wear scarlet on most occasions of ceremony, former mayors "having the Cap of Dignity attached to their gown. and being entitled to introduce a snord and mace into their badges." Violet robes are also worn on certain occasions marked in the almanac of the *Alderman's Pocket*-Book, and black gowns when the lord mayor wears his. The sheriffs and recorders have scarlet, violet and black gowns, and the members of the common council have deep mazarine blue gowns, which seem to have been first prescribed in 1761. (X.)

Academical Dress.—Like judicial robes, academical dress has been considered to be of ecclesiastical origin. The medieval scholar was, of course, a clerk and had to wear the clerkly gown and the tonsure. The ecclesiastical dress that he wore had itself probably developed out of the ordinary civilian dress at an earlier period. The robes worn in the earliest times at Oxford and Cambridge, at least in part, were monastic or ecclesiastical in origin, but the hood was certainly derived from a lay garment, at one time commcn to all classes and both sexes, as Herbert Norris pointed out (see *Bibliography*). This lay hood was adopted by monks, clergy and all university students, and eventually mas retained in a specialized form by the various faculties, as an academical distinction. The statutes of certain colleges required of the scholars as early as the 14th century the tonsure and a "decent habit" suitable to a clerk; *i.e.*, a long gown, which it is stipulated in some cases must be closed in front like the Benedictine habit. Some colleges had liveries. prescribed perhaps by the founder of the college and laid down by the statutes. The differences of colour and shape in the undergraduate gowns of most of the Cambridge colleges are supposed to be a survival of this, but in fact the Cambridge college undergraduate gonns all date from the period 1805–40; *i.e.*, are late Guelphic (that is, Hanoverian) in origin and thus quite modern.

The gown was norn by all grades as befitting clerks. It is hard to determine whether there was at first any difference between the gowns of the senior nongraduates and the bachelors of arts and that of the masters and doctors and the bachelors in the superior faculties, but it seems improbable. It was frequently fur-lined, or at least trimmed with fur, but the use of the more costly furs was

forbidden, especially in the period between 1350–1500, to all below the degree of master, except sons of noblemen, or those possessing a certain income, bachelors using budge (common fur or black lamb's wool); students and even doctors in theology were also, at one time, restricted to budge, lamb's wool and to sombre habits. The robes of masters had to be flowing and reach to the ankles (toga talaris), and it was the masters who had the earliest distinctive dress that could be called truly academical.

The cope (*i.e.*, the *capa* or *cappa* clausa, the closed and essentially ecclesiastical cope or cape, not to be confused with the open and purely decorative cope of the clergy) probably originated in the ordinary everyday mantle of the clergy. Its wear in England was made obligatory by Cardinal Archbishop Stephen Langton, 1222, at the provincial synod held at Oseney abbey, near Oxford. All bishops, deans, archdeacons, rural deans, priests and all church dignitaries were ordered to wear it. This kind of cope, closed in front, was originally black; it sometimes, for the sake of convenience, had a slit in front to allow of the passage of the hands, this type of opening being the form or variation adopted by the doctors in theology and retained by them until the present day, although later on the slit was extended to the ground. Another variation was to make two side slits, one for each arm, a variation (the pallium or *chimaera*) adopted by the doctors in law and in physic and by the superior bachelors; *i.e.*, the bachelors in canon law, physic and possible in theology. This type is the forerunner of the convocation habit and ecclesiastico-academical chimere.

About 1330–40 doctors began to adopt scarlet for their hoods and later for their robes; at any rate by about 1500, probably long before, all doctors wore scarlet and had discarded their black *cappae* clausae for scarlet ones, the original sombre, black form being retained by the M.A.s and B.D.s. The wearing of robes of scarlet, violet or murrey, and also the "sleveless cote" (*i.e.*, convocation habits and chimeres), *supertunica*, of these colours, mas formally ratified by an act of 24 Henry VIII (1533, *caput* 13) entitled "an Act for the Reformation of Excess in Apparel." The cope still survives at Cambridge as the dress worn by the vice-chancellor and by regius professors of divinity, law and medicine when presenting for degrees; it is lined with white fur.

The hood was originally worn by all scholars, as by everybody, and had evidently no academical significance. Sometimes a cap was worn also, the hood being thrown back. There were evidently hoods of two kinds for masters from about 1432, when masters and doctors were allowed to use silk in their linings during the summer months, so that there were silk-lined and miniver-lined hoods. These two types of hood survived, at least in Oxford, until as late as 1657, or even a little later, in the time of Dr. John Fell, dean of Christ Church and vice-chancellor, and Anthony à Wood, M.A., the antiquary. Eventually (from about 1674–75, in the time of George Edwards and David Loggan) the silk-lined hood was the type principally retained by masters and doctors, the miniver-lined hood being preserved as a proctorial insignia only. At a later date, at Cambridge, a distinction was made between the hoods of nonregent masters, which were lined with silk, and those of regents which were lined with miniver. Later again, the regents wore their hoods in such a way as to show the white lining, while the nonregents wore theirs "squared," so that the white did not show. Hence the name "white hoods" and "black hoods" given to the upper and lower houses of the old senate respectively. It is not settled when the modern colouring of hoods arose; they probably followed those of the robes of the faculties, but about these there is equal uncertainty. The Oxford proctor still wears a miniver hood. The modern Oxford doctors' and B.D., and the Cambridge hoods have preserved the original shape more closely than the Oxford M.A. type, being a hood and cape combined, the cape having at Cambridge now, incorrectly, square corners: the cape, being semi-circular, should be rounded.

There seem to have been in Tudor times at least three varieties of academical headdress; one, the round cap of velvet for graduates in the secular faculties, survives as part of the full dress of doctors (except doctors in theology) to the present day. The square cap was adopted at the universities, according to N. F. Robinson, after 1520, in imitation of the University of Paris. In this connection should be mentioned the term "tufthunting" (*i.e.*, attempting to thrust oneself into the society of one's social superiors), derived from the gold tufts or tassel worn by noblemen and fellow commoners on their college caps. Originally, in the two ancient English universities, no one wore a cap except doctors in the superior faculties of theology, canon law and physic. The type of cap they wore was a tight round skullcap type, with a little point at the crown: it was called the "pileus," and was thus a cap of dignity. All other graduates and nongraduates had their hoods, which were thus a shoulder cape and a covering for the head. It appears that in Paris caps were made by sewing four pieces of cloth together, and the seams produced little raised ridges, and had a squaring effect. From this particular cap (squarish in effect), two types of cap evolved: (1) the biretta or priest's cap, simply a stiffened, rather taller *pileus*, made of the four pieces of cloth, and (2) the academical or doctor's cap (*pileus* quadratus), a velvet cap of dignity for doctors in theology. Doctors in the secular faculties adopted in the early Tudor period a soft round lay cap of velvet (*pileus* rotundus). Foundation choristers and scholars were permitted square caps in 1549. Between 1549 and 1580 there were frequent rulings and fresh statutes issued on the subject of caps. B.A.s and other junior graduates were not authorized to wear caps until between 1575 and 1580, and then only "humbly and submissively in the Schools." By 1580 a cap had been established for all members of the two ancient English universities, and the restriction to doctors and senior graduates had broken down. The beautiful series of illustrations of the academical dress in the Bodleian library at Oxford, by George Edwards and by David Loggan, 1674 and 1675, respectively, show the caps then in use.

Academical dress underwent much inquiry and some revision at the time of the Reformation, chiefly in the direction of sobriety, uniformity and laicization, "excess of apparel" being repressed as severely as ever, but not with much more effect. There have been few far-reaching changes since the Laudian code of 1636. Cambridge in the 20th century inquired into and revised its regulations as to dress. and in the Ordinances clear rules are laid down; the Oxford regulations have not been revised since 1770, and have now fallen into chaos. Some of them are dead letters: at Oxford one hood (the pale blue B.Litt. hood of 1895) by 1946 had come to be worn for four degrees, B.C.L., B.M., B.Sc. and B.Litt. The dark blue hood, lined with white fur, proper to the B.C.L. and B.M. degrees, was no longer to be seen at Oxford. The modern robe makers sell the pale blue silk B.Litt. hood, lined with white fur; for all four degrees and for the B.Phil. In 1957–58 a new hood was invented for the B.Phil. degree. This is of the debased Oxford M.A. pattern, of dark blue ribbed rayon lined with white silk: the white silk takes the place of the white fur. It is, in fact, a freak hood. The B. Mus. hood, originally dark blue as B.C.L. and B.M., was, before World War I, of dark purple: by 1945 or so it had become a brilliant lilac.

In the absence of any official regulations, the Oxford branch of the National Federation of Merchant Tailors drew up in 1957 an illustrated catalogue of what they described as the correct colours and materials of the various robes. ,This catalogue is said to have been approved by Congregation and it was deposited in the Bodleian. But some of the colours are still incorrect. Congregation never appointed a subcommittee to thresh out the whole subject, as did Cambridge in 1932–34, and thus, at Oxford, the tailors have prescribed for the university.

Doctors of both universities have three sets of robes: first, the full-dress robe of scarlet cloth; second, the scarlet, murrey or violet convocation habit and hood of scarlet (now at Cambridge a cope, at Oxford the so-called *cappa clausa*); third, the black gown or undress. The first is worn by all doctors except the doctor in music, and is accompanied by the round cap of velvet except in the case of the D.D., who continues to wear the square cap (or ecclesiastical cap) with all three forms of dress; strictly, the D.D. square cap should be soft, of black velvet and with a tuft or plain without tuft or tassel. The Oxford D.D. also wears a cassock, sash and scarf. The scarlet robe is of a different, some-

what more of a Tudor lay (or civic) shape than the M.A. and B.A. gowns. As now worn, it is faced with silk of the same colour as the hood silk lining of the faculty, except in the case of the Oxford D.D. full-dress robe, which is faced with and has bell-shaped sleeves of black velvet. The second or Cambridge cope has now gone almost out of use, but is still worn when presenting for degrees, etc., but only actually in Cambridge. It is sometimes worn over the black gown. There are several types of black gown, but the tufted gown of David Loggan's day has now gone out of use. The M.D. and Mus.D. black gowns at Cambridge are non made after the pattern of the LL.D. gown, with a square-ended sleeve and flap collar, trimmed with black lace, but the D.D.. Sc.D. and Litt.D. wear the M.A. silk gown, the former with the scarf. the two latter with lace on the sleeve, placed horizontally for Sc D. and vertically for Litt.D. Some doctors in divinity wear the full-sleeved gown with scarf. At Cambridge the headdress of a D D is the square cap, of secular doctors the velvet bonnet with gold cords. The doctors in music wear, as they have done since about 1600, a full-dress robe of white or cream damask brocaded silk. lined with pink satin at Oxford and with cherry-coloured satin at Cambridge. Formerly (1550 period) doctors in music at Cambridge wore the M.D. robes *(Cambridge Grace Book* Δ 1545).

The Oxford sleeveless commoner's gown, though still by statute *toga talaris,* now reaches little below the waist, the full-sleeved or bell-sleeved scholar's gown to the knee. The tufted silk gown of the gentleman commoner and the nobleman's gold-lace gown are not yet abolished by statute, but have fallen into disuse. The University of Oxford act, 1854, brought in and passed by Gladstone, abolished these class distinctions at Oxford, although they lingered on until about 1869 at Christ Church, so that King Edward VII as prince of Wales. wore a gentleman commoner's bell-shaped sleeved gown when up in 1860–62. Vice-chancellors have no official dress, but wear the robes of their degree. The chancellors of the older universities wear a black damask silk robe with gold lace and a black velvet square cap with gold tassel and band: those of the newer universities have had robes "created" by experts or by the robe makers, who are nowadays to a large extent the arbiters of academical dress. but based on Oxford and Cambridge customs largely. The Hull chancellor's and vice-chancellor's robes are of blue: these robes at Southampton are of black figured damask silk with gold ornamentation.

United States.—An intercollegiate commission in 1893 drafted a uniform code for academical caps, gowns and hoods which has since been accepted by 700 to 800 degree-granting colleges and universities in the United States. Three types of gown and three types of hood have been devised for bachelors, masters and doctors, respectively. The square caps remain the same except that the doctor's may be made of velvet and have a tassel of gold. The bachelor's gown is made of black worsted material and may be distinguished by its pointed sleeves of the B.A. Oxford type, though hanging only to the knee. The master's gown, made of silk, has closed sleeves of M.A. type (the arm coming through a slit at the elbow), which are square at the end and extend well below the knee.

The doctor's gown is also made of silk, and, like a judge's robe, has full round open bell-shaped sleeves, is faced with velvet and has three bars of velvet on each sleeve. The hoods are lined with silk with the colour or colours of the college or university granting the degree and trimmed with velvet of the colour that represents the department of learning in which the degree was obtained. The velvet trimming of the doctor's gown may also be of the departmental colour or it may be black if preferred. Colours of the more common departments of learning are as follows: arts and letters, white; theology and divinity, scarlet; laws, purple; philosophy, blue; science, golden yellow; medicine, green; dentistry, lilac; music, pink; engineering, orange.

A few institutions, notably Harvard. retain an individual code for their hoods. The U.S. system of hoods is. therefore, progressive and enables anyone conversant with the system to pick out the university (by the colour or colours in the lining). the faculty (by the edging on the cowl or hood portion proper) and the grade (by the size and shape, bachelors and masters having silk hoods of Oxford M.A. shape, masters' being made considerably longer than bachelors', doctors' being of cloth (rayon or silk) of the Cambridge M.A. type but with rounded corners to the cape portion). Obviously, only a very few universities, such as Harvard, Yale and Princeton, can have a single distinguishing colour as a hood lining; other universities and colleges have to have two colours, the second or subsidiary colour being sewn inside as a chevron. This system. although distinctive and advantageous in some respects, produces a somewhat patchy result in effect. But obviously it would be impossible to distinguish the degree hoods of 700 to 800 degree-granting colleges or universities without some such device.

The U.S. intercollegiate code has also devised a similar set of hoods for holders of continental and other foreign degrees.

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ROBESON, PAUL (1898–), U.S. Negro actor and singer, was born at Princeton, N.J., April 9, 1898. He graduated from Rutgers college, New Brunswick, N.J., with an extraordinarily distinguished scholastic and athletic record, and in 1923 completed the law course at Columbia university. His first stage appearance was in *Taboo* (1922), but he made his reputation in *All God's Chillun's Got Wings* and in the title roles in *Emperor Jones* (1923) and *Black Boy* (1926). After appearing in *Show Boat* in England. he toured the U.S., Europe and the U.S.S.R. with recitals of Negro spirituals. Robeson entered films in 1933, playing in *The Emperor Jones, Sanders of the River* and *Showboat.* In 1943 he appeared in a New York production af *Othello,* which established the longest Shakespearean run in America.

In 1950 the U.S. state department voided his passport, charging that he had supported various Communist causes and "peace" movements. (M. S. BY.)

ROBESPIERRE, MAXIMILIEN FRANCOIS MARIE ISIDORE DE (1758–1794), French revolutionist, the son of an advocate, was born at Arras on May 6, 1758. His family, according to tradition, was of Irish descent. Maximilien was one of four orphan children who were left in the care of relatives when their father left Arras. His direct ancestors in the male line had been notaries at the village of Carvin, near Arras, from the beginning of the 17th century. His grandfather, being more ambitious, established himself at Arras as an advocate, and his father followed the same profession, marrying Jacqueline Marguerite Carraut, daughter of a brewer in the same city, in 1757. Of this marriage four children were born. two sons and two daughters, of whom Maximilien was the eldest; but in 1767 Madame Derobespierre, as the name was then spelled, died, and the disconsolate widower at once left Arras and wandered about Europe until his death at Munich in 1769. Maximilien was sent to the college of Arras and the college of Louis-le-Grand at Paris. Here he had for fellow pupils Camille Desmoulins and Stanislas Fréron. Admitted an advocate in 1781, Robespierre returned to his native city to seek for practice. His reputation had already preceded him, and the bishop of Arras, De Conzié, appointed him criminal judge in the diocese of Arras in March 1782. This appointment, which he soon resigned to avoid pronouncing a sentence of death, did not prevent his practising at the bar, and he speedily became a successful advocate. He now turned to literature and society and came to be esteemed as one of the best writers and most popular dandies of Arras. He was a member of an Arras literary and musical society known as the "Rosati," of which L. N. M. Carnot was a member. The sympathetic quality of his voice won for his

verses recited before this society applause not justified by their merits. In 1788 he took part in the discussion as to the way in which the states-general should be elected, showing clearly and forcibly in his *Adresse à la nation artésienne* that, if the former mode of election by the members of the provincial estates were again adopted, the new states-general would not represent the people of France. By the *Avis aux habitants de campagne* (Arras, 1789), which is almost certainly by him, he secured the support of the country electors, and, though but 30 years of age, poor and without influence, he was elected fifth deputy of the *tiers état* of Artois to the states-general. This election opened the way to his public career.

The Constituent Assembly.—When the states-general met at Versailles on May 5, 1789, the young deputy of Arfois already possessed the one faculty which was to lead him to supremacy: he was a fanatic. Robespierre believed in the doctrines of Rousseau with all his heart, and would have gone to death for them; and in the belief that they would eventually succeed and regenerate France and mankind, he was ready to work with unwearied patience. While the constituent assembly occupied itself in drawing up a constitution, Robespierre turned from the assembly of provincial lawyers and wealthy *bourgeois* to the people of Paris. However, he spoke frequently in the constituent assembly, and often with great success. and was eventuallv recognized as second only to Jerôme Pétion de Villeneuve—if second to him—as a leader of the small body of the extreme left—the 30 voices, as Mirabeau contemptuously called them. When he instinctively felt that his doctrines would have no success in the assembly, he turned to the Society of the Friends of the Constitution, known later as the Jacobin club. The death of Mirabeau strengthened Robespierre's influence in the assembly, but on May 15, 1791, he showed his jealous suspicion of his colleagues by proposing and carrying the motion that no deputies who sat in the constituent could sit in the succeeding assembly. The flight of the king on June 20 and his arrest at Varennes made Robespierre declare himself at the Jacobin club to be *ni monarchiste ni républicain.* After the "massacre" of the Champ de Mars (on July 17, 1791) he established himself, in order to be nearer to the assembly and the Jacobins, in the house of Duplay, a cabinetmaker in the Rue St. Honoré and an ardent admirer of his, where he lived (with but two short intervals) till his death. At last came his day of triumph, when on Sept. 30, on the dissolution of the constituent assembly, the people of Paris crowned Pétion and himself as the two incorruptible patriots.

On the dissolution of the assembly he returned for a short visit to Arras, where he met with a triumphant reception. In November he returned to Paris and on Dec. 18 made a speech which marks a new epoch in his life. Jacques Pierre Brissot, the *âme politique* of the Girondin party which had been formed in the legislative assembly, urged vehemently that war should be declared against Austria, and the queen was equally urgent, in the hope that a victorious army might restore the old absolutism of the Bourbons. Two men opposed the projects of the queen and the Girondins—Jean Paul Marat and Robespierre. Robespierre feared a development of militarism, which might be turned to the advantage of the reaction. From that moment began the struggle which ended in the coups d'état of May 31 and June 2, 1793. Robespierre persisted in his opposition to the war; the Girondins, especially Brissot, attacked him violently, and in April 1792 he resigned the post of public prosecutor at the tribunal of Paris, which he had held since February, and started a journal, *Le Dkfenseur de la Constitution,* in his own defense. It is noteworthy that during the summer months of 1792 in which the fate of the Bourbon dynasty was being sealed, neither the Girondins in the legislative, assembly nor Robespierre took any active part in overthrowing it. But Robespierre, though shocked at the shedding of blood, was willing to take his seat on the commune of Paris, which had overthrown Louis XVI, and might check the Girondins. The strong men of the commune were glad to have Robespierre's assistance, not because they cared for him or believed in him but because of the help got from his popularity, his reputation for virtue which had won for him the surname of "the Incorruptible," and his influence over the Jacobin club and its branches, which spread all over France. He therefore presented the petition of the commune of Paris on Aug. 16 to the legislative assembly, demanding the establishment of a revolutionary tribunal and the summoning of a convention. The massacres of September in the prisons, which Robespierre in vain attempted to stop, showed that the commune had more confidence in J. N. Billaud-Varenne than in him. Yet, as a proof of his personal popularity, he was a few days later elected first deputy for Paris to the national convention.

The Convention.—On the meeting of the convention the Girondins immediately attacked Robespierre; they were jealous of his influence in Paris, and knew that his single-hearted fanaticism would never forgive their intrigues with the king at the end of July. All personal disputes, however, gave way in December 1792 before the question of the king's trial, and here Robespierre took up a position which is at least easily understood. These are his words spoken on Dec. 3:

> This is no trial; Louis is not a prisoner at the bar; you are not judges; you are—you cannot but be—statesmen, and the representatives of the nation. You have not to pass sentence for or against a single man, but you have to take a resolution on a question of the public safety, and to decide a question of national foresight. It is with regret that I pronounce the fatal truth: Louis ought to perish rather than a hundred thousand virtuous citizens; Louis must die, that the country may live.

This great question settled by the king's execution, the impracticable plans of the Girondins drove G. J. Danton, Carnot, Robert Lindet and even Billaud-Varenne to the side of Robespierre, whom, it is apparent, they thoroughly understood. In the month of May 1793 Camille Desmoulins, acting under the inspiration of Robespierre and Danton, published his *Histoire des Brissotins* and *Brissot démasqué;* Maximin Isnard declared that Paris must be destroyed if it pronounced itself against the provincial deputies; Robespierre preached insurrection at the Jacobin club; and on May 31 and June 2 the commune of Paris destroyed the Girondin party.

Committee of Public Safety.—On July 27, 1793, when the struggle was practically decided, the convention elected Robespierre to the new Committee of Public Safety. Robespierre was always in a minority in the committee of 12, at least 7 of whom, Carnot, Billaud-Varenne, J. M. Collot d'Herbois, Comte Prieur-Duvernois, Prieur de la Marne, A. J. Saint André and Lindet, were men of action and not under his personal influence. Robespierre was not the inventor of the Terror or its machinery, the revolutionary tribunal and the representatives of the committee on mission in the provinces. He served it by his gift of eloquence. He had a fanatical following among the Jacobins and was one of the most popular orators in the convention, on which his carefully prepared addresses made a deep impression. His panegyrics on the system of revolutionary government and his praise of virtue led his hearers to believe that the system of the Terror, instead of being monstrous, was absolutely laudable; his pure life and admitted incorruptibility threw a lustre on the committee of which he was a member; and his colleagues were glad to avail themselves of these advantages so long as he did not interfere with their work. Moreover, he alone never left Paris, while all the others, except Bertrand Barère de Vieuzac, were constantly engaged on missions to the armies, the navy and the provinces. It has been asserted that Robespierre, Georges Couthon and Saint-Just took upon themselves the direction of "la haute politique," while the other members acted only in subordinate capacities; undoubtedly it would have suited Robespierre to have had this believed, but as a matter of fact he was in no way especially trusted in matters of supreme importance.

It is clear, therefore, that Robespierre was not the sole author of the overthrow of the Dantonists and the Hébertists, though he thoroughly agreed with the majority and had no desire to save them, the Hébertist principle of decentralization and the Dantonist moderatism being equally obnoxious to him.

Fall of **Danton.**—Both parties must be crushed. Before the blows at the leaders of those two parties were struck, Robespierre retired for a month (Feb. 13–March 13, 1794) from active business in the convention and the committee, apparently to con-

sider his position; but he came to the conclusion that the cessation of the Reign of Terror would mean the loss of that supremacy by which he hoped to establish the ideal of Rousseau; for Danton, he knew, was essentially a practical statesman and laughed at his ideas and especially his politico-religious projects. He must have considered, too, that the result of his siding with Danton would probably have been fatal to himself. The result of his deliberations was that he abandoned Danton and co-operated in the attacks of the committee on the two parties. On March 15 he reappeared in the convention; on March 19 J. R. Hébert and his friends were arrested. and on March 24 they were guillotined. On March 30 Danton, Camille Desmoulins and their friends were arrested, and on April 5 they, too, were guillotined.

It was not until after the execution of Danton that Robespierre began to develop a policy distinct from that of his colleagues in the committee, an opposition which ended in his downfall. He began by using his influence over the Jacobin club to dominate the commune of Paris through his devoted adherents, two of whom, J. B. E. Fleuriot-Lescot and C. F. de Payan, were elected respectively mayor and *procureur* of the commune. He also attempted to usurp the influence of the other members of the committee over the armies by getting his young adherent, Saint-Just, sent on a mission to the frontier. In Paris Robespierre determined to increase the pressure of the Terror: no one should accuse him of moderatism; through the increased efficiency of the revolutionary tribunal Paris should tremble before him as the chief member of the committee, and the convention should pass whatever measures he might dictate. To secure his aims, Couthon, his other ally in the committee, proposed and carried on June 10 the outrageous law of 22nd Prairial, by which even the appearance of justice was taken from the tribunal, which, as no witnesses were allowed, became a simple court of condemnation. The result of this law was that between June 12 and July 28, the day of Robespierre's death, no fewer than 1,285 victims perished by the guillotine in Paris. It was the bloodiest and the least justifiable period of the Terror. But before this there had taken place in Robespierre's life an episode of supreme importance, as illustrating his character and his political aims; on May 7 he secured a decree from the convention recognizing the existence of the Supreme Being. This worship of the Supreme Being was based upon the ideas of Rousseau in the *Social Contract,* and was opposed by Robespierre to Catholicism on the one hand and the Hébertist atheism on the other. In honour of the Supreme Being a great fete was held on June 8; Robespierre, as president of the convention, walked first and delivered his harangue, and as he looked around him he may well have believed that his position was secured and that he was at last within reach of a supreme power which should enable him to impose his belief on all France, and so ensure its happiness. The devotion of Robespierre's adherents was further excited by the news that a half-witted girl, named Cécile Renault. had been found wandering near his house with a knife in her possession, intending to play the part of Charlotte Corday. She was executed on June 17, on the very day that M. G. A. Vadier raised a laugh at Robespierre's expense in the convention by his report on the conspiracy of Catherine Théot, a madwoman, who had asserted that Robespierre was a divinity.

The 9th Thermidor.—Robespierre felt that he must strike his blow now or never. Yet he was not sufficiently audacious to strike at once, as Payan and Jean Baptiste Coffinhal, the ablest of his adherents, would have had him do, but retired from the convention for several weeks. as he had done before the overthrow of the Hébertists and the Dantonists, to prepare his plan of action. These weeks, the last of his life, Robespierre passed very peacefully. He continued to live with the Duplays, with whose daughter Éléonore he had fallen in love, and used to wander with her in the Champs Élysées during the long summer evenings. At last, on July 26, Robespierre appeared, for the first time for more than four weeks, in the convention and delivered a carefully studied harangue, which lasted for more than four hours, in which he declared that the Terror ought to be ended, that certain deputies who had acted unjustly and exceeded their powers ought to be punished and that the Committees of Public Safety and General Security ought to be renewed. The majority of the Committee of Public Safety determined to act promptly. The convention, moved by Robespierre's eloquence, at first passed his motions; but he was replied to by Joseph Cambon the financier, Billaud-Varenne, J. B. A. Amar and Vadier, and the convention rescinded their decrees and referred Robespierre's question to their committees. On the following day, July 27, or in the revolutionary calendar the 9th Thermidor, Saint-Just began to speak on behalf of the motions of Robespierre, when violent interruptions showed the temper of the convention. Jean Lambert Tallien, Billaud-Varenne and Vadier again attacked Robespierre; cries of "Down with the tyrant!" were raised; and, when Robespierre hesitated in his speech in answer to these attacks, the words "C'est le sang de Danton qui t'étouffe" showed what was uppermost in the minds of the Mountain. Robespierre tried in vain to gain a hearing, the excitement increased and at five in the afternoon Robespierre, Couthon and Saint-Just, with two young deputies, Augustin Robespierre (younger brother of Maximilien) and Philippe François Joseph Lebas, the only men in all the convention who supported them, were ordered to be arrested. Robespierre was speedily rescued from his prison, with the other deputies, by the troops of the commune and brought to the *hôtel de ville.* There he was surrounded by his faithful adherents, led by Payan and Coffinbal. But the day was past when the commune could overawe the convention, for now the men of action were hostile to the commune and its chief was not a master of coups d'état. On the news of the release of Robespierre, the convention had again met and declared the members of the commune and the released deputies outlawed. The national guards under the command of vicomte de Barras made their way to the *hôtel de ville;* Robespierre was shot in the lower jaw by a young gendarme named Meda while signing an appeal to one of the sections of Paris to take up arms for him, though the wound was afterward believed to have been inflicted by himself; and all the released deputies were again arrested After a night of agony, Robespierre was the next day taken before the tribunal, where his identity as an outlaw was proved, and without further trial he was executed with Couthon and Saint-Just and 19 others of his adherents on the Place de la Révolution on the 10th Thermidor (July 28), 1794.

Character.—The character of Robespierre, when looked upon simply in the light of his actions and his authenticated speeches, and apart from the innumerable legends which have grown up about it, is comparatively simple. A well-educated and accomplished young lawyer, he might have acquired a good provincial practice and lived a happy provincial life had it not been for the Revolution. Like thousands of other young Frenchmen, he had read the works of Rousseau and taken them as gospel. Just at the very time in life when this illusion had not been destroyed by the realities of life, and without the experience which might have taught the futility of idle dreams and theories, he was elected to the states-general. At Paris he was not understood till he met with his audience of fellow disciples of Rousseau at the Jacobin club His fanaticism won him supporters; his singularly sweet and sympathetic voice gained him hearers; and his upright life attracted the admiration of all As matters approached nearer and nearer to the terrible crisis, he failed, except in the two instances of the question of war and of the king's trial, to show himself a statesman, for he had not the liberal views and practical instincts which made Mirabeau and Danton great men. His admission to the Committee of Public Safety gave him power, which he hoped to use for the establishment of his favourite theories, and for the same purpose he acquiesced in and even heightened the horrors of the Reign of Terror. It is here that the fatal mistake of allowing a theorist to have power appeared: Billaud-Varenne systematized the Terror because he believed it necessary for the safety of the country; Robespierre intensified it in order to carry out his own ideas and theories. Robespierre's private life was always respectable; he was always emphatically a gentleman and man of culture, and even a little bit of a dandy, scrupulously honest, truthful and charitable. In his habits and manner of life he was simple and laborious; not gifted with flashes of genius, he had to think much before he could come to a decision; he worked hard all his life.

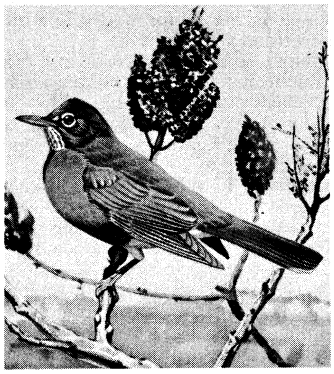
On the family of Robespierre *see* A. J. Paris in the *Mémoires,* 2nd series, vol. iii, of the Academy of Arras; the *Oeuvres de Maximilien Robespierre,* 3 vol. (1840), published by Laponneraye with preface by Armand Carrel, contain some of his speeches and the memoirs of Charlotte Robespierre on her brothers. An edition of the *Oeuvres,* 2 vol. (1913) was edited by A. Lesueur. The standard work on Robespierre's career is Ernest Hamel, *Histoire de Robespierre d'après des papiers de famille, les sources originales et des documents entièrement inédits,* 3 vol. (1865–67). After the appearance of the first volume, the publisher refused to proceed for fear of prosecution until compelled to do so by the author. Another edition with a different title appeared in 1878. *See* also C. d'Hericault, *La Re'volution de Thermidor,* 2nd ed. (1878); Karl Brunnemann, *Maximilien Robespierre* (1880); F. A. Aulard, *Les Orateurs de l'Assemblée Constituante* (1882); M. de Lescure, "Le Roman de Robespierre," in *La Société française pendant la Terreur* (1882); E. Hamel, *La Maison de Robespierre* (1895); Hilaire Belloc, *Robespierre* (1901); C. F. Warwick, *Robespierre and the French Revolution* (1909); A. Mathiez, *Études Robespierristes,* 2 vol. (1897, 1918), and *Autour de Robespierre* (1925). Many of the books which have been written about Robespierre are most untrustworthy, and the picture of him given by Thomas Carlyle

in his *French Revolution* is unjust.

ROBIN, a large North American thrush (*Turdus migratorius*), one of the most familiar songbirds in the eastern U.S. Its name was derived from its resemblance to another bird, the smaller European robin (*Erithacus rubecula*), called also redbreast or robin redbreast.

American Robin.—The American robin is about 10 in. long, with brick-red breast, blackish-gray upper parts and a yellow bill. It has bold white markings around the eye, under the chin and on the tips of the outer tail feathers. Females are slightly paler, and the young have spotted breasts as in other thrushes. Most robins are highly migratory, spending the winter in flocks in the southern U.S., but a few winter as far north as southern Canada. The robin is a shy woodland bird in northern forests, but elsewhere it has adjusted so completely to man that to see a robin pull an earthworm from the ground is a sight familiar to everyone.

The nest, of vegetation and trash, with a firm molded inner layer of mud, is built in trees, open sheds, bridges, etc. Three to five bluish-green eggs are incubated by the female for 12 days. Both parents tend the young, which fly in 14–16 days. There are two to three broods per season.



ALBERT E. GILBERT

AMERICAN ROBIN (TURDUS MIGRATORIUS)

Its song consists of caroling phrases, differing in pitch, with pauses between them—a cheerful, bubbling air. There are various call notes, harsh and scolding. Earthworms, insects, berries and some grains are taken for food. The arrival of the first robins, usually males, is looked forward to in the early spring.

European Robin.—The robin of the old world is about 5½ in. long, with brownish-orange breast and forehead, brownish-olive upper parts and a white abdomen. The young have a mottled dark brown-and-buff breast. It is a woodland bird primarily but is notably confiding toward man. Everywhere it is well known for its cocky, jaunty attitudes. It is migratory in northern Europe, but only partially so or sedentary farther south. The nest is in holes and crannies in walls, banks, trees and the like. The five to six whitish eggs are incubated 13–14 days by the female, who is fed by the male. The young fly in 12–14 days and then a second brood is reared. The bird sings almost all year, uttering high-pitched warbling phrases, and has various call notes. Food is mainly insects.

There is considerable folklore about the robin; the old-world lore that it is bad luck to kill one has been applied also to the American robin.

See David Lack, *The Life of the Robin,* rev. ed. (1947), *Robin Redbreast (1950).* (R. S. PR.)

ROBIN HOOD, English legendary hero. The oldest datable mention of Robin Hood known at present occurs in the second edition of *Piers Plowman,* the date of which is about 1377. In that poem the figure of Sloth is represented as saying:

> "I can nou3te perfitly my pater-noster, as
> the prest it syngeth:
> But I can rymes of Robyn Hood and Randolf
> Erle of Chestre."

He is next mentioned by Andrew of Wyntoun in his *Original Chronicle of Scotland,* written about 1420. Of his popularity in the latter half of the 15th and in the 16th centuries there are many signs. In the Elizabethan era and afterward mentions abound. Of the ballads themselves, *Robin Hood and the Monk* is possibly as old as the reign of Edward II *(see* Thomas Wright's *Essays on England in the Middle Ages,* ii, 174); *Robin Hood and the Potter* and *Robyn and Gandelyn* are certainly not later than the 15th century. Most important of all is *A Lytell Geste of Robyn Hode,* which was first printed about 1510 *(see* A. W. Pollard's *Fifteenth Century Prose and Verse* [1903]). This is evidently founded on older ballads; we read in *The Seconde Fytte,* II, 176 and 177:

> "He wente hym forthe full mery syngynge,
> As men have told in tale."

In fact, it does for the Robin Hood cycle what a few years before Sir Thomas Malory had done for the Arthurian romances.

These are the facts about him and his balladry. Of conjectures there is no end. He has been represented as the last of the Saxons—as a Saxon holding out against the Norman conquerors as late as the end of the 12th century *(see* Augustin Thierry's *Norman Conquest,* and compare Sir Walter Scott's *Ivanhoe).* J. M. Gutch maintains that he was a follower of Simon de Montfort. The Robin Hood story has probably some historical basis. Sloth in Langland's poem couples him with Randle, earl of Chester. whom we believe to have been the third Randle *(see* Bishop Thomas Percy's folio manuscript, ed. Hales and Furnivall, i, 260 [1867–68]); and, possibly enough. Hood was contemporary with that earl, who flourished in the reigns of Richard I, John and Henry III. His myth was, as is evident from what we have already said, full grown in the first half of the 14th century.

That the Robin Hood story attracted to it and appropriated other elements is illustrated by its subsequent history. Thus later on we find it connected with the Morris dance; but the Morris dance mas not known in England before the 16th century or late in the 15th. The Maid Marian (*q.v.*) element has been thought to have been introduced for the purpose of these performances, which were held on May day and were immensely popular *(see* Hugh Latimer's *Frutefull Sermons* [1571], p. 75; also *Paston Letters,* ed. J. Gairdner, iii, 89). After 1615, the date of the pageant prepared for the mayoralty of Sir John Jolles, draper, by Anthony hlunday and entitled *Metropolis Coronata,* the yeoman of the older version was metamorphosed into the earl of Huntingdon. for whom in the following century William Stukeley discovered a satisfactory pedigree. The earl of Huntingdon was probably a nickname for a hunter. The rise, development and decay of the myth deserve thorough study.

What perhaps is its greatest interest is its expression of the popular mind about the close of the middle ages. Robin Hood was at that time the people's ideal, as Arthur is that of the upper classes. He is the ideal yeoman, as Arthur is the ideal knight. He readjusts the distribution of property; he robs the rich and endows the poor. He is an earnest worshiper of the Virgin, but a vigorous hater of monks and abbots. He is the great sportsman, the incomparable archer, the lover of the greenwood and of a free life, brave, adventurous, jocular, openhanded. a protector of women. The story is localized in Barnsdale and Sherwood; *i.e.,* between Doncaster and Nottingham. In Yorkshire, Nottinghamshire and Lincolnshire a host of place names testify to the popularity of the Robin Hood legend—Robin Hood's Bay, Robin Hood's cave, Robin Hood's chase. Robin Hood's cup (a well), Robin Hood's chair and many more.

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ROBINSON, BOARDMAN (1876–1952), Canadian-U.S. political cartoonist and painter, was born in Somerset. Nova Scotia, on Sept. 6, 1876. As a student in Paris in 1898, he was influenced by the great tradition of French political cartooning begun by Honoré Daumier. In New York city his trenchant cartoons later appeared in many newspapers and periodicals, and he affected a whole school of political cartoonists. including artists such as H. Glintenkamp, Robert Minor, William Gropper, Daniel Fitzpatrick and Edmund Duffy. As a teacher at the Art Students league, New York city, 1919–30, and as founder and head of the Colorado Springs (Colo.) Fine Arts centre, 1936–47, he taught many outstanding artists. Robinson also made illustrations for *Spoon River Anthology, The Brothers Karamazov, Moby Dick* and *Leaves of Grass* and created the murals in the Department of Justice building in Washington, D.C. His remarkable gift was his calligraphic line; its searching quality inspired a new kind of political cartooning in the United States. He died in Stamford,

Conn., on Sept. 5, 1952.

See Albert Christ-Janer, *Boardman Robinson* **(1946).**

(A. W. C.-J.)

ROBINSON, EDWARD (1794–1863), U.S. biblical scholar, who is considered the father of biblical geography, was born in Southington, Conn., on April 10, 1794. In **1837** he became professor of biblical literature in Union Theological seminary, and left the U.S. for three years of study in Palestine and Germany, the fruit of which, his *Biblical Researches* (published simultaneously in England. Germany and the U.S. in 1841), brought him the gold medal of the Royal Geographical society in **1842.**

Later Biblical Researches appeared in 1856. His plans to sum up his important topographical studies in a work on biblical geography were cut short by cataract in **1861** and by his death in New York city on Jan. 27, **1863.** His *Biblical Researches,* supplemented by the *Physical Geography of the Holy Land* (1865), mere based on careful personal exploration and tempered by a thoroughly critical spirit, which was possibly at times too skeptical of local tradition.

Of scarcely less value in their day were Robinson's *Greek Harmony of the Gospels* **(1845)** and his *Greek and English Lexicon of the New Testament* (1836).

ROBINSON, EDWIN ARLINGTON (1869–1935), U.S. poet whose main emphasis was on the psychological, was born in Head Tide, Me.. Dec. 22. **1869.** He grew up in Gardiner. Me., the "Tilbury Town" of his poetry, where he attended the public schools. In **1891** he enrolled at Harvard as a special student. but withdrew after two years because of family financial difficulties. Most of his life after **1898** he lived in New York city, but he spent his summers writing at the MacDowell colony in New Hampshire. In **1896** he privately printed *The Torrent and The Night Before,* which was incorporated in *The Children of the Night* **(1897).** Robinson worked at various odd jobs, including that of subway time checker, until his poetry was brought to the attention of Pres. Theodore Roosevelt, who, in 1904, offered him a position in the New York customhouse. This he held until he resigned in 1909. *The Man Against the Sky* **(1916)** firmly established him in the first rank of U.S. poets of his day and he subsequently had few financial worries. He won three Pulitzer prizes for poetry *(Collected Poems,* **1921;** *The Man Who Died Twice,* 1924; and *Tristram,* 1927). His work after **1928** showed a decline in strength and became rather repetitious. He died in New York city on April **6,** 1935.

He used traditional verse forms, particularly the sonnet, with new vigour, and was a master of blank verse. Often bleak and sombre in tone. straightforward but condensed, his verse reveals the author's sharp psychological insight, restless quest for moral values and intellectual honesty, Robinson's principal volumes include three long poems on Arthurian themes: *Merlin* (1917), *Lancelot* (1920) and *Tristram* (1927); and psychological studies with a psychoanalytical bent, *Avon's Harvest* **(1921);** *Roman Bartholow* (1923); *Dionysus in Doubt* **(1925);** *Cavender's House* (1929); *Matthias at the Door* (1931); and *Amaranth* (1934). His letters, compiled by Ridgeley Torrence, were published in 1940.

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ROBINSON, HENRY CRABB (1775–1867), English journalist and diarist. who is remembered chiefly as the friend of Charles Lamb, Samuel Coleridge. William Wordsworth and Robert Southey, was born at Bury St. Edmunds on March **13,** 1775. He traveled much on the continent of Europe. and acted as special war correspondent for the *Times,* 1807–08. From **1813** to **1828** he practised at the bar. He was a great conversationalist, and his breakfast parties rivaled those of Samuel Rogers. He died at London on Feb. 5, **1867.**

His *Diary* of **35** vol., his *Journals* of **30** vol, and his *Letters and Reminiscences* in **36** vol. contain vivid pictures of contemporary celebrities. Thomas Sadler edited *The Diary, Reminiscences, and Correspondence of H. Crabb Robinson,* **3** vol. **(1869)** and E. J. Morley edited the *Correspondence of Henry Crabb Robinson with the Wordsworth Circle,* **2** vol. (1927).

ROBINSON, JOHN (1575–1625), English Nonconformist clergyman, settled in Amsterdam, Neth., in **1608,** but in the following year moved, with a large contingent, to Leyden, where he ministered to a community whose numbers gradually grew from 100 to 300. In **1620** a considerable minority of these sailed for England in the "Speedwell." and ultimately crossed the Atlantic in the "Mayflower"; Robinson intended to join his flock later, but he died on March 1, **162;.** His *Works* were reprinted by R. Ashton in 3 vol. in **1851.** *See* also **CONGREGATIONALISM.**

ROBINSON, JOSEPH TAYLOR (1872–1937), U.S. political official, was born near Lonoke, Ark., Aug. **26, 1872.** After graduating from the University of Arkansas and receiving his law degree at the University of Virginia, he returned to Lonoke in **1895** to practise. He became interested in politics at once. was elected a member of the state legislature, 189**5-97,** and served as delegate to the Democratic national convention in 1900. In 1902 he was elected U.S. representative, in which office he was continued until he was elected governor of Arkansas in **1912.** He was governor only a few weeks when he was elected by the state legislature to fill the position of U.S. senator left vacant by the death of Sen. Jefferson Davis. Robinson was re-elected senator in **1918** and in 1924. In 1923 he was chosen to succeed Sen. O. W. Underwood as chairman of the minority conference and Democratic floor leader. He possessed an unusual kno ledge of parliamentary procedure, was a ready debater and an influential legislator. He was the Democratic party's candidate for vice-president in **1928.**

ROBINSON, LENNOX (1886–1958), Irish dramatist, was born at Douglas, County Cork, on Oct. **4, 1886,** and educated at Bandon grammar school. His first play, *The Clancy Name,* was produced in 1908 at the Abbey theatre, Dublin, of which he was manager from 1910 to 1914. **In** 1915 he was appointed organizing librarian to the Carnegie trust, a post which he held until **1925.** From **1919** to 1923 he was again manager of the Abbey theatre, and in 1923 became director. Robinson's plays *The Lost Leader* **(1918)** and *The Whiteheaded Boy* **(1916)** were both produced in London and in the United States. In addition to numerous plays, he wrote a novel. *A Young Man From the South* (1917), *Ireland's Abbey Theatre* (1951) and the autobiographies. *Three Homes* (1938) and *Curtain Up* (1941). He died in Dublin on Oct. 14, 1958.

Other plays include *The Cross Roads* (1909); *Patriots* **(1912);** *The Dreamers* (1915); *The Round Table* (1924); *Birds' Nest* (1938): *Pictures in a Theatre* (1947); *The Lucky Finger* (1949).

ROBINSON, SIR ROBERT (1886-), British chemist, who was awarded the Nobel prize for chemistry for his research on the alkaloids in 1947, was born at Bufford, near Chesterfield, Derbyshire, on Sept. **13, 1886,** and educated at Fulneck school, Leeds, and the University of Manchester, where he obtained the degree of D.Sc. in **1910.** He was professor of pure and applied organic chemistry in the University of Sydney. New South Wales (1912–1**j),** and then occupied chairs of chemistry successively in the universities of Liverpool (1915–**21**), St. Andrews (1921–22), Manchester (1922–28) and at University college, London (1928–**30).** He was appointed to the Waynflete chair of chemistry in the University of Oxford in 1930 and retired in 1955. His extensive researches in organic chemistry dealt not only with the structure, including the syntheses, of many complicated organic bodies, but also with the electrochemical (electronic) mechanism of organic reactions. His studies of the structure of the plant pigments or anthocyanins led him to extend his investigations to another group of vegetable bodies, the alkaloids, the whole series of researches being remarkable for Robinson's brilliant syntheses. His discoveries of the detail of the structure of alkaloid molecules led to the successful production of certain antimalarial drugs. Many honours were conferred on him, including the Copley medal of the Royal society in 1942. He mas knighted in 1939 and received the Order of Merit in 1949. He was president of the Royal society, 1945–50 and of the British Association for the Advancement of Science. 19**j**5.

(D. McK.)

ROBOT. This term has long been in use in many languages.

Derived from the Czech word *robota* ("work"), it passed into popular use after 1923 to describe either mechanical devices so ingenious as to be almost human, or workers whom mechanical and repetitive work was making almost into machines. Its popular usage is based on the play R.U.R. (Rossum's Universal Robots), written by the Czechoslovakian writer. Karel Capek, in which society is described as depending on mechanical workers, called robots, which can do any kind of mental or physical work and which when worn out are scrapped and replaced by new. In the play the robots develop intelligence and a spirit of revolt, turn upon their employers and exterminate their creators.

The construction of a mechanical man has captivated the imagination of men since antiquity and early literature contains many schemes for the construction of some device that would require no human effort. It is not improbable that this idea has had a marked influence upon the development of mechanics and other branches of physics. In the Icelandic saga, Frithiof's ship needed no helmsman; she understood what was said to her and obeyed. Modern "robots" automatically hold ships true to the compass course (see GYROCOMPASS; NAVIGATION). In a medieval romance a great brazen head in the castle of a giant would tell those who inquired whatever they wished to know about the past, present or future. Modern robots also answer questions about the future, predicting, for example, ocean tides for every port in the world for years ahead with great precision. (See MATHEMATICAL INSTRUMENTS.) Mythical manlike monsters permeate the folklore of all peoples. Albertus Magnus in the middle ages, Roger Bacon, Descartes and other philosophers built androids or automatons in human form. which could open doors and play musical instruments. Anthropoid figures which apparently perform actions which call for independent thought are still to be seen and are often accepted with credulity by the public. On the other hand modern mechanical men have been constructed and placed at the disposal of industry, that have sensitive fingers and ears, talk with a predetermined conversation, that are able to test by "a sense of taste" chemicals, and with some equivalent of the sense of smell and balance. By the use of photo-electric cells, the partial equivalent of the sense of sight has been accomplished. (See the articles SELENIUM CELLS, PHOTOELECTRICITY, AUTOMATIC MACHINES.)

Perhaps the most valuable outcome of these endeavours will be the development of mechanisms capable of taking over those tasks that men and women find too monotonous or otherwise burdensome. One such device is the Televox, invented in 1927 by R. J. Wensley of the Westinghouse Electric and Manufacturing Co. This device permits the use of the network of the telephone system for the distant control of an electrical mechanism by means of certain sounds. The mechanism is arranged to answer the telephone and execute orders in a manner peculiarly similar to that of a human being. It was developed for the use of public utility companies to, supplement the use of supervisory control systems of electrical sub-stations, reservoir systems, gas regulators, etc.

The Televox can transmit electric meter readings, heights of water, gas pressures, position of valves and switches, and can execute actual mechanical operations at the direction of a distant operator. In using the Televox a call is put through exactly as though there were a human operator on the other end of the phone. The person making the call uses certain tones of the desired pitch to transmit the message. It is essential that a consistency of pitch be maintained. These tones are ordinarily delivered by electrically driven tuning forks. The telephone transmitter converts the tones into electrical vibrations, which at the distant station are caused to actuate steel reeds, which in turn actuate the selecting and operating relays. The responses are obtained from an instrument placed near the transmitter which sounds certain combinations of long and short notes, to form a code understandable by the operator at the other phone. The machine "hangs up" the receiver when the order has been executed, thereby ending the "conversation."

There are a number of processing machines which control all processes in a given industry, including temperature and humidity control during the process, starting, stopping, and varying the different materials which enter into the process in accordance with a time schedule, and independent of an outlet. If anything goes wrong, the machine stops and shows a red light until the operator has made the necessary changes. At the conclusion of the operation the machine shows a green light until the operator has removed the material in process.

The Tagliabue Automatic Flue-Gas Analyzing Machine which makes an analysis for CO_2 and for CO every minute, and records the results. is such a robot.

The Product Integraph is a robot ahich solves almost any second-order differential equation. It performs, by a combination of electrical and mechanical means. certain computations which are actually beyond the power of the human brain, so far demonstrated

Other processes, which if performed by mathematics would require from a week to a year to solve, are solved by the integraph in a fen minutes or hours.

ROB ROY (1671–1734), the designation of a Highland outlaw whose prowess is the theme of one of Sir Walter Scott's novels, and who was by descent a Macgregor. He received the name Roy from his red hair, and latterly adopted Campbell as his surname on account of the acts proscribing the name of his own clan. At first he devoted himself to rearing cattle on his estates on the Braes of Balquhidder, but having formed a band of clansmen, he obtained, after the accession of William III, a commission from James II to levy war on all who refused to acknoaledge him as king. Shortly afterwards he married Helen Mary, daughter of Macgregor of Comar. On the death of Gregor hfacgregor, the chief of the clan, in 1693 he was acknowledged chief, obtaining control of the lands stretching from the Braes of Balquhidder to the shores of Loch Lomond, and situated between the possessions of Argyll and those of Montrose. To assist in carrying on his trade as cattle-dealer he borrowed money from the 1st duke of Montrose, and, being unable to repay it, was in 1712 evicted and declared an outlaw. Taking refuge in the Highlands, Rob Roy supported himself by depredations on the duke and his tenants, all attempts to capture him being unsuccessful. During the rebellion of 1715, though nominally siding with the Pretender, he took no part in the battle of Sheriffmuir except in plundering the dead on both sides. He was included in the Act of Attainder; but through the influence of the duke of Argyll, he obtained, on making his submission at Inveraray, a promise of protection. He established his residence at Craigroyston, near Loch Lomond, whence he levied blackmail as formerly upon Montrose. Through the mediation of Argyll, he was reconciled to Montrose, and in 1722 he made submission to General Wade; he was carried off, and imprisoned in Newgate, and in 1727 was pardoned just as he was to be transported to Barbados. He died at Balquhidder on Dec. 28, 1734, and was buried in Balquhidder churchyard.

The best lives are K. Macleay, *Historical Memoirs of Rob Roy* (1818; new ed., 1881); A. H. Millar, *Story of Rob Roy* (1883). See also Sir W. Scott's introduction to the novel *Rob Roy*. An early account, *The Highland Rogue, etc.* (1723), is ascribed to Defoe.

ROBSART, AMY, first name of LADY AMY DUDLEY (1532–1560), wife of Lord Robert Dudley, afterwards earl of Leicester. She was the daughter of Sir John Robsart of Norfolk, and was married to Lord Robert on June 4, 1550. When Elizabeth became queen in 1559 Lord Robert was soon known to be her favourite, and it was believed that she would marry him if he were free. His wife never came to court and was never in his company. In 1560 she went by her husband's directions to Cumnor Place, a house near Oxford, rented by his agent Anthony Forster or Forrester, member of parliament for Abingdon. Here she was found lying dead on the floor of the hall on Sept. 8, 1560, by her servants. The circumstances of her death were never, cleared up.

See G. Adlard, *Amy Robsart and Leycester* (London, 1870), and W. Rye, *The Murder of Amy Robsart* (London, 1885); Sir B. H. T. Frere, *Amy Robsart of Wymondham; the Story of her Life and the Mystery of her Death* (Norwich, 1937).

ROC, or more correctly RUKH, a fabulous bird of enormous size which carries off elephants to feed its young. The legend of the roc, familiar from the *Arabian* Nights, was widely spread in

the east; and later the home of the monster was sought in Madagascar, when gigantic fronds of the *Raphia* palm very like a quill in form appear to have been brought under the name of roc's feathers *(see* Yule's *Marco Polo,* bk. iii, ch. 33). Such a feather was brought to the Great Khan, and we read also of a gigantic stump of a roc's quill being brought to Spain by a merchant from the China seas.

The roc is hardly different from the Arabian *'ankā (see* PHOENIX) ; it is also identified with the Persian *simurgh.*

BIBLIOGRAPHY.—For a collection of legends about the roc, see E. W. Lane, *Arabian Nights* (1839), chap. xx, notes 22, 62; H. Yule, *The Book of Ser Marco Polo* (1871). *See* also S. Bochart, *Hierozoicon* (1663), bk. vi, ch 14; Al Kazwini, *Kosmographie* (1847–48), i, 419 *et seq.;* Ibn Batūta, *Voyages* (1853), iv, 305 *et seq.;* Ad Damiri, *Hayat al-Hay-awan,* trans. A. S. G. Jayakar (1906).

ROCAMADOUR, a village of southwestern France, in the *département* of Lot. 36 mi. N.K.E. of Cahors by road. Pop. (1954) 204. Rocamadour owes its origin to St. Amadour or Amateur, who, according to tradition, chose the place as a hermitage for his devotions to the Virgin Mary. The renown of Rocamadour as a place of pilgrimage dates from the early middle ages. Rocamadour is most strikingly situated. Its buildings rise in stages up the side of a cliff on the right slope of the gorge of the Alzou. Flights of steps ascend from the lower town to the churches halfway up the cliff. The chief of them is the church of Notre-Dame (1479), containing the wooden figure of the Madonna reputed to have been carved by St. Amadour. The interior walls of the church of St. Sauveur are covered with paintings and inscriptions recalling the pilgrimages of celebrated persons. The subterranean church of St. Amadour (1166) extends beneath St. Sauveur and contains relics of the saint. On the summit of the cliff stands the medieval château built to defend the sanctuaries.

ROCAMBOLE *(Allium scorodoprasum,* family Liliaceae), a hardy bulbous perennial plant occurring in a wild state in sandy pastures and waste places throughout Europe and Asia Minor (often called giant garlic) but not common in the south; in Great Britain it is rare, and found only in the north of England and the south of Scotland. It is practically unknown in the United States.

The plant is grown for its bulbs, which are smaller and milder than those of garlic, and consist of several cloves chiefly produced at the roots. The cloves are planted about the end of February or in March, and treated like shallot.

ROCH, ST. (Lat. ROCHUS; Ital. Rocco; Span. ROQUE; Fr. ROCH) (d. 1327), a confessor whose death is commemorated on Aug. 16; he is specially invoked against the plague. According to his *Acta,* he was born at Montpellier, France. about 1295. On the death of his parents in his 20th year he gave all his substance to the poor.

During an epidemic of plague in Italy, he tended the sick at Aquapendente, Cesena and Rome, and effected miraculous cures by prayer and simple contact. After similar ministries at Piacenza he himself fell ill. He was expelled from the town and withdrew into the forest, where he would have perished had not a dog belonging to a nobleman named Gothardus supplied him nith bread.

On his return to Montpellier he was arrested as a spy and thronn into prison, where he died Aug. 16. 1327, having previously obtained from God this favour — that all plague-stricken persons invoking him be healed. His cult spread through Spain, France. Germany, Belgium and Italy. A magnificent temple was raised to him at Venice. (H. DE.)

ROCHAMBEAU, JEAN BAPTISTE DONATIEN DE VIMEUR, COMTE DE (1725–1807). French soldier, was born at Vendbme (Loir-et-Cher) on July 1, 1725. He was brought up at the Jesuit college at Blois, but entered a cavalry regiment. He served in Bohemia and Bavaria and on the Rhine. and in 1747 had attained the rank of colonel. He became governor of Vendôme in 1749, and after distinguishing himself in 1756 in the Minorca expedition was promoted brigadier of infantry. In 1757 and 1758 he fought in Germany. notably at Crefeld, received several wounds in the battle of Clostercamp (1760) and was appointed *maréchal de camp* in 1761 and inspector of cavalry. In 1780 he was sent, with the rank of lieutenant general. in command of 6,000 French troops to help the American colonists under Washington against the English. He landed at Newport, R.I., on July 10, but was held there inactive for a year, because of his reluctance to abandon the French fleet, blockaded by the British in Narragansett bay. At last, in July 1781, Rochambeau's force was able to leave Rhode Island and joined Washington on the Hudson. Then followed the celebrated march of the combined forces to Yorktown, where on Sept. 22 they joined the troops of Lafayette; Cornwallis was forced to surrender on Oct. 19. Congress voted Rochambeau and his troops the thanks of the nation and presented him with two cannon taken from the English. These guns, which Rochambeau took back to Vendôme, were requisitioned in 1792. On his return to France he was loaded with favours by Louis XVI and was made governor of Picardy.

During the Revolution he commanded the army of the north in 1790, but resigned in 1792. He was arrested during the Terror, and narrowly escaped the guillotine. He was subsequently pensioned by Bonaparte, and died at Thoré (Loir-et-Cher) on May 10, 1807.

A statue of Rochambeau by Ferdinand Hamar, the gift of France to the United States, was unveiled in Lafayette square, Washington. by Pres. Theodore Roosevelt on May 26, 1902.

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ROCHDALE, a county and parliamentary borough, Lancashire, Eng., 11 mi. N.N.E. of Manchester by road. Pop. (1961) 85,785. Area 14.9 sq.mi. The town lies at the foot of a western spur of the Pennines and at the junction of the Spodden with the Roch, which latter flows through the town (the central part has been covered in). The moribund Rochdale canal also passes through the town. The manufacture of cotton, woollen and rayon materials are the main industries, and there are engineering, asbestos, rubber, electrical and other works. Rochdale has an art gallery, a museum, a repertory theatre and five parks in addition to Hollingworth lake (117 ac.) 3½ mi. S.E.

Rochdale was the birthplace of the co-operative movement, the Rochdale Pioneers' Equitable society having been founded there ip 1844. The first shop, in Toad lane, has been restored to its original appearance. A statue of John Bright (1811–89) recalls the connection of the statesman's family with Rochdale.

Rochdale was incorporated in 18j6, but the parliamentary borough has returned one member since 1832. The county borough was created in 1888 and extended in 1933.

Rochdale (Recedham, Rachedam, Rachedal) takes its name from the river on which it stands. A Roman road passed the site, and a Saxon castle stood in Castleton. During Edward the Confessor's reign most of the land was held by Gamel the Thane, but after the Conquest the manor came into the hands of Roger de Poictou, from whom it passed to the Lacys and became merged in the duchy of Lancaster. From 1462 to 1625 the crown leased it to the Byron family. In 1625 Charles I conveyed the manor in trust, and in 1638 it was sold to Sir John Byron, afterward Baron Byron of Rochdale, whose descendants held it till 1823 when it was sold to the Deardens. Henry III (1240–41) granted to Edmund de Lacy the right to hold a weekly market on Wednesday and an annual fair on the feast of SS. Simon and Jude (Oct. 28).

ROCHDALE PIONEERS: *see* CO-OPERATIVES.

ROCHEFORT, HENRI VICTOR, MARQUIS DE ROCHEFORT-LUÇAY (1830–1913), one of the most effective polemical writers ever known in France. He was born at Paris on Jan. 31, 1830. He made a name as a successful journalist and writer of vaudevilles during the second empire, and began his turbulent career as an abusive political journalist when in May 1868 he founded and edited *La Lanterne.* It was suppressed on its 11th appearance, and Rochefort was fined and imprisoned. But the paper was then published in Brussels, Belg., and smuggled into

France. It circulated throughout Europe because it was printed in English, Spanish, Italian and German as well as in French. He also contributed to Victor Hugo's newspaper *Le Rappel,* founded in 1869. and in that year founded yet another opposition journal, *La Marseillaise.* As a leader of the republican opposition to the rule of Napoleon III, he was elected in 1869 to the *Corps le'gislatif* for a Paris constituency. Imprisoned again, he was released when the empire fell in Sept. 1870 and became a member of the provisional government of national defense. His open support for the Paris Commune of 1871 led to his resignation from the national assembly and his condemnation under military law. Though transported to New Caledonia he escaped after three months to the United States and lived abroad in London and Geneva, Switz., until the general amnesty of 1880 permitted him to return to France.

Hitherto the brilliant invective of his journalism had served the cause of the left, and now in *L'Intransigeant* he championed the more extreme Radicals and Socialists against Léon Gambetta, Jules Ferry, and the moderate Republicans. But he rashly backed Gen. Georges Boulanger against them, and in 1889 found himself again sentenced to prison for his activities. After the collapse of Boulangism he returned temporarily to the support of Socialism, but again swung over to the right in the Dreyfus case and belaboured the leaders of the Dreyfusards. He left *L'Intransigeant* in 1907, and wrote until his death for the national and conservative *La Patrie.* He wrote also many plays and novels, and had a genius for satire. He died at Aix-les-Bains in July 1913.

See his *Les Aventures de ma vie,* 5 vol. (Paris, 1896–98), partly in Eng. trans, by E. W. Smith, 2 vol. (London, 1896); A. Zévaès, *Henri Rochejort le pamphlétaire* (Paris, 1946). (*D* TN.)

ROCHEFORT, a small town of Belgium, on the Lomme, a tributary of the Lesse, in the southeast of the province of Namur close to the Ardenne. Population (1955 est.) 3.796. It has ruins of the old castle, which gave the place its name and a title to a long line of counts who had the right of coining their own money. This castle underwent many sieges and suffered much in the earlier wars, especially at the hands of Marshal de Chatillon in 1636.

Rochefort is noted for its healthfulness, and is a favourite place of residence and resort.

There are many grottoes, one of which. in the town itself, contains six halls or chambers; the largest, called the Sabbat, is remarkable for its great height. But the most famous are the grottoes of Han, 3 mi. from Rochefort where the Lesse river passes by a subterranean and undiscovered passage under the hillcalled Boème or Boine. The endedvour to trace the course of the river led to the discovery of the grottoes, which consist of 1 j separate halls, connected by passages more or less short and emerging on the river in a dark and extensive cavern forming a sort of side creek or bay. Near Rochefort are the famous red marble quarries of St. Remy, and the old Cistercian abbey of that name is now a Trappist seminary.

ROCHEFORT, a town of western France, capital of an *arrondissement* in the *de'partement* of Charente-Maritime, 20 mi. S.S.E. of La Rochelle on the state railway from Nantes to Bordeaux. Pop. (1954) 23,753.

The lordship of Rochefort. held by powerful nobles in the 11th century, was united to the French crown by Philip the Fair early in the 14th century; but it was alternately seized during the Hundred Years' War by the English and the French and in the Wars of Religion by the Catholics and Protestants. Colbert in 1665 chose Rochefort as the seat of a repairing port between Brest and the Gironde, so the town rapidly increased in importance, and the Dutch admiral Cornelius Tromp with his fleet failed to destroy the new arsenal. The naval school, afterward transferred to Brest, was originally founded at Rochefort. Its fleet, under Adm. Roland Michel de la Galissonnière, a native of the place, defeated Admiral Byng in 1755 and did good service in the wars of the republic. But the destruction of the French fleet by the English in 1809 in the roadstead of Ile d'Aix and the preference accorded to Brest and Toulon and the unhealthfulness of its climate diminished its prosperity. It was from the Ile d'Aix that Napoleon embarked on the "Bellerophon" in 181 j.

Rochefort is capital of the fourth maritime *arrondissement.* The commercial harbour, higher up the river than the naval harbour, has two small basins, a third basin with a depth at neap tide of 24 ft. and at spring tide of 30 ft., and a dry dock. Trade is in wood. cereals, salt and coal.

ROCHESTER, JOHN WILMOT, 2ND EARL OF (1647–1680), English poet and wit, the son of Henry Wilmot, the 1st earl, was born at Ditchley in Oxfordshire on April 10, 1647, and succeeded his father as 2nd earl in 1658. He was educated at Wadham college, Oxford, and in 1661, although he was only 14 years of age, received the degree of M.A. On leaving Oxford he traveled in France and Italy with a tutor. He returned in 1664, and at once made his way to Charles II's court, where his youth, good looks and wit assured him of a welcome. In 1665 he joined the fleet serving against the Dutch as a volunteer. He became gentleman of the bedchamber to Charles II. John Dryden had dedicated to Rochester his *Marriage-d-la-Mode* (1672); but Dryden's *Aurengzebe* (1675) was dedicated to Lord Mulgrave, who was Rochester's enemy. Consequently Rochester thwarted Dryden at every turn, and in 1679 a band of roughs set on the poet in Rose alley, Covent Garden, and beat him. Rochester obviously felt no shame for this infamous attack, for in his "Imitation of the First Satire of Juvenal" he says, "Who'd be a wit in Dryden's cudgelled skin?" His health was already undermined, and in the spring of 1680 he retired to High lodge, Woodstock park. He began to show signs of a more serious temper, and at his own request was visited (July 20 to July 24) by Bishop Burnet, who attested the sincerity of his repentance. He died, however, two days after the bishop left him.

When his son Charles, the 3rd earl, died on Nov. 12, 1681, Rochester's titles became extinct.

As a poet Rochester was a follower of Abraham Cowley and of Boileau, to both of whom he was considerably indebted. His love lyrics are often happy. but his real vigour and ability are best shown in his critical poems and satires.

The political satires are notable for their fierce exposure of Charles II's weakness.

BIBLIOGRAPHY. — *Poems on Several Occasions by the Right Honourable the Earl of Rochester . . .* (Antwerp, 1680) was really printed in London Other issues, slightly varying in title and contents, appeared in 1685, 1691 and 1696 *Valentinian, a Tragedy,* adapted from Beaumont and Fletcher, was printed in 1685; a scurrilous attack on Charles II in the shape of a play in heroic couplets, *Sodonz,* was printed in 1684, and is supposed, in spite of Rochester's denial, to have been chiefly his work. No copy of this is known, but there are two manuscripts extant. The completest edition of his works is *The Poetical Works oj the Earl of Rochester* (1731–32). Expurgated collections are to be found in Johnson's, Anderson's and Chalmers' editions of the *British Poets.* His *Familiar Letters* were printed in 1686, 1697 and 1699. His political satires are available in the *Bibliotheca Curiosa, Some Political Satires of the Seventeenth Century,* vol. i (Edinburgh, 1885).

ROCHESTER, LAWRENCE HYDE, EARL OF (1642–1711), English statesman, second son of Edward Hyde, earl of Clarendon, was born in March 1642. After the restoration of Charles II he sat as member of parliament, first for Newport in Cornwall and afterward for the University of Oxford, from 1660 to 1679. In 1661 he was sent on a complimentary embassy to Louis XIV of France, while he held the court post of master of the robes from 1662 to 1675. In 1665 he married Henrietta (d. 1687), daughter of Richard Boyle, earl of Burlington and Cork. When his father was impeached in 1667, Lawrence joined with his elder brother, Henry, in defending him in parliament, but the fall of Clarendon did not injuriously affect the fortunes of his sons. They were connected with the royal family through the marriage of their sister, Anne, with the duke of York, afterward James II, and were both able and zealous royalists. In 1681 Lawrence Hyde, who had been made first lord of the treasury and a privy councillor in 1679, was made Viscount Hyde of Kenilworth, and in November following earl of Rochester.

He was compelled to join in arranging the treaty of 1681, by which Louis XIV agreed to pay a subsidy to Charles, at the very moment when he was imploring William, prince of Orange, to save Europe from the ambitions of the French monarch. In Aug. 1684

he was removed from the treasury to the post of lord president of the council. He was still president of the council when James II became king in Feb. 1685, and he was at once appointed lord treasurer. But in spite of their family relationship and their long friendship, James and his treasurer did not agree. In Jan. 1687 he was removed from his office of treasurer.

After the revolution of 1688 Rochester, after a brief protest, accepted the new regime. From Dec. 1700 until Feb. 1703 he was lord lieutenant of Ireland, and in 1710 he was again made lord president of the council.

Rochester died on May 2, 1711, and was succeeded by his only son, Henry (1672–1753), who in 1723 inherited the earldom of Clarendon. When Henry died without issue on Dec. 10, 1753, all his titles became extinct.

The correspondence of Rochester with his brother the earl of Clarendon, together with other letters written by him, was published with notes by S. W. Singer, 2 vol. (London, 1828).

ROCHESTER, a city and municipal and parliamentary borough of Kent, Eng., on the Medway river, 31½ mi. E.S.E. of Hyde Park corner, London; it adjoins Chatham. Pop. (1951) 43,934. Area 5.9 sq.mi. Its situation on the Roman way from the Kentish ports to London, as well as at a Medway crossing, gave Rochester (Durobrivae; Hrofaecaestrae and Hrofi c. 730) an early importance. It was a walled Romano-British town, and the original bridge across the Medway (Durobrivae, an old British word probably meaning "stronghold bridge") probably dated from that period. The church of St. Andrew was founded by King Aethelbert, who also made Rochester a bishop's see. It was a royal borough in the time of William I, who built a castle there, probably on Boley hill. Richard I granted the citizens quittance of pas-*sagium* from crusaders in the town of Rochester in 1189. In 122 j Henry III granted them the city, a guild merchant, the right to be impleaded only within the city walls and other liberties. These charters were confirmed by subsequent sovereigns down to Henry VI, who in 1446 incorporated the city and granted it the power of admiralty and many privileges. Charters were granted in later reigns down to Charles I, whose charter of 1629 remained the governing charter until 1835. Rochester returned two members to parliament from Edward I's time until 1885, one from then until 1918. two from 1918 to 1950; one from then on.

The cathedral church of St. Andrew was originally founded by St. Augustine in 604, for whom Aethelbert built the church. It was partly destroyed by the Danes, but was rebuilt by Bishop Gundulph. the second Norman bishop (1077–1108). Gundulph or Gundulf established (1082 or 1083) Benedictine monks there. Bishop Ernulf (1115–24) completed and also renovated the church, lengthening it by two bays eastward; the old chapter house remains. The Norman west front was built about 1125–30, and in 1130 the new cathedral was consecrated. The work included an extended choir by William de Hoo (122 j), enlargement of the main transepts, the building of piers for a central tower and treatment of the nave to the third bay. About 1352 a low central tower was built, to which a spire was added in the next century. Toward the end of the 15th century St. Mary's chapel was added. The ruins of Gundulph's tower stand detached from and are earlier than the church; it was built by Bishop Gundulph probably as a defensive work for the eastern boundary of the city. The crypt beneath the choir is Early Norman in the western part. The remainder is Early English, and there are traces of mural painting. The library attached to the modern chapter house contains, among various relics, the *Textus Roffensis,* being records of the cathedral compiled in the time of Bishop Ernulf.

On the eminence overlooking the right bank of the river are the remains of the Norman castle, part of which was built by Bishop Gundulph at the order of William Rufus in the 11th century. The castle was besieged by King John, by Simon de Montfort in the reign of Henry III and by the followers of Wat Tyler. It was repaired by Edward IV, but soon afterward fell into decay, although the massive keep still stands. This is the work of William de Corbeil or Corbeuil, archbishop of Canterbury, to whom the castle was granted in 1123. It is a quadrangular four-storied structure, flanked by turrets, with a height of 113 ft. Remains of the 13th-century walls which once surrounded the city also exist. Charles Dickens lived at Gad's hill. above Strood, to the northwest. At Borstal, southwest of Rochester, was a large convict prison where early experiments on the educational treatment of delinquent boys between the ages of 16 and 21 were carried out, which resulted in the Borstal system (*q.v.*).

Among the principal buildings in the city are the guildhall (1687), the Richard Watts' almshouses (founded in 1579) and the almshouse of St. Catherine (built 1805), which originated in 1316 as a leper's hospital. An Elizabethan mansion was acquired by the corporation for a museum as a memorial of Queen Victoria's diamond jubilee. The principal schools are the cathedral grammar school or King's school, founded in 1544, and the Sir Joseph Williamson's Mathematical school (1701), formerly for sons of freemen but now open to all. St. Bartholomew's hospital (1708) occupies modern buildings, though the ancient chapel remains. A municipal airport has been provided by the corporation.

The Medway is navigable to Rochester bridge and vessels drawing 26 ft. can reach it. Since the 1850s Rochester has become increasingly industrialized with cement, engineering and other works. The towns of Rochester, Chatham and Gillingham form one great conurbation sometimes known as the Medway Boroughs,

ROCHESTER, a city of Minnesota, U.S., in Olmsted county, home of the world-famous Mayo clinic, is located about 80 mi S.E. of Minneapolis-St. Paul in the rich diversified agricultural plains region of southeastern Minnesota. It has one of the largest hatchery-breeding farm operations in the country as well as a large dairy processing plant. The establishment of an electronic data processing centre there has added to the growing industrial pattern of the city.

The site at the confluence of three tributaries of the Zumbro river was chosen by settlers in 1854 and named for Rochester. N.Y., by George Head. The city was incorporated in 1858 with a population of about 1,500.

Long famed as a health centre, Rochester houses the Mayo Foundation for Medical Education and Research, which is one of the world's largest graduate medical schools, and a branch of the University of Minnesota. There is a large privately operated hospital, and the Mayo clinic which is actually a combination of hospitals and hotels. The clinic operates with the co-operation of the largest voluntary association of physicians, surgeons, medical technicians and researchers in the world engaged in private practice. It was established in 1889 by William U'0rrall Mayo and his sons Charles Horace (*q.v.*) and William James Mayo (*q.v.*) and greatly stimulated Rochester's growth. The total number of hospital beds in the city, including the state mental hospital immediately east of the city, is more than 3,300.

As these medical services attract patients from all over the U.S. and the world, a cosmopolitan atmosphere is apparent. Because of a fairly constant transient population of 6,000–9,000 at any given time, the 1960 census return of 40,663 and earlier population figures are misleading. (For comparative population figures *see* table in MINNESOTA: *Population.)* Along with excellent public education facilities, the town has five parochial schools, two schools of nursing, a school of music and an evening community college. (JE. C. T.)

ROCHESTER, a city of northwestern New York, U.S., and seat of Monroe county, is located 70 mi. E. of Buffalo and 90 mi. W. of Syracuse, and is bisected by the Genesee river, which flows into Lake Ontario. The area is a prosperous manufacturing centre of quality photographic, optical and precision instruments; it is in the heart of a fruit and truck farming belt; and the gateway to the Finger Lakes resort area to the south. The climate is characterized by short pleasant summers and long, harsh winters.

History and Industrial Growth. — Rochester's first settlement dates from 1789. In 1788 Oliver Phelps obtained from the Seneca Indians land on the west side of the Genesee river to establish grist mills which would utilize the natural water power of the river falls. In 1789 Ebenezer "Indian" Allen was deeded 100 ac. of this land for the construction of a sawmill and grist mill. Allen's venture was a failure, and further settlement was impeded by the malarial conditions known as Genesee fever.

Col. Nathaniel Rochester. Revolutionary War soldier and Maryland aristocrat, laid out the town in 1811 and named it Rochesterville, shortened in 1822 to Rochester. In 1812 the first dwelling unit. a log cabin, was occupied by Hamlet Scrantom and his family and marked the beginning of permanent settlement. Rochester was incorporated as a village in 1817 and chartered as a city in 1834.

The early economy was built upon the extensive wheat production of the Genesee valley region. Rochester's cheap natural water power and the city's connection with the eastern section of the Erie canal in 1822 assured its economic development as a milling centre. By 1840 the city, one of the early boom towns of the "west," had 20,000 residents. By the 1860s the clothing and shoe industries, given impetus by the American Civil War and the arrival of skilled immigrants, thrived; Rochester had also become the flour milling capital of America. But by 1878 this latter industry had passed its peak and was moving westward to Minnesota. In 1942 the last flour mill was closed. After the Civil War, Rochester was transformed from the "flour city" to the "flower city." Large nursery and seed enterprises were developed with James Vick pioneering the mail order approach to seeds and shrubs. Although the business aspects of horticulture declined by the beginning of the 20th century, the influence of this industry is still manifested in the residents' concern with flowers, gardens and shrubs. Rochester's lilac collection in Highland park is widely known.

By the latter part of the 19th century the area was developing into a quality manufacturing centre with emphasis upon photographic, optical and precision instrument products. The major industries with few exceptions were founded by Rochester men utilizing local capital. Notable among these was George Eastman (*q.v.*), who was interested in photography and scientific experimentation. He developed a machine which coated dry photographic plates and began business in 1880 with six employees, becoming a major film and camera manufacturer.

Two industrialists, John Jacob Bausch and Henry Lomb, who perfected better techniques for grinding lenses, established their optical company there. Other entrepreneurs built successful manufacturing firms specializing in thermometers, machine tools, check protectors, mail chutes, glass-lined enameled steel tanks and dental equipment.

Aside from photographic, optical and precision equipment, the chief modern manufactures are electrical goods, clothing and textiles. shoes, machine tools and fabricated metal products. Lithography. printing and food processing are also important.

Organized labour has never been strong. Photographic instrument workers are relatively unorganized. Men's clothing workers are strongly organized as are the workers in the metal and printing trades, transportation and building trades.

Frederick Douglass, the Negro abolitionist and runaway slave, published his anti-slavery paper, *The North Star,* in Rochester when the community was an important terminus for the Underground Railroad (*q.v.*) to Canada. The area is regarded as a cradle of modern Spiritualism because of Margaret and Katharine Fox's numerous seances (the "Rochester Rappings") in the late 1840s which attracted world attention. Susan Brownell Anthony, a leading advocate of woman's suffrage, aided Clara Barton (*q.v.*) in establishing the second American Red Cross chapter in 1881 in Rochester. Lewis Henry Morgan (*q.v.*) an early ethnologist and the area's greatest intellect, wrote *Ancient Society* and *The League of the Iroquois.* A noted social reformer was the theologian, Walter Rauschenbusch (*q.v.*) who expounded. prior to World War I. the social gospel philosophy of Christianizing the social order of America.

Population. — Rochester with a population of 318,611 in 1960 is the central city of a standard metropolitan statistical area comprising Monroe county which had a population of 586,387. Although the city's population decreased by 4.2% between 1950 and 1960, the population of the metropolitan area increased by 20.3%. (For comparative population figures *see* table in NEW YORK: *Population.)* In the metropolitan area Irondequoit. Greece and Brighton are the largest suburban towns. These towns along with Gates, Chili, Pittsford, Perinton, Henrietta, Penfield and Webster, are predominantly residential in character, although industrial parks have been created in the last three. The fringe metropolitan area towns of Hamlin, Clarkston, Sweeden, Ogden, Riga, Wheatland, Rush and Mendon are predominantly rural in character, although limited suburbanization has occurred.

The area's earliest settlers were of northern European ancestry who migrated chiefly from New England. Prior to the American Civil War, significant numbers of Irish and Germans became residents. Before World War I, large numbers of Italian immigrants arrived, and they represent the largest foreign-born group in the area. At least 15% of the population is of Italian extraction. There are smaller numbers of Polish, Ukrainians, Dutch. Lithuanians and Jewish immigrants from Germany and eastern Europe and their descendants.

Administration. — The Republican party has dominated the political affairs of the area, with few interruptions, since the Civil War. In 1925 Rochester adopted the city-manager form of government. The governing body, the city council, is composed of five councilmen-at-large and four district councilmen elected for four-year terms. The council selects one of its members as mayor. In the other 19 metropolitan towns the chief official, the supervisor, is elected for a two-year term.

Education, Culture and Recreation. — George Eastman's philanthropy supported or helped to establish a number of cultural and public facilities including the Eastman theatre, the city's university, the Dental dispensary and Durand-Eastman park.

The two major educational institutions are the University of Rochester (founded 1850) which includes the well-known Eastman school of music and school of medicine and dentistry, and the Rochester Institute of Technology (1829). Undergraduate collegiate education is provided by Nazareth (1924; Roman Catholic) St. John Fisher (1951; Roman Catholic) and Roberts Wesleyan (1866) colleges, and theological education by St. Bernard's seminary (1893; Roman Catholic) and Colgate-Rochester Divinity school (1819; Baptist). The Rochester Philharmonic orchestra provides musical concerts during the winter season. The area has an excellent system of parks and recreational facilities including Hamlin State park on Lake Ontario, Genesee Valley park, the yacht basin in Irondequoit bay, the ski jump at Powder Mill park and Highland park, with its floral displays, in Rochester.

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ROCK, in geology a mass of the mineral matter of which the crust of the earth is composed. *See* GEOCHEMISTRY; GEOLOGY; PETROLOGY.

ROCKEFELLER, the name of a U.S. family founded by JOHN DAVISON ROCKEFELLER (1839–1937), industrialist. founder of the Standard Oil enterprise and of the first great American oil fortune. He was born in Richford, N.Y., on July 8. 1839, the son of a small trader. In 1853 the family settled in Cleveland, O. In 1859 Rockefeller formed a partnership with M. B. Clark in the produce and commission business. The first U.S. oil well was drilled that summer in Titusville, Pa., and in 1863 Rockefeller organized the firm of Andrews, Clark and company to enter the oil refining business as a sideline. Two years later the firm was reorganized as Rockefeller and Andrews. His brother WILLIAM ROCKEFELLER (1841–1922) joined him in the organization of William Rockefeller and company for the operation of a second refinery in Cleveland. In 1867 the two Cleveland refineries were consolidated into the partnership of Rockefeller, Andrews, Flagler and company, and three years later this firm was replaced by a joint stock company, the Standard Oil Company of Ohio, with John D. Rockefeller as president. Under his direction, this company obtained control of the oil industry by means of mergers, favourable railroad rates. rebates and other devices which at that time were not illegal. In 1882 was organized the Standard Oil trust, which controlled 95% of the oil refining business in the country and had in addition substantial interests in iron ore mines, lumber tracts, manufacturing plants, transportation and other

businesses. In 1899 the supreme court of Ohio held this trust to be a violation of the Sherman Anti-Trust act, and the trust was replaced by the holding company device, Standard Oil of New Jersey, which existed until 1911 when the United States supreme court declared it also to be illegal. By this time John D. Rockefeller had retired from active business and was devoting his time to giving away a large part of his fortune. For this purpose he established charitable corporations governed by trustees and operated by officers devoted to a continuous study of opportunities for public service. It is estimated that by this means Rockefeller's benevolences mounted to nearly $600,000,000. His first large benefaction was to The University of Chicago (*q.v.*), which received from him a total of $35,000,000. He died at his home in Ormond Beach, Fla., on May 23, 1937.

JOHN DAVISON ROCKEFELLER, JR. (1874–1960), the only son of John D. Rockefeller and Laura Spelman Rockefeller, was born in Cleveland, O., on Jan. 29, 1874. After graduation from Brown university in 1897, he entered his father's office, working closely with him in the business, philanthropic and civic enterprises of the family. His life was devoted primarily to philanthropic and civic activities. He was associated with his father in the creation and development of the Rockefeller Institute for Medical Research, the General Education board, the Rockefeller foundation and the Laura Spelman Rockefeller memorial. In 1923 he founded the International Education board, which operated in the fields of the natural sciences, the humanities and agriculture until it was terminated in 1937, its capital fund of more than $21,000,000 having been expended. Deeply interested in the conservation of natural resources and in preserving historic places, the younger John D. Rockefeller made many contributions for these purposes, including among them the restoration of Williamsburg, Va. His contributions from Jan. 1, 1917, to Dec. 31, 1955, amounted to about $400,000,000. He died in Tucson, Ariz., on May 11, 1960.

NELSON ALDRICH ROCKEFELLER (1908–), second son of John D. Rockefeller, Jr., was born at Bar Harbor, Me., on July 8, 1908. He graduated from Dartmouth and was associated with the family interests thereafter. In addition, he served during World War II as co-ordinator of inter-American affairs and as assistant secretary of state (1944–45). In 1958 he was elected governor of New York.

Other of the five sons of John D. Rockefeller, Jr., have been associated with the various Rockefeller benevolent corporations, New York city banks and other businesses: JOHN DAVISON ROCKEFELLER III (1906–); LAURANCE S. ROCKEFELLER (1910–); WINTHROP ROCKEFELLER (1912–); and DAVID ROCKEFELLER (1915–). *See* also STANDARD OIL COMPANIES.

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(J. R. LT.)

ROCKETS. This article is divided into the following sections:

I. INTRODUCTION

Rocket is the generic term for a wide variety of jet-propelled missiles, research vehicles, thrust devices and fireworks. Forward motion results from reaction to a rearward high-speed flow of hot gases generated in the rocket motor. Either solid or liquid propellants may be used to provide combustion gases.

A rocket motor. or engine, is one of the family of jet-propulsion devices whose other members include turbojet, pulse-jet and ramjet engines. The rocket engine is unique, however, in that the elements of the propulsive jet. fuel and oxidizer, are self-contained within the vehicle. The thrust produced is independent of the atmosphere or medium through which the vehicle travels. Other kinds of jet-propulsion engines carry their fuel only. This fuel is burned with the oxygen content of the air, scooped into the engine as the vehicle flies along. Thus these other varieties of jet engines are called air-breathing and are limited to operation within the blanket of atmosphere which surrounds the earth. Seventy-five thousand feet is about the upper limit of travel for air-breathing jet engines.

Rocket power is used for both military and peaceful purposes—and has been for hundreds of years. Rockets can be used to hurl explosives against targets thousands of miles away, or to lift data-gathering instruments—and man—into interplanetary space for scientific research and exploration.

The recorded history of rockets dates from the 13th century, but interest in them has risen and fallen as various other devices, such as the mortar and artillery, became competitive. Since World War II, however, rocket technology has reached such a level that it is doubtful that they will ever disappear again from the scene. As matters stand now, there is no technical competitor for rocket-propulsion systems for many missions. For instance, a rocket-powered ballistic missile can be fired against targets 6,000 mi. or more away. The speed at which it travels may be as high as 15,000 m.p.h. At the same time, as the recognized power plant for space flight, the rocket is the key to exploration of nature in a new dimension. In fact, the same basic vehicle used to carry an explosive warhead over intercontinental distances may be used instead to place man or a ton or more of scientific instruments in satellite orbit around the earth.

Launchings of earth satellites and of lunar and interplanetary research probes are but the prelude to an era of space exploration. Until 1955 man was a passive observer of laws of celestial mechanics. Since then he has begun to apply these laws through the use of rocket power. *See* also MISSILES; SPACE EXPLORATION.

II. HISTORY TO WORLD WAR II

1. Early History.— NO one knows when or by whom rockets were invented. In all probability the rocket was not suddenly "invented" but gradually developed over a long period of time, perhaps in different parts of the world at the same time. Some historians of rocketry, notably Willy Ley, trace the development of rockets to 13th century China, a land noted in ancient times for its fireworks display. In the year 1232 A.D. when the Mongols laid siege to the city of Kai-feng Fu (K'ai-feng), capital of Honan province, the Chinese defenders used weapons that were described as "arrows of flying fire." There is no explicit statement that these arrows were rockets, but some students have concluded that they were because the record does not mention bows or other means of shooting the arrows. In the same battle, we read, the defenders dropped from the walls of the city a kind of bomb described as

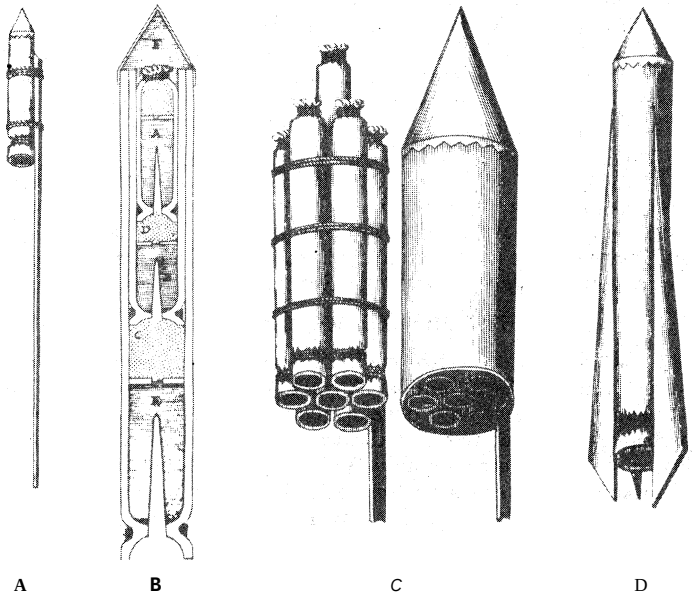
"heaven-shaking thunder." From these meagre references some students have concluded that the Chinese by the year 1232 had discovered gunpowder and had learned to use it to make explosive bombs as well as rockets.

In the same century rockets appeared in Europe. There is indication that the first use was by the Tatars against the Polish duke Henry in the battle of Liegnitz in 1241. The Arabs used rockets on the Iberian peninsula in 1249; and in 1288 Valencia was attacked with rockets. The Italian historian L. A. Muratori writes that a lucky hit of a rocket was decisive in a battle for Chioggia in 1379.

Around 1248 Roger Bacon (*q.v.*), an English Franciscan monk, wrote formulas for gunpowder in his *Epistola,* with great secrecy and the use of ciphers. He evidently experimented with various proportions of the three classic ingredients, saltpetre, charcoal and sulfur, raising the amount of saltpetre to 41%. The Chinese had used rather less saltpetre, which resulted in slower-burning mixtures. In Germany, a counterpart of Bacon, Albertus Magnus, was writing of powder charge formulas for rockets in his book *De mirabilis mundi.* About 1325 the first firearms were invented, utilizing a closed tube and gunpowder to propel a ball charge somewhat erratically over varying distances. Military engineers then began to invent and refine designs for guns and rockets, on a parallel basis. *(See* ARTILLERY.)

The French historian Jean Froissart (*q.v.*) suggested that rockets fired from tubes would give them better direction. In his book *Bellifortes* (1405), Konrad Kyeser von Eichstadt wrote of several designs of rockets. In Italy Joanes de Fontana conceived a number of novel war weapons based on rocket propulsion. One was a rocket-driven car designed to breach walls or gates. Another was a naval torpedo, designed to skim across water and ram its spiked nose into ships. Many other ideas were suggested in print, such as Count Reinhart von Solm's rockets with parachutes; or the count of Nassau's underwater explosive rocket. The extent to which many of these designs were reduced to working models or weapons is not known. By now rockets were used also for signaling and, especially by pirates, for setting fire to the tarred rigging of ships at sea. They had many names, such as "flying fire" or "wild fire."

The tale of Wan-Hu, presumably legendary, is an interesting milestone in the early history of the rocket. As the story goes, about the year 1500 a Chinese, Wan-Hu, made what must have been the first attempt at rocket flight, constructing a vehicle utilizing two large kites to which were attached some sort of seat. Forty-seven rockets were attached and fired simultaneously. Wan-Hu and his contrivance simply disappeared in the loud explosion which followed!



COURTESY OF M. SUBOTOWICZ

FIG. 1.—HISTORICAL EXAMPLES OF ROCKETS

(A) conventional stick-guided war rocket or fireworks skyrocket, and the earliest known concepts of (B) a step rocket, (C) a clustered rocket and (D) a fin-stabilized glide rocket. Drawings by Kazimierz Siemienowicz from *Artis magnae artilleriae,* pars prima (1650)

Of considerable historical interest are the work and writings of a Polish artillery expert, Kazimierz Siemienowicz. His monograph on military weapons, *Artis magnae artilleriae,* is noteworthy for three reasons. It contains the earliest known drawings of the step (or staged) rocket, the clustered rocket and the winged rocket. All of these concepts were to prove important several hundred years later. (See *Fundamental Principles of Rocket Propulsion,* below). Siemienowicz' book was published (in Latin) in Amsterdam in 1650. Translation of this document into French (1651), German (1676), English and Dutch (1729) gives eloquent testimony to the importance of this work. More than 200 figures were drawn on copperplate by Siemienowicz himself. Design characteristics of rockets, such as length-to-diameter ratios are given, as well as such constructional details as how to shape properly dimensioned holes for rocket nozzles. Siemienowicz died shortly after the publication of this book. His contributions to rocket technology are seldom recognized.

By 1668 military rockets, hard-pressed by development of guns and cannons, had increased in size and performance. In that year, a German. Col. Christoph Friedrich von Geissler, designed a rocket weighing 132 lb., constructed of wood, wrapped in glue-soaked sailcloth. It carried a gunpowder explosive charge weighing 16 lb.

Although the art of constructing rockets had now become quite widely known there was little appreciation or understanding of exactly how and why a rocket operated; *i.e.,* the physical principles involved. It was not until the last quarter of the 17th century that Isaac Newton formulated his famous laws of motion laying the basis for modern mechanics. Prior to this time Aristotelian theories of motion—philosophical in nature and unsupported by physical fact—had persisted for 20 centuries. Newton stated in his third law that every action is accompanied by an equal reaction in the opposite direction. The thrust of a rocket is derived from the reaction, in the opposite direction, to the expelled jet of combustion gases.

Despite the hard work of individual European enthusiasts, the use of rockets in military campaigns was sporadic. A revival of interest occurred after a series of battles in India late in the 18th century. Haidar Ali, prince of Mysore, developed rockets as weapons. The rockets had metal tubes, permitting higher internal pressures. They weighed 6–12 lb. and were flight-stabilized by a 10-ft. bamboo stick. The range of these rockets was a startling 1–14 mi. Although not individually accurate, dispersion errors of individual rockets became unimportant when large numbers were fired in mass attacks. These rockets were particularly effective against cavalry. Haidar Ali's son, Tipu Sahib, continued to develop and expand the use of rocket weapons increasing the number of rocket gunners from 1,200 to a corps of 5,000. The British suffered heavily, particularly in battles at Seringapatam in 1792 and 1799.

2. 19th-Century Developments.— The news of the successful use of rockets in these engagements spread through Europe. A British colonel, William Congreve, began to experiment privately. Within a few years he was able to match and exceed the range of the Indian rockets. In 1806 British rockets caused great fires during an attack on Boulogne. In 1807 a massed attack, using about 25,000 rockets, burned most of Copenhagen to the ground. In the decisive battle of Leipzig (1813) Congreve rockets are credited with playing an important role. Later the same year Danzig was subjected to a series of massed rocket bombardments in three successive months. The last attack caused the surrender of the city.

In the United States, the British used their rocket corps in two important engagements during the War of 1812. One was the battle of Bladensburg (Aug. 24, 1814) when their use drove back the American troops. As a result, the British were able to advance on Washington, D.C., capturing and burning the city. In September the British forces attempted to capture Ft. McHenry,

which guarded Baltimore harbour. They were unsuccessful but on that occasion Francis Scott Key, inspired by the sight of the night engagement, wrote the stirring words of the *Star Spangled Banner,* later adopted as the U.S. national anthem. "The rockets' red glare" and "bombs bursting in air" ever since have continued to memorialize Congreve's rockets.

Back in Europe, the Dutch army bought some Congreve rockets. A Captain de Boer conducted some experiments and arrived at a proposal to eliminate the heavy, stabilizing guide stick and substitute three metal vanes. Despite the fact that this lighter design should have worked, it was apparently not adopted. The stick-stabilized rocket was used until William Hale's invention several years later.

Congreve's rockets were successful for several reasons. He experimented with a number of black powder formulas and set down standard specifications. In the production of hundreds of thousands of rockets over two decades apparently a number of small refinements in design were made. Although none of these modifications materially improved performance, the sum total of the improvements resulted in a fairly reliable and potent weapon in the hands of a skilled rocket brigade. Congreve rockets ranged in weight from 25 to 60 lb. Some warheads were bombs, some steel ball charges for antipersonnel use. Extreme ranges increased to nearly three miles. They were competitive in weight and performance with the ponderous ten-inch mortar and were much more mobile. In appearance they resembled large skyrockets, the guide stick being 12–16 ft. long. Being recoilless, their launching equipment was simple and lightweight, and they could be fired from small boats. Thin copper tubes were used for initial directional guidance or, for massed bombardment, collapsible A-frames were employed. The success of Congreve's rockets caused the addition of rocket batteries to artillery units or the formation of independent rocket corps in most armies of Europe, as far east as Russia.

The next significant development in rocketry occurred about the middle of the 19th century. William Hale, a British subject, contrived a way of eliminating the dead weight of the stabilizing stick. When he placed a series of canted and curved vanes at the rear of the rocket, the exhaust gases imparted a spin to the rocket. Spin-stabilized rockets were a real improvement in performance and ease of handling. But by this time black powder rockets could no longer compete with artillery. The rocket corps of most European armies had been dissolved. Firearms and heavy field-pieces with rifled bores were outclassing rockets except on rare occasions. These exceptions were usually in mountainous terrain. On such ground, rockets could move into choice firing locations while the much heavier mortars were confined to roads or flat ground. Thus we find that the Austrian rocket corps, using Hale rockets, won a long series of engagements in such terrain against Hungary and Italy. Other successful uses were by the Dutch colonial services against natives in the Celebes and by Russia in a series of engagements in the Turkestan War.

Two thousand Hale rockets were produced by the U.S. army for the Mexican War, but from the little that has been recorded they were not particularly successful. Although the U.S. *Ordnance Manual* of 1862 listed 16-lb. Hale-type rockets with a maximum range of about $1\frac{1}{4}$ mi. their use in the U.S. Civil War is not known. There is a story that President Lincoln was interested in rocket development and was narrowly missed by an explosion in a test at the naval gun factory in Washington.

The extensive use of Congreve and Hale rockets lasted less than a century though they had appeared widely and were well known. Various applications of rocket power for other than military purposes began to appear. One of the best known was the use of a rocket to carry a lifeline to sailing ships in distress or stranded near shore. A thin line was first carried to the ship by the rocket. Then the crew would haul a heavier line out and use a breeches buoy to transfer the men, one at a time, to safety. In the 19th century hundreds of lives were saved in this way, using line-throwing mortars and rockets. Another application of rockets was in aiding lifeboats to negotiate a heavy surf. Rockets were used to throw a small grappling anchor with a light line over the surf onto the beach. By this technique, the boat could be kept straight as the occupants pulled themselves toward shore through the surf.

A line-carrying rocket was designed by Colonel Boxer about 1855 which achieved increased range by firing two rocket motors, one after the other, tandem fashion. This was the first known application of a concept sketched by Siemienowicz 200 years earlier. It differed from the modern two-staged rocket since the container of the first motor did not drop off but was carried along empty.

Signal flares also were carried aloft by rockets. One design of such a rocket by Congreve utilized a parachute to keep the flare visible for a longer period of time. A Captain Scoresby hunted whales by rocket-propelled harpoon in 1821. A woodcut from an 1865 newspaper, advertising the sale of such devices, shows a seaman launching a rocket harpoon from a shoulder-held tube equipped with a circular blast shield. The launcher appears quite similar to the bazooka of World War II.

One interesting 19th-century development was the concept of a rocket-propelled torpedo. Both the U.S. army and the British navy conducted experiments with such devices in the period 1860–80 and several ingenious devices were designed. Nevertheless, none of this work led to a real weapon. One of the fundamental problems of the rocket torpedo, as pointed out by William Hale, was that as the powder in the rocket motor was consumed, the torpedo grew lighter, making it difficult to hold the torpedo at constant level below the surface.

On the sidelines during the development of military rockets there were individual enthusiasts and inventors in nearly every country. Largely unknown, and sometimes considered a dangerous nuisance, they achieved varied success and recognition. In the early 19th century Claude Ruggieri, an Italian rocket maker, staged a number of shots in Paris in which rats and mice were sent aloft by rockets and returned by parachute. Ruggieri even planned to send up a small boy using a rocket cluster, but the police intervened.

During the 1880s and 1890s, inventors in all countries began to consider reaction propulsion. There were designs of flying devices propelled by steam jets (Charles Golightly), rocket-propelled airplanes (Werner von Siemens) and airships (Gen. Russell Thayer, Nicholas Petersen, Sumter B. Battey). There was even a helicopter design (Phillips) utilizing reaction propelled, counterrotating blades.

In the light of the times, many of these concepts were ingenious and prophetic in nature. It should be remembered that at that time the only existing mechanical prime movers were the steam engine and clockwork. Steam boilers were too heavy and clockwork mechanisms too limited in power to be of value in airborne devices. It was logical, therefore, to turn to reaction jets of steam or rocket gases. Models of some of these inventions, such as Phillips' helicopter, actually flew. But technology had not advanced sufficiently for any of these aerial, reaction-powered devices to be practical, despite the fact that, in theory, the principles involved in many cases were sound. What was lacking was sufficient power. But sufficient power was coming. In 1845 the German chemist Christian Friedrich Schonbein accidentally discovered guncotton (nitrocellulose). Fifteen years later Nobel was commercially producing nitroglycerin. Use was made of these and other combustible materials in firearms and artillery but it was about 50 years or so before their value was to be demonstrated for rockets. *(See* PROPELLANTS.)

The schemers and dreamers continued, however. In 1881 a Russian explosives maker, Nikolai Ivanovich Kibalchich, was arrested for his part in an assassination attempt on Tsar Alexander II. While in prison he conceived of a rocket airplane which functioned by successive explosions of compressed powder candles. Kibalchich's writings were doomed to lie in prison archives after his execution until the overthrow of the government in 1917.

About 1891 a most ingenious German inventor, Herman Ganswindt, conceived of a propulsion system, rather similar to that of Kibalchich but employing steel cartridges loaded with dynamite. But Ganswindt went further. He wanted to give his vehicle sufficient speed to attain escape velocity (see *Fundamental Principles of Rocket Propulsion,* below), *i.e.,* to leave the earth. Apparently,

Ganswindt was the first to connect the potentiality of rocket propulsion to space flight. In other countries the same dream was about to occur.

In Russia in 1895, a young mathematics teacher in Borovsk (District of Kaluga) published his first article on space travel. Konstantin Eduardovich Tsiolkovski was among the first to grasp the importance of exhaust velocity and the reason rockets had been limited by black powder formulas. He recognized that by using liquid fuels, *e.g.,* liquefied hydrogen and oxygen, much greater efficiencies would result. Tsiolkovski continued to make important contributions to the theory of space vehicle design but the language barrier, combined with his modesty and retiring nature, caused him to be little known for many years.

3. 20th Century to World War **II.**—In Sweden about the turn of the century, inventor Baron von Unge interested Alfred Nobel in a device described as an "aerial torpedo." Based upon the stickless Hale rocket, a number of design improvements were incorporated. Velocity and range were increased and about 1909 the Krupp armament firm purchased the von Unge patents and a number of rockets for further experimentation. But these rockets still used black powder as the propelling charge and their capabilities were limited. Von Unge, however, believed that his aerial torpedoes nould be valuable as air-to-air weapons between slow-moving dirigibles.

In the U.S., meanwhile, Robert H. Goddard (*q.v.*) was conducting theoretical and experimental research on rocket motors at Worcester, Mass; He utilized high-pressure steel motors with a tapered nozzle. In this way Goddard achieved much greater thrust and efficiency. Another of Goddard's concepts was a long-range bombardment rocket whose motor was fired in pulses. Somewhat similar to the pulsed momentum principle suggested by Kibalchich and Ganswindt, the impulses were to have derived from charges of solid fuel injected into the combustion chamber in rapid succession.

During World War I Goddard developed a number of designs of military rockets weighing $1\frac{1}{2}$ to 17 lb. to be launched from a lightweight hand launcher. By switching from black powder to double-base powder (40% nitroglycerin, 60% nitrocellulose), a far more potent propulsion charge was obtained. These rockets, forerunners of the bazooka of World War II, were proving successful under tests at the U.S. army Aberdeen proving ground when the armistice was signed. But Goddard's main interest as a physicist was in utilizing the new potential of rockets to reach high altitudes. His notebooks, after his death, revealed interest in a circumlunar rocket (carrying a camera to photograph the far side of the moon) and also in ion rockets.

Using Smithsonian institution funds, Goddard continued his research at Worcester. Switching from solid to liquid propellants he launched the first liquid-propellant rocket March 16, 1926. Liquid oxygen and gasoline powered this test vehicle, which contained turbine-driven pumps. The altitude was only 184 ft., but the significance was as great as the few feet the Wright brothers flew on their initial flights at Kitty Hawk. Later, under Guggenheim foundation funds, Goddard developed further research rockets at Roswell, N.M., in the 1930s. Although he never achieved the altitudes or velocities he knew were possible, Goddard proved himself a brilliant inventor. His later designs utilized both turbopumps and gyrostabilizers. Carbon vanes were used to deflect the rocket exhaust to correct deviations in the flight path. In 1919 the Smithsonian published a historic paper by Goddard entitled, *A Method of Reaching Extreme Altitudes.* At the end of the paper he extrapolated his calculations and discussed the possibility of a rocket reaching the moon with a payload of flash powder to signal its arrival to astronomers. The significance of this work, like Tsiolkovski's, was that the suggestions were made not by an exuberant inventor or enthusiast but a thoughtful scientist with sound academic background.

World War I saw very little use of rocket weapons. Artillery development far outclassed existing rocket designs which had changed little in the previous decades. The French, however, did successfully use incendiary rockets against hydrogen-filled dirigibles. Some French airplanes were equipped with wing-launched rockets for successfully attacking captive balloons, used for observation. German units devised a technique for dealing with barbed wire entanglements in trench warfare: a heavy rocket was used to lob a grappling hook with a trailing line across the wire; the hook would be wound back by means of a winch, pulling down the wire.

In 1923. while Goddard mas working in Worcester, an obscure German mathematics teacher, Hermann Oberth, published *Die Rakete zu den Planetenraumen* ("The Rocket Into Interplanetary Space"). In this thin pamphlet was set forth, with a grasp remarkable for his time, the potentialities of rockets to achieve great velocity. Oberth pointed out that science and technology had reached a level where the realization of manned space vehicles might be achieved in several decades. A later, major work, *Wege zur Raumschiffahrt* ("Way to Space Travel") (1929), not only set forth design concepts for immense interplanetary space vehicles utilizing clustered liquid-propellant motors, but also contained a chapter on electric propulsion and the ion rocket, predating actual development work on electrostatic propulsion by 30 years.

The decade which followed was an exciting one. Germans such as Walter Hohmann, Hermann Noordung and Austrian Baron Guido von Pirquet published technical studies on rocket power and space vehicles. In France, the famous aviator and test pilot Robert Esnault-Pelterie lectured and wrote on high-altitude rockets and interplanetary flight. It was Esnault-Pelterie who coined the term astronautics for the science of space flight. In 1929 Esnault-Pelterie and the French banker André Hirsch established an annual astronautics award for the experimenter who had done most to further space flight. In Russia, Jakov I. Perelman and Nikolai A. Rynin were interpreting and expanding Tsiolkovski's work.

This was also the period of the promotional use of rockets—to propel cars and sleds as carried out by the German engineer, Max Valier. Although Valier was a competent designer of both solid and liquid rocket motors, such applications of rocket power tended to mislead the public by deflecting attention from those fields where rockets had no competition; *i.e.,* in high-altitude, high-speed flight.

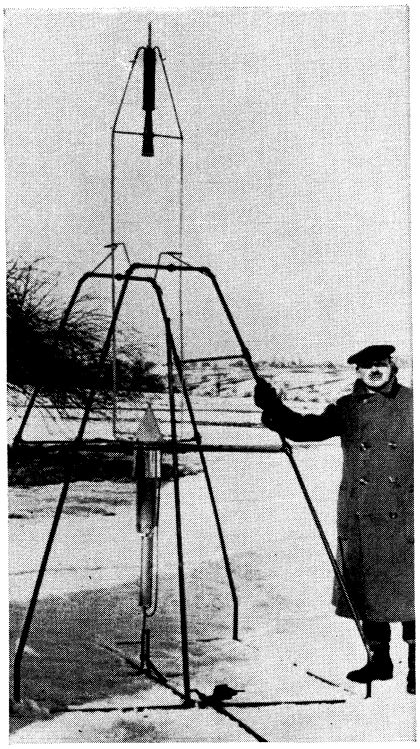
In the period 1927–33 rocket and space flight societies were formed in Germany, Austria, the U.S.S.R., the U.S. and Great Britain. These groups provided a meeting place for discussion and experimentation and their journals became a means of disseminating information. Willy Ley, a founding member of the German space flight society, related the story of these formative years of modern rocket experimentation in his book *Rockets, Missiles and Space Travel* (rev. ed., 1957).

III. HISTORY DURING WORLD WAR II

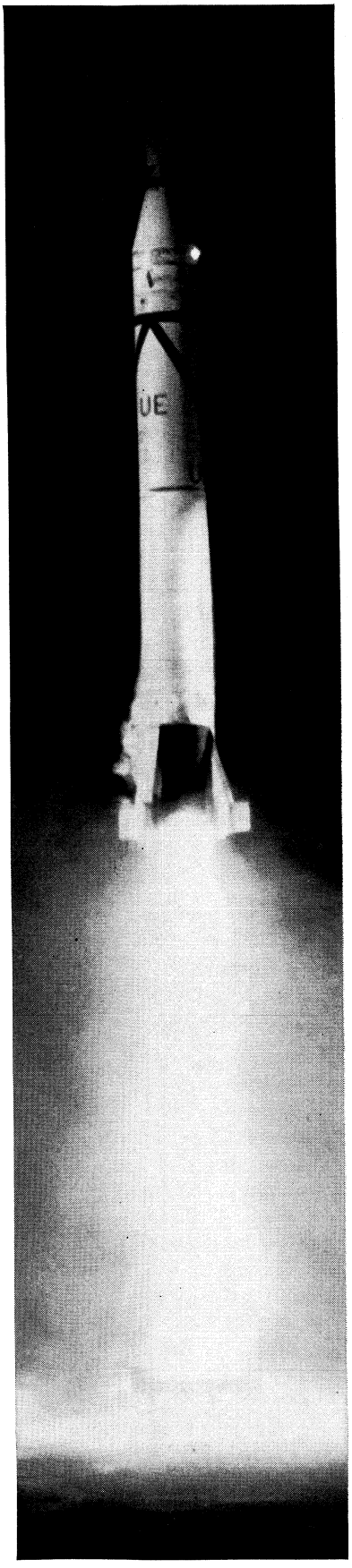
1. Germany.— The work of the German society, *Verein fur Raumschiffahrt,* attracted the attention of German army Capt. Walter Dornberger. In 1932 he hired young Wernher von Braun, who had been active in the experimental work of the German rocket society, and a few others and began experimenting at the artillery proving ground south of Berlin. Eventually, the vast rocket test, development and production site at Peenemiinde arose under the military leadership of Major General Dornberger and the technical direction of Von Braun. The fascinating story of the intensive development and engineering of the A-4 (popularly known as the V-2) is recorded in Dornberger's book, *V-2* (1954).

The V-2 rocket was nearly 47 ft. long, had a cylindrical diameter of $5\frac{1}{2}$ ft. and weighed about 27,000 lb. at takeoff. The one-ton warhead contained 1,654 lb. of high explosive. Propellants were liquid oxygen and a 75% ethyl alcohol-water mixture. Approximately 8,400 lb. of alcohol and 10,800 lb. of oxygen were burned at a rate of 300 lb. per second. The rocket motor produced 55,000 lb. thrust for about one minute at which time the engine was shut off by an integrating gyro system. Propellant supply was by turbopump, driven by high-strength hydrogen peroxide decomposed by a catalyst. Yaw and pitch control was accomplished by two pairs of graphite carbon vanes in the rocket exhaust. Ignition of the alcohol-liquid oxygen propellants was effected by a pyrotechnic pinwheel inserted in the motor. Estimated maximum range was about 200 mi.

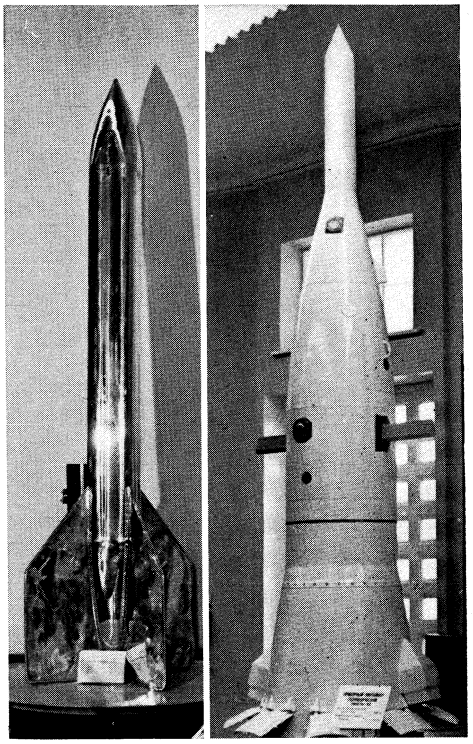
ROCKETS



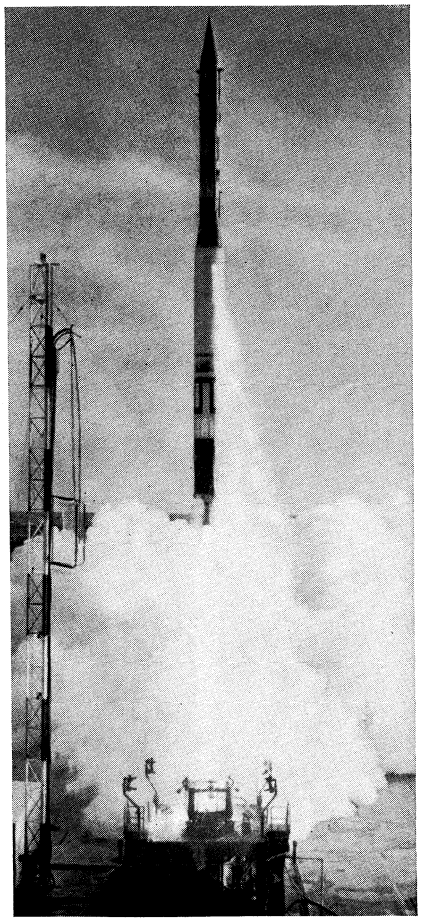
R. H. Goddard (*q.v.*), U.S. rocket pioneer, shown with the liquid-propellant rocket which he devised and launched in 1926. The fuel consisted of liquid oxygen and gasoline



Jupiter-C (Explorer) which was launched from Cape Canaveral Jan. 31, 1958, and placed the first U.S. satellite (30.8 lb.) into orbit



Early examples of rockets of the U.S.S.R. ***Left,*** the "Aviavnito," a liquid-propellant (oxygen and ethyl alcohol) rocket of 1936. *Right:* A-2 rocket capsule which carried 3,300 lb. to an altitude of 130 mi.



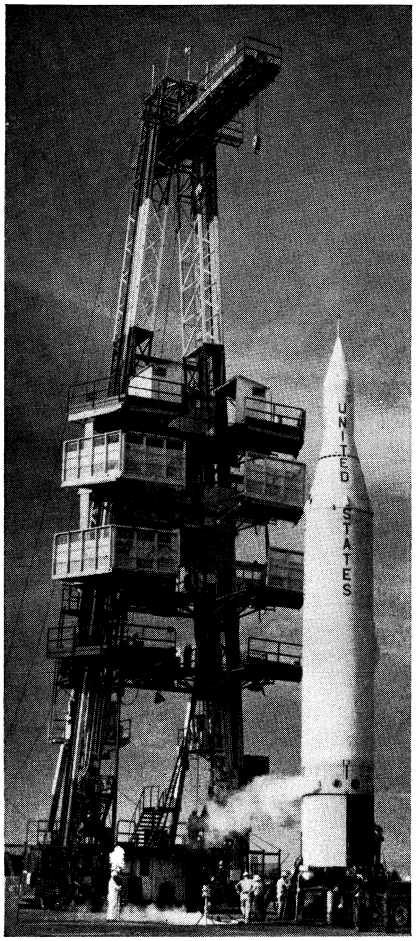
First successfully launched U.S. Vanguard rising from Cape Canaveral, Fla., March 17, 1958. A 3¼-lb. satellite was placed into orbit around the earth

U.S. Atlas-Able rocket which was unsuccessful in an attempt to send a space probe to the vicinity of the moon in November 1959

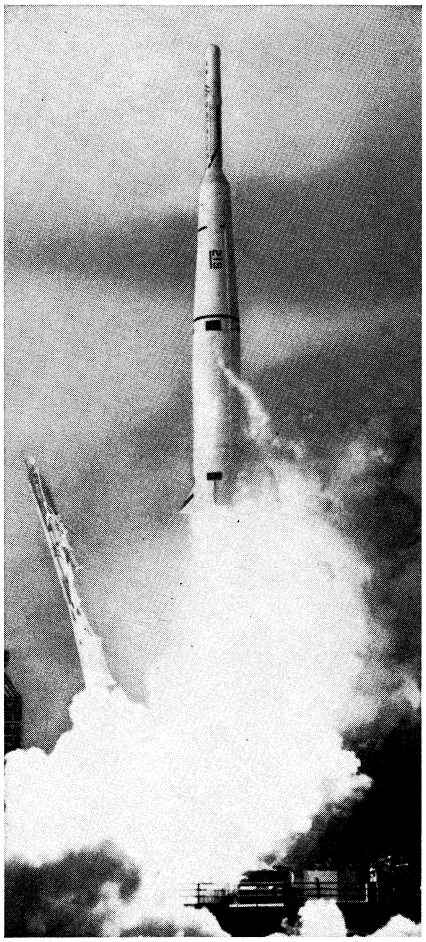
EARLY ROCKET DESIGNS OF THE U.S. AND U.S.S.R.

BY COURTESY Of (TOP LEFT. EOTTOM RIGHT) NATIONAL AERONAUTICS AND SPACE ADMIAISTRATION. (TOP RIGHT, 2) SOVIET EMBASSY, (BOTTOM LEFT AND CENTRE] U.S. DEPT. OF DEFENSE AND (BOTTOM LEFT) U.S. NAVY, (CENTRE) U.S. ARMY

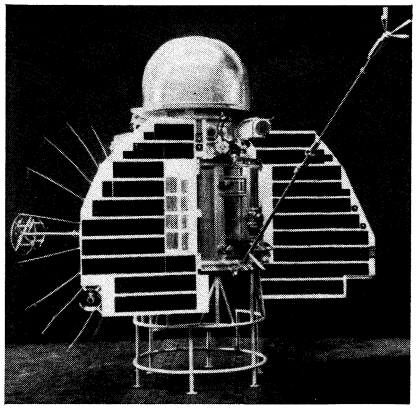
ROCKETS



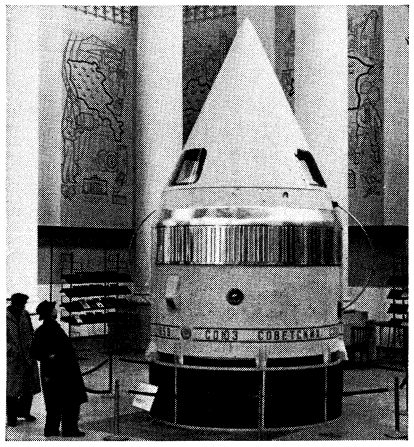
U.S. Juno II, Jupiter space carrier, which placed Explorer VII, a 91.5-lb. earth satellite, into orbit Oct. 13. i959



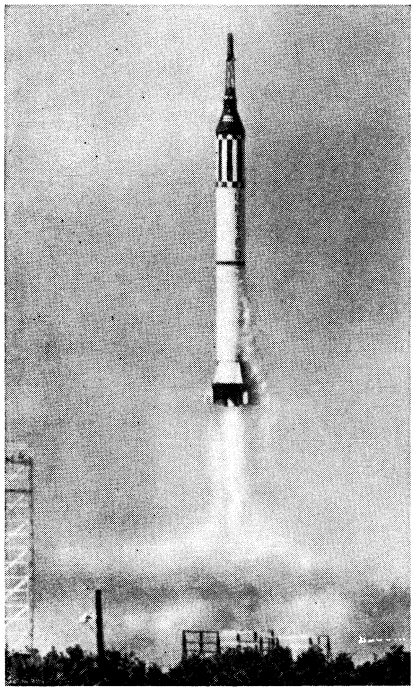
U.S. Thor-Able launched from Cape Canaveral March 11, 1960, carrying Pioneer V, a 94.8-lb. interplanetary space probe



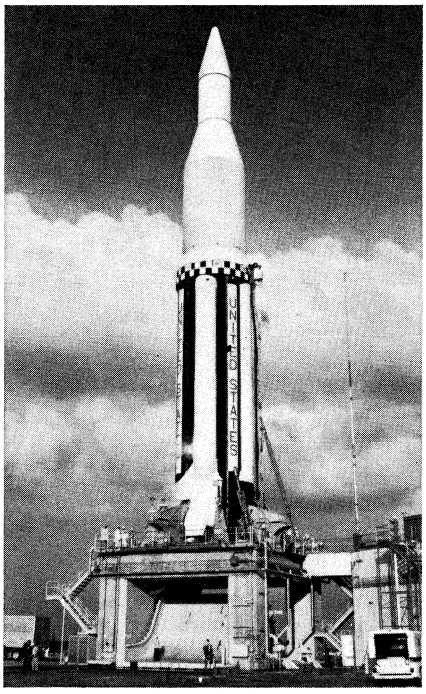
Instrument package of an interplanetary probe launched 'from the orbit of Soviet Sputnik VIII Feb. 12, 1961. Radio contact was lost before anticipated rendezvous with Venus



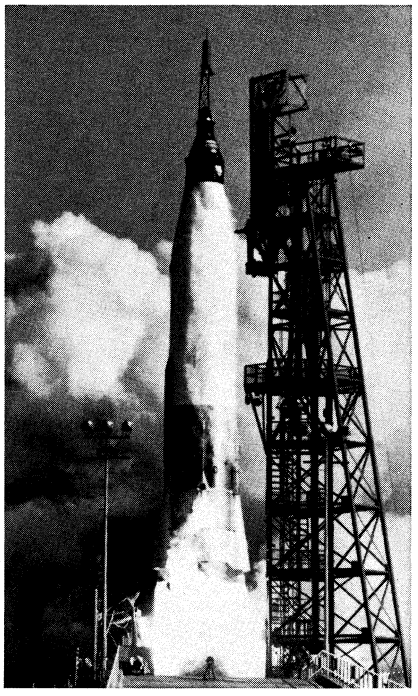
Model of last stage of Lunik I, Soviet lunar probe which was launched Jan. 2, 1959. The 3,245-lb. satellite entered into orbit around the sun after passing near the moon



Redstone-based vehicle launching first U.S. astronaut, Alan B. Shepard, into sub-orbital flight May 5, 1961, the first in a series of tests of the Mercury one-man satellite



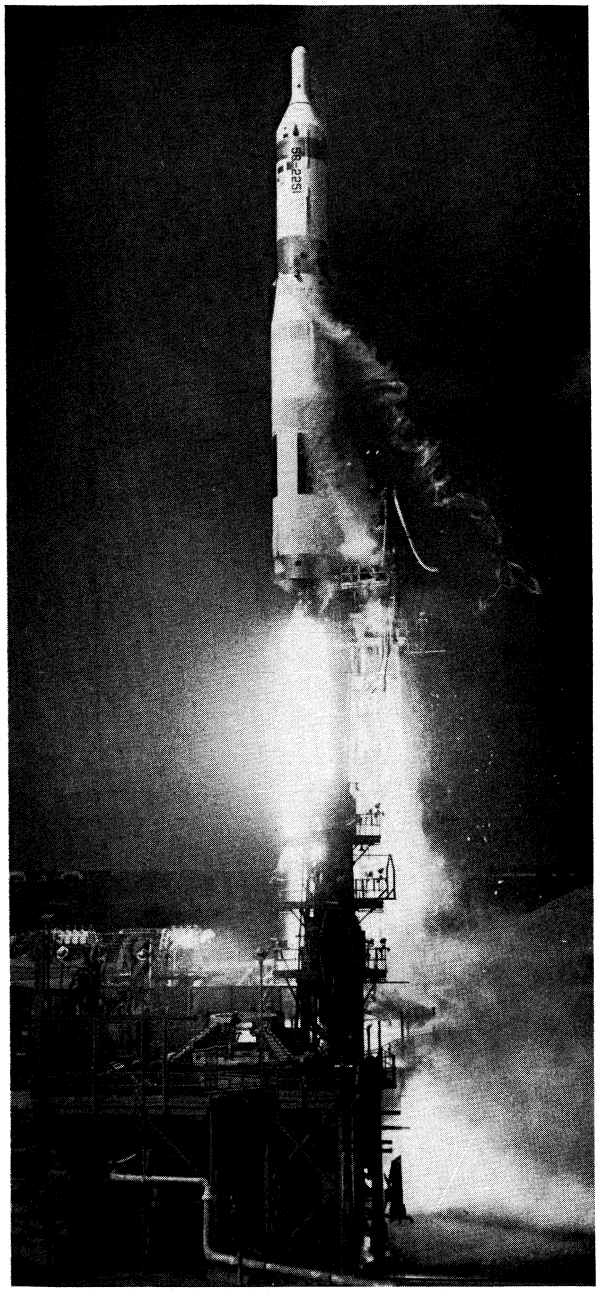
U.S. Saturn C-1 at Cape Canaveral prior to the successful launching of its first stage Oct. 27, 1961. The throe-stage space booster was designed to place Apollo A in an earth orbit



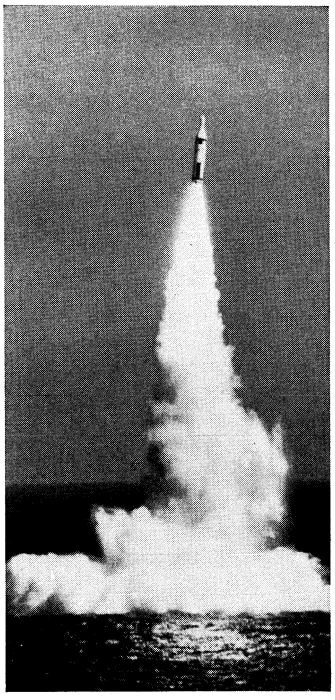
Mercury-Atlas 6 launching the Friendship 7, U.S.-manned spacecraft which carried John H. Glenn, Jr., on three orbits around the earth to a landing in the Atlantic ocean Feb. 20, 1962

SPACE RESEARCH VEHICLES OF THE U.S. AND THE U.S.S.R.

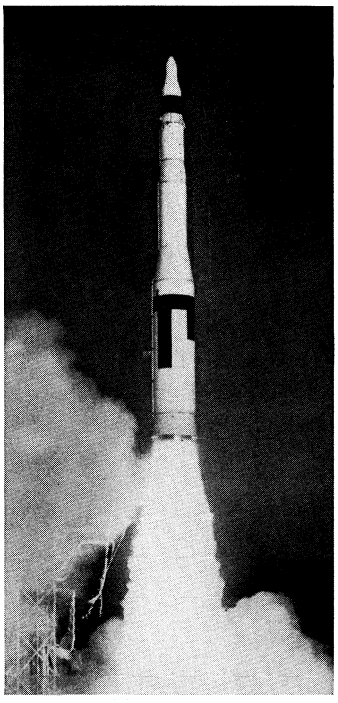
BY COURTESY OF (TOP LEFT) U.S. AIR FORCE, (TOP RIGHT, CENTRE RIGHT) SOVIET EMBASSY, (BOTTCM CENTRE AND RIGHT) N A.S.A.; PHOTOGRAPHS. (TOP CENTRE) UNITED PRESS INTERNATIONAL, (BOTTOM LEFT) WIDE WORLD



Titan I, an intercontinental ballistic missile (ICBM) of the air force. With a first stage thrust of 300,000 lb. and a second stage thrust of 80,000 lb., the 98-ft. missile has a range of over 5,000 mi.



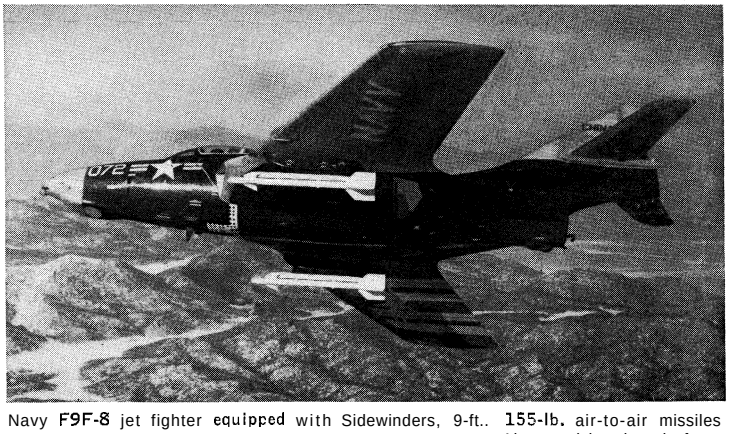
Underwater launching of a Polaris A-2 missile from a submarine, Feb. 27, 1962. The 28,000-ib. missile is capable of traveling 1,500 nautical miles



Minuteman, solid-propellant, 70,000-lb. missile. Its range exceeds 6,000 nautical miles: launch is from underground silos

SS-11, French surface-to-surface, wire-guided missile, after being launched from a U.S. army helicopter. The short-range, antitank missile is visually tracked and can be launched from the ground as well as from a helicopter

Lacrosse, a short-range surface-to-surface missiie of the army designed for tactical use in field support

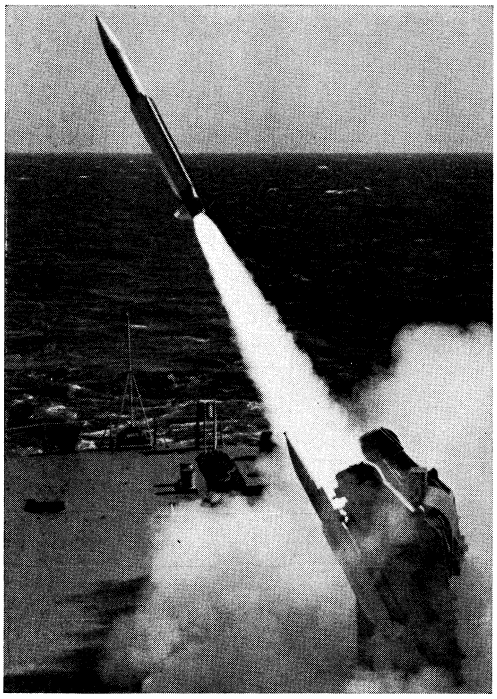


Navy F9F-8 jet fighter equipped with Sidewinders, 9-ft.. 155-lb. air-to-air missiles with heat-homing guidance system; range is about 3 mi. Also used by the air force

ROCKET-POWERED BALLISTIC MISSILES

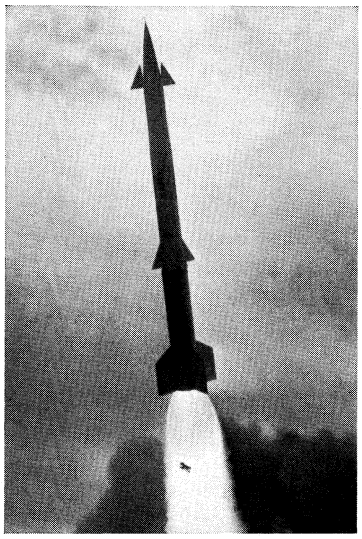
BY COURTESY OF (TOP LEFT. TOP RIGHT) U.S. AIR FORCE (TOP CENTRE) DEPT. OF DEFENSE. U.S. NAVY PHOTO. (BOTTOM RIGHT) U.S. NAVY, (CENTRE RIGHT, BOTTOM LEFT) U S. ARMY

ROCKETS

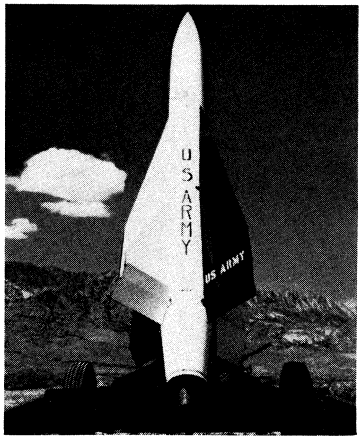


Tartar, surface-to-air missile of the navy designed for anti-aircraft use. Radar beam-guided, a homing system takes control as the vehicle approaches the target

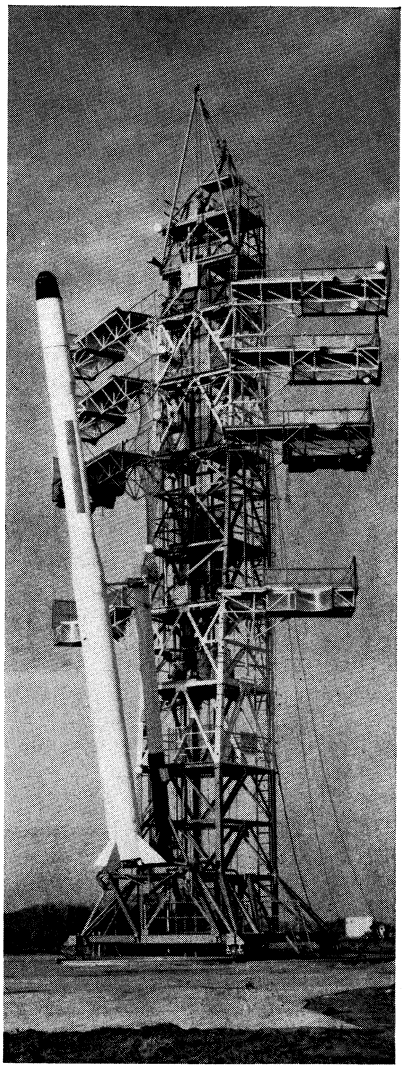
Redeye, U.S. army surface-to-air missile. The 20-lb. anti-aircraft missile is fired from a bazooka-type launcher



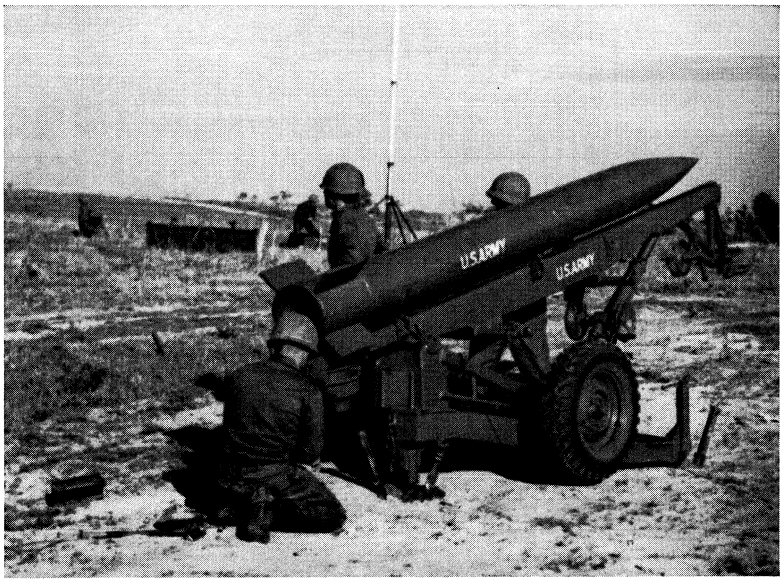
Test model of Nike-Zeus being fired at White Sands. N.M., missile range. Developed by the U.S. army, eventual design is toward an anti-ICBM missile



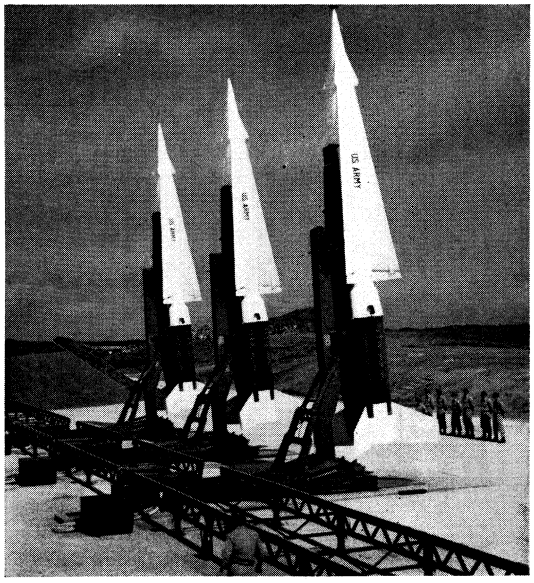
Hawk, surface-to-air missile of the **U.S.** army and marine corps designed to intercept low-flying aircraft



U.S. Scout, a small, four-stage, solid propellant rocket space booster capable of placing 150 lb. in a 300-mi, earth orbit



Little John **XM-51** being readied for firing. An unguided surface-to-surface rocket, **it** is used by the U.S. army for field support. Range, 10 mi.



Nike-Hercules battery. These surface-to-air missiles are **designed** to intercept and destroy high-flying aircraft

MISSILES AND A SPACE BOOSTER

BY COURTESY OF (TOP LEFT) U.S NAVY (TOP RIGHT) N A S A , (OTHERS) U S. ARMY

The first operational V-2 was fired late in the war against Paris on Sept. 6, 1944. Two days later the first of over 1,000 missiles was fired against London. The missile traveled on a ballistic arc trajectory, reaching a maximum speed of more than 1 mi. per second and an altitude of 60 to 70 mi. Since the warhead approached the target faster than the speed of sound, there was no warning of the approach of the bomb.

Although the V-2 did not become a decisive weapon, it was nevertheless a monumental engineering achievement. Large rocket motor developments after World War II, in both the U.S. and the U.S.S.R., were outgrowths of the V-2 engine design. The term V-2 stands for *Vergeltungswaffe zwei* ("vengeance weapon two"). The V-1 was not a rocket, but a pulse-jet-powered pilotless aerial bomb.

In addition to the V-2 the Germans developed a wide variety of other rocket-powered guided missiles of many categories which reached varied stages of completion before the end of the war. The Hs-293 was a rocket-powered, winged-bomb launched by long-range bombers against Allied shipping. The bomb was guided in flight by remote control radio. The X-4 was an ingenious air-to-air missile, guided by fine wires. The Wasserfall was a refined supersonic surface-to-air (antiaircraft) guided missile which was almost ready for production. Other guided missiles in this category were the Rheintochter, Schmetterling and Enzian. An interesting intermediate step between the guided missile and the piloted interceptor was the Natter, designed by Erich Bachem. This vehicle, carrying a pilot, was designed to be launched vertically toward attacking bomber formations. The Natter was designed to have a maximum horizontal flight speed of 620 m.p.h.

There were many other German rocket developments in unguided weapons. The best known were the Nebelwerfer and Wurfgerat rocket launchers used extensively on the Russian front. Projectiles ranged from 5 to 17 in. in diameter; smokeless powder served as the propellant. They carried incendiary or high-explosive charges in the warhead. In addition, there was a small unguided rocket, the Taifun, under development. The Taifun was designed to be launched in ripple fire against aircraft. Both solid- and liquid-propellant designs were under investigation.

The Rheinbote was a four-stage, solid-propellant rocket. It weighed nearly two tons, was about 40 ft. long, and had an impressive range—125 mi. However, the payload of 88 lb. of high explosive could not compete with other weapons such as aircraft bombardment and the V-2. The Rheinbote was significant, however, in that practical recognition was made of the value of the step principle suggested by Siemienowicz nearly 300 years before.

Other German rocket weapons included the Fritz-X (a bomb which utilized a rocket motor to increase target penetration); various aircraft rockets, including the excellent R-4M; and the X-7, a short range, wire-guided rocket designed for antitank use. Two versions of a rocket-powered airplane, the Messerschmitt Me-163B, and Me-163C appeared too late in the war to be important. But their flight speeds, 560–590 m.p.h., would have made them extremely effective against long-range bomber formations. The Austrian Eugen Sanger and his brilliant co-worker Irène Bredt (later Mrs. Sanger) headed the air force rocket test station at Trauen. It was here that the experimental work was conducted which laid the basis for the significant report, *A Rocket Drive for Long Range Rocket Bombers* by Sanger and Bredt, published privately by Robert Cornog (1952).

2. Great Britain.— In Great Britain, development of rockets was considered by the war office in 1934. In 1935 a program was under way headed by A. D. Crow (later Sir Alwyn). Initial effort was aimed at achieving the equivalent destructive power of the 3-in. and later the 3.7-in. antiaircraft gun. More than 2,500 rounds of an accepted 3-in. design were fired in the winter of 1938–39. The results of these trials indicated an accuracy less than the competitive 3.7-in. gun and priority accorded the work was reduced. After the outbreak of the war, however, the 3-in. rocket was accepted for production since antiaircraft units were required around hundreds of prime industrial and transportation targets. Single, double and then multiple, projectors were produced. Massed batteries of projectors fired salvos of as many as 128 rounds.

Two important innovations were developed by the British in connection with the 3-in. rocket. Both devices were directed against the German dive bombers—a serious menace in 1940. One was a rocket-propelled aerial defense system. A parachute and wire device was rocketed aloft, trailing a wire which unwound at high speed from a bobbin on the ground. Altitudes as high as 20,000 ft. were attained. Several versions of this device were used, quite successfully, from ships. The other device was a type of proximity fuze utilizing a photoelectric cell and thermionic amplifier. Change in emission of light from a nearby airplane (projected on the cell by means of a lens) triggered a thyratron and the detonating train of the shell.

A 5-in. rocket, capable of projecting a 30-lb. bomb to ranges of 2–4 mi., was developed for heavy coastal bombardment prior to landings. Automatic ripple fire in successive groups reduced the chance of mutual interference between rockets. With this weapon a tremendous rate of firepower was possible. For example, a single rocket ship was able to launch 1,000 lb. per second of high explosive for nearly a full minute.

3. United States.— The United States did not commence active development of rockets until mid-1940. At that time, the National Defense Research committee (NDRC) authorized a program under the direction of C. N. Hickman at Indian Head, Md. Hickman had worked with Goddard on the hand-launched rocket tests at Aberdeen in 1918. Aided by army Capt. L. A. Skinner, Hickman supervised the development of a refined design, known as the bazooka. About 22 in. long, $2\frac{1}{2}$ in. in diameter and weighing 3.4 lb. the rocket was fired from a $4\frac{1}{2}$-ft. shoulder launcher which weighed 14.5 lb. The bazooka was used extensively against tanks. Its maximum range was short (600 yd.) and it traveled slowly but it carried a particularly potent warhead weighing 1.8 lb. This warhead contained a conelike shaped charge which utilized the Munroe effect. This important application of explosive to achieve deep penetration was discovered by a U.S. professor, Charles E. Munroe in 1887. It was the characteristics of the shaped charge, not the use of rocket power to achieve high velocity, that made the bazooka so effective. In fact, the shaped charge is not effective if impacted at high speeds. The bazooka was the only U.S. rocket in World War II which utilized this type of warhead. (*See* BAZOOKA.)

Another U.S. army development was the Calliope, a 60-tube launching projector for 43-in. rockets mounted on Sherman-type tanks. The launcher was mounted on the tank's gun turret and both azimuth and elevation were controllable. Ripple fire was used to eliminate interference of rockets in salvo firing. Other launchers were developed for trucks and jeeps.

Close liaison was established between the U.S. NDRC and similar research groups in Great Britain. Advantage was taken of earlier rocket developments of the British. A $3\frac{1}{4}$-in British rocket was redesigned to utilize U.S. ballistite propellant in place of slower burning cordite. An antisubmarine rocket known as Mousetrap was developed along the lines of the British Hedgehog.

Other conventional rockets developed in the U.S. included a 43-in. barrage rocket with a range of 1,100 yd. and a 5-in. rocket of longer range. This latter rocket was extensively used in the Pacific theatre from type LSM-R launching barges against shore installations, particularly just before landing operations. Firing rates of these flat bottom boats was 500 per minute. The largest rocket developed by the U.S. was Tiny Tim. Ten ft. long, $11\frac{3}{4}$ in. in diameter, and weighing 1,284 lb., the rocket's warhead held 150 lb. of TNT. Tiny Tim was an airborne rocket. To eliminate wind drag resulting from exterior mounting, the rocket was carried internally in the bomb bay. Firing was effected by a lanyard which ignited the rocket motor at a safe distance below the airplane.

Significant research and development was conducted in the U.S. on solid rocket propellants. Not only were formulas and production techniques of double-base propellants refined but the composite (cast) class of propellants (see *Rocket Propellants*, below) were investigated extensively and developed at the Guggenheim

Aeronautical laboratory at California Institute of Technology (GALCIT) and elsewhere.

The GALCIT laboratory, under the direction of Theodor von Kármán developed, in addition, solid- and liquid-propellant rocket units for jet-assisted take-off (jato) for aircraft. Use of such jato units permitted aircraft, particularly seaplanes, to take off in a much shorter distance or to take off with increased loads. The U.S. navy conducted similar jato development at Annapolis, Md., concentrating on liquid propellants.

Because the U.S. had great industrial capacity, unhampered by air raids, and urgent needs for its own forces as well as for allies, its production of solid-propellant rockets increased to a high rate by the end of the war. At the close, rockets of all sizes were being manufactured at the rate of 1,000,000,000 per year. Weights of different designs ranged from 3 to 1,300 lb.; diameters, 2 to 12 in.; lengths, 1 to 10 ft.; velocities, 650 to 1,500 ft. per second; maximum ranges (ground firing), 40 to 10,000 yd.; and accuracies (angular dispersion), $\frac{1}{16}°$ to 3°.

4. **U.S.S.R.**—As far as is known, Russian rocket development activity during World War II was limited. Extensive use was made of barrage, rippfe-fired rockets against the Germans. Both A-frame and truck-mounted launchers were used. According to Ley (see *Bibliography)* much of the rocket material came from the U.S. Later, however, the Russians mass-produced a 3.2 in. rocket known as Katyusha. From 16 to 60 Katyushas were fired from a boxlike launcher known as the Stalin Organ, mounted on a gun carriage. Rocket-propelled bombs of high penetration were used by fighter aircraft, especially against tanks. Weights of these bombs ranged from 13 to 220 lb.

5. Other Countries. — Rocket development in other countries during World War II was on a lesser scale. In Japan 12 types of rocket ordnance were identified by postwar intelligence interrogation teams. Rocket development had been conducted for ten years, but at a slow rate. Uses of rockets included infantry combat, antitank, antiaircraft, antisubmarine and heavy bombardment rockets weighing 815 lb. The best known Japanese rocket development was the Ohka (kamikaze) piloted glide bomb used against warships. Air-launched from a maximum altitude of 27,000 ft. from a bomber, the 20-ft.-long Ohka carried 1,135 lb. of high explosive in the warhead. Three solid-propellant rocket motors provided thrust for maneuvering and to increase speed in final dive on target ships. Maximum range was about 55 mi.; a final speed of 535 m.p.h. was possible. The dramatic aspect of this weapon was the suicide of the kamikaze pilot, for no escape was possible.

In Italy, despite the early experimental work of army Gen. G. A. Crocco, virtually no rocket weapons were developed during the war. There was some work on antitank rockets and rocket-accelerated bombs, but no accomplishments of note are recorded. Likewise in France, no rocket ordnance of operational importance appeared. Esnault-Pelterie, however, supervised development of a liquid oxygen-gasoline motor with a thrust of 660 lb. Little is known of this work since it ceased when the Germans marched into Paris in 1940.

IV. POST-WORLD WAR II DEVELOPMENTS

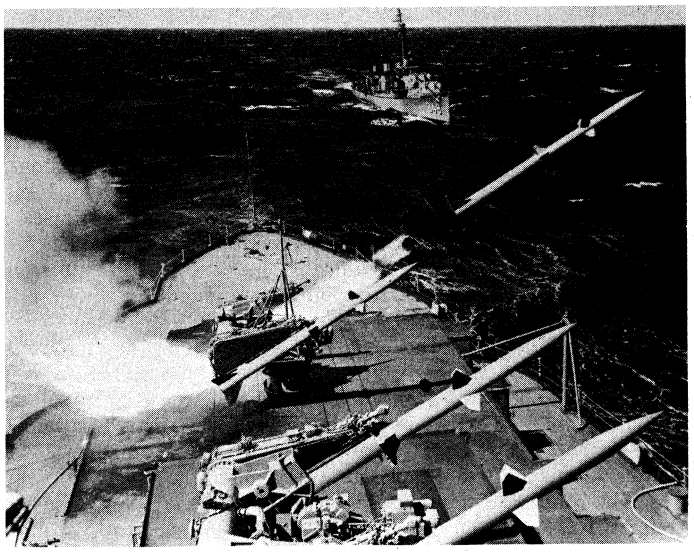
When World War II came to a close in Aug. 1945, development and production of rockets was a massive enterprise in the United States and Great Britain. Despite a few ingenious uses of rocket power, however, the major effort was conservative and on conventional lines, adapting technical improvements to existing weapons. Nowhere was there the depth of appreciation and scope of plans for guided missiles or long-range ballistic rockets that there was in Germany. Recognition of the potential of rocket power by the Allied powers came too late in the war to catch up with German developments in rocket technology. And, anyway, the war was being won without dependence on these concepts.

Appreciation of the potential importance of German technical efforts was evidenced by the speed with which technical intelligence teams followed close behind front-line troops as they moved across Germany. Intensive and intelligent work on the part of these teams resulted not only in obtaining masses of technical data, design drawings and missiles, but also an opportunity for interrogation of key scientists and missile engineers. The top planning and technical staff of Peenemunde, headed by Maj. Gen. Walter Dornberger and Wernher von Braun, fled south in the last few days of the war in order to surrender to U.S. troops. Thus the priceless experience of the German rocket effort and the knowledge of about 150 rocket experts became available to the Allies. The Russian troops which captured Peenemunde found mostly wreckage and had orders to destroy what was left. However, the Russians took many German technicians to the U.S.S.R. and the exchange of technical and scientific data continued until a few years later. Thus the U.S.. France, Great Britain and the U.S.S.R. all had the benefit of information on guided missiles captured in Germany.

In general, early postwar development of rockets followed most of the lines suggested by German work with two important additions: rockets for scientific study of the upper atmosphere and to power supersonic research aircraft. Rockets were used to propel all varieties of guided missiles, competing successfully in these missions with air-breathing jet engines. Refinement of all components of these systems and improved technology based upon extensive research programs have resulted in rocket-powered weapons of immense capabilities.

1. United States. — Not only did the U.S. obtain the services of top German rocket experts but also, from the underground V-2 factory at Niedersachswerfen, 300 boxcar loads of components of V-2 missiles — enough for about 100 complete vehicles. About 70 V-2's were fired during the period 1946–51 at White Sands (N.M.) proving ground. These firings provided much experience in handling and launching large rockets. Important data were obtained in upper atmosphere research conducted by the Naval Research laboratory. Such research rockets are known as sounding rockets. The ability of the V-2 to carry a ton of research instruments to about 100 mi. eclipsed the capability of the WAC Corporal research rocket, whose payload capacity was 25 lb. to about 40 mi. One series of interesting tests in the V-2 program at White Sands was the Bumper-WAC program in which the WAC Corporal was mounted as a second stage on the V-2. An altitude of 250 mi. was achieved with this combination in Feb. 1949.

In anticipation of the end of supply of V-2 rockets, a program was undertaken by the office of naval research for a high-altitude rocket designed specifically for research. This rocket was the single-stage Viking. As with the V-2, liquid oxygen and alcohol were used as propellants. Because of the need to achieve maximum results on minimum budgets, development was slow. Improvements were made in nearly all the 14 Vikings fired, to correct deficiencies uncovered in previous launchings.



BY COURTESY OF U.S. NAVY

FIG. 2. — TESTING THE U.S. NAVY TERRIER

A ship-launched guided missile, powered by solid-propellant rocket booster and sustainer motors, it can intercept aircraft at a 20-mi. range and 60,000-ft. altitude

TABLE I.——Solid-Propellant Research Rockets (U.S.)

Rocket	No. of stages	Payload (lb.)	Altitude (mi.)
Arcas	1	12	40
Nike-Cajun	2	20	100
Arcon	1	40	70
Iris	2	100	200
Terrapin	2	8	80
Rockoon (balloon-Deacon)	1	20–30	50–70
Rockaire (aircraft-Deacon)	1	40	40
Farside (balloon-clusteredrocketsj	4	10	4,000
Asp	1	25	40
Aerobee	1–3	40–250	75–250
Hasp	1	6	20
Deacon	1	30	20
Dan (Deacon-Nike)	2	30	60
Exos	3	40	300
Scout	4	50	8,000

More than half of the Vikings carried research instruments to peak altitudes greater than 100 mi. in the period 1949–57. The highest flight took a payload of 825 lb. to 158 mi. in 1954. The story of the Viking program is related in *The* ***Viking*** Rocket Story (1955) by the project director. Milton W. Rosen.

Another important liquid-propellant research rocket was the Aerobee series initiated by the navy bureau of ordnance. About half the size of the Viking, the Aerobee could carry a 150-lb. payload to about 70 mi. altitude, or larger payloads to lesser heights. Like the WAC Corporal, the Aerobee used red fuming acid and aniline-furfuryl alcohol mixtures as propellants. A solid-propellant booster rocket was used in launching. A later version of this rocket, known as Aerobee-Hi, carried a 65-lb. payload to an altitude of 260 mi. in 1958.

A wide variety of smaller solid-propellant rockets were developed for research purposes. The development of miniaturized instruments greatly extended the usefulness of such small rockets, and resulted in greater ease of launching and reduction in cost of each firing. The development of large plastic balloons to carry rockets to high altitudes before launching is another technique for improving performance of research rockets. Aircraft, too, have been used to launch rockets with the resulting benefit of altitude and initial velocity of several hundred miles per hour. (See Table I.)

Sounding rockets have been used to obtain a great wealth of data about the upper atmosphere. Measurements have been made of wind velocity, and pressure, temperature and density of the upper atmosphere. The composition of the atmosphere at high altitudes, its molecular and atomic structure have been examined. The earth's magnetic field and the ionosphere—the layer of electrified particles which reflect radio waves back to the earth—have been measured. Other observations have included the aurora and cosmic rays, and X-ray and ultraviolet portions of spectra from the sun and the stars. Photographs of cloud patterns above the earth's surface from altitudes above 100 mi. give indications of weather movement of importance to meteorology. The impact and erosion effects of micrometeorites have been measured. The significance of such studies is that the sounding rocket is a scientific research tool enabling measurements to be made which heretofore have not been possible. From such raw scientific data come new theories and understanding of man and his environment.

The concept of a rocket-powered airplane for high-speed research studies originated in the U.S. at the time the Germans were developing their Me-163 rocket-powered interceptor. After the war this work continued under air force sponsorship in co-operation with the National Advisory Committee for Aeronautics (NACA). The 6.000 lb. liquid oxygen-alcohol rocket engine was a navy bureau of aeronautics development. This engine consisted of four 1,500-1b.-thrust combustion chambers which could be fired independently or in combination.

Initial flights of the Bell Aircraft Corp. airplane, the X-1, were made in 1946. Because of the rapid rate of burning of the rocket propellants—almost one ton per minute, with all four motors—powered flight lasted only a few minutes. All landings were without power, gliding down to the desert floor at Edwards air force base, Calif. For the same reason, the X-1 was carried aloft and launched from a specially modified B-29 bomber. Supersonic speed was achieved for the first time in 1947. In 1948 a new altitude record was set at 70,140 ft.

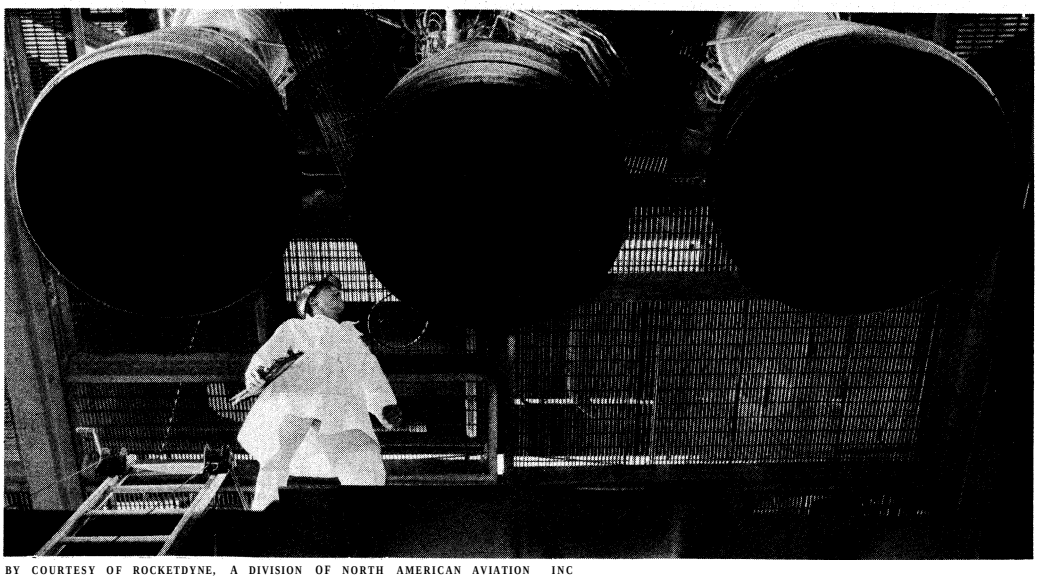
Another version of this airplane, the X-1A, used a turbopump propellant supply system instead of the heavier, nitrogen pressure feed method. The X-1A reached a speed of 1,650 m.p.h. at 90,000 ft. in 1953. Meanwhile the navy in co-operation with NACA had developed another rocket research airplane built by Douglas Aircraft Co.. Inc. Known as the D-558 this airplane, which also carried a turbojet engine, was first to fly at Mach 2 (twice the speed of sound).

The Bell X-2 was a rocket-powered research aircraft designed for even higher speeds. The rocket engine developed 12,000-lb. thrust—twice as much as the X-1. Mach 3.3 (2,200 m.p.h.) and 126,000 ft. altitude records were made in the X-2.

In 1958 another rocket research airplane. the X-15, was revealed to the public. Built by North American Aviation. Inc., the X-15 was powered by a rocket engine estimated at 50,000-lb. thrust. It was designed to be launched at 40.000 ft. from a B-52 bomber and to reach altitudes of more than 100 mi. Flight speeds greater than 3,000 m.p.h. (Mach 6–7) were attained in 1961.

The long-range ballistic missile was not a major development in the U.S. until 1954. Until that time air-breathing subsonic missile developments such as the Snark and Navaho were counted upon by military planners to supplement and supersede long-range strategic bomber aircraft.

In 1954 two developments put the intercontinental ballistic missile (ICBM) in a new light. One of these developments was the thermonuclear bomb with destructive power measured in megatons (millions of pounds of TNT equivalent). The other was the miniaturization and refinement of inertial guidance systems which were sufficiently accurate to place the warhead of the ICBM close



BY COURTESY OF ROCKETDYNE, A DIVISION OF NORTH AMERICAN AVIATION INC

FIG 3 — POWER PLANT OF THE ATLAS ICBM

The outer booster engines each deliver 165,000-lb. thrust and later drop off; the centre engine produces 60,000-lb. thrust and continues to power the rocket. The diameter of the nozzle exit of the sustainer engine is nearly as great as the larger-thrust booster engines, providing high efficiency at low atmospheric pressure of high altitudes

TABLE II.—*Significant U.S. Guided Missiles Using Rocket Propulsion*

Name	Cognizant service	Propellant	Remarks
Air-to-air category			
Falcon	Air force	Solid	Operational, homing capability
Genie	Air force	Solid	Operational, nuclear warhead
Sidewinder	Navy	Solid	Operational, infrared homing
Sparrow	Navy	Solid	Operational, radar homing
Air-to-surface category			
Bullpup	Navy	Solid	Operational, command guidance, Bulldog is later version
Antisubmarine category			
Asroc	Navy	Solid	Launched from surface ships, Asroc is a rocket-propelled acoustic homing torpedo
Weapon Alfa	Navy	Solid	Operational, ship-launched
Subroc	Navy	Solid	Submarine-launched, nuclear warhead, also for surface targets
Surface-to-air category			
Hawk	Army	Solid	Complements Nike, for low-flying aircraft
Nike-Hercules	Army	Solid booster and sustainer	Operational, replacement for similar, lower performance Nike-Ajax
Nike-Zeus	Army	Solid	Antimissile defense
Tartar	Navy	Solid	Ship-launched, lighter, smaller weapon than Terrier
Terrier	Navy	Solid	Operational, ship-launched
Surface-to-surface category			
Atlas	Air force	Liquid	ICBM (5,500 nautical miles), 1%-stage, take-off thrust 360,000 lb.
Corporal	Army	Liquid	Operational, deployed in Europe, 75–100-mi. range, 20,000-lb. thrust, acid-aniline engine
Jupiter	Army	Liquid	IRBM (1,500 nautical miles), 150,000-lh. thrust, liquid oxygen-hydrocarbon fuel engine
Lacrosse	Army	Solid	Close tactical support use, as against pillboxes
Minuteman	Air force	Solid	ICBM
Pershing	Army	Solid	Replacement for lesser range, liquid-propelled Redstone
Polaris	Navy	Solid	Launched from nuclear submarine; 2-stage
Redstone	Army	Liquid	200-mi. range, 75,000-lb. thrust, liquid oxygen-alcohol engine
Sergeant	Army	Solid	100–200-mi. range (depending on warhead), 50,000-lb. thrust, replacement for Corporal
Thor	Air force	Liquid	IRBM, 150,000-lb. thrust, liquid oxygen-hydrocarbon fuel engine
Titan	Air force	Liquid	ICBM, 2-stage, 2–190,000-lh. thrust engines first stage, 1–60,000-lb.thrust (sea-level rating) second stage, liquid oxygen-hydrocarbon fuel

to a target 5,000 or more miles around the world.

The first ICBM authorized was the Atlas, followed later by the Titan. The Atlas, built by the Astronautics division of General Dynamics Corp., was a 1%-stage vehicle. Whereas a two-stage vehicle drops both first-stage rocket engine and tankage, the 1½-stage vehicle drops only the rocket engine and the second stage continues to use the original tankage. The first Atlas was fired full range from Cape Canaveral, Fla., missile range in Nov. 1958.

The Titan, built by the Martin Co., was a conventional two-stage vehicle. The first successful tests of the Titan were not made until 1959. Both the Atlas and Titan burned liquid oxygen and hydrocarbon fuel (similar to kerosene).

A major logistic problem in ballistic missiles using cryogenic propellants, such as liquid oxygen, is the necessity for fueling just prior to launching. This weakness, which means delay in retaliatory fire, could be eliminated by the use of solid propellants. Development of solid propellants to near-competitive performance with liquids reached a point by 1958 that a solid-fueled ICBM, the Minuteman, was authorized. This ICBM would be launched from underground "silos" in so-called "hard" launching sites, relatively impervious to attack.

Three intermediate range ballistic missiles (IRBM) capable of 1,500-nautical-mile range were in production in the late 1950s in the United States. The air force Thor and the army Jupiter used the same liquid propellants as the Atlas and Titan. The navy solid-fueled Polaris missile was designed to be launched from submarines, either surfaced or submerged.

By 1961 the U.S. had, in all categories, more than 40 operational missiles, most of them rocket, powered. Of those which utilized other means of jet propulsion, such as the Matador or Snark, most were launched by solid-propellant booster rockets. Nearly all aircraft firms were engaged in missile development and production. Rocket-engine manufacturers had grown from small wartime beginnings to major industries. The largest liquid-propellant rocket engines developed more than 150,000-lb. thrust. Three of these motors were clustered in a 360.000-lb. thrust launching booster developed for the Navaho. before the cancellation of this missile. Solid-propellant motors producing 405,000-lb. thrust had been successfully fired.

Two developments were under way to obtain rocket boosters of 1,000,000- to 1,500,000-lb. thrust. One of these was a clustered rocket engine of eight units. The other was a single-chamber motor. Both of these large units were under development for space flight applications. A 1,-000,000-lb. thrust booster fitted with one or more appropriate upper stages has the potential capability of placing 20.000 lb. in low satellite orbit or sending about 5,000 lb. to nearby planets.

Significant Rocket Vehicles.—So many different rocket-powered vehicles are operational or under development that space does not permit more than a few details of the better known missiles. See Table II.

Unguided Rockets.—By 1960 the U.S. army had two unguided artillery rockets in field use. The Honest John carried a 1,500-lb. warhead to a range of about 15 mi. A smaller version, Little John, was more mobile but had less capability. Both were single-stage, solid-propellant rockets.

The U.S. navy 5-in. World War II air-to-surface rocket, known as Holy Moses, was produced extensively until 1955. It was replaced by a lighter-weight version known as Zuni. As many as 48 Zunis could be carried by a single carrier-based aircraft.

Other military uses of rockets include boosters for long-range, cruise-type, turbojet-powered missiles such as Matador. Mace, Regulus and Snark. Ram-jet-powered surface-to-air missiles, such as Bomarc and Talos, also require booster rockets. The Bomarc has a liquid-propellant booster, the Talos, solid propellant.

Various combinations of solid-propellant rockets have been used as test vehicles in research programs. One, the HTV (hypersonic test vehicle), utilizes clusters in two stages (seven and four) and

TABLE III.—*U.S. Satellite and Space-Probe Launching Vehicles*

Name	Cognizant organization	Propellant	Remarks
Atlas-Agena B	NASA	Liquid	Similar to Thor-Agena B but employs Atlas ICBM booster; capable of orbiting 5,000 lb. at 300 nautical miles or 750 lb. to escape velocity
Centaur	NASA	Liquid	Based upon Atlas ICBM; upper stage powered by 2-15,000-lb. thrust liquid hydrogen-oxygen engines; capable of orbiting 8,500-lb. payload at 300 nautical miles or 1,300 lb. to escape velocity
Delta	NASA	Liquid-solid	Three stages based upon Thor ICBM: second stage liquid, third stage solid; capable of orbiting 500 lb. at 300 nautical miles. 60-lb. payload to escape velocity
Saturn	NASA	Liquid	Two versions under development. Saturn C-I employs cluster of 8 improved Atlas engines in S-I first stage and a cluster of 6 Centaur liquid hydrogen-oxygen engines in S-IV second stage, capable of orbiting 15,000 - 20,000 lb. at 300 nautical miles. Advanced Saturn employs cluster of 5-1,500,000-lb. thrust, liquid oxygen-keroseoeenginesin S–IC first stage, plus S-II and S-IVB upper stages using 5- and 1-200 000-lb thrust, liquid hydrogen-oxygen engines, respectively.
Scout	NASA	Solid	Capable of orbiting 150 lh. at 300 nautical miles; 50 lb. payload to 8,000 mi. as sounding rocket
Thor-Agena B	NASA	Liquid	Two stages, based upon Thor IRBM; Agena B engine develops 15,000 lb. thrust using inhibited red fuminng itric acid (IRFNA) and unsymmetrical dimethyl hydrazine (UDMH); capable of orbiting 1,600 lb. at 300 nautical miles.

carries a small payload to Mach 10. A larger test vehicle, the X-17, is a three-stage vehicle for ballistic missile re-entry research. Two stages are fired to reach altitude and the third stage fires on the way down. Velocities greater than Mach 15 are achieved in this manner. Another use of rocket propulsion by the military is for target drones.

2. U.S.S.R.—As noted above, after World War II hundreds of German rocket engineers and scientists were taken to Russia. Although the senior members of the Peenemunde staff went to the United States, a considerable body of rocket knowledge and experience became available to the U.S S.R. By 1955 most of these men and their families had returned to Germany. Their apparent use was to pass along their knowledge to native Russian engineers and scientists whose programs were kept completely secret and separate. It is known that V-2's were produced in the U.S.S.R. with modifications and improved performance.

The Soviet Union evidently placed major effort on two categories. surface-to-air missiles for defense against aircraft and long-range ballistic missiles. The first proof of the successful development of reliable large-thrust rocket engines was the launching of the first earth satellite sputnik 1, on Oct. 4, 1957. Subsequent launchings of sputniks 2 (Nov. 3, 1957) and 3 (May 15. 1958) and the planetoid Mechta (1959) proved conclusively that the U.S S R. had ICBM launching capability. Take-off thrust of the launching vehicles was estimated in the 600,000- to 800,000-lb. range; propellants used were reported to be liquid oxygen and hydrocarbon fuel. similar to the large U.S. engines but possibly using a propellant additive.

Russian rockets were publicly shown for the first time in the Revolution anniversary parade in Nov. 1957. One was a two-stage surface-to-air missile, somewhat smaller than the Nike-Ajax. Four others were ballistic missiles of different sizes. One of these four weapons had an estimated range of perhaps 500 mi. The other three appeared to match roughly the capabilities of the U.S. army missiles, Corporal, Honest John and Little John. The largest missile was referred to generally as T-1 or M-101. This medium-range ballistic missile (MRBM) of a reported 600–800 mi. range was apparently an outgrowth of the German V-2. The take-off thrust was estimated at about 75,000 1b.—the same performance rating as the U.S. Redstone engine.

Little was known about the Russian IRBM (T-2) and ICBM (T-3). It was reported that the T-2 rocket engine had a take-off thrust rating of 220,000 lb., operated at high chamber pressure (900 p.s.i.) and burned liquid oxygen and hydrocarbon fuel. The T-3 ICBM was reported to be a three-stage missile with a take-off thrust of more than 600,000 lb.

In general, it was conceded that the U.S.S.R. took greater advantage of the heritage of German World War II rocket development than did its allies. It was reported, for example, that the German Wasserfall, supersonic, surface-to-air missile was put into production shortly after the war and was defending major cities by 1952.

In the field of sounding rockets the U.S.S.R. developed a number of vehicles. One of these was the POL II, capable of lifting a 100-lb. payload to 100 mi. Space medical research was conducted with dogs in such rockets. Recovery was effected by drag flaps followed by deployment of parachute.

3. Great Britain.— Immediately after the war, Great Britain test fired two German V-2 rockets at Cuxhaven, utilizing German crews. The handling and launching operations were documented in film and technical reports. But postwar Britain proceeded at a slow rate in rocket development.

In the surface-to-air category the ram-jet-powered Bloodhound was the first missile to become operational. Four solid-propellant boosters were used to launch the missile to speeds abeve the minimum for ram-jet operation. The Bloodhound was in use by both the British army and air force. The Thunderbird was the standard army antiaircraft missile. Four equally spaced, solid-propellant boosters were used for launching; the sustainer motor was also of the solid propellant type. A similar weapon was the British navy Seaslug. Although differing in external configuration, the Seaslug also used four wrap-around solid-propellant boosters and sustainer motors. Test versions of both the Thunderbird and Seaslug utilized liquid-propellant motors.

In the air-to-air category, the Fireflash was the first British guided missile development to be publicly revealed, in 1953. Four wrap-around solid-propellant boosters accelerate the centre vehicle, known as a dart, toward the target. The dart had no sustainer motor. The Firestreak was a single-stage, solid-propellant rocket-powered missile in operational use in the Royal Air Force and Navy. Twice as heavy as the U.S. Sidewinder, the Firestreak similarly used infrared heat homing on target.

In the ballistic missile field, a number of British squadrons utilized the U.S. Thor IRBM. In the meantime, the Blue Streak was under development as a 2,800 nautical-mile range weapon. This distance resulted in another missile designation, the long-range ballistic missile (LRBM). The Blue Streak utilized the 150,000-lb. thrust liquid-propellant engine of the U.S. Thor and Jupiter. Although the development program was successful, the far greater rate of development of ballistic missiles in the United States caused cancellation of the Blue Streak. The Black Knight was the re-entry research vehicle used for Blue Streak development. The power plant of the Black Knight was four liquid-propellant, hydrogen peroxide-kerosene, motors of 5,000-lb. thrust each. The possible use of the combination of these two vehicles for orbiting a 2,000-lb. satellite was suggested.

The Blue Steel was an air-to-surface missile which used two hydrogen peroxide-kerosene rocket motors developing a total thrust of 16,500 lb. A range of at least 400 mi. was anticipated. Two rocket-powered antitank missiles under development were the V. 891 and the Pye P.V. Another larger. but similar, command guided missile was the Malkara developed by the Australian commonwealth. The British used the missile range at Woomera, Austr., for major test purposes.

Hydrogen peroxide jato units and liquid-propellant rocket engines for interceptor aircraft have been successfully produced in Great Britain. A most significant development was the 8,000-lb. variable thrust peroxide-kerosene aircraft motor, Spectre, under the direction of A. V. Cleaver at De Havilland Aircraft Co. Ltd.

The best-known British research rocket was the Skylark. Powered by a solid-propellant, 11,500-lb. thrust motor, it was designed to carry a 100–150 lb. payload to 95 mi. altitude. The Skylark was used during the International Geophysical year, 1957–58, to measure high altitude pressures, temperatures, winds and ionospheric electron densities.

Elsewhere in the British commonwealth, Canada has developed a rocket-powered air-to-air missile, Velvet Glove, reported to use solid propellant. In 1959 Canada announced that a solid-propellant sounding rocket capable of carrying a 100-lb. payload to 100 mi, altitude had been developed.

4. France.— After the war France obtained the services of a small number of German rocket engineers and scientists. Several dozen designs of various type missiles are known to have been studied but few emerged for operational use. No rocket-powered surface-to-surface missiles are known other than small, wire-guided antitank weapons, S.S. 10 and an improved version, S.S. 11. The S.S. 10 has been purchased by armed forces of the U.S., Israel, Sweden and west Germany.

Surface-to-air rocket-powered missiles were the Parca and the R. 422. Two air force air-to-air missiles were the M. 510 (two stage solid propellant, optical homing) and the AA. 20 (also known as the 5103). Two sounding rockets, Veronique and Monique, have been developed. The Veronique was a single-stage liquid-propellant (acid oxidizer) rocket engine, developing 8,250-lb. thrust at take off. Research payload capability was 130 lb to 84 mi. The Monique was a smaller solid-propellant rocket, early versions of which were capable of carrying a 33-lb. payload to 25 mi.

Other French rocket developments worthy of mention include liquid-propellant (nitric acid-furaline) engines for aircraft. The Trident fighter was powered by two 6,615-lb. thrust rocket engines. Other fighter and interceptor aircraft (Durandal and Mirage 111-A) carried liquid-propellant engines for burst speed in addition to turbojet power plants.

5. Other Countries.— In Switzerland, rocket development cen-

tred around Zurich. There the Contraves A. G. and the Armament division of Oerlikon Machine and Tool works evolved a rocket-powered, single-stage surface-to-air missile. The 2,200-lb. thrust rocket engine used nitric acid and kerosene propellants. Development of this supersonic (Mach 2.4) weapon was a private venture. Extensive trial firings were carried out in Switzerland and France as early as 1950–51. In 1952, the U.S. evaluated 25 of an early model, known as Type 51. Range of the 1958 model, RSD-58, was about 19 mi. to altitudes over 65,000 ft. A training version was delivered to the Italian air force and Japanese defense agency. Other Contraves-Oerlikon rocket developments included excellent 5 cm. and 8 cm. aircraft rockets.

Postwar Germany produced a wire-controlled antitank rocket carrying a shaped charge warhead. With a range of over ½ mi the Cobra weighed only 20 lb. Under Eugen Sanger theoretical studies of photon rocket propulsion and practical development of steam rocket propulsion for jato were conducted.

In Sweden a number of smaller rocket-powered weapons were known to have been developed but almost no information has been released. One surface-to-air design. with tandem solid-propellant booster, had a liquid-propellant sustainer rocket motor. The Robot 321A was the designation of a ground-launched test vehicle used in the development of an air-to-air missile. SAAB and Bofors were the major firms engaged in this work.

Italy had a number of small-scale rocket developments under way since the war. An Italian subsidiary of Contraves produced Swiss design Oerlikon rockets. The Contraves C. 7 was an air-to-air rocket with infrared homing.

In Spain, Hispano Suiza produced a multipurpose 3.15-in. solid-propellant rocket. With air-to-air, surface-to-air and air-to-surface application, it carried a 2.2-lb. warhead.

Japan carried out an intensive small-scale sounding rocket development program utilizing solid propellants. This work conducted at the University of Tokyo under Hideo Itokawa, produced a number of two-staged research rockets designed to carry a 15-lb. payload to 80 mi. Air-to-air missiles. MM-1 and TMA-1, had solid-propellant rocket motors developed by Fuji Precision industries.

Minor efforts in rocket development were known to exist in Argentina (A-3F antitank missile) and Norway.

V. FUNDAMENTAL PRINCIPLES OF ROCKET PROPULSION

Jet propulsion—of which the rocket is one type—is based upon reaction of a body to the rearward thrust of a jet of gas. The physical principle involved was set forth in Sir Isaac Newton's *Principia Mathematica* published in 1687. In this work are stated three laws of motion. The third law states. in its simplest form, that for every action there is an equal and opposite reaction.

A simple example of reaction propulsion is the brief flight of a toy balloon after it has been filled with air and released. The forward motion of the balloon results from the rearward expulsion of air from the balloon. The thrust does not result, as sometimes erroneously presumed, from the jet pushing against the surrounding air. The force imparted by the jet is equivalent to the product of the mass flow of the air and the velocity of the jet. In the case of a chemical propellant rocket, the jet is composed of the gaseous combustion products of the propellant mixture which is burned inside a thrust chamber and ejected at supersonic velocity through a nozzle. The gas velocity in a properly designed converging-diverging nozzle is sonic at the throat (most narrow) portion of the nozzle and becomes supersonic as it travels through the diverging (exhaust) end of the nozzle.

In mathematical terms, the propulsive force derives from the momentum of the gas and is expressed as

$$F = \frac{\dot{W}}{g} \times V_e \qquad (1)$$

where F represents thrust in pounds, $\dot{W}$ the propellant flow rate, in pounds per second, g the acceleration of gravity in feet per second per second and V_e the nozzle exhaust velocity in feet per second. More precisely, another term must be added to the expression

$$F = \frac{\dot{W}}{g} \times V_e + (P_e - P_o) A, \qquad (2)$$

where P_e is the exit pressure, P_o ambient pressure and A, the nozzle exit area. Since P_o would be equal to zero in a perfect vacuum, it may be seen that rocket engine performance increases with altitude. Thrust ratings of upper-stage rocket engines are often given both at sea level and at operating altitudes; the latter rating is always higher. Effective exhaust velocity c may be expressed

$$c = \frac{Fg}{\dot{W}} = v_e + \frac{P_e - P_o}{W} A_e g \qquad (3)$$

Inspection of equation (1) shows that thrust can be increased by increasing the jet velocity and/or the mass flow of propellant gases. Jet velocity is related to the heat of combustion of the particular propellants burned. This is expressed

$$V_e = \sqrt{2g J \Delta H} \qquad (4)$$

in which J is Joule's mechanical equivalent of heat (778 ft. lb. per B.T.U.) and ΔH is the thermochemical energy of the propellant in B.T.U. per pound.

Limitations on mass flow of propellant gases arise from such design considerations as maximum temperatures and pressures feasible within permissible engine weights.

Since the kinetic energy in a rocket jet is derived from conversion of the chemical energy of combustion to directed kinetic energy, high thermochemical energy per unit weight of propellant is desired. In practice, the kinetic energy of the rocket exhaust jet may be only 40% to 70% of the theoretical heat energy from combustion of the propellant. Minor losses arise from incomplete combustion and heat lost to the thrust chamber walls. Larger efficiency losses come from unavailable thermal energy which leaves the exhaust nozzle as residual enthalpy.

An important rocket term is specific impulse, I_{sp}, which is the thrust per pound per second of propellant burned

$$I_{sp} = \frac{F}{\dot{W}} \quad \frac{\text{lb.}}{\text{lb./sec.}} \qquad (5)$$

Since the pound units cancel out, I_{sp} is given in units of seconds. Specific impulse is related to the energy content of combustion in the following general equation

$$I_{sp} = \sqrt{\frac{2J}{g}(h_c - h_e)} \qquad (6)$$

where h_c is the enthalpy of combustion products before expansion (B.T.U. per pound), h_e is the enthalpy of combustion products after expansion (expansion at constant entropy and chemical equilibrium maintained). Calculations performed with equation (6) are called shifting equilibrium calculations.

A more convenient expression, generally accurate to within a few per cent, assumes that specific heat of the gas is constant and utilizes ideal gas relationships; *i.e.*, frozen composition calculation

$$I_{sp} = \sqrt{\frac{2R}{g} \cdot \frac{k}{k-1} \cdot \frac{T_c}{M} \left[1 - \left(\frac{P_e}{P_c}\right)^{\frac{k-1}{k}}\right]} \qquad (7)$$

where R is the universal gas constant (foot-pounds per °R. per mole). k is the ratio of specific heats C_p/C_v, T, is the combustion chamber temperature (°R.). M is the average molecular weight of the combustion products (pounds per mole). P_e is the pressure of the gas at the exit plane of the nozzle (pounds per square inch absolute), P, is the combustion chamber pressure. This relationship is for a fully expanded exhaust nozzle; *i.e.*, P_e = ambient pressure. From inspection of equation (7) it may be seen that specific impulse is increased by increased chamber pressure and combustion chamber temperature and lowering of molecular weight of exhaust gases.

As a rocket-powered vehicle moves, the weight (mass) of the vehicle continuously decreases as the propellant is consumed and

disappears to the rear as exhaust jet. The velocity of a rocket vehicle may be calculated approximately

$$V = c \log, \frac{M_i}{M_f} \quad (8)$$

where c is effective exhaust velocity, M_i is initial mass and M_f is final mass, after all propellants have been burned. The expression M_i/M_f is known as the mass ratio. The true velocity will be somewhat less in practice due to air drag and energy lost in overcoming gravity. In the design of efficient long-range rockets every effort is made to reduce structural weight to a minimum and increase to a maximum the percentage weight of propellant. In the case of the V-2, 69% of the take-off weight was propellants. Take-off acceleration may vary from several g's to a few tenths of a g in large rockets taking off vertically.

The final velocity of a rocket-powered vehicle can be increased, theoretically, to any desired value by the technique of staging; *i.e.*, setting a series of rockets, one on top of the other, and firing them successively. Thus each successive stage is smaller and commences firing at a higher initial velocity. In practice, however, the complications of duplicating mechanical items. cost and reduction in reliability set a practical limit to the number of stages that are employed. An example of the benefit of staging may be obtained from the Bumper-WAC program conducted in the U.S. in 1948–50. A WAC Corporal rocket, placed on top of the V-2, was fired after burnout of the V-2. Whereas a V-2 alone achieves a maximum altitude of about 100 mi. and a maximum velocity of 3,500 m.p.h., the Bumper-WAC sent the WAC Corporal to a velocity of 5,000 m.p.h. and a peak altitude of 250 mi. Although 1,500-mi. intermediate-range ballistic missiles (IRBM) can achieve the necessary velocity to reach these distances with one stage (Jupiter. Thor), ICBM's are multistaged. Likewise, satellite launching vehicles, that must reach speeds of at least 18,000 m.p.h. are multistaged (Jupiter-C, Vanguard j. For lunar and interplanetary flights a minimum escape velocity of 25,000 m.p.h. must be achieved.

The efficiency of a rocket-propelled vehicle increases from zero at rest to a maximum when the velocity of the jet is reached. Thus rocket systems are inefficient at low speeds.

VI. ROCKET MOTORS, ENGINES AND POWER PLANTS

A rocket motor or thrust chamber assembly is composed of a combustion chamber and nozzle. The injector head is considered a part also in the case of a liquid-propellant motor. The term rocket engine (liquid propellant only) refers to the motor plus associated turbopump assembly nith gas generator, propellant lines. valves, regulators. mounting lugs, igniter. etc. A rocket power plant refers to the complete propulsion system including propellant tankage, gimbal mounting (or jetevators. vanes, etc), tankage-level sensing devices and associated computers. etc.

The best known rocket motors burn chemical propellants, either solid or liquid. Combustion of the propellants provides the hot gas which is exhausted in a jet through a nozzle to the rear Other types of rocket motors employ hybrid systems (liquid propellant burned in a solid-propellant core) and air-turborockets which utilize some ram air for part of the combustion process. Two nonchemical types of rocket propulsion systems are nuclear and electrical. These systems have received serious attention only since World War II and have particular application for space flight missions.

1. Solid-Propellant Rocket Motors.—The outstanding feature of solid-propellant motors is their relative simplicity in design All of the propellant is contained in the combustion (or thrust) chamber, usually cylindrical. to which is attached an exhaust nozzle. An electrical or pyrotechnic igniter fires the propellant charge.

Major advantages of solid rockets result from their condition of readiness and their reliability which results from simplicity. Disadvantages arise from a somewhat lower specific impulse range **(I,,** of 175–250 sec.) compared to liquid-propellant motors **(I,,** of 230–270 sec.) and performance variation caused by storage temperature.

The design configuration and chemical composition of solid-propellant charges vary widely. The charge (or grain) may burn from one end only, cigarette fashion. Or, the grain may be a hollow cylinder or have a star-shaped, interior burning surface. Important parameters of solid-propellant charge design are surface area and burning rate of particular propellant mixtures.

2. Liquid-Propellant Rocket Motors.—In this class of rocket motors, the liquid combustibles are contained in tanks and fed into the thrust chamber through an injector head by a propellant supply system. Most liquid-propellant rockets use two combustibles (bipropellant system) such as liquid oxygen and kerosene. Monopropellant systems which depend upon exothermic decomposition of a substance, such as high-strength (90%–95%) hydrogen peroxide, also exist. Such systems usually have loner performance but are simpler to design.

3. Combustion Chambers.—As in the case of all components of a rocket vehicle, a premium is placed on reduction of weight to the minimum adequate to perform the necessary function reliably. Combustion chambers are usually made of metal for strength and are cylindrical or bell-shaped in configuration. Thrust chambers for solid-propellant rockets are uncooled. Burning time is usually short and the walls of the chamber are not exposed to high temperature combustion if the grain burns outward from an interior core. In the case of liquid motors. the thrust chamber volume is designed to provide sufficient time for mixing and burning of the propellants before passing through the exhaust nozzle. Closely associated with combustion chamber design for liquid motors are cooling techniques and injector design.

4. Cooling Techniques.—The wall of a combustion chamber may be uncooled if the duration of operation of the motor is short. In such a case the metal wall acts as a heat sponge or sink. absorbing heat for a short time. At least one liquid-propellant booster rocket has been designed to operate for a few seconds with uncooled walls. But liquid rockets operate usually for longer periods of time, 15 seconds to 2 or more minutes. To accommodate chamber temperatures of 4,000° to 5,000° F. a number of techniques have evolved. Molded ceramic liners of low thermal conductivity and high melting point have been used; but such materials are

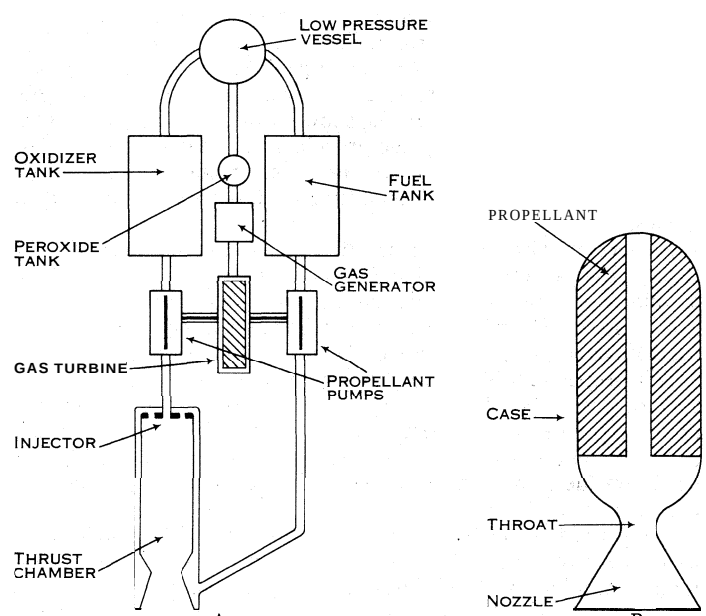


FIG. 4.— (A) LIQUID-PROPELLANT. REGENERATIVELY COOLED. -AND (B) SOLID-PROPELLANT ROCKET MOTORS

Gas pressure from the storage vessel, in a typical liquid-propellant rocket, forces high-strength hydrogen peroxide into the gas generator where a catalyst causes decomposition. Gaseous products (steam and oxygen) drive the turbine wheel which rotates centrifugal propellant pumps. Light gas pressure on propellant tanks prevents cavitation of high-performance pumps. One propellant flows directly to the rocket motor injector head; the other flows through a jacket around the combustion chamber, cooling the motor, and then through the injector. Propellants are sprayed into the combustion chamber where they burn smoothly and uniformly, exhausting in a jet through a supersonic nozzle. The solid propellant contains both the fuel and oxidizer within it. This type burns from the internal axial slot outward to the case, or from the rear toward the front **end**

often subject to cracking from high thermal stresses occurring at start. Another method is film cooling wherein water or a propellant is admitted through holes in the chamber and the liquid flows along the wall and absorbs heat. The most used method is regenerative cooling. In this technique, one of the propellants flows along the outside of the nozzle and thrust chamber wall before it is injected into the motor. The heat which the propellant thus absorbs is not lost but is added to the heat of combustion in the thrust chamber. Design of the cooling flow passages is critical since it is necessary to prevent boiling of the propellant and yet obtain a light weight structure and low pressure drop. A high pressure drop results in greater design weight and higher pressure flow systems. Because the heat transfer rates to the walls are greatest in the narrow neck of the nozzle, the coolant flow rate is usually highest at this point.

5. Design Criteria. — In the design of combustion chambers for liquid rockets the following parameters are significant: thrust, pressure and temperature of combustion gases, average molecular weight and ratio of specific heats of products of reacting propellants, velocity of flow of propellants (stay time), rates of chamber length to diameter (aspect ratio), nozzle entrance half angle, duration of continuous operation and chemical characteristics of propellants.

In the design of exhaust nozzles the combustion gases are expanded nearly isentropically to ambient pressure. In the case of a sounding or ballistic rocket the ambient pressure decreases with altitude. For high altitude or operation in the vacuum of space the diameter of the nozzle exit becomes very large and the construction weight prohibitively high. Thus nozzle design is usually subject to compromise and certain reductions in efficiency (nozzle losses) are accepted.

The function of the injector head is to meter the propellants at a predetermined rate and mixture-ratio and to atomize and combine the mixture within the combustion chamber so that burning takes place smoothly and completely. The pressure drop across the injector must not be too great or an excessive burden is placed upon the propellant supply system and the weight of construction increased unnecessarily. Good injector design reduces to a minimum the volume and length of a combustion chamber. A number of types of injector design have evolved. In the impinging spray type. propellant streams in pairs or clusters are injected to intersect at high velocity so that they break up into small droplets, evaporate and burn. In the showerhead type, a series of concentric rows of holes spray the propellant into the chamber. The rows of sprays may or may not impinge. Sometimes concentric slots are used to produce intersecting conical sheets of propellant sprays.

A German (Enzian) design utilized a splash plate within the thrust chamber on which liquid-propellant streams played. Good mixing is obtained in this design but hot spots may occur on the splash plate. Premix injectors have been tried wherein mixing is accomplished just prior to injection into the thrust chamber. Since rocket propellants by their nature are high energy substances. this type of design is subject to explosion. Swirl-type sprays are another approach to injection configuration. Shop producibility, critical tolerances and cost are factors which enter into injector head considerations and some compromises in performances are usually accepted.

Often related to injector head dynamics is the phenomenon of oscillatory combustion in the combustion chamber. Often exhibiting audible effects of chugging and screaming, these high-speed pressure differentials can destroy a rocket motor in a few seconds. Because the mixture ratios of different propellants vary widely. a rocket motor is tailored for specific propellants and it is not generally possible to operate an engine efficiently on different propellants than those for which it was designed.

Valves for rocket engines offer design problems from the nature of the propellants and requirements of high reliability and precise operation. Many rocket fights have aborted because of sticking valves. Valves are usually operated by electric solenoids or are pneumatically and/or hydraulically actuated.

Design of tankage for propellants has evolved in recent years to integral systems wherein the thin wall of the tank is the skin of the rocket vehicle itself. In addition to the weight of the propellant, rocket tankage must withstand some gas pressure head for turbopump systems and several hundred pounds pressure for gas pressurized propellant supply systems.

6. Propellant Supply Systems. — The simplest method of forcing liquid propellants into the combustion chamber is by gas pressure. An inert gas is used, such as helium or nitrogen. Because the combustion chamber pressure is usually 300 lb. or more. the pressurizing gas must be higher to overcome frictional losses in propellant lines: valves, thrust chamber cooling jacket and injector head. This high pressure necessitates heavy tanks affecting adversely the mass ratio of the vehicle. Gas pressurization is a simple and reliable system, however. It was used successfully in the U.S. V-1 supersonic research airplane. In this case liquid nitrogen was converted in a heat exchanger to high-pressure gas. For small vehicles helium gas at several thousand pounds pressure may be used with operating pressure being reduced through a regulating valve. Another source of pressurizing gas is the reaction of small quantities of the propellants themselves in a specially designed gas generator or even within the propellant tanks. In turbopump systems a source of high-velocity gas drives a turbine wheel which, in turn, drives centrifugal pumps between the propellant tanks and the rocket motor. High-strength hydrogen peroxide (95%–98%) is commonly decomposed by a catalyst bed within a gas generator. The decomposition products, oxygen and steam, are led through a nozzle and impinge on the turbine blades. The propellant pumps are centrifugal. They may be located on opposite ends of the turbine shaft or, in cases of large pumps, driven by a gear train. A certain pressure head is necessary to prevent cavitation. This is supplied from a lightweight high-pressure storage bottle.

7. Ignition. — Liquid-propellant combinations which ignite spontaneously are called hypergolic. Because ignition rates may be low when propellants such as acid and aniline are sprayed into a cold thrust chamber, a slug of another more highly reactive propellant may be injected initially. If ignition does not take place rapidly, the accumulation of unburned propellants may build up quickly to a point where chamber pressure limitations are exceeded when combustion does occur, resulting in an explosion. In the case of nonhypergolic propellants, such as liquid oxygen and gasoline. a source of flame, hot wire, spark or pyrotechnic (squib) igniter must be provided. The V-2 used a swastika-shaped, pyrotechnic pin wheel mounted on a light frame within the combustion chamber.

8. Ground Testing. — Many tests are required in the development of a rocket motor design. The term static test is used to describe rocket motor operations wherein the motor is bolted to a test stand and fired. Static test stands provide for measurements of thrust, propellant flows and a variety of significant temperatures and pressures. Control is maintained from within a reinforced concrete bunker or blockhouse. The rocket firing is viewed by means of mirrors or periscopes or at a distance through bulletproof glass. Closed-circuit television may also be used in the case of large motors. In liquid motor development. so-called battleship (heavyweight) propellant tankage is employed and gas pressure often used to force the propellants into the thrust chamber. In initial-chamber design tests water cooling provides a large safety factor over regenerative cooling. Flow measurement tests of injector heads and gas generator and turbine pump development usually proceed separately. Eventually all components are married for system tests. When missiles are in final stages of development the entire vehicle is mounted in other test stands and fired. These are known as captive tests. The cost of rocket test facilities, with associated plumbing. tankage, propellant storage and necessary safety provisions of reinforced concrete and large safety distances, is naturally great.

Scaling of successful rocket motor designs is not simple. The requirements for very large thrust engines for space flight operations can be met in two ways — manifolding (or clustering) a number of existing engines or designing one new and larger engine. The first technique is simpler. In the United States, the require-

ment for a rocket engine of over 1,000,000-lb. thrust was approached by both methods. In the one case, eight 150,000-lb. thrust engines were specified to be clustered and at the same time a single-barrel engine of 1,000,000-lb. thrust class was ordered. The time for completion of the second approach was estimated to be three to four times as long but held promise of eventual higher mass ratio advantages.

9. Nuclear Rockets. — The development of reliable nuclear fission reactors has led to the possibility of utilizing nuclear energy as a source of power for rockets. In this case the energy does not derive from the heat of combustion of a chemical reaction but from fission of nuclear particles. Although the amount of energy potentially available is very much greater, the conversion to kinetic energy in a rocket exhaust jet is more complicated. Two nuclear rocket systems were under study and development in the United States in the early 1960s. One was the rather audacious notion, suggested shortly after World War II, of obtaining impulse by a series of small nuclear explosions. In theory, these explosions behind a sturdy structure would propel it upward. The more conventional approach to a nuclear rocket is to use the heat of a fission reactor to heat a working fluid and expel the hot gas through a nozzle. Since the nuclear products are in a closed cycle, no radioactive particles are in the exhaust. The most obvious working fluid would be low-molecular-weight hydrogen. The working fluid or propellant in this system would not be burned but simply heated and ejected. Some of the major problems associated with the design of a nuclear reactor are related to the design of an efficient heat exchange to transfer heat energy from the reactor to the propellant and in cooling the thrust chamber walls. The range of specific impulse (*i.e.*, pounds thrust per pound per second of propellant flow) achievable with nuclear rockets is estimated in the order of 700–1,000 sec. Chemical propellants have a limitation of about 430 sec.

10. Electrical Propulsion Systems. — Whereas chemical-propellant rockets are characterized by high thrust for short durations, a number of electrical systems have been proposed which would yield a low thrust over a long period of time. Specific impulses of such systems range from about 1,000 to 10,000 sec. acd more. Several approaches to electrical thrust systems are under development. All such systems, because of low thrust, must be carried to the altitude of a low earth satellite orbit. From this orbit these devices will operate in pulsed fashion or continuously for weeks, months or even years in the case of distant interplanetary flight. Electric power to operate these thrust devices would be obtained from direct conversion of solar energy (solar batteries) or from nuclear electrical generators, as in a plasma thermocouple. It can be shown that specific impulses of 1,500 to 5,000 sec. are optimum for space missions from low-altitude earth satellite orbit to lunar orbits. In unmanned space journeys, such as placement of communications satellites in the 24-hour, stationary orbit (22,300 mi.), additional flight time (of extra days) is not necessarily important. The advantages of using electrical propulsion of 1,500 to 5,000 sec. are, however, truly significant. Earth take-off weights may be reduced as much as one-half to accomplish the same mission using chemical rocket propulsion throughout. In the particular case of a communications satellite payload, which could utilize the electrical power supply of the propulsion system, earth take-off weight might be reduced to one-third. In other words, an Atlas launching vehicle could accomplish the same task in conjunction with electrical propulsion that would require 1,000,000-lb. thrust booster utilizing chemical propulsion throughout the mission. Among the electrical thrust devices under development is the electrothermal arc jet. This device utilizes an electric arc to heat the propellant, or working fluid, which is expelled through a rocket nozzle to the rear. Another device under development accelerates the plasma, produced by the electric arc, by means of a magnetic field. Still other electric thrust devices operate in a pulsed fashion and utilize magnetohydrodynamics (MHD) to accelerate high-temperature gases as in the MHD shock tube.

Best known of the electrical thrust devices is the ion rocket. In this system electrostatic fields rather than electromagnetic fields are used to accelerate dust particles or positively-charged ions such as metallic cesium. Specific impulse ranges of this device are estimated at 5,000 to 100,000 sec. Of even higher specific impulse is the photon rocket — wholly theoretical — wherein energy is converted to light and expelled as such.

11. Other Systems. — One final low-thrust device for space propulsion is the so-called hydrogen heater in which solar energy is concentrated by hemispherical reflectors onto a heat exchanger, which in turn heats hydrogen to high temperature, whereupon it is accelerated through a rocket nozzle to the rear. Although the above low-thrust propulsion schemes for space missions appear exotic compared to conventional rocket systems, the inherent advantages of these high-specific-impulse propulsion devices make their development not only desirable but likely for interplanetary exploration.

VII. ROCKET PROPELLANTS

Rocket propellants, by the chemical process of combustion. provide the hot gases which produce reaction force (thrust) when ejected to the rear. These chemical propellants are divided classically into solid and liquid categories. Some studies have been conducted on solid-liquid systems. In many space flight propulsion systems such as the nuclear rocket. plasma jet or hydrogen heaters, the propellant is not a combustible but serves as a working fluid, its purpose being to transform heat and other forms of energy into kinetic energy.

1. Solid Propellants. — Various formulations of black powder (gunpowder) were the only source of propellant for rockets until late in the 19th century when nitroglycerin was discovered. Saltpetre was the oxidizer in this classic mixture, while the sulfur and charcoal served as fuel. This exothermic reaction may be written approximately

$$2KNO_3 + S + 3C \rightarrow K_2S + 3CO_2 + N_2 + 550 \text{ cal. per gram of mixture reacting}$$

In a rocket motor black powder yields a specific impulse **(I,,)** of 50–70 sec., depending upon chamber pressure and formulation (typical. by weight: 75% KNO,, 15% C and 10% S). The flame temperature of gunpowder is about 1,500"–3,000" F. and the mixture burns smoothly even below combustion chamber pressures of 100 lb, per square inch (p.s.i.). The volume of gas produced is about 400 times the original volume of the charge.

By shifting from potassium to sodium nitrate, 60 cal. per gram more heat is generated. Moreover, since the average molecular weight of the combustion products is reduced slightly, the exhaust jet velocity is increased.

With the advent of nitro explosives new possibilities opened up for obtaining high-temperature gases smoothly and reproducibly. Motor design changes were required to accommodate the higher combustion temperatures and pressures. Rocket propellants based upon nitrocellulose (guncotton) are known as single-base propellants. Mixtures of nitrocellulose and nitroglycerin are known as double-base propellants. These double-base mixtures are similar to smokeless powders for firearms. To improve the physical and chemical properties of double-base propellants, additives of a few per cent are usually present as stabilizers in order to prevent decomposition in storage or to improve combustion characteristics and to bond the propellant to the motor casing.

Double-base propellants require a minimum operating chamber pressure of about 500 p.s.i. for smooth burning. Lower pressure results in irregular burning and oscillatory combustion. Flame temperature is in the order of 5,000" F. Heat yield is in the order of 850–1,200 cal. per gram. Specific impulse is about 180–210 sec. The volume of gases produced from double-base propellants is about 1,500 times initial propellant volume.

Solid propellants are divided into two main classes : homogeneous and composite. The term homogeneous is applied to solid-propellant mixtures in which the propellant or mixture of propellants are intimately associated in a colloidal state. Single- and double-base propellants are examples of homogeneous propellants. In composite (or heterogeneous) propellants, the substances, although finely ground, are in distinctly separate phases. An example of composite propellant is gunpowder.

Nitrocellulose or nitroglycerin are different than gunpowder with respect to the process of chemical combustion. The molecules of saltpetre (KNO_3), sulfur (S) and carbon (C) in gunpowder must be intimately mixed in order to react. Nitrocellulose contains within each molecule sufficient fuel and oxidizer for complete reaction without the addition of other substances. In this regard. nitrocellulose may be considered a monopropellant.

In World War II both single- and double-base propellants were used extensively. In an important German double-base mixture, WASAG R-61, diethylene glycol dinitrate was substituted for nitroglycerin.

In the U.S., a number of new important composite propellants were produced. One of these was the GALCIT series which was a mixture of 75% potassium perchlorate and 25% asphalt oil. Another variety was the NDRC mixtures. A typical example of these was about 46% each ammonium picrate and sodium nitrate mixed with *8%* plastic resin binder. Other composite mixtures used ammonium nitrate as oxidizer and still others utilized synthetic rubber as fuel. An important advantage of composite propellants was their ability to be cast directly in the case.

Generally speaking, a solid rocket propellant may be formulated and designed to wide performance specifications with individual motors operating from a fraction of a second to *30* sec. or more burning time; from a fraction of *1* lb. to 500,000 or more pounds thrust. Rocket motors containing more than 25.000 lb. of propellant have been made and fired. Total impulse, *i.e.*, thrust (lb.) × time (sec.), of many million pound-seconds have been achieved in the U.S. Solid-propellant rocket systems are generally lower in performance than liquid systems but offer advantages in readiness of operation and ruggedness desired for field operations.

Classic problems in solid-propellant production include variation in performance with temperature, development of cracks or shrinkage in storage or transit and sensitivity to moisture. Most propellants tend to have higher burning rates in warm climates. Rocket stores may vary in military field operations from −70° F. to 150° F. Cracks, fissures or shrinkage increase the burning surface area so that pressure build-up on firing may reach disastrous proportions. X-ray inspections are a common specification of rocket grain manufacture. Some formulations are hygroscopic and must be stored in dry atmosphere or moisture will be absorbed and performance reduced. A new technology of rocket propellant surveillance has developed which treats the practice and procedures of storage and periodic inspection of rocket materiel. Procedures are evolved during development of rockets so that safe and adequate provisions may be put into effect when production programs are under way. Rocket propellants are inherently high-energy, unstable substances, intimately mixed. Physical-chemical processes such as deterioration, degradation and autoignition are important as well as variations in shape, size and density resulting from temperature and humidity effects as well as stress relief processes resulting from aging.

With better understanding of rocket propellants and improved design and production techniques, operational reliability is improving while performance and size of motors increase.

2. Liquid Propellants. — Generally speaking, liquid propellants have higher specific impulse than solid propellants and are more flexible in use, since throttling is possible. But liquid rocket systems are more complex and tend to be less rugged and reliable.

Rocket systems using liquid propellants fall into two general classes: monopropellant and the more common bipropellant. Monopropellants may be substances which decompose when heated or upon contact with a catalyst and give off large quantities of heat. An example is 90% hydrogen peroxide which decomposes into water (steam) and oxygen. By mixing hydrogen peroxide with a fuel such as an alcohol. a combustion reaction also takes place yielding more beat. Other monopropellants are nitromethane, ethylene oxide, hydrazine and propyl nitrate. Monopropellant systems are simpler but are lower in performance than bipropellant systems. Specific impulses of the above monopropellants range from 160–220 sec.

Tsiolkovski, Oberth and Goddard all independently recognized and wrote of the advantages of liquid bipropellants. In these systems one propellant is the oxidizer and the other the fuel. Common oxidizers are liquid oxygen, hydrogen peroxide and fuming nitric acid. The fuels used most have been ethyl alcohol (75% + 25% water), kerosene or gasoline, hydrazine derivatives, aniline and furfuryl alcohol.

Although experiments have been performed on literally thousands of fuels and a lesser number of oxidizers, no completely ideal propellants have emerged. Each propellant has some minor or major disadvantages that must be weighed against the particular design application and mission. For example, the problems of corrosivity and toxicity of fluorine or the low density of hydrogen may be accepted to obtain the high performance of these propellants in space applications. Or. the lower specific impulse of solid propellants may be accepted to obtain the advantages of readiness in antimissile defense systems.

In evaluation of liquid propellants the following properties are of engineering importance to the rocket designer: heat of reaction, average molecular weight of combustion products, stability (*e.g.*, to heat, shock), speed of reaction, ignition characteristics, density, viscosity, vapour pressure, specific heat and corrosivity. For re² generative cooling — and all large, long-burning engines are so cooled — at least one of the propellants must have sufficient stability, specific heat capacity, thermal conductivity and high saturation temperature to serve as a coolant. Despite its low temperature (−183° C.), for example, liquid oxygen is unsatisfactory as a regenerative coolant. In the case of the V-2, the ethyl alcohol fuel was diluted to *75%* with water to improve its cooling ability.

Quite apart from properties affecting rocket power plant design, are logistic and handling qualities of liquid propellants. For bulk storage and transfer of propellants, corrosivity, stability and vapour pressure are important as well as freezing point and inflammability. Toxicity is important to personnel. Cost and bulk availability are further important considerations to program planners.

By 1959 achievable specific impulses of rocket motors in operational missiles had climbed to about 270 sec. In the U.S., development programs for storable oxidizers such as nitrogen tetroxide, chlorine trifluoride and perchloryl fluoride were under way as well as major programs for liquid hydrogen and liquid fluorine. Fruition of these propellant programs and development of rocket motors with higher operating pressures may result in specific impulses of 370 sec. or better — near the maximum for chemical-combustion rockets.

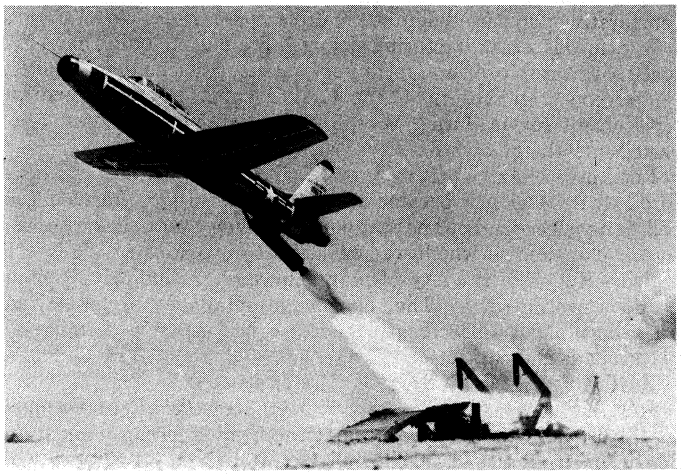
In the realm of exotic propellants, considerable research effort has been applied to the study of free radicals in the hope of stabilizing these energetic metastable substances. Also, studies of liquid ozone, boron hydrides and metal additives have been conducted. See also PROPELLANTS.

VIII. CONTROL OF ROCKET FLIGHT

Most rockets require stabilization of some sort to minimize flight path deflection caused by wind, nonuniformity of rocket structure, rocket jet misalignment and/or other factors Also. in the case of long-range ballistic missiles or satellite launchers. it is necessary for the rockets to take off vertically, programing a pitch deflection (tilt) at some high altitude and velocity. The techniques used for flight control vary according to type of mission and accuracy requirements. Radio control and/or inertial guidance (stabilized platform) systems initiate the correction and deflection signals to the vehicle.

In the case of some barrage-type rockets, launched by the thousands, dispersion errors may be accepted because of overlapping explosive effect in the target area. Aircraft rockets are often stabilized by fixed fins located at the rear of the rocket. Folding fins which open, by inertia, after firing are also used. Short-range bazooka rockets and ballistic rockets of j-to-10-mi. range are usually fin stabilized. Spin stabilization is used on some rockets. In these designs, the rocket nozzle is replaced by a series of smaller nozzles, canted at an angle to impart torque as well as thrust. A unique method of wire control, based upon the Ger-

man air-to-air X-4 rocket has been used. This technique is utilized by some antitank rockets of about one mile range. Fine wire is trailed from a pair of bobbins on the fins of the rocket and command signals given by the operator watching through a telescope.



BY COURTESY OF U.S. DEPARTMENT OF DEFENSE

FIG. 5.—A SOLID-PROPELLANT ROCKET, ATTACHED BENEATH THE TAIL OF A U.S. AIR FORCE F-84 FIGHTER PLANE. BOOSTS THE AIRCRAFT INTO THE AIR FROM A ZERO-LENGTH LAUNCHER. ELIMINATING THE NEED OF A GROUND TAKE-OFF RUN

Moveable control surfaces, or spoilers, alter the initial flight trajectory toward the target.

If the rocket is designed to operate at high altitudes, as in the case of sounding rockets, satellite launchers and ballistic missiles of ranges greater than 100 mi., aerodynamic forces are no longer available because of the low density of the air. One technique, employed first by Goddard, is to place carbon and molybdenum deflection vanes within the rocket exhaust. Usually two pairs are employed for corrections about all three axes; one pair for pitch, the other for yaw, and in opposition, for roll. In flight, deviations from flight path are sensed by gyros within an automatic control (autopilot) system and corrective signals are sent to servomotors which operate the vanes. This deflection system may be used also to program the tilt from vertical launch to ballistic flight path. Radio command may also be used to initiate the tilt program. A modification of the jet vane method is the jetevator, a ring-shaped deflector mounted at the nozzle periphery which rotates slightly into the edge of the rocket jet as required. Gimbal mounting of the engine. permitting the motor to swivel a few degrees in any direction, is another method of flight path control. This system was developed for the U.S. Viking and has been used successfully on IRBM's and ICBM's. Another technique suggested is the use of plug valves in the divergent portion of the nozzle which would release pressure when opened, thus causing change in thrust alignment. Magnetohydrodynamic (MHD) deflection of a rocket jet is another possible flight control concept. Since a rocket jet may be highly ionized it is conceivable that a magnetic field may induce deflection of the exhaust gases without physical contact.

Roll control (*i.e.*, rotation about the long axis) is sometimes required, particularly on larger ballistic missiles. Small jets mounted transversely on the side of the missile are commonly used for this purpose.

IX. MISCELLANEOUS APPLICATIONS OF ROCKET POWER

In addition to the primary uses of rocket power—for missile propulsion, fireworks, aircraft and for upper-atmosphere research and space exploration—rocket systems have been used for a great variety of other purposes.

Rockets are used in the U.S. to propel supersonic sleds along a twin-rail track. These sleds serve as test beds for acceleration tests of various components such as parachutes, aircraft ejection seats and nose cones. Important aeromedical tests on men have also been performed with rocket sleds. Accelerations as high as 100 gravity (g), decelerations of 150 g and velocities up to 4,600 ft. per second are possible. Both liquid- and solid-propellant rockets are used. Braking is accomplished by a parachute or, more often, by extending a scoop beneath the sled into a trough of water between the track rails.

During World War II one of the problems of hunting submarines from aircraft was that the submarine was not visible until it was directly beneath the airplane. Dropping a bomb from this point was not feasible because the forward velocity of the airplane would cause the bomb to follow a ballistic arc, landing far away. A novel solution to this problem was the retro bomb which, when released from the wing of an airplane, fired a rocket canceling the forward momentum. The bomb then dropped vertically on the target. Various sized rocket charges accommodated the different cruise air speeds of several types of aircraft.

Buried land mines were attacked in World War II by rocket-propelled devices. One of these devices, known as the Snake, pulled a 100-ft. train of skis, linked together and carrying TNT. Another version was a U-shaped motor which dragged primacord explosive to detonate the mine field.

A unique device based upon a German development was the Wedge. This item used a powerful rocket to drive a 1-in. rod, 6 ft. long into the ground. By pulling out the rod, inserting a length of primacord and detonating, a hole of 10–12 in. in diameter was created. Various other wartime rocket-propelled material included smoke bombs which in barrage-firing could swiftly erect a smoke screen. Antiradar rockets, used in the Allied invasion of Normandy, released metal foil strips, known as window. at peak of trajectory. These foil strips caused spurious radar reflections and appeared as swarms of aircraft on radar screens. Grapnels, even rope ladders, have been boosted over heights by rocket in commando-type operations. Recoilless rifles and mortar-fired rockets have been developed.

Solid rocket propellants have been used for turbojet engine starters, to furnish gas pressure to power small gyroscopes or electric turbogenerators for guided missiles, and to pressurize flame throwers. Firing solid-propellant charges in specially designed tools in oil wells creates high pressures which fracture the earth and increase oil production. Rocket jets have been used to drill holes through earth and rock. Rocket motors provide a high-temperature jet which is useful for materials tests as in the case of ballistic missile nose-cone development.

In the U.S. X-I j research airplane, the rocket motor is designed to accelerate the vehicle to 100 mi. altitude. In the outer reaches of the atmosphere the craft's wings and tail surfaces would be useless to orient the airplane correctly for re-entry flight on the downward side of the ballistic trajectory. Accordingly, rocket jet nozzles on the wings and fuselage are designed to rotate and correctly orient the X-15 under these conditions.

Rockets have been used to propel target aircraft and missiles, parachute-test vehicles, helicopter rotor blades; to spread fire extinguishing fluid over brush and forest fires, to spread a fine spray of oil over rough seas to calm the surface, to string telephone wires and to accurately deliver emergency supplies, food, ammunition and communications equipment.

The possibility of delivering a number of men and equipment accurately and at long ranges with IRBM and ICBM vehicles has been proposed. Even rocket boost of individual soldiers for short distances over ditches and streams has been achieved.

Rockets have been attached to automobiles, boats, gliders, iceboats, motorcycles. rail cars and even a man on skates. Needless to say, these experiments, which occurred mostly in the 1920s and 1930s, were more ingenious than efficient, more publicity-seeking than sound.

X. ROCKET'S AND SPACE FLIGHT

Man's dream of traveling through space to the moon and the planets is an old one—as old as astronomy itself. Centuries before the Christian era the courses of planets and stars were plotted but there was no appreciation then of the distance to these "abodes of the gods"; no understanding of the lack of atmosphere a short distance from the earth's surface; nor even that the world

was round. However, once man had learned that the moon and planets were actual bodies, a long way off, he had an urge to visit them. Willy Ley (see Bibliography) traces the story of man's interest in space flight from its earliest beginnings; 17th-century authors related fantasies in which man was drawn by "wild swans" or carried aloft "on the dew" to visit the moon. As the telescope developed and Newton's laws became applied, the physical problems of space journeys became more apparent. Jules Verne's famous De la terre *à* la *lune* ("From the Earth to the Moon") was published in 1865. Verne shot a space ship with passengers on a flight around the moon appreciating correctly many aspects of the voyage such as weightlessness in free fall.

By 1900 the recognition of rocket propulsion as the key to space flight began to spread. Individual scientists such as Tsiolkovski, Goddard and Oberth wrote serious technical treatises on the potentialities of rocket-powered flight. Rocket and space flight societies focused public attention on their experimental efforts. Their dreams were great but financial support was limited and successes were few. And each society had its share of crackpots. The aim of these societies was interplanetary flight rather than improved war rockets, but the latter were to appear first, in World War II.

The German heritage of the V-2 to the postwar world made it abundantly clear that with only a small extrapolation, payloads could be accelerated to satellite velocity. The development of the ICBM by the U.S. and C.S.S.R. furnished the additional power necessary for escape velocity. During the International Geophysical year (July 1, 1957–Dec. 31, 1958) the U.S. placed five satellites in orbit and the U.S.S.R. three. But the largest U.S. satellite payload was only 150 lb. whereas the Russian sputnik 3 carried 2,925 Ib. of instruments. This greater rocket capability of the U.S.S.R. enabled that nation in 1959 to launch a i94.9-lh. payload as a planetoid into solar orbit to impact 858.4 lb. on the moon and to photograph, albeit crudely, 70% of the unseen side of the moon irom a satellite and to transmit the picture (11 days later) to the earth.

It was clear by 1960 that the space age had arrived. Projects were under way for reconnaissance, meteorological and communications satellites. In May 1960 the U.S.S.R. put into orbit around the earth a 9,983-lb. spaceship that included a pressurized cabin containing a dummy figure of a man. On April 12 the following year Russian Maj. Yuri Gagarin orbited the earth in Vostok 1 and landed safely 108 min. later. In Xug. 1961 Gherman Titov (U.S.S.R.) orbited ior 24 hr. By mid-1962 the U.S. had made two manned suborbital (ballistic) flights (Alan B. Shepard, Jr., and Virgil I. Grissom) and orbited John H. Glenn. Jr., and M. Scott Carpenter.

Whenever a new scientific frontier has been penetrated the eventual results have been of economic benefit to mankind. It could only be hoped that in moving into this new dimension man would also learn better thr art of living with his neighbours, and that the rocket. developed as a machine of war, would become a tool for peaceful research and understanding.

See SPACE EXPLORATION; *see* also references under "Rockets" in the Index volume.

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(F. C. D. III)

ROCKFORD, a city of Illinois. U.S.. the seat of Winnebago county, is located on the Rock river in the midst of an important industrial, agricultural and commercial area in the north-central part of the state. 17 mi. S. of the Wisconsin line and 90 mi. N.W. of Chicago, Founded by New Englanders in 1834, it was named for the rock bottomed ford, the site of a stagecoach stop on the trip between Chicago and Galena. It mas incorporated as a village in 1839 and as a city in 1852. Supplied with water power by a dam constructed in 1844, the town grew rapidly; in 1960 the population of the city was 126,706 and that of the standard metropolitan statistical area (Winnebago county) was 209,765. (For comparative population figures see table in ILLINOIS: *Population.*)

Rockford is a'manufacturing city, its products including machine tools, hardware, furniture, farm implements, household appliances, leather goods and paint. Camp Grant, a reception and medical replacement centre during World Wars I and II, has been converted into the greater Rockford airport.

Rockford college, a private institution founded in 1847 as Rockford Female seminary, became coeducational in 1959. In 1958 the college acquired land on the east edge of the city for a new campus, the development of which was expected to extend over a 15-year period. Rockford is a city of many churches, including a Roman Catholic procathedral. The town has a symphony orch'estra, an art gallery and a little theatre and also has many well-equipped playgrounds and parks. (H. E. B.)

ROCK GARDENING: see HORTICULTURE.

ROCKHAMPTON, a seaport on the east coast of Queensland, Austr., on the Fitzroy river at the head of ocean navigation 35–40 mi. from the sea. Pop. (1961) 44,102. The Fitzroy and its tributaries (Dawson, Mackenzie, etc.) drain a basin of 54,522 sq.mi. of great diversity and econoinic value. The hinterland of Rockhampton includes rich agricultural and dairying lands and large mineral resources including coal fields. Around Rockhampton itself a fertile agricultural area produces tropical fruits, maize and dairy products. The harbour is kept open by dredging. Difficulties are the shifting sand and mud banks caused by severe floods which usually occur during summer. Railway repairing and other industries are carried on and nearby are large meat-preserving and freezing works. Mt. Morgan, 24 mi. S.S.W., became one of the richest gold mines in Australia after 1885. The Dawson river valley is the centre of the cotton region in Australia and also has wheat.

ROCK HILL, a city of York county, S.C., U.S.. 27 mi. S. of Charlotte, N.C. Having become the site of a U.S. post office in 1852, it was incorporated as a village in 1870 and as a city in 1892. Major industries include textiles and paper manufacturing. Located in Rock Hill are Winthrop college (the South Carolina state college for women), the Glencairn (azalea) garden, a children's nature museum and the York County hospital. The city has a council-manager form of government, in effect since 1915. For comparative population figures see table in SOUTH CAROLINA: Population. (J. H. Wo.)

ROCKINGHAM, CHARLES WATSON WENTWORTH, 2ND MARQUESS OF (1730–1782), twice prime minister of England, received his education at Westminster school and St. John's college, Cambridge. In 1751 he became lord-lieutenant of the north and east ridings of Yorkshire and a lord of the bedchamber, and in 1760 was made a knight of the Garter. In May 1i62 the earl of Bute became first lord of the treasury, and the marquess of Rockingham was among those who in the following year were dismissed from their lord-lieutenancies. In July 1765 Lord Rockingham formed his first administration with Gen. Henry Seymour Conway and Augustus Henry Fitzroy, duke of Grafton, as secretaries of state. In May 1766 the duke of Grafton, a far abler man than Rockingham, seceded from the government; in Aug. 1766 he succeeded his former chief as first lord of the treasury and prime minister. Lord Rockingham again became prime minister in 1782, with Charles Fox and Lord Shelburne (afterward marquess of Lansdomne) as secretaries of state. He died on July 1. 1782.

ROCK ISLAND, a city and the seat of Rock Island county, western Illinois, U.S., lies along the Mississippi river near the mouth of the Rock river and opposite the large federal island which gave the settlement its name. With Moline, East Moline and Davenport, Iowa, it forms a complex known as the "Quad Cities." Settlers were attracted by the presence of Ft. Armstrong on the island and by the cornfields of the Fox Indians. Ft. Armstrong (now a federal arsenal) was headquarters of operations in

the Black Hawk war. As settlers moved in. Rock Island (originally called Stephenson) became a transportation hub and was first incorporated in 1841. In 1854 the town was reached by the Rock Island railroad. whose promotors built the first bridge across the hlississippi. Industry is diversified, including railroad shops and the manufacturing of foot ear and farm equipment. Swedish immigrants established Augustana college and theological seminary in 1860. The college library contains material rich in Swedish Americana. Pop. (1960) 51,863. For comparative population figures *see* table in ILLINOIS: *Population;* for the metropolitan area *see* DAVENPORT. (D. L. A)

ROCKNE, KNUTE KENNETH (1888–1931), was head football coach at Notre Dame university. Notre Dame, Ind., 1918–1931. He was born in Voss, Nor., on March 4, 1888, and went to the United States in 1893. A star in football and track at Notre Dame in 1911, 1912 and 1913, when he was captain of the football team, he was assistant coach from 1914 until he became head coach in 1918. His won-lost record at Notre Dame was 105 victories, 12 defeats and 5 ties. He had five undefeated seasons. His "four horsemen" backfield, Harry Stuhldreher, Don Miller, Jim Crowley and Elmer Layden, was football's most famous.

Rockne, recognized as one of the greatest coaches the game has known, was the first to use shock troops in football, substituting virtually complete teams as players tired, and he perfected the famous Notre Dame shift. He was only 43 when he was killed in a plane crash in Kansas on March 31. 1931. (J. D. McC.)

ROCK RIVER, a nonnavigable river in the north central U.S., rises in Washington county in eastern Wisconsin and flows in a generally southwesterly direction to join the Mississippi river at Rock Island, Ill. Its 300-mi. length is shared about equally by the two states and from source to mouth it drops about 500 ft. Ten small dams on the river have a total power generating capacity of 12,545 kw. The river drains an area of 10.879 sq.mi., most of which is good agricultural land. The bottom lands along the lower course are frequently subjected to extensive flooding in the spring and require levee protection. Major cities along the river include Watertown, Janesville and Beloit, Wis., and Rockford, Dixon, Sterling and Rock Island. Ill. Its principal tributaries are the Pecatonica, Kishwaukee and Green rivers. Sear Oregon, Ill., in Lowden Memorial state park. Lorado Taft's heroic 48-it. statue of "Black Hawk" rises majestically above the wooded slopes of the valley. (E. HG.)

ROCKVILLE CENTRE, a village of Nassau county on Long Island in the southeastern part of New York state. U.S., about 20 mi. E. of New York city. The area was first skttled in the 17th century when a few families built several log huts. In 1853 the settlement, which was mainly a farming community, was named Rockville Centre after the Rev. Mordecai ("Rock") Smith.

The village. which was incorporated in 1893, became one of the residential suburbs on Long Island with a large portion of its population commuting to New York city for employment. For comparative population figures *see* table in NEW YORK: *Population.* (D. L. *D.)*

ROCKY MOUNT, a city of North Carolina. U.S., in Nash and Edgecombe counties, 54 mi. E. of Raleigh on the Tar river. Incorporated in 1867, it grew up around the state's second cotton mill. built in 1818 on the river. Its name derives from unusual outcroppings of rock at this coastal plains site. There in 1836 P. T. Barnum made the first recorded stop with his own circus troupe. It was chartered as a city in 1907 and in 1927 the city manager-council form of government was adopted.

Rocky Mount is one of the largest bright-leaf tobacco markets in the world. Its varied industry includes cotton mills, railroad shops, and plants producing fertilizer, lumber, bricks, steel tanks and cottonseed oil. For comparative population figures *see* table in NORTH CAROLINA: *Population.* (W. S. P.)

ROCKY MOUNTAIN NATIONAL PARK, in north central Colorado, U.S., 406 sq.mi. in area, was established in 1915 to preserve an outstanding section of the front range of the Rocky mountains. Located about 64 mi. N.W. of Denver, the region is famous for its high mountain peaks, broad valleys, rugged gorges, flowered meadows, alpine lakes and plunging streams, and also for its abundant wildlife, with such animals as the Rocky mountain bighorn sheep, mule deer, American wapiti, mountain lion, beaver and many species of birds inhabiting the area. A remarkable variety of plant life can be seen within the park, with more than 700 species of plants known to be present. The tundra of the high country in the park is a unique island of arctic vegetation, surrounded on all sides by plant communities of lower latitudes. Within the park are 65 named peaks which are more than 10,000 ft. in elevation. Long's peak (14,255 ft.) is the highest summit in northern Colorado, and one of the world's most popular climbs. The pastoral landscapes of the meadows and the rolling moraines are the result of glacial deposition. About 300 mi. of trails permit hiking, and the national park service provides guided field trips and informal nature walks. Trail Ridge road traverses the park, with about 11 mi. of the highway being above the 11,000-ft. timber line. Except for 12 mi. between Estes park and Hidden valley kept open for winter sports enthusiasts. this road is closed by snow to transmountain travel from about Oct. 15 to May 30. Slopes and ski runs are available for skiing during the winter months.

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ROCKY MOUNTAINS, the principal division of that vast system of highlands occupying part of the western United States, northern Mexico, western Canada and extending into northern Alaska. Standing between the great continental plains on the east and the region of elevated basins, ranges and plateaus extending from central Mexico through Nevada to northern British Columbia on the west, they constitute the backbone of the continent. as well as a major topographical feature of the entire globe. The Rocky mountain system does not include any of the Pacific border mountain system of North America (the Alaska range, Coast range, Cascade range, Sierra Nevada, Sierra Madre Occidental), from which it is separated by the basin, range and plateau province of Mexico. Nevada and British Columbia.

At the south the Rockies begin in the Sierra Madre Oriental, north of Oaxaca, Mex. North of Monterrey, Mex., the Sierra Madre Oriental is submerged in a rugged plateau region through which the Rio Grande has cut a narrow gorge at the Big Bend. North of the Mexican border, in west Texas and southern New Mexico, the mountain zone consists of a series of separate ranges and mountain basins between the Rio Grande on the west and the Pecos river on the east. In northern New Mexico the mountains become prominent again, reaching elevations above 13,000 ft. Thence they sweep northward and northwestward through the United States. Canada and across northern Alaska to the Arctic ocean near Point Hope. As a whole the mountain system is about 4,700 mi. long. The section designated as the Rocky mountains extends only 2,200 mi., 1,290 mi. of which are in the United States. Its greatest width is attained in Utah and Colorado, where the system of ranges is 350 mi. across. In Colorado there are 55 summits surpassing 14,000 ft., Mt. Elbert (14.431 ft.) being the highest of the system outside of Mexico. Colorado contains more than 250 mountains between 13,000 and 14,000 ft. Northwest of Colorado breadth and elevation diminish until at the Canadian boundary the ranges are less than 100 mi. wide, with few elevations exceeding 9,500 ft. In Canada, for 450 mi.. the system forms the boundary between British Columbia and Alberta. From Colorado almost to the Peace river in British Columbia, the Rockies carry the watershed of the continent (the continental divide). But this does not mean that they present a continuous chain of great peaks. On the contrary, the zone of uplift is rather a vast complex of separate ranges, interrupted at places by wide gaps of lofty rolling plateaus and intermontane basins or parks. In the Yukon territory of Canada, the system is a broken highland zone between the upper Yukon river on the southwest and the Mackenzie river on the east and northeast. At about 67° N. latitude the system swings westward across the border into Alaska and continues in

a southwesterly arc to the Arctic ocean south of Point Hope. In Alaska the system is designated the Brooks range and contains the highest, most rugged mountain zone north of the Arctic circle, reaching heights a little over 9.000 ft.

Geology.— The Rocky mountain system is one of the younger systems of the world, although very old rocks are found at the core of many of the ranges. The major uplift of the system occurred in Late Cretaceous and Early Tertiary time, in what is called the Laramide revolution, about 70,000,000 years ago. However, the portion of the continent now occupied by the Rocky mountains had undergone a number of vicissitudes prior to its final uplift. Though individual ranges vary somewhat in their story. a generalized geologic history of the system includes the following events: the oldest rocks in the system were-laid down as sediments in a shallow sea in Pre-Cambrian time—1,000,000,000 to 2,000,000,000 years ago. About 1,000.000.000 years ago this thick accumulation of shales, sandstones and limestones was compressed, folded and contorted by mighty forces within the earth's crust and uparched into an ancestral mountain system. The sedimentary rocks were altered by the heat and pressure into metamorphic rocks such as schist, slate, gneiss and marble. During the upheaval great masses of molten material were injected or melted their way upward into the core of the uplift. When it cooled, this material became granite. The processes of erosion now began to wear down this ancient mountain system. Rain fell; streams ate valleys into the surface; mud, silt and sand were carried out of the highlands into the adjacent water bodies. Gradually the uplift was carved into a rugged mountain system and then slowly reduced to a vast low-level plain, called a peneplain. Eventually the region again sank below the level of an encroaching shallow sea.

Throughout most of the two succeeding geologic eras, the Paleozoic and Mesozoic, the site fluctuated between low-lying swamp ground and shallow seas. In these seas were deposited a great depth of sedimentary material. Silt, mud and pebbles were carried down from highlands on the west. This material eventually consolidated into shales and conglomerates. Limey material was precipitated from sea water to form limestone. Sand accumulated along the shore and in river estuaries to form sandstones The skeletons and shells of a complex assemblage of life forms were left in the sediments as fossils. These run a wide range from simple shells to dinosaurs. The depth of the sediments laid down during these times is very great. In some localities the total thickness from top to bottom is more than 10 mi. The greatest extent of sea occurred near the end of this episode. when a Cretaceous water body extended from the Gulf of Mexico to the Arctic ocean, and from the Mississippi to the Nevada plateaus. This vast continental trough with its great accumulation of sedimentary rocks is called the Rocky Mountain geosyncline.

Then at the end of the Cretaceous period, the bottom of the geosyncline began to arch upward. Great compressive forces from the west thrust folds and blocks of the thick sedimentary rocks upward and eastward along a zone from southern Mexico to western Alaska. Accompanying the uplift and folding was the breaking of great sheets and plates of rock, which were pushed eastward along nearly horizontal or gently dipping fractures (thrust faults) like cards in a deck pushed one over another. Displacement along some of these thrust planes is measured in tens of miles. Weakening of the earth's crust permitted molten material from below to break through in volcanic upheavals at numerous points. pouring forth lava and ash. Other steep angled faults were formed along the eastern margins of the emerging ranges. This vast upheaval is called the Laramide revolution, taking its name from the Laramie range of Wyoming and lasted through several million years.

During the upheaval and after its close, the processes of wind and water erosion ate away at the uplift, carving it first into a magnificent group of mountain ranges and eventually wearing it down again to a low peneplain. Then only several million years ago the peneplain was again uplifted as a broad highland plateau. The process of dissection was begun anew. By now many of the canyons and valleys were cutting down through the great masses of sedimentary beds to expose the old metamorphic and granite rocks which had comprised the ancestral Rockies over a billion pears earlier. About 1,000.000 years ago the Pleistocene ice age capped all of the higher ranges with glaciers. These crept outward through the valleys, scouring them into their typical U-shaped profile and fretting the highlands with cirques and serrated ridges. The present-day configuration of most of the higher ranges can be traced to glacial scouring. Greatly diminished glaciers still are found in the high mountains from the Wind River range of central Wyoming northward.

Divisions.— The Rocky mountain system can be divided conveniently into six divisions. From south to north these are: (1) the Sierra Madre Oriental of eastern Mexico; (2) the southern Rocky mountains of New Mexico. Colorado and Utah; (3) the middle Rocky mountains of Wyoming; (4) the northern Rocky mountains of Montana and Idaho; (5) The Canadian Rockies of British Columbia, Alberta and Yukon territory; (6) The Brooks range of Alaska. There are natural gaps or low passes in the crest of the system between all of these divisions except one. The Rio Grande and Pecos uplands divide the Sierra Madre Oriental from the southern Rockies. The Wyoming basin (Great Divide basin) lies between the southern and middle Rockies. The Yellowstone plateau separates the middle Rockies from the northern Rockies. There is no natural break between the northern Rockies and the Canadian Rockies. The Yukon-Porcupine-Mackenzie lowland separates the Canadian Rockies from the Brooks range.

Szerra *Madre Oriental*.—The Sierra Madre Oriental serves as the eastern rim of the central plateau of Mexico from a point just north of Oaxaca to north of Monterrey, a distance of about 700 mi. (See MEXICO.) On the east it falls away abruptly to the gulf coastal lowland. Westward it descends gently onto the dissected central plateau. At the north the range is relatively low—5,000 to 7,000 ft. At the south, however, the range is met from the west by the primary east-west volcanic axis of the central plateau, At this junction stands Mexico's highest peak, the magnificent volcanic cone of Orizaba or Citlaltépetl (18,701 ft.). Nearby is Cofre de Perote or Nauhcampatépetl (14,045 ft.).

Southern Rockies —In the Rockies of Colorado, the most magnificent groups are probably the Sawatch range (96 mi. by 32 mi.) and the Sangre de Cristo range (220 mi. long) in the central part of the state. In the southwestern corner the Elk, San Miguel (with the spectacular Lizard Head, 13,113 ft.), Needle and San Juan groups, form a wild and rugged mass of peaks.

The Wasatch mountains of central Utah. overlooking the great basin for 100 mi. present abrupt ranges. Associated with the Wasatch mountains is the Uinta group (96 mi. by 40 mi.), of which Kings peak (13.498 ft.) is loftiest.

Central Rockies.—The ranges just mentioned connect with the main axis of elevation of the Rockies in the region of Yellowstone park through a belt of rather indefinite uplands running north and south along the western boundary of Wyoming. There are the Crawford mountains. the Wyoming range, the Gros Ventre mountains, the Snake River range and the Teton range. The Teton range presents perhaps the most splendid spectacle of all the Rocky mountain ranges. It is 40 mi. long and 10 mi. wide, rugged and precipitous. Granite spires rise abruptly 6,000 to 7.000 ft. above the flats of Jackson's Hole. The principal peaks are the Three Tetons (Grand Teton, 13,766 ft.) and Mt. Moran (12,800 ft.) at the northerly extremity. Reverting to the continental divide of the western part of Wyoming, the important uplift of the Wind River range is next in order, northwest of Great Divide basin. It is about 100 mi. long; the core is more than 13.000 ft. in elevation and sends out long lateral ridges between which remarkable canyons occur Its most prominent summits are Fremont peak (13,730 ft.) ascended in 1842 by John C Fremont; Gannett peak (13.785 ft.), the highest in Wyoming, and Chimney Rock (13,340 ft). Numerous small glaciers are on the northeast slopes. The largest, Dinwoody, covers several square miles.

Northeast of the Wind River range, across the Big Horn basin, lie the Big Horn mountains, a prodigious offshoot of the main range toward the great plains, 146 mi long and 40 to 50 mi. wide. The axis averages 12.000 ft in elevation, rising about 9,000 ft. above the neighbouring prairies. A few of the peaks surpass 13,000 ft and bear small glaciers in their rugged amphitheatres.

The highest is Cloud peak (13,165 ft.).

Northern Rockies.—Between the northern boundary of Yellowstone park and the Yellowstone river. the Beartooth and neighbouring ranges display what are probably the principal mountain masses of this division. In the vicinity of Mt. Cowen (11,206 ft) and Emigrant peak (10,921 ft.) the relief becomes as great as 6,400 ft., and Granite peak (12,799 ft.), the highest mountain in Montana, is situated there, as are Grasshopper glacier and other small ice bodies. The Beartooth range has a score of summits of 12,000 ft. or more.

The continental divide, however, leaves Yellowstone park in a northwesterly direction. At the 114th meridian it swings off abruptly to the northeast through the Butte and Helena districts. Beyond this swing, the western axis of elevation continues northwestward as the Bitterroot mountains to within 125 mi. of the Canadian border along the boundary between Idaho and Montana. The average elevation is between 7,000 and 8,000 ft. The highest peaks occur on projecting lateral spurs—Scott peak (11,393 ft), El Capitan (9,936 ft.) and St. Mary (9,335 ft.). This 125-mi. interval is filled by the Coeur d'Alene (6,000 ft) and Cabinet ranges. the latter culminating in Snowshoe peak (8,712 ft.). West of the Bitterroots in central Idaho lies a labyrinth of peaks and ridges (11.000 to 12,000 ft.); Mt. Borah (12,662 ft.) is the highest point in that state.

In the region of Butte and Helena, Mont., the continental divide is generally featureless, the passes around Butte averaging 6,000 ft. or less. The Anaconda range contains Mt. Haggin (10,598 ft.) and Mt. Evans (10,635 ft.). Beyond Helena, the divide veers to the north-northwest and follows the Lewis range, which is so wild and rugged that no roads for vehicles cross it for 200 mi. Opposite the Lewis range, the westerly margin of the Rockies is defined by the White Fish range (west of the north fork of Flathead river) and the Mission range (60 mi long, southeast of Flathead lake). The latter culminates in the glacier-bearing Mt MacDonald (10,-300 ft). Between the Mission and Lewis ranges is the Swan range (Mt Holland. 9.272 ft.). The principal continental pass there is Marias pass (5.215 ft). crossed by the Great Sorthern railroad. The finest scenery in this quarter is within Glacier Sational park (*q.v.*), nith 20 peaks between 9,000 and 10.000 ft and six between 10,000 and 10.438 ft. Mt. Cleveland is the loftiest summit. The park contains about 40 small glaciers and several large ones (from 2 to 5 sq mi apiece), besides a myriad of attractive lakes.

Canadian Rockies.—In Canada the axis of the Rockies is continuous for 1.000 mi. It is simpler, straighter and more sharply defined Prominent passes of the divide are: Crows Nest pass (Canadian Pacific railnay). 4.453 ft.; Vermillion pass (motor road). 5.376 ft ; Kicking Horse pass (Canadian Pacific railway). 5,320 ft , and Yellowhead pass (Canadian Sational railway), 3.717 ft. Proceeding northwesterly from the U.S. boundary. there are no glaciers for 100 mi . the peaks being mostly below 9,000 ft. A little farther on is Mt. Joffre (11.316 ft.), the first real glacier-hung peak. From there to beyond Mt. Robson (12,972 ft., the highest of all) the system is continuously alpine for about 285 mi. The Canadian Pacific railway crosses the chain 200 mi from the boundary near the famous Lake Louise. Halfway between this and Mt. Joffre stands the handsome Mt. Assiniboine (11,870 ft.). In the 150-mi. gap between the Canadian Pacific and the Canadian National railways at Jasper, are situated Mt Forbes (11,902 ft.) and Mt. Columbia (12.294 ft.), the fifth and second in rank in the Canadian Rockies respectively. In these mountains about 50 peaks surpass 11,000 ft. Glaciers and snon fields abound. and with the neighbouring groups just mentioned there is presented the best sweep of truly alpine territory to be found in Xorth America outside of Alaska. The northwesterly 500 mi. of the range are imperfectly known, although the mountains are lower.

The *Brooks* Range.—Across northern Alaska, the Brooks range serves as a watershed betneen the Yukon river drainage and that of the Arctic ocean. It includes. from east to west, such separate mountain groups as the Davidson, Romanzof, Franklin, Philip Smith. Endicott. Schwatka, Baird and De Long mountains. The highest peak is Mt Michelson (9.239 ft.) in the Romanzof mountains near the east end of the range. To the west the range crest lowers to 3,000–4,000 ft. Anaktuvuk pass (2,200 ft.) lies near the centre of the range. Almost the entire range is devoid of trees, being north of timberline. See also the articles on the states and provinces in which the Rocky mountains lie and on the national parks found in the Rocky mountains.

See W. W Atwood, The Rocky Mountains (1945) ; N. M. Fenneman, Physiography of Western Untted States (1931). (T. M. G.)

ROCKY MOUNTAIN SPOTTED FEVER AND OTHER SPOTTED FEVERS. Rocky mountain spotted fever is a typhuslike disease (see TYPHUS FEVER), first described in the Rocky mountain section of the U.S., caused by a specific microorganism (Rickettsia rickettsii) and transmitted to man by ticks. It is identical with a disease known as São Paulo fever in Brazil and with the spotted fever of Colombia. A closely related disease, but distinct etiologically, is *fièvre* boutonneuse caused by R. conorii, transmitted by ticks and occurring in the countries bordering on the Mediterranean sea and scattered localities of eastern and southern Africa.

History and **Distribution.**—Rocky mountain spotted fever was known along the Snake river in Idaho as early as 1873, but its first clinical description in a medical journal was given by E. E. Maxey in 1899. It was characteristically a disease of the open range and was noted to occur most frequently among hunters, trappers, fishermen, cattlemen and sheepherders. Up to 1930, it was thought to be confined to 11 states of the northwest, although one case was reported in Indiana. In connection with field investigations of endemic typhus in the southeastern U.S., it was noted that some cases in rural districts in the more northern states and among urban dwellers vacationing in the country were severe and did not exactly correspond to the clinical picture of endemic typhus. A high proportion of these patients had histories of tick bites within a short time preceding their illness. In 1931 L. F. Badger, R. E. Dyer and A. S. Rumreich recovered the causative agent from three patients who were residents of northern Virginia, and proved that it was identical with that of Rocky mountain spotted fever. After that time, the disease was shown to be widely distributed in the U.S., present in two provinces of western Canada, in two states of Brazil and in Colombia.

Epidemiology.—The predominance of the disease in the western U.S. among persons exposed to the open range. and the seasonal limitations to late spring and early summer months, were explained when the vector (carrier) species was identified as a wood tick, Dermacentor andersoni. It is widely distributed in the adult form upon large mammals, particularly cattle and sheep, in the western range country of the Pacific coast states, Nebraska. North and South Dakota and Nevada, and from New Mexico and Arizona on the south to Alberta, Saskatchewan and British Columbia on the north. Adult ticks live two to four years or more. Engorged females deposit their eggs in the soil. The winter is passed in the adult, nymphal or egg stage. Larvae, or seed ticks, emerge in the late spring and seek a blood meal on small animals. If successful, they molt to the nymphal stage, which may not become active until the follo ing spring.

Many small animals. especially rodents, are susceptible to infection with the rickettsiae of Rocky mountain spotted fever and after having been bitten by an infected tick develop an inapparent form of the disease. While the microorganisms are in the peripheral circulation, these animals serve as a source of infection for uninfected larval, nymphal or adult ticks which chance to feed upon them. The rickettsiae pass through the stage-to-stage development in the tick and are carried to successive generations in decreasing numbers by transovarial passage. The infection is thus maintained in nature by the alternation of the small animal and tick hosts. Among the rodent hosts should be mentioned particularly the jack and the cottontail rabbits. The rabbit tick *Haemaphysalis leporis-palustris*, although it does not attack man, is one of the vectors in maintaining continuous passage in small animals.

The occurrence of the human disease in the eastern and southern U.S. was explained when it was discovered that the common dog tick, Dermacentor variabilis, which attacks man also acts as a vector. Dogs and field mice are involved in maintaining the reser-

voir of infection. In the southwestern U.S. human cases were also traced to the lone star tick *Amblyomma americanum*. In Brazil the common vector is *Amblyomma cajennense*. Many other tick species were found to be experimentally infectable but were epidemiologically unimportant.

Clinical and Pathological Features. — The clinical course of the disease is essentially similar to that described for typhus fever (*q.v.*). In severe cases of spotted fever the rash tends to be more hemorrhagic and to be accentuated on the extremities, particularly about the wrists and ankles. Occasionally, a lesion may be detected at the site of the tick bite, but a typical primary eschar is lacking. Nervous and mental symptoms are common; restlessness. insomnia, disorientation and delirium are frequent manifestations of involvement of the central nervous system. Prostration may be marked from the beginning, merging into coma with death possible as early as the sixth or seventh day. Convalescence is apt to be slow and may be complicated by visual disturbances, deafness and mental confusion. Although recovery may be delayed it is usually complete. The case-fatality rates, as in typhus, vary directly with age. The crude rate for reported cases in the U.S. is about 18%.

The underlying pathology is essentially the same as that of typhus fever. The microorganism (R. *rickettsii*) proliferates in the endothelial cells lining the smaller blood vessels. causing damage to the vessel walls with hemorrhage. infiltration with round cells and thrombosis. Lesions are widely distributed in the tissues of the body but are characteristically common in the central nervous system and skin. Occasionally, there may be large areas of subcutaneous hemorrhage, particularly in the scrotum. Diagnosis is confirmed by blood tests. The Weil-Felix reaction becomes positive with *Bacillus proteus* X 19 and usually with X 2 and negative with *B. proteus* X K during the second week of the illness. The complement-fixation test becomes positive about the same time. The microorganisms may be recovered and identified following inoculation of guinea pigs with blood obtained from a patient early in the course of the illness. Reports in the 1950s indicated that early institution of treatment with antibiotics — chloramphenicol (chloromycetin) and aureomycin — greatly shortens the disease and decreases the risk of death.

Prevention. — Prevention depends primarily upon exercise of personal care in protection against tick bites. Persons exposed to known infected areas should frequently examine the clothing and body for ticks. Usually the tick does not become attached to its host immediately but crawls about for several hours. The chance of receiving infection from the bite of a tick is directly proportional to the length of time that the tick has fed. Ticks should be removed from the person or from a pet with a small forceps or with a piece of paper. The skin area involved should be swabbed with an antiseptic and the forceps disinfected with heat or chemicals. Hands should be washed with soap and water after such an operation.

There is a satisfactory vaccination procedure against Rocky mountain spotted fever; it should be administered in the spring or early summer before the beginning of the tick season, and should be repeated annually as the maximum degree of protection conferred is for less than a year. The degree of immunity afforded is relative. but the chance for subsequent infection is lessened and the risk of death is greatly reduced.

Fievre Boutonneuse (**Fièvre** Exanthematique).—A. Connor and **A.** Bruch in 1910 described a mild typhuslike fever which they believed to be an endemic disease of Tunisia, north Africa, and proposed the name boutonneuse fever. It was subsequently observed to occur in Marseilles, France, and still later was discovered to have a wide geographic distribution. It was reported from most of the Mediterranean countries and the Crimea. Available evidence suggests that the diseases described as Kenya typhus and South African tick-bite fever are probably identical with boutonneuse fever, although conveyed by a different species of tick. One review indicated the widespread distribution of this human tick-borne rickettsiosis in Africa.

Primarily, the vector was found to be a brown dog tick, *Rhipicephalus sanguneus;* subsequently. other ticks were incriminated. The microorganism is *Rzckettsia conorii.* The reservoir probably exists in nature in the lower animals, but the dog is apparently an important source of infection. The course of the disease is somewhat similar to Rocky mountain spotted fever, but it is milder. The case fatality rate is less than 3%. A primary lesion, called a *tache noire* ("black spot") is frequently found. It is somewhat similar in appearance to the primary eschar characteristically seen in tsutsugamushi disease. It is, of course, located at the site of the infecting tick bite and, therefore, may be found on any part of the body, but usually on a part covered by clothing. The Weil-Felix reaction with X 19 strain of *B. proteus* becomes positive late in the disease. Experimental evidence suggested that both chloramphenicol (chloromycetin) and aureomycin would be highly effective in the treatment of boutonneuse fever. Prevention depends upon protection from tick bites as outlined above. *See* also RICKETTSIAE.

See M. C. Pincoffs, E. J. Guy, L. M. Lister, T. E. Woodward and J. E. Smadel, "The Treatment of Rocky Mountain Spotted Fever with Chloromycetin," *Ann. Int. Med.*, 29 656 (1948); W. H. Price, "The Epidemiology of Rocky Mountain Spotted Fever," *Am. J.* Hyg., 60:292 (1954) (K. F. M.)

ROCOCO, a term used to describe a phase of European art originating in France and commencing in the first quarter of the 18th century. Its name is derived from the French word *Rocailles* which was used to designate the artificial grottoes and fantastic arrangements of rocks in the gardens of Versailles; and it indicates one of the features of the rococo style in its typical form — its absolute freedom and irregularity of rhythm. the twisted curves of a shell being as it were the standard of the whole system of design. Historically, it was an extreme development of the ideas of individual imagination and love of broken curves which characterized baroque (*q.v.*).

For the grave and pompous dignity of the style of Louis XIV, the rococo substitutes playfulness and exquisite gracefulness and charm. Up to about the middle of the 18th century, rococo art remained gay and freakish and showed much exotic influence as, for instance, the influence of Chinese art. Then a renewal of interest in classical art and archaeology which had meanwhile taken place in Italy began to make itself felt in French art. During the later phase of the rococo, much of the playfulness disappeared, and a greater calm and balance were introduced into the style; but it retained gracefulness and charm, till eventually, between 1780 and 1790, the severe neoclassical movement superseded it. This later phase of the rococo must be regarded as a stage of transition from the rococo proper to the neoclassical art of Louis XVI.

See LOUIS STYLES.

ROCROI, a town of northern France. in the *département* of Ardennes, 22 mi. N.N.W. of Charleville by rail, and within 2 mi. of the Belgian frontier. Pop. (1954) 863. Originally called Croix-de-Rau or Rau Croix, it was fortified in the 16th century and besieged by imperialists in 1555. Invested by the Spaniards in 1643, it was relieved by Louis II, the duc d'Enghien (afterward the great Condé). Captured in 1658 by the same duke for Spain, it was not restored to France till the treaty of the Pyrénées in 1659. In 1815 Rocroi was besieged by the Allies. The fortifications constructed by Vauban close in the town.

Battle of **Rocroi.**—In 1643 (*see* THIRTY YEARS' WAR) the Spaniards, under Francisco de Mello, invading France through the Ardennes, laid siege to Rocroi. The town lay in a small plain surrounded by woods and marshes, and could only be approached through a narrow defile. Contrary to the advice of Marshal de l'Hôpital, the young duc d'Enghien (*see* CONDÉ, LOUIS II DE BOURBON), decided to attack the Spaniards before the town. Mello omitted to block the defile and Enghien led his army through it in safety and formed up on a low ridge facing the Spanish lines. His infantry, commanded by Espenan, was in the centre, cavalry under Gassion on the right, cavalry under La Ferté on the left, a small reserve under Sirot in rear — altogether 16,000 infantry and 7,000 cavalry. with 12 guns.

The Spanish army, now concentrated on a parallel ridge facing the French. was similarly organized, 18,000 infantry in the centre under Fontaine, cavalry on the right under Isembourg, on the

left under Albuquerque—27,000 men and 18 guns. Mello also expected a reinforcement of 6,000 men under Beck. Evening was approaching when La Ferté suddenly led his wing forward without orders. Enghien instantly ordered him back, and Mello surprisingly allowed him to return untouched.

On May 19 the French army stood to arms at 3 A.M., Enghien, like Henry of Navarre, donning a hat adorned with white plumes instead of an armoured helmet. A deserter had reported that a battalion of musketeers was in ambush in a wood on the French right. Enghien sent a regiment of infantry to dislodge them, while cavalry caught them as they retired and cut them to pieces. Relieved of this danger, Enghien led eight squadrons against Albuquerque's front, while Gassion with a similar force attacked his left flank. Albuquerque's force gave way, and Enghien, ordering Gassion to pursue, swung against the left of the Spanish infantry.

Meanwhile La Ferté led an unauthorized attack against Isembourg and was completely defeated, himself and his guns captured, while his men fled, hotly pursued by the Spaniards. Fortunately Sirot's reserve stood firm and threw off Isembourg's attack. Espenan also had advanced against the Spanish infantry, but seeing La Ferté's disaster, drew off. At this critical moment Enghien with his cavalry struck the second line of Spanish infantry in the rear and, dispersing them, swept on to attack Isembourg's victorious cavalry who fled, leaving their own and La Ferté's captured guns in Enghien's hands. There now remained only the front line of the Spanish infantry, standing in square upon the ridge. The Spaniards stood motionless till the French were within 50 paces; then the front face of the square opened and 18 guns belched death at the oncoming French; crashing musketry joined their roar and the attackers fell back with terrible loss. Twice Enghien renewed the attack, only to be beaten off, but the Spanish ammunition was running low, their losses were heavy, the recaptured French guns were brought into action, Sirot came up with his reserve and Gassion from his pursuit.

Realizing that further resistance was hopeless, the Spanish officers signaled their desire for quarter; Enghien stepped forward to receive their surrender, but the Spanish infantry, misunderstanding his intention, opened fire upon him. Infuriated, the French massacred the Spaniards almost to a man. Beck, warned of his danger, retreated and the victory was complete.

ROD, EDOUARD (1857–1910), French-Swiss novelist, was born at Nyon on March 31, 1857. He studied at Lausanne and Berlin, and in 1878 found his way to Paris. In 1881 he dedicated his novel *Palmyre Veulard* to Zola, of whom he was at this period a disciple.

A series of novels of similar tendency followed. In *La Course à la mort* (1885) he turned to the analysis of moral motives. He is at his best in presenting cases of conscience, the struggle between passion and duty, and the virtues of renunciation. *Le Sens de la vie* (1889), one of his most famous books, is in the nature of a complement to *La Course à la mort*. Of his many later works, *La* Vie *privée de Mzchel Teissier* (1893), translated as *The Private Life of an Emznent Politician* (1893), is justly famous. He was an ardent student of Rousseau, and his play *Le Réformateur* (1906) is based on an episode in Rousseau's life. He died in Jan. 1910.

RODBERTUS, JOHANN KARL (1805–1875), German economist, author of a conservative interpretation of social reform and a strong supporter of monarchy and economic nationalism, was born at Greifswald on Aug. 12. 1805, the son of a university professor. Educated in law at Prussian universities, Rodbertus acquired in 1836 the landed estate of Jagetzow in Pomerania. Until his death, on Dec. 6, 1875, he carried on economic studies as well as historical studies and participated in Prussian politics.

The substance of his social-economic reasoning is a principle of government regulation of wages so that they might rise in proportion to increases in national productivity. Unlike Malthus and Ricardo—who believed that wages rise naturally in conformance with rising conceptions of a conventional standard of living—Rodbertus maintained that wage earners, when left to their own devices, cannot earn more than a bare minimum of physical existence. All increases of national productivity therefore accrue to the owners of property. Since property owners constitute a minority of the population, crises of underconsumption and retarded production occur while yet a majority of the population is not prosperous: "thus society pays dearly because labour is hired too cheaply."

Rodbertus, unlike Marx, did not call into question the entire complex of the political and economic institutions of capitalism, but in entrusting the government with legislating the conditions of wage payments, he furnished a conservative basis of state intervention; thus in his time he won support for social legislation in circles inaccessible to socialist agitation or fearful of it.

See H. Dietzel, *Karl Rodbertus: Darstellung seines Lebens und seiner Lehre* (1886); *E.* C. K. Gonner, *Social Philosophy of Rodbertus* (1899). (G. W. Z.)

RODENT, a member of the Rodentia (*q.v.*), order of gnawing mammals, more numerous than any other order and containing about 2,000 species. More widely distributed than any other group, they are found on all but the most desert oceanic islands. Most are small to medium-sized, but the pygmy mice are among the smallest of mammals, while the capybara may attain a length of 4 ft. and a weight of 100 lb. Rodents are largely terrestrial, many burrowing, many tree-living, a few gliding by skin-folds and some partly aquatic.

Rodents are noted for destroying or injuring crops and food stores. Many small species eat quantities of insects and their eggs. Most rodents are eaten in primitive societies, while rabbits, hares, and squirrels (*qq.v.*) are eaten by civilized people. Beavers, chinchillas, muskrats and squirrels (*qq.v.*) produce valuable furs. Plague (*q.v.*) is transmitted by rats and ground squirrels, tularemia (*q.v.*) by rabbits. (J. E. Hl.)

RODENTLA, an order of placental mammals characterized by their front or incisor teeth, which are reduced to a single functional pair in each jaw, chisellike and growing throughout life. Rodents are small or medium in size, plantigrade or partly so and generally five-toed. Canine teeth are absent; the cheek teeth, $\frac{3}{3}$ to $\frac{6}{6}$ in number, may be rooted or ever-growing and are arranged in an unbroken series. (*See* TEETH.) The orbits are not surrounded by bone except in the aberrant maned rat, *Lophiomys*. The skull is characterized by large premaxillae, completely separating the nasals from the maxillae; by the wide space between incisors and cheek teeth and (except in the Duplicidentata) by the anteroposteriorly elongated groove for the articulation of the lower jaw.

Rodents feed chiefly on vegetable matter, but most species eat also insects and other animal matter, while a few are fishers or predators.

A wide difference of opinion exists as to the classification of this order; the scheme here followed being that of T. Tullberg (1899), with modifications.

SUBORDER SIMPLICIDENTATA

The Simplicidentata have only one pair of incisors, above and below; these have enamel only on the front surface, and in chewing the movement is obliquely backward and forward. True rodents may be divided into two sections or infraorders: the angle of the lower jaw arises from the underside of the incisor socket in the Sciurognathi; in the Hystricognathi the angle arises from the outer side. Rodents are an ancient group; and the earliest members are quite as distinct from other mammals as are the recent types, and almost as different from each other. Adaptations to similar habits occur in unrelated groups, leading to superficial similarities of structure and appearance that are frequently very detailed.

SCIUROGNATHI

This section contains nine superfamilies, some of which may be more closely related than this classification indicates.

Aplodontioidea.—The skull is characterized by a small or moderate infraorbital foramen; the masseter muscle does not pass through this, nor does it extend in front of the zygomatic

arch on the rostrum. Postorbital processes are absent or poorly marked. The tibia and fibula are free.

Family Ischyromyidae is known from the Lower Eocene to the Upper Oligocene. These rodents had marmotlike skulls and primitively cusped, rooted molars, which in later forms became crested. The dentition included $\frac{2}{1}$ premolars.

Family Aplodontiidae has as its sole existing representative the sewellel or mountain beaver of the Pacific United States. It is about the size of a marmot, with short tail, small rounded ears and small eyes. Aplodontia is burrowing in habit, living in damp woods. The cheek teeth are rootless and early lose the pattern; the premolars are $\frac{2}{1}$.

Family Mylagaulidae includes the strange horned rodents of the Miocene and Pliocene. In habits these animals were much like pocket gophers of the present, living in burrows on the plains. The male had a pair of horns on the nose, while the female was hornless.

Family Protoptychidae contains a few forms from the Eocene, characterized by an inflated mastoid bulla. Eomys of the European Upper Eocene is type of another primitive family, often referred to the Muroidea or Dipodoidea, from its generalized structure.

Sciuroidea.—Only the family Sciuridae can be placed here. The infraorbital foramen is small, while the masseter muscle arises in front of the zygomatic arch from the rostrum. Postorbital processes are present. The premolars are $\frac{2-1}{1}$. This group is a successful one, represented all over the world, except the Australian region and the oceanic islands.

Subfamily Sciurinae includes the tree and ground squirrels; it may be divided into six tribes.

Sciurini, the typical squirrels (see SQUIRREL) of Eurasia and America, includes numerous species. A number of genera have been allowed by authors; most of these are better considered subgenera. *Sciurus,* the typical genus, is complex and is most widespread. The European red squirrel (S. vulgaris) is found from Great Britain to Japan and eastern Siberia; it varies from reddish to dark gray and black in different parts of that range. The gray squirrel of the eastern United States, the Pacific gray squirrel and numerous other American species are closely related. Seven or eight subgeneric groups occur in the Neotropical region, exhibiting a great variety of colour and size.

The pygmy squirrels of Central and South America, *Microsciurus,* are the smallest of the American species, hardly larger than mice. with delicate skull and narrow rostrum. Rheithrosciurus, the tufted-eared ground squirrel of Borneo, has many grooves on the front of the upper incisors. It is doubtfully referred to the typical tribe.

Tamiasciurini, the common North American red squirrels, *Tamiasciurus,* differ from all other squirrels in the reproductive system of the male; the baculum (*os* penis) is absent and the accessory glands are unique.

Funambulini includes the tree squirrels of Africa and several oriental genera. The Indian palm squirrels, *Funambulus,* are striped blackish, white and olive. Ratufa, the largest of the tree squirrels, includes black, red or yellowish forms, with white or yellowish undersides; they are found in India and the Malay region as far as Bali and Borneo. The African giant squirrels, Protoxerus, are characteristic of the tropical forest area. These squirrels are about 11 in. long, with scantily haired underparts. The red-faced giant squirrels, *Epixerus,* resemble the preceding genus but have an elongated skull. The African side-striped squirrels, *Funisciurus,* have cheek teeth $\frac{5}{4}$, the lower molars basined. The brush squirrels, *Paraxerus,* are found in the scrub of the hill country of central Africa; most are olive-gray but several striped species are known and several mountain species are handsomely coloured. Heliosciurus is a common squirrel from Rhodesia to Gambia; the forms vary from gray and olive to rich reddish brown. Myosciurus, the African pygmy squirrel, with head and body about two and one-half inches, is restricted to the Cameroons and Gabun.

Callosciurini contains mostly oriental species. *Callosciurus,* the common oriental squirrel, is represented by several species in Burma, China, the Malay region, the Philippines and Celebes. A great variety of coloration is exhibited in this genus; white, gray, buff, olive and reddish species or races are known, while one group, often separated as *Tamiops,* is striped. Menetes, a long-nosed ground squirrel from Burma, Siam and the Malay peninsula, is distinguished by well-marked flank stripes. Red-cheeked ground squirrels, Drenzomys. characterized by long-nosed skulls, are found from S. China and Burma to the Malay peninsula and Borneo. The oriental pygmy squirrels, *Nanosciurus,* occur from Malaya to the Philippines and Celebes. Striped ground squirrels, Lariscus, of Borneo, Java, Sumatra and the Malay peninsula, are distinguished by short tails and three dark dorsal stripes. Rhinosciurus, the long-nosed ground squirrel of the Malay region, including Sumatra and Borneo, is largely insectivorous. It has weak, tweezerlike incisors and extensile tongue. The Celebes long-nosed ground squirrel, *Hyosciurus,* has long front claws and normal incisors. The pygmy ground squirrel of North Borneo has broad incisors and black and white flank stripes.

Xerini, the spiny squirrels (*q.v.*) of Africa, are represented in North Africa by Atlantoxerus, and throughout the plains country and grasslands south of the Sahara by Xerus. X. rutilus, the typical form, occurs in Ethiopia, Somaliland and Kenya; it is yellowish-brown without stripes, the skull with convex profile. X. (Euxerus) erythropus of Equatorial Africa has a long narrow skull and white flank mark; its colour is reddish. X. (Geosciurus) *inauris* of South Africa is pale yellowish-brown, with a well-marked white lateral stripe.

Marmotini, containing the marmots and typical ground squirrels, is best represented in Asia and North America. The chipmunks (*q.v.*), Tamias and Eutamias, have cheek pouches, are light in build and climb well. Eutamias is found in eastern Asia and in western North America, while Tamias is restricted to eastern North America. The spermophiles (*q.v.*), sousliks (see SUSLIK) or ground squirrels (*q.v.*), Citellus, are found from Hungary through Asia and North America south to Mexico. The tail is usually short and flattened and the claws enlarged; the size varies from about five inches to more than one foot, excluding the tail. Cynomys, the prairie dog (*q.v.*) is confined to western North America. Marmots (*q.v.*), *Marmota,* are found in the Alps and eastward from Poland through Asia and in North America as far south as Alabama and New Mexico. Cheek pouches are absent. *Spermophilopsis,* the sand marmot of southern Siberia. may belong here. It is golden in colour, the pelage silky. The single species is a little smaller than the marmots. Cheek pouches are present and the cheek teeth are simplified in pattern.

Subfamily Petauristinae. The flying squirrels (*q.v.*) of the northern hemisphere are found from Scandinavia and northern Asia to the Malay region and throughout the forested parts of North America. The fore- and hindlimbs are connected by a broad skin fold, supported by a cartilaginous spur arising from the wrist, by means of which they glide from tree to tree. About 11 genera are recognized. Petaurista, the giant flying squirrel of southern Asia, occurs from India and Japan to Java and Palawan; the various forms are red or black, sometimes spotted with white. The woolly flying squirrel, *Eupetaurus* of the Himalayan region, is about the same size (head and body about 24 in.; tail 18 in.); its cheek teeth are high-crowned, unlike those of other Sciuridae. Sciuropterus, a smaller type, is found in northern Europe and Asia, east to Japan. Closely related species, usually recognized as generically distinct (*Glaucomys*), are found in North America as far south as Honduras. In the Malay region a number of other genera occur, varying in size from that of a mouse to that of a rat; they are distinguished by dental and cranial characters.

Castoroidea.—Two families are included here, one of which is extinct. The masseter muscle is similar in its attachment to that in the Sciuridae, but postorbital processes are absent; the cheek teeth are complicated in pattern and rootless in Recent forms, although originally four-cusped and rooted.

Family Castoridae is represented by two living species of beaver (*q.v.*), although formerly it was a large and varied group. Fossil forms carry the beavers back to the Middle Oligocene but, except for differences in tooth pattern, the earlier forms are much like the later ones. Subfamily Castoroidinae includes giant forms

almost as large as a bear, with cheek teeth of a different pattern. These were characteristic of the Pleistocene of North America and Europe. Older types were smaller, the earliest appearing in the Lower Miocene.

Family Eutypomyidae includes a few Middle Oligocene castoroids, with two upper premolars. The cheek teeth have numerous small enamel islands.

Geomyoidea.—Two families of American rodents are referred to this superfamily. They combine characters of the squirrel, beaver and mouse groups; the masseter muscle and structure of the infraorbital canal agree with that of the squirrels. Postorbital processes are absent and all have external fur-lined cheek pouches.

Family Geomyidae. The pocket gophers (*q.v.*) are stout-bodied, burrowing rodents with small eyes and ears and large front claws. The skull is massive and flat. The fossil subfamily, Entoptychinae of the Oligocene and Miocene, had rooted teeth but otherwise resembled Recent gophers. The Geomyinae contains forms with simple, ever-growing cheek teeth.

Family Heteromyidae includes three subfamilies. The pocket mice (*q.v.*), Perognathinae, are known from Oligocene times on. The cheek teeth are rooted, the cusps of the lower premolars form a quatrefoil pattern, those of the other teeth form cross-crests. The kangaroo rats (*q.v.*), Dipodomyinae, have rootless teeth without pattern when worn; the enamel is restricted to bands. The spiny pocket rats, Hetcromyinae, have rootless teeth, which when worn form a C-pattern, narrow anteroposteriorly. *Heteromys*, the typical genus, occurs in Central America and northern South America, also in Trinidad.

Anomaluroidea.—Part of the masseter muscle passes through the infraorbital canal, while the lateral masseter is restricted to the zygomatic arch, differing in these respects from other rodents except the Dipodoidea and Hystricoidea.

Family Anomaluridae includes arboreal rodents without postorbital processes, cheek teeth $, and large auditory bullae. On the underside of the tail is a series of imbricated scales. A skin membrane extends between fore- and hindlimbs, supported by a cartilaginous spur from the elbow, except in *Zenkerella*. *Anomalurus* includes various species which are confined to Equatorial Africa as far south as Northern Rhodesia. The subfamily Idiurinae contains two genera: *Idiurus*, with a flying membrane, and *Zenkerella*, which is without this membrane. These are found in the West African forest area.

Family Pseudosciuridae may belong here; it agrees in the attachment of the masseter. The cheek teeth are cusped or crested, with low crowns, while the skull is long and flattened. The several genera are found in the Eocene and Oligocene of Europe.

Family Theridomyidae is also extinct, known only from the Middle Eocene to the Oligocene of Europe. The earliest forms had teeth somewhat squirrellike in pattern, while in later types the pattern was reduced to enamel islands.

Family Pedetidae. *Pedetes*, the jumping-hare (*q.v.*) of eastern and southern Africa, is a kangaroolike rodent about the size of a fox, buffy brown in colour with white hip stripe. *Parapedetes*, a similar form, occurs in the Miocene of Africa.

Ctenodactyloidea.—The African family Ctenodactylidae includes three genera. Part of the masseter muscle passes through the infraorbital foramen, which is large. The mandible lacks a coronoid process, the teeth are prismatic and the auditory and mastoid bullae are inflated. *Ctenodactylus*, the gundi of North Africa (Morocco to Tripoli) is about the size of a squirrel, with short tail and pale buffy coloration. *Massoutiera* is the long-tailed gundi of the Sahara desert and Senegal. *Pectinator* of Somaliland and Eritrea has a long bushy tail and $\frac{5}{5}$ cheek teeth, more than in any rodent except certain Bathyergidae. *Pectinator* is known from the Miocene of India, while other representatives of the family are reported from the Pliocene of the Mediterranean region.

Gliroidea.—This subfamily includes the dormice and their relatives. They resemble squirrels in habit and general appearance. The tail is bipennate or bushy. The cheek teeth are usually $\frac{4}{4}$ but may be $\frac{3}{3}$, with transverse crests. The lower leg bones are fused. The caecum is absent in most species.

Family Gliridae, the true dormice. The typical genus, *Glis*, includes the large edible dormouse (*q.v.*) found from France and Spain to Asia Minor. *Muscardinus*, the common dormouse, ranges from England to the Mediterranean and near east; it is much smaller than *Glis*, about as long as a house mouse but with heavier body. Several other types occur in Europe and Asia. The African dormice are often given subfamily rank (Graphiurinae), differing from the typical group in having a more primitive attachment of the lateral masseter muscle, and the teeth have only poorly marked cross-crests. *Graphiurus*, a large gray dormouse, is restricted to South Africa. *Claviglis* is smaller, with more rounded skull; it contains a number of species in various parts of Africa south of the Sahara. Subfamily Platycanthomyinae is characterized by cheek teeth $\frac{3}{3}$ in number; the crowns wear flat. The pelage is mixed with flat spines, while the tail is tufted. *Platycanthomys* is found in India and is arboreal. *Typhlomys* of China is apparently fossorial, with reduced eyes; it has a small caecum. Subfamily Seleviniinae contains only the Recent *Selevinia*, described in *1938* from central Asia. It differs from typical dormice in its mouselike tail, vestigial basin-crowned molar teeth and large incisive foramina.

Dipodoidea.—The jerboas and jumping mice (*qq.v.*) are included here. Cranially, they have a large infraorbital canal through which the medial masseter muscle passes, as in the Anomaluridae and Ctenodactylidae. The cheek teeth are typically $\frac{4}{3}$, the first upper one small.

Family Zapodidae. These mouselike rodents differ from the true mice chiefly in the characters of the superfamily. Subfamily Sicistinae, found in Europe and Asia, includes only *Sicista*, the birch mouse. This yellowish-brown rodent is marked by a single black dorsal stripe; it climbs readily, living in birch forest and feeds on seeds. The North American jumping mice (*q.v.*), subfamily Zapodinae, are long-tailed, long-legged rodents, found also in China.

Family Dipodidae includes jumping rodents resembling kangaroo rats but with even longer feet. The three middle metatarsal bones are usually fused into a cannon bone. Cheek teeth are $\frac{4-3}{3}$. The lateral toes are reduced or lost. The bullae are large and the mastoid inflated. *Euchoreutes* of central Asia is type of a sub. family; it is characterized by ungrooved incisor teeth, cheek teeth $\frac{4}{3}$, the zygomatic arch slanting gradually upward to the lachrymal, and enormous ears. *Cardiocranius* and *Salpingotus* of Mongolia and central Asia form a third subfamily characterized by unfused metatarsal bones and less angular zygomatic arch than in the Dipodinae.

Muroidea.—The mice and their allies are characterized by the slitlike infraorbital foramen, through which the medial masseter muscle passes and which is compressed by the development of the zygomatic plate, the flattened area from which part of the lateral masseter arises. The cheek teeth are $\frac{3}{3}$. The cardiac part of the stomach is lined by a cornified layer; the colon forms a spiral loop.

Family Cricetidae is characterized by the upper molars, the cusps of which are arranged in two rows. This pattern is frequently obscured, the cusps wearing down to form zigzag crests. Cricetids, only slightly different from modern types, are known from the Oligocene of America and Asia. Subfamily Cricetinae includes the native American muroids with the exception of the Holarctic voles and their allies. *Cricetus* and several related hamsters (*q.v.*) are found in Europe and Asia; they are heavy-bodied, short-tailed burrowing rodents. *Oryzomys*, found from Patagonia to New Jersey, is represented by numerous species, one group of which extends to the Galapagos Islands. The American harvest mice, *Reithrodontomys*, vary from small to large mice characterized by grooved incisors, while the white-footed or deer mice, *Peromyscus*, with internal cheek pouches, are the dominant North American forms from Alaska to Panamá. *Onychomys*, the grasshopper mouse, resembles the old world hamsters in appearance but lives chiefly on insects and other mice. ***Neotoma***, the pack rat, is quite ratlike in appearance but its teeth are more like the Microtinae in their zigzag pattern. A great variety of tropical American genera are known.

Subfamily Myospalacinae includes a gopherlike genus from Siberia and northern China. The cheek teeth are ever-growing and prismatic,

resembling the Microtinae. Subfamily Nesomyinae includes a few genera from Madagascar. *Nesomys* has teeth much like *Oryzomys. Hypogeomys,* a burrowing form, has prismatic teeth suggestive of those of *Neotoma,* as has also *Macrotarsomys. Eliurus* differs from these in having cross-crested teeth.

Lophiomys, the maned rat of eastern Africa, is given subfamily or even family rank because of its odd skull; the temporal fossa is completely roofed over by bone, the surface of which is granulated; the teeth, however, are cricetid. The tail is bushy. The feet are specialized for an arboreal life, with a partly opposable hallux.

Subfamily Microtinae includes the voles and lemmings (*qq.v.*) found in the northern hemisphere south to Guatemala and Burma. The cheek teeth are high-crowned and prismatic, forming a complex zigzag pattern. The skull is angular, marked with muscle ridges. As a rule, voles are heavy-bodied, short-tailed rodents, more or less modified for burrowing. *Ondatra,* the muskrat (*q.v.*), is the largest of the group, with a long dorso-ventrally flattened tail and partly webbed hind feet. This is connected with the following forms by intermediates like *Arvicola,* the Eurasian water vole, and *Neofiber,* the round-tailed muskrat of Florida. *Microtus,* the voles or meadow mice, are usually small. The lemmings, *Lemnus* and allies, have ever-growing cheek teeth with short lower incisor (the root ending in the lower jaw opposite the molars): they are chiefly arctic and northern forms. A few genera have rooted cheek teeth: *Ellobius* and *Prometheomys,* the subterranean voles of southern and central Asia; *Clethrionomys,* the red-backed bank vole of northern Europe, Asia and America; *Phenacomys,* including the red tree mouse and other North American voles. *Brachytarsomys* of Madagascar shows many similarities to the voles but it has probably developed independently from the primitive Cricetidae, probably the Nesomyinae.

Subfamily Gerbillinae contains a number of jumping rodents, with broad brain case, inflated mastoid and auditory bullae and prismatic cheek teeth, the transverse crests developed from paired cusps both above and below. The upper incisors are grooved in all but a few species. Gerbils (*q.v.*) are widespread in Africa and southern Asia. The typical genus *Gerbillus* occurs in both regions. The mastoids are not highly inflated, nor prominently bulging when the skull is viewed from above. *Tatera* is found throughout the range of the subfamily; it is more ratlike. *Ammodillus,* a dwarf form from Somaliland, lacks a coronoid on the mandible. *Pachyuromys* of North Africa, has extremely inflated bullae and mastoids and a short clublike tail in which fat is stored, while *Desmodzllus* is a fat-tailed gerbil from the deserts of South Africa. *Meriones,* found in Africa and Asia, has molars which are laminated throughout life and rootless. *Psammomys* has high-crowned but rooted molars; it is found in North Africa and Palestine.

Family Spalacidae contains several burrowing rodents of the old world, resembling the American pocket gophers in general appearance but with cheek teeth of a different pattern, and the zygomasseteric structures are derived from a primitive muroid type. *Spalax,* the blind mole rat of southern Europe, Egypt and western Asia, forms a subfamily by itself. Rhizomyinae contains the bamboo rats, *Rhizomys,* of India, China and the Malay region, large rodents with soft, silky gray fur and short tail. The east African mole rats, *Tachyoryctes,* are smaller, about eight inches head and body length, with soft reddish-brown fur.

Family Muridae is an old world group, although some species have accompanied man to almost all parts of the globe. The upper molars have three rows of cusps, which often unite to iorm cross-crests. Subfamily Murinae contain the typical rats and mice, with a few aberrant forms. About 400 species are recognized. *Mus,* the house mouse and closely allied species, is almost world-wide. *Rattus,* containing the well-known black and brown rats and many other species native to Asia and Africa, is especially varied in the Austro-Malayan region; several species have been carried all over the world on ships and even on primitive native boats. The bandicoot rats (*q.v.*), *Nesokia* and *Bandicota,* are burrowers, found from Egypt to China and the Malay region. African giant rats, *Cricetonzys,* measure 30 in. in total length, the tail long with a white tip. The spiny mice, *Acomys,* are widely distributed in east Africa, southwestern Asia, Cyprus and Crete; these are almost as spiny as hedgehogs. The field rats of hirica, *Arvicanthis* and its relatives, are volelike but coarse-haired, some with stripes. Genera oi various relationships have become arboreal, oiten becoming quite similar in appearance. Several shrew rats (*Mycteromys, Echiothrix* and *Melasmothrix),* with long wedge-shaped head and shrewlike appearance, are found in Java, Sumatra and Celebes. The Philippine shrew rat *(Rhynchomys)* has minute cheek teeth and short white incisors; it may feed on insects and worms. Two bushy-tailed rats *(Phlaeonzys* and *Crateromys)* occur in the northern Philippines. The Australian native mice and rats form a varied group, some rabbitiike, others with saltatorial or leaping adaptations. Several giant rats occur in Celebes, New Guinea and the Solomons. heavy-bodied and as large as the African species.

Subfamily Hydromyinae contains the water rats of Australia and New Guinea and several genera in the Philippines. Most species have only two molars, characterized by basined crowns, and the infraorbital foramen is wide. Large feet and the otterlike pelage fit them for a life in the water. Subiamily Dendromurinae contains the African tree mice, characterized by reduced number of cusps on the molars. The tree mice *(Dendromus)* have opposable first toes, often with nails; the yellowish brown upper parts often have a single black stripe. The West African bush mouse *(Prionomys)* is pale chocolate in colour. Spiny tree rats *(Deomys)* from West Africa and the Congo, are remarkable for their long tails. The fat mice (*Steatomys*), widely distributed in Africa, are hamsterlike, short-tailed members, while *Saccostomys* of the savannas is coloured a handsome pale gray and possesses internal cheek pouches. The mouse gerbils of South-West Africa *(Malacotlzrix)* also belong here. Subiamily Otomyinae contains several African swamp rats, resembling large voles but with laminated teeth and long soft fur.

HYSTRICOGNATEII

These rodents are characterized by the angle of the lower jaw, arising from the side of the root of the incisor. Except in the Bathyergidae, the medial masseter muscle passes through the infraorbital foramen, which is large.

Bathyergoidea.—This superfamily includes only the burrowing molerats of south and tropical Africa. The tibia and fibula are fused. *Heliophobius* is remarkable in having $\frac{6}{6}$ cheek teeth, some of which may be deciduous. *Bathyergus* has normal incisors and large claws; the other genera have long-rooted incisors, the upper incisor roots extending to the back of the palate or into the pterygoids. *Georychus* has cheek teeth $\frac{4}{4}$; it is widespread in tropical and southern Africa. *Heterocephalus,* the naked mole-rat of Kenya, Ethiopia and Somaliland, has only $ cheek teeth. The Bathyergidae is represented by two genera in the Oligocene of Mongolia, one of these a large form. The cranial characters of the family were even then well established.

Hystricoidea.—The porcupines (*q.v.*) of both the old and new worlds are included here, although some doubt exists as to their relationships. Quite possibly most of their similarities may be convergence. Both families have a covering of quills and the teeth are complex, wearing flat at an early age.

Family Hystricidae includes the old world porcupines. They are ground-living rodents and their long quills are firmly attached to the skin. *Hystrix* contains the larger forms, two ieet oi more in length, with short tails and inflated skulls, and is found in southern Europe, Africa and southern Asia. *Thecurus* is smaller, with a flattened skull profile and nasals ending opposite the infraorbital canal; it is restricted to Borneo, Sumatra and Palawan, in the Philippines. *Atherurus* is widespread in Africa and Asia, extending south to Sumatra. It is smaller, like a large rat, with a tail about half the length of the body, ending in a brush of hollow quills, each of which resembles a string of flat beads. The long-tailed porcupine (*Trichys*) has short spines and the skull has postorbital processes.

Family Erethizontidae contains the American tree porcupines, characterized by less complex patterns on the cheek teeth, short paroccipital processes on the skull. The hind feet are modified for an arboreal life, the first toe being replaced in function by a movable pad. *Erethizon,* the North American porcupine, is a large, heavy-bodied rodent, the quills of the body nearly hidden by long hairs. *Coeadou,* from South and Central America, is smaller and has a long prehensile tail. *Echinoprocta,* found in Colombia, has a short tail, only a little longer than the foot and not prehensile, but it resembles *Coendou* cranially. *Chaetomys* deserves subfamily rank; its teeth are more simple, the skull has well-developed postorbital processes and the spiny covering is restricted to the head and forelimbs. The tail is long and scaly.

Cavioidea.—The mandible differs from that in the Hystricoidea in that the angle is not distorted laterally. The coronoid is small and a deep groove indicates the insertion of the deep masseter.

Family Caviidae includes the guinea pigs, cavies and capybara (*qq.v.*). The cheek teeth are ever-growing and prismatic. The clavicles are absent, the lateral toes of the hind foot are lost and the tail is much reduced. Subfamily Caviinae is characterized by two- or three-lobed teeth. *Cavia* is represented by a number of South American species related to the well-known guinea pig and rather similar to it. *Kerodon rupestris* of Brazil is characterized by blunt nails on the toes. *Dolichotis,* containing two distinct species, is restricted to Argentina; it is rabbitlike in appearance and habits, especially D. *patagonzca,* the mara.

Several rodent families described from the Santa Cruz Miocene of South America are related to the Caviidae and others are referable to this family.

Subfamily Hydrochoerinae, *Hydrochoerus,* the aquatic capybara, with complicated posterior molars, is found irom Panamá to Paraguay. It is the largest existing rodent, uith a body length of four feet and heavy build Fossil rodents closely allied to the capybara are known irom the Pleistocene of both South and North America.

Family Dinomvidae includes only one living species, with mandible more like that of the Hystricoidea The tail is longer than the broad feet. The skull is broad and porcupinelike; the molars consist of iour transverse alates. The family is known from the Miocene of South America and the West Indies.

Family Heptaxodontidae contains a number of extinct forms of the Pliocene, among them rodents even larger than the capybara.

Family Dasyproctidae includes the pacas and agoutis (*qq.v.*) of tropical America. The agoutis, subfamily Dasyproctinae, are the size of rabbits, with short tail and three toes on the hind foot. The

pacas, subfamily Cuniculinae, have an enormous cheek plate developed from the zygomatic arch. The teeth are lobate, the crowns wearing flat and the lobes becoming enamel lakes. The hind foot has five toes.

Chinchilloidea.—The cheek teeth are ever-growing, consisting of two or three transverse plates. The skull has large bullae and inflated mastoid. The angle of the mandible is narrow and produced posteriorly, while the coronoid is minute. The fibula is small. The lateral toes of the hind foot are vestigial or lost. Only the family Chinchillidae is included here; it has been distinct since the Oligocene and is unknown outside of South America, the plains of Argentina and the Andes from Ecuador south. *Chinchilla lavigera* and *C. brevicauda* are soft-furred rodents, about the size of a large squirrel (*see* CHINCHILLA). Almost equally soft-furred are the rabbit-eared species of *Lagidium*, found from Peru and Chile to southern Argentina.

The larger viscachas *(Lagostomus)* of the Argentine pampas are the size of a hare (head and body 20 in., tail 8 in.), with large head and robust body. They live in colonies like prairie dogs but are nocturnal. The viscacha (*q.v.*) is gray, with blackish and white facial markings and a white stripe on the hind leg.

Octodontoidea.—The zygomasseteric structure resembles that in the Hystricoidea. The cheek teeth usually have an E-pattern, the branches of which may become islands on wear; in some forms there are four branches instead of three.

Family Capromyidae includes two groups. The hutias (*Capromys*) of the Greater Antilles and Venezuela are harsh-haired, robust rodents, with ever-growing cheek teeth of the E-pattern. The coypu or nutria rat (*Myocastor*) is a large beaverlike rodent found from Brazil and Argentina to Chile. *(See* NUTRIA.*)*

Family Octodontidae contains a number of rodents, chiefly Chilean or Argentine in distribution, with simplified kidney-shaped or bilobed cheek teeth. Subfamily Ctenomyinae includes the fossorial tuco tucos *(Ctenomys)*, which resemble burrowing rodents of other groups. The cheek teeth are kidney-shaped. Subfamily Octodontinae contains ratlike or mouselike forms with tufted tails, chiefly found in the southern Andes. *Spalacopus* and *Aconaemys* of this group are fossorial types, resembling *Ctenomys* but with cheek teeth of the figure-eight pattern.

Family Abrocomidae includes only a single Recent genus *Abrocoma*, characterized by ratlike appearance, short hairy tail and inflated bullae. The cheek teeth are ever-growing, prismatic, the upper ones like a distorted figure eight, the lower ones somewhat E-shaped, with a single re-entrant angle on the cheek side. The incisive foramina are large.

Family Echimyidae contains many rodents of ratlike appearance, with pelage coarse or spiny and rooted cheek teeth. These have a distorted E-pattern, both above and below, wearing down to produce transverse enamel islands. Subfamily Echimyinae includes genera with narrow cheek teeth. Subfamily Dactylomyinae is characterized by broad upper cheek teeth with four lateral lobes and by soft fur. The third and fourth digits of the feet are usually elongated.

Family Thryonomyidae is represented by the cane rats of Africa, *Thryonomys*. The incisors are broad and powerful, the upper ones three-grooved. The cheek teeth show a modified E-pattern.

Family Petromyidae. The rock rat of South-West Africa *(Petromys)* resembles a large, bushy-tailed rat. The cheek teeth have a distorted eight-pattern.

SUBORDER DUPLICIDENTATA

Two pairs of upper incisors are present, the second pair small and situated behind the first; the enamel extends completely around the Incisors. This group is often considered a distinct order, the Lagomorpha.

Family Ochotonidae includes the pikas or mouse hares; these have no external tail, the ears are short and the hind legs not modified for leaping. Pikas (*q.v.*) are widely distributed from southeastern Europe through Asia to western North America.

Family Leporidae contains the hares and rabbits (*qq.v.*); the hind limbs are elongated, the tail short and recurved and the ears are long. The cheek teeth number $\frac{6}{5}$. *Lepus*, the hare genus, occurs throughout the northern hemisphere and in Africa, represented by numerous species. *Caprolagus* of Assam and adjacent areas has harsh pelage, a brown tail and ears shorter than the head. *Nesolagus* of Sumatra is striped with black, while the rump is mahogany brown. *Pentalagus*, found in the Liu Kiu Islands, has only five upper cheek teeth; it has a black dorsal stripe. *Romerolagus*, which occurs in high mountains of southern Mexico, is tailless and is otherwise primitive. The cottontails (*q.v.*) of North and South America, *Sylvilagus*, have short ears but dig little. The red hares of South Africa (*Pronolagus*) are heavily built types with brown or red tails. The true rabbit, *Oryctolagus*, originally distributed over North Africa and southern Europe, is distinguished from *Lepus* by its short ears and limbs, its digging habits and the young, which are born blind and helpless.

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(J. E. HL.)

RODEO, a series of cowboy contests deriving from the days of the early cattle industry of the southwestern plains of the United States nhen men, forced to spend months and even years on the range, would gather together in the "cowtowns" at the end of the trails and vie for the unofficial title of best bucking horse rider, roper, etc., the contests being accompanied by heavy betting. As the cowboy was curtailed in scope by the railroads and fencing, the contests became regular, formal programs of entertainment.

Many western towns and areas claim the distinction of being the first place to hold a rodeo in the United States, among them Cheyenne, Wyo., in 1872 and Winfield, Kan., in 1882, but at best such early contests were merely exhibitions of riding and roping skill and not the highly organized shows that modern rodeo became. Denver, Colo., is traditionally accepted as the birthplace of paid spectator rodeo, Oct. 1887.

Formerly, as now, various titles were given to these shows, such as stampede, frontier day, roundup or fiesta. The word rodeo, which is of Spanish origin, did not come into general use until the 1920s. Originally an outdoor sport, rodeo moved indoors in 1917 at the Stockyards coliseum in Fort Worth, Tex., thus becoming a year-round sport with a season extending from the second week in January until the end of December.

Both professional and amateur rodeo programs are built around the five standard events: saddle bronc riding, bareback riding, calf roping, bull riding and steer wrestling. Other events such as team roping, steer roping, steer decorating, wild cow milking, barrel bending and a variety of races are added as facilities and funds permit. The specialty numbers. such as trick riding, fancy roping and the dog. horse and steer acts (known as contract acts) are held simultaneously or spaced in the program to permit officials to prepare'chutes. equipment, etc., for following contests. Integral parts of every rodeo are the queen and clown, the latter serving a useful purpose in distracting the attention of the contest animals while the dismounted or thrown rider has a chance to leave the arena. Other features such as mounted quadrilles and allied western classes may be presented, and often a popular motion-picture or television star entertains.

Organized on Nov. 1, 1936, and originally called the Cowboy's Turtle association, the Rodeo Cowboy's association (R.C.A.) raised the standards of rodeo. The R.C.A. represents the contestants' interests and regulates their personal behaviour and the types of shows to be entered, provides insurance for contestants and establishes a system of fines and black lists to regulate managers' and contestants' activities. In 1929 the Rodeo Association of America, an organization of rodeo managers and producers, was founded to standardize events, rules, judging and arena conditions and to nork out common problems pertaining to the production of professional rodeos. In 1946 the group was renamed the International Rodeo association (I.R.A.). In 1959 the I.R.A. was renamed International Rodeo Management, Inc. (I.R.M.I.). The R.C A. established its own point award system, naming an all-around champion and champions in the five standard events, team roping and steer roping each year.

Rodeo contestants originally were the working cowhands of the west; today they come from all parts of the country. This highly specialized field demands a great degree of skill and stamina of the professional contestants, who may compete in as many as 80 rodeos during the year; participation does not guarantee a living. since events to be remunerative must be won, and the contestant is continually faced with the hazards of accidents and injury.

Rodeo stock is valuable, and the horses and bulls are well cared for to the point of being pampered. Good bucking horses are not from wild herds or killers but are usually halterbroken and gentle until mounted. They are encouraged in their dislike of being mounted and further annoyed by the flank strap, which is placed around the hind quarters; any foreign object on the rear of a horse has a tendency to make him buck.

After the end of World War II, rodeo became an important amateur sport among small saddle clubs, high schools, colleges and even prisons in the United States. This resulted in formation of the National High School and National Intercollegiate Rodeo association and the American Junior Rodeo association. Rodeo

spread to other parts of the world, becoming especially popular in Canada and Australia. (L. SR.; E. W. Co.)

RODERICK or RUADRI (d. 1198), king of Connaught and high king of Ireland, was the son of Turlough (Tordelbach) O'Connor, king of Connaught, who had obtained the overkingship in 1151, but had lost it again in 1154 through the rise of Muirchertach O'Lochlainn in Ulster. Roderick succeeded to Connaught in 1156, and after ten years' fighting won back the title of high king. His ill-advised persecution of Dermot (Diarmait MacMurchada), king of Leinster, furnished the pretext for the Anglo-Norman invasion of Ireland. Roderick endeavoured to expel the invaders, but was driven behind the Shannon. He delayed his submission to Henry II until 1175, when a treaty was concluded at Windsor. Roderick, under this agreement, held Connaught as the vassal of England, and exercised lordship over all the native kings and chiefs of Ireland; in return he undertook to pay an annual tribute. The treaty did not put an end to the wars of the Norman adventurers against Connaught and Roderick's dependents.

He held out till 1191, but then, weary of strife, retired to the cloister. He died in 1198, the last of the high kings of Ireland.

RODEZ, a town of southern France, capital of the *département* of Aveyron, 51 mi. N.N.E. of Albi by rail. Pop. (1954) 17.136. Rodez, *Segodunum* under the Gauls. *Ruthena* under the Romans, was the capital of the *Rutheni,* a tribe allied to the Arverni, and was afterward the chief town in the district of Rouergue. In the 4th century it became Christian, and St. Amans, its first bishop, was elected in 401. In the middle ages the bishops held temporal power in the "cite," and the counts in the "bourg." The Albigenses were defeated near Rodez in 1210. The countship of Rodez, detached from that of Rouergue at the end of the 11th century, belonged first to the viscounts of Carlat, and from the early 14th century to the counts of Armagnac. From 1360 to 1368 the English held the town. After the confiscation of the estates of the Armagnacs in 1475 the countship passed to the dukes of Alençon and then to the D'Albrets. Henry IV finally annexed it to the crown of France. Rodez is situated on the southern border of the Causse of Rodez, on an isolated plateau bordered on the east and south by the Aveyron river. The cathedral (1277–1535) has a great Flamboyant rose window in the principal facade, which is flanked by two square towers and has no portal. Each transept has a fine Gothic doorway. On the north side of the building rises a 16th century tower. The episcopal palace (17th and 19th centuries) is flanked by a massive tower, relic of an older palace.

The industries include wool spinning, and the weaving of woolen goods.

RODGERS, JOHN (1773–1838), U.S. naval officer, one of a family noted for its naval officers, was born in 1773 on a farm in Harford county, Md., the son of a Scottish immigrant, Col. John Rodgers. After service from an early age on merchant ships, John Rodgers entered the U.S. navy when it was organized in 1798. He was second in command to Commodore Samuel Barron (1763–1810) in the expedition against the Barbary pirates and succeeded him in the command in 1805, in the same year bringing both Tunis and Tripoli to terms.

In 1811 Rodgers was in command as commodore of the U.S. frigate "President" off Annapolis when he heard that a U.S. seaman had been '(pressed" by a British frigate off Sandy Hook. Commodore Rodgers was ordered to sea "to protect American commerce." On May 16, 1811, he sighted and followed the British sloop "Little Belt." and after some hailing and counter-hailing. of which very different versions were given by both sides, a gun was fired. Each side accused the other of aggression, and an action ensued in which the "Little Belt" was cut to pieces.

The action was one of the incidents leading up to the War of 1812. A U.S. court of inquiry later confirmed Rodgers' version of the encounter, and he was acclaimed by the United States government for his conduct. When hostilities broke out, Rodgers commanded a squadron and was wounded by the bursting of one of his guns while pursuing the British frigate "Belvidera." He was subsequently president of the board of navy commissioners, 1815–24 and 1827–37. He died in Philadelphia, Pa., on Aug. 1, 1838.

His brother GEORGE WASHINGTON RODGERS (1787–1832) served in the War of 1812 and in the war with Algiers (1815). He was commander of the "Peacock" in the Mediterranean squadron from 1816 until 1819.

Rear Admiral JOHN RODGERS (1812–1882), a son of Commodore John Rodgers. served in the Union navy during the Civil War and from 1877 to 1882 was superintendent of the Naval observatory at Washington, D.C.

G. W. Rodgers had two sons who were naval officers, CHRISTOPHER RAYMOND PERRY RODGERS (1819–1892) and GEORGE WASHINGTON RODGERS (1822–1863). The former served as commandant of midshipmen at the U.S. naval academy, 1860–61, and as superintendent. 1874–78. The latter succeeded his brother as commandant of midshipmen in Sept. 1861, but the following year he went on active duty with the West India squadron. He was killed on Aug. 17, 1863, while attacking Charleston. S.C., as commander of the "Catskill."

RODGERS, RICHARD (1902–), U.S. composer who, with Lorenz Hart (1895–1943) and Oscar Hammerstein II (1895–1960), was responsible for some of the most popular U S. musical comedies from the mid-1920s. Born in New York city on June 28, 1902. Rodgers began writing show tunes about 1925. Among his more successful scores were those for *Connecticut Yankee* (1927); *Present Arms* (1928); *Jumbo* (1935); *On Your Toes* (1936); *Babes in Arms* (1937); *The Boys From Syracuse* (1938); *Pal Joey* (1940); *Carousel* (1945); *The King and I* (1951); *Flower Drum Song* (1958); and *Sound of Music* (1959). *Oklahoma* (1943) and *South Pacific* (1949) were awarded Pulitzer prizes.

RODIN, (FRANÇOIS) AUGUSTE (RENÉ) (1840–1917), French sculptor, was born in Paris on Nov. 12, 1840. From 1854 to 1857 he was a pupil at the Petite École de dessin (later renamed École des Arts Decoratifsj; then, having been refused admission to the École des Beaux-Arts, he began to earn his living as an ornament maker and became an assistant to the sculptor A. E. Carrier-Belleuse. His "Man With a Broken Nose" (1864), which was rejected by the Salon, early revealed his ability. In 1871 he was in Brussels, working for Carrier-Belleuse on the "Caryatides" of the new Bourse and also undertaking a certain amount of work on his own account. In 1875 he visited Florence and Rome, where he was much impressed by the works of Donatello and Michelangelo.

BY COURTESY OF THE METROPOLITAN MUSEUM OF ART GIFT OF THOMAS F RYAN 1910

"THE THINKER" BY AUGUSTE RODIN. IN THE METROPOLITAN MUSEUM OF ART NEW YORK

Rodin's plaster maquette of "The Bronze Age," exhibited in the Salon of 1877, attracted considerable attention; the modeling, indeed, was so fine as to give rise to the accusation of its having been cast from a living man. In 1880. however, when he exhibited his "John the Baptist Preaching" and the final bronze of "The Bronze Age," Rodin silenced his critics and established his position in the world of sculpture. Thenceforward. he was to receive commission after commission; and the first of them was from the French government, which ordered a door for the Musée des Arts Decoratifs, with a series of bas-reliefs representing scenes from Dante's *Divine Comedy.*

Rodin worked on this commission for the rest of his life. His original idea was to divide the door into panels, as Ghiberti had divided his "Gate of Paradise" for the baptistery in Florence. One panel was to represent Paolo and Francesca; another was to show Ugolino devouring his children; and the upper part of the door was to contain a seated figure of Dante himself (eventually entitled "The Thinker"). However, his old friend Alphonse Legros

then invited Rodin to London (1881–82), and there Rodin made a close study of the illustrations of Dante by John Flaxman and William Blake; thereafter, he abandoned architectural considerations entirely and no longer followed Dante's text. The project underwent many changes, and Rodin's studio was filled with works begun as components of the door and then set aside. The plaster maquette of "The Gate of Hell" (1917), which was finally cast in bronze in **1938,** constitutes the last version of the project that Rodin left, but there is no doubt that he would have worked still longer on it had he lived. He died at Meudon on Nov. **17,** 1917.

"The Gate of Hell" does, in fact, show Ugolino, Paolo and Francesca among swirling processions of damned souls; and "The Thinker" occupies the lintel. However, a number of other works which are now quite separate from "The Gate" were originally conceived also as subsidiary themes for it. These include "Adam" (1880), "Eve" **(1881),** "The Fair Armouress" (François Villon's Belle Heaulmière, **1885)** and "The Prodigal Son" **(1889).** Even "The Kiss" (1886), often regarded as Rodin's masterpiece, was originally conceived to form part of "The Gate" as a figure of Faith.

Other sculptures commissioned from Rodin were "The Burghers of Calais," "Victor Hugo" and "Balzac." The first of these, uhich was not set up in Calais until **1896,** is based on Jean Froissart's account of the famous incident and shows the burghers going barefoot, with nooses round their necks, to deliver the keys of Calais to the king of England. (There is a replica of this on the embankment at Westminster.)

The "Victor Hugo" was commissioned by the state for the Panthéon in **1889,** but the first maquette (1890), which showed the poet seated with the upper part of his body naked, proved to be unacceptable. Rodin eventually produced a standing version, which mas set up in the garden of the Palais Royal in 1909 but withdrawn afterward. The "Balzac" was commissioned by the Société des Gens de Lettres in **1891.** The maquette, sent to the Salon in **1898,** consisted of a block nearly ten feet high, with the subject's head emerging from the folds of a voluminous dressing gown. This provoked an indignant outcry, but the bronze cast of it was eventually set up on the Boulevard Raspail in 1939. Meanwhile, Rodin was producing other sculptures, including "Thought" **(1886)** and a series of portrait busts. The latter may be counted among his finest achievements; they comprise "Dalou" (1883), "Victor Hugo" (1883), "Rochefort" **(1884);** "W. E. Henley" (1884), "Octave Mirbeau" (1889), "Puvis de Chavannes" (1891), "Gustave Geffroy" (1905), "Clemenceau" **(1911)** and "Pope Benedict XV" (1915).

In 1900, Rodin's reputation stood so high that he could envisage a special exhibition of his work as a feature of the Paris universal exhibition. Altogether **168** examples were assembled, and an unprecedented success was achieved. The sculptor received the homage of Europe. Among Rodin's later works. mention must be made of the series of "Hands." in which hands are made to exemplify some literary or moral idea. This theme may perhaps be traced back to **1898,** when he produced "The Hand of God" as an image of creativity. "The Hand of the Devil," holding a woman, appeared in 1903, "The Secret," or "Prayer," in 1910 and "The Hand Coming Out of the Tomb" in 1910 also. At the same time, Rodin turned toward literature; his conversations on art were collected by Paul Gsell and published as *L'Art* in 1910 (Eng. trans., Art, **1912);** and his book, *Les Cathédrales de France,* appeared in 1914.

From 1908, Rodin was living in the former Hôtel Biron, where the state had provided accommodation for a number of artists and writers. There, Rainer Maria Rilke, a close friend of Rodin's, suggested that they should establish themselves together, and Rodin thereupon offered to bequeathe all the works of his own that remained in his possession, all his collections and his villa at Meudon to the French state, on condition that he be allowed to spend the rest of his life in the Hôtel Biron and that on his death the building be converted into a Rodin museum. The hotel and the villa now constitute the two sections of the Musée Rodin, which contains most of Rodin's sculpture, his drawings, some paintings, his library and his art collections.

Numerous replicas of Rodin's sculptures can be seen in museums outside France. The Rodin museum in Philadelphia, inaugurated in 1929, is an architectural copy of the villa at Meudon.

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RODNEY, GEORGE BRYDGES RODNEY, BARON (1718–1792), English admiral. who won the important battle against French forces off Dominica in 1782, was born in Feb. 1718. George was sent to Harrow, being appointed, on leaving, by warrant dated June **21,** 1732, a volunteer on board the "Sunderland." While serving on the Mediterranean station he was made lieutenant (1739) on the "Dolphin." In 1742 he attained the rank of post captain, having been appointed to the "Plymouth." After serving in home waters, he obtained command of the "Eagle" (60 guns), and in this ship took part in Hawke's victory off Ushant (Oct. **14, 1747)** over the French fleet. On that day Rodney gained his first laurels for gallantry, under a chief to whom he was in a measure indebted for subsequent success. In 1749 he was appointed governor and commander in chief of Newfoundland, with the rank of commodore, it being usual at that time to appoint a naval officer, chiefly on account of the fishery interests. He was elected M.P. for Saltash in 1751.

During the Seven Years' War Rodney rendered important services. In 1757 he had a share in the expedition against Rochefort, commanding the "Dublin" **(74).** Next year, in the same ship. he served under Boscawen at the taking of Louisburg (Cape Breton). In 1759 and again in **1760** he inflicted great loss on the French transports collected on the Normandy coast for an attack on Great Britain. Elected M.P. for Penryn in **1761,** he was in October of that year appointed commander in chief of the Leeward Islands station, and within the first three months of 1762 had reduced the important island of Martinique, while both St. Lucia and Grenada had surrendered to his squadron. At the peace of **1763** Admiral Rodney returned home, having been during his absence made vice-admiral of the blue and having received the thanks of both houses of parliament. In **1764** Rodney was created a baronet. From 1765 to 1770 he was governor of Greenwich hospital. In 1771 he was appointed rear admiral of Great Britain, and in **1778** admiral of the white. From 1771 to 1774 he held the Jamaica command, and during a period of quiet was active in improving the naval yards on his station. Election expenses and losses at play in fashionable circles had shattered his fortune; he could not secure payment of the salary as rear admiral of Great Britain; and he lived for some time in Paris until the generosity of a friend enabled him to meet his debts.

Sir George was appointed once more commander in chief of the Leeward Islands late in 1779. His orders were to relieve Gibraltar on his way to the West Indies. He captured a Spanish convoy off Cape Finisterre on Jan. **8,** 1780, and eight days later defeated the Spanish admiral Don Juan de Langara off Cape St. Vincent, taking or destroying seven ships. On April **17** an action, which, as a result of the carelessness of some of Rodney's captains, was indecisive. was fought off Martinique with the French admiral Guichen. Rodney, acting under orders, captured the valuable Dutch island of St. Eustatius on Feb. **3, 1781.** It had been a great entrepôt of neutral trade, and was full of booty. which Rodney confiscated. As large quantities belonged to English merchants, he was entangled in a series of costly lawsuits.

After a few months in England, recruiting his health and defending himself in parliament, Rodney returned to his command in Feb. **1782,** and a running engagement with the French fleet on April **9** led up to his crowning victory off Dominica, when with **35** sail of the line he defeated the comte de Grasse, who had 33 sail (April **12).** The French inferiority in numbers was counter-

balanced by the greater size and superior sailing qualities of their ships, yet five were taken and one sunk after 11 hours' fighting. This important battle for Jamaica was a blow to French naval prestige, and it enabled Rodney to write: "Within two little years I have taken two Spanish, one French and one Dutch admiral."

On his return to England Rodney received a barony and a pension of £2,000 a year. From this time he led a quiet country life till his death (May 24. 1792), in London.

Rodney was unquestionably an able officer, but he was also vain, selfish and unscrupulous, both in seeking prize money and in using his position to push the fortunes of his family. He made his son a post captain at 15. for example. He was accused by his second-in-command. Samuel Hood. of sacrificing the interest of the service to his own profit, and of showing want of energy in pursuit of the French on April 12, 1782. It must be remembered that he was then prematurely old and racked by disease.

See Sir George Mundy, *Life and Correspondence of Admiral Lord Rodney* (2 vol., 1830); Rodney letters in 9th *Report* of Hist. manuscripts Corn., pt. iii; "Memoirs," in *Naval Chronicle,* i, 353–393 (1799); and J. Charnock, *Biographia Navalis,* v. 204–228 (1794–98).

RODÓ, JOSÉ ENRIQUE (1872–1917), Uruguayan philosopher, author and politician, was born in Montevideo on July 15, 1872. He was educated in a free lay school and at the University of Montevideo, where he showed extraordinary aptitude ior history, literature and philosophy. In 1895 he was one of the founders of the *National Review of Literature and Social Sciences,* in which, in the following year, he published an essay on literary criticism, "El que vendrá." which brought him immediate recognition as a writer and critic. In 1898 he was made professor of literature in the university and two years later was appointed director of the National library, but in 1901 he gave up both positions to enter congress, to which he was elected in 1902 and 1908 and where he took an earnest part in initiating social legislation; he was not, however, a radical, and in a pamphlet. *Liberalismo y jacobismo* (1907), he strenuously opposed government antichurch legislation. In 1910 he represented Uruguay at the centenary of Chilean independence. Rodó's influence. however, as a rallying point of Latin-American youth was due to his authority as exponent of optimism. as stylist and as advocate of unity in Spanish-American literature and culture. His first important philosophical work. *Ariel,* based on Renan's eclecticism, appeared in 1900 in defense of Latin-American culture against the utilitarianism of the United States. In 1909 he published *Motivos de Proteo,* an assertion of the inevitability of change and the possibility of self-improvement, which represents Rodó's highest attainment as thinker and master of the Spanish language, and caused him to be hailed by Spanish-Americans as their philosopher par *excellence.* His essays on Rubén Dario (1899), Bolivar and Montalvo won him a similarly unique place in Spanish-American letters. to which, in those on. Bolivar and Montalvo, included in El *Mirador de Próspero* (1913), he gave models of historical and critical essays. He died at Palermo in May 1917.

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RODOSTO: *see* TEKIRDAG.

RODRIGUEZ (officially RODRIGUES), an island in the Indian ocean in 19° 41′ S., 63° 23′ E.; a dependency of the British colony of Mauritius, from which it is 350 mi. distant. It has a length from east to west of 9½ mi., a width of 4½ mi. and an area of 40 sq.mi. It is surrounded by a fringing reef of coral, studded with islets. This reef. only 100 yd. wide on the east. extends 3 mi. west, and both north and south forms a flat area partly dry at low water. Two passages through the reef are available for large vessels—these passages leading respectively to Port Mathurin on the north coast and to Port South East. The island is a mass of volcanic rock. rnainly a doleritic lava, rich in olivine. The land is hilly and the main ridge rises abruptly on the east, but more gradually on the west, where there is a wide plain of coral limestone, studded with caves. Of several peaks on the main ricige the highest is Mt. Limon (1,300 ft.). The ridge is deeply cut by ravines, the upper parts of which show successive belts of lava separated by thin beds of ashes, agglomerate and ochre-coloured clays. In places the cliffs rise 300 ft. and exhibit 12 distinct lava flows. The climate is like that of Mauritius, but Rodriguez is more subject than Mauritius to cyclones during the northwest monsoon (November to April).

Flora and Fauna.—When discovered, Rodriguez was clothed with fine timber trees; but goats, cattle and bush fires combined to destroy the greater bulk, and indigenous plants in many cases were ousted by intrusive foreigners. Parts are still well wooded, and elsewhere there is excellent pasturage. The sweet potato, manioc, maize, millet, sugar cane, cotton, coffee, rice and tobacco are cultivated. Wheat is seldom seen, but Sieva beans (*Phaseolus lunatus*), lentils, gram (*Cicer arietinum*), dhal (*Cajanus indicus*) and peanuts are all grown. Mangoes, bananas, guavas, pineapples, custard apples, and especially oranges, citrons and limes flourish.

At present the only indigenous mammal is a species of fruit-eating bat (*Pteropus rodericensis*), and the introduced species are familiar creatures such as deer, pig, rabbit, rat, mouse, etc. Until recently there occurred a large land tortoise (*Testudo vosmaeri*). The island's limestone caves have yielded a large number of skeletons of the now extinct bird, the solitaire (*Pezophaps solitarius*). Of indigenous birds 13 species have been registered. The guinea fowl (introduced) has become exceedingly abundant, partly owing to a protective game law; and a francolin (*Francolinus ponticerianus*) is also common. The marine fish-fauna does not differ from that of Mauritius, and the fresh-water species, with the exception of *Mugil rodericensis* and *Myxus caecuticus,* are common to all the Mascarenes. The insects comprise at least 60 species of Coleoptera, 1j Hymenoptera. 21 Lepidoptera, 1j Orthoptera, and 20 Hemiptera. Forty-nine species of coral have been collected, showing a close affinity to those of Mauritius, Madagascar and the Seychelles.

History.—Rodriguez or Diego Ruy's island was discovered by the Portuguese in 1645. In 1690 the Dutch government sent a body of French Huguenots under François Leguat to the Island of Bourbon. but they, finding the French authorities in possession, proceeded to Rodriguez where eight of their number were landed on April 30, 1691, with a promise that they should be visited within two years. Though the two years passed without misadventure, the colonists, instead of awaiting the arrival of their friends, left the island on May 8. 1693, and made their way to Mauritius, where they were treated with great cruelty by the governor. From the Dutch the island passed to the French, who colonized it from Mauritius. Large estates were cultivated and the islanders enjoyed considerable prosperity. In 1809–10 Rodriguez was seized by the British, in whose possession it has since remained. The abolition of slavery proved disastrous to the prosperity of the island and in 1843 the population had declined to about 250. Thereafter there mas a gradual recovery in the economic condition and a steady increase in population.

Population.—By 1956 there were 16,535 inhabitants, most of them fishermen and small cultivators, and mainly of African origin, being descendants of slaves introduced by the French, and Negro immigrants direct from Africa. There are a few families of European descent and a small colony of Indians and Chinese. The bulk of the people are French-speaking and Roman Catholic. There are two small settlements. Port Mathurin, the capital, and Gabriel, in the centre of the island.

Administration.—The island is under the charge of a civil commissioner aided by officers of the police, health and agricultural departments of Mauritius. The civil commissioner, a magistrate, administers justice. (W. H. Is.)

RODZIANKO, MIKHAIE VLADIMIROVITCH (1859–1923), Russian politician. was born in 1859, of a family of great landowners. In 1906 and 1907 he was a member of the council of the empire for the zemstvo of the province of Ekaterinoslav He was a member of the third and fourth dumas. He joined the right wing of the Octobrist (moderate Liberal party) and with the support of the conservatives was elected president of the third duma. As president of the fourth duma he took part in the struggle for constitutional changes in the government opposing the re-

actionary policy of the government and defending the rights of the duma. At the revolution, he sent a telegram to the tsar, urging his abdication. After the revolution he emigrated to Yugoslavia, where he died on Jan. 24, 1923.

RODZINSKI, ARTUR (1894–1958), U.S. conductor, was born at Split (Spalato), in the former kingdom of Dalmatia (Yugoslavia), on Jan. 2, 1894. After World War I he became a choral director and opera conductor in Lwów (Lvov), Pol., and later conducted opera and the Philharmonic orchestra in Warsaw. He became a U.S. citizen in 1933, served as assistant to Leopold Stokowski, conductor of the Philadelphia orchestra, from 1926 to 1929, and later conducted the orchestras of Los Angeles, Cleveland, New York and Chicago: He died on Nov. 27, 1958, in Boston, Mass.

ROE, later changed by deed poll to VERDON-ROE the name of two English brothers who were aviation pioneers.

SIR (EDWIN) ALLIOTT VERDON-ROE (1877–1958), British aircraft designer, the first Englishman to construct and fly his own airpiane. He was born at Patricroft, near Manchester, Eng., on April 26, 1877, and educated at St. Paul's school, London. He went to British Columbia at the age of 14, but returned a year later and served a five-year apprenticeship at the Lancashire and Yorkshire Railway's locomotive shops. He then spent two years at sea, after which he entered the motor industry. On June 8, 1908, he flew a distance of 75 ft in a biplane of his own design with a 24 h.p. Antoinette engine, nearly a year before the first officially recognized flight in England (by J. T. C. Moore-Brabazon, later Lord Brabazon of Tara, in 1909). He founded the aviation firm of A. V. Roe and Co., Ltd.. with his brother, Humphrey, in 1910. Avro aircraft were used with great success in World War I and Avro 504N airplanes were the standard training aircraft for the Royal Air Force for a long period between World Wars I and II Verdon-Roe later turned his attention to the design of flying boats, founding Saunders-Roe, Ltd.. of Cowes, Isle of Wight. Knighted in 1929, he died on Jan. 4, 1958.

HUMPHREY VERDON-ROE (1878–1949) was born at Patricroft, near Manchester, Eng., on April 18, 1878. Commissioned in the Manchester regiment, he served in the South African War, retiring from the army soon afterward. He joined the firm of Everard and Co., webbing manufacturers in Manchester, and when his elder brother, Alliott, founded the firm of A, V. Roe and Co., he cooperated with him. He was not a pilot, but flew much as a passenger and in 1917 joined the royal flying corps as an observer. In 1918, he married Marie Carmichael Stopes and with her founded the first birth control clinic, at Holloway, London, in 1921. He died in London on July 25, 1949. (D. CR.)

ROE, SIR THOMAS (*c.* 1581–1644), English diplomatist, was born at Low Leyton, Essex, and was educated at Magdalen college, Oxford. He was appointed esquire of the body to Queen Elizabeth I, was knighted in 1605 and in 1610 was sent by Henry, prince of Wales, to the West Indies and South America to discover gold. Elected M.P. for Tamworth (1614) and Cirencester (1621), his reputation was secured by his successful mission (1615–19) to the court of the great mogul, Jahangir, at Agra, where he obtained protection for an English factory at Surat. Appointed ambassador to the Ottoman Porte in 1621, Roe secured further privileges for English merchants, concluded a treaty with Algiers in 1624 and gained support from Transylvanian prince Gabriel Bethlen for the European Protestant alliance and the Palatinate cause.

Through his friendship with the patriarch of the Greek church the *Codex Alexandrinus* was presented to James I, and Roe himself collected several valuable manuscripts, which he gave to the Bodleian library. In 1629 he mediated successfully between the kings of Sweden and Poland and in 1630 negotiated treaties with Danzig and Denmark. In 1637 he was appointed chancellor of the order of the Garter. Subsequently he took part in the peace conferences at Hamburg, Kegensburg and Vienna. In June 1640 he aas made a privy councillor and in October he became member of parliament for the University of Oxford. He died on Nov. 6, 1644.

His *Journal* of the mission to the Mogul was re-edited for the Hakluyt society, 2 vol (1899). Of his correspondence, *Negotiations in His Embassy to the Ottoman Porte (1621–28)*, vol. i, was published in 1740, but the work was not continued. Letters relating to his mission to Gustavus Adolphus (1629–30) were edited by S. R. Gardiner for the Camden Society Miscellany, vol. vii (1875), and his correspondence with Lord Carew in 1615 and 1617 by Sir John Maclean for the same society in 1860. Roe published a *True and Faithful Relation . . . Concerning the Death of Sultan Osman . . . 1622;* a translation from the anonymous work once attributed to Paolo Sarpi, A *Discourse Upon the Reasons of the Resolution Taken in the Valteline . . .* (1628); and in 1614 T, Wright published *Quatuor Colloquia,* consisting of theological disputations between himself and Roe. Several of his speeches, chiefly on currency and financial questions, were also published.

Two other works are mentioned by Anthony a Wood: *Compendious Relation of the Proceedings . . . of the Imperial Dyet Held at Ratisbon in 1640 and 1641* and *Journal of Several Proceedings of the Knights of the Order of the Garter.*

ROEBLING, JOHN AUGUSTUS (1806–1869), U.S. civil engineer, designer of many great suspension bridges, among which the Brooklyn bridge is the most famous, mas born at Mühlhausen, Prussia, on June 12, 1806. Soon after his graduation from the polytechnic school at Berlin he moved to the United States, and in 1831 began to practise his profession in western Pennsylvania. He established near Pittsburgh, Pa., a wire rope factory, and in May 1845 completed his first important structure, a suspended aqueduct across the Allegheny river. This was followed by the Monongahela suspension bridge at Pittsburgh and several suspended aqueducts on the Delaware and Hudson canal. Moving his wire factory to Trenton, N.J., he began in 1851 the erection at Niagara falls of a long-span wire suspension bridge with double roadway. for railway and vehicular use *(see* BRIDGES), which was completed in 1855. Because of the novelty of its design, the most eminent engineers regarded this bridge as foredoomed to failure; but, with its complete success, demonstrated by long use. the number of suspension bridges rapidly multiplied, the use of nire ropes instead of chain cables becoming virtually universal.

The completion, in 1867, of the still more remarkable suspension bridge over the Ohio river at Cincinneti, O., with a clear span of 1,057 ft., added to Roebling's reputation, and his design for the great bridge spanning the East river between Manhattan and Brooklyn, New York city, was accepted, While personally engaged in laying out the towers for the bridge, Roebling received an accidental injury, which resulted in his death, at Brooklyn, from tetanus, on July 22, 1869. The bridge was completed under the direction of his son, Washington Augustus Roebling (1837–1926).

See H. Schuyler, *The Roeblings; A Century of Engineers, Bridgebuilders and Industrialists (1931)*; D. B. Steinman, *The Builders of the Bridge* (1945).

ROEBOURNE, a settlement of the northwest division of Western Australia, 8 mi. from the northwest coast, 920 mi. N. of Perth. It is a centre for the West Pilbara Goldfield district. There were extensive pearl fisheries off its port at Cossack bay. Pop. (1954) 463.

ROEBUCK, JOHN ARTHUR (1801–1879), English politician, was born at Madras, India, on Dec. 28, 1801, and was brought up in Canada. He returned to England in 1824 and was called to the English bar in 1831. He became M.P. for Bath in 1832. In his youth he was strongly influenced by Benthamite ideas and was a close personal friend of John Stuart Mill. He was an original member of the Reform club in 1836, and in 1838 appeared at the bar of the house of commons to protest, in the name of the Canadian assembly, against the suspension of the Canadian constitution. Roebuck was out of parliament from 1837 to 1841, but on his return he spoke eloquently in favour of many of the Chartist claims. He opposed Sir Robert Peel's income tax of 1842 and frequently scted as a radical spokesman. At the general eiection of 1847 Roebuck lost his seat, but two years later he was returned for Sheffield. He became a vigorous advocate of a firm and active foreign policy. In 1850 he strongly supported Lord Palmerston, and in 1855, dissatisfied with Lord Aberdeen's conduct of the Crimean War, he moved for a committee of inquiry. When Aberdeen's government tried to resist Roebuck's motion, the government was defeated and Aberdeen resigned. In later life,

his radicalism faded and he became a bitter critic of trade unions and Gladstonian liberalism, although he continued to support administrative reform. In 1877 he was a supporter of Lord Beaconsfield's policy. and in 1878 he nas made a privy councilor. He died in London on Nov. 30, 1879.

Sre R E Leader, *Life* (London, 1897). (*A.* BRL.)

ROEBUCK, the smallest European deer (a full-grown buck standing 27 in. at the shoulder), the typical representative of a genus *(Capreolus)* in which the antlers lack a brow tine and belong to the forked type, while the tail is rudimentary *(see* DEER). The antlers are short, upright, and deeply furrowed, the beam forking at about t o-thirds of its length and the upper prong again dividing, thus making three points. The coat in summer is foxy red above and white below; in winter this changes to a grayish fawn, with a white rump patch. The roebuck or roedeer (C. *capreolus*) inhabits southern and temperate Europe and Asia, represented by various races in Sweden. Scotland, Armenia. Spain and parts of Asia. They frequent woods, preferring those that have underwood and are in the neighbourhood of cultivated ground where they visit in the evening in search of food. Before pairing, the bucks pursue the does round specially trodden circular or octagonal runs. Pairing takes place in August, but the fawns are not born till the following May. Roe were formerly abundant in all the wooded parts of Great Britain, but are now restricted to the Highlands of Scotland and a few localities farther south. They take readily to water. The Siberian roe (C. *c. pygargus),* common in the Altai, is larger and paler. with shorter and more hairy ears and small irregular snags on the inner border of the antlers. The Manchurian roe (C. *c. bedfordz)* is about the size of the European species, with antlers of the type of those of the Siberian roe, but more slender.

ROEMER, OLE (Latinized OLAUS) (1644–1710), Danish astronomer. was born at Aarhuus, Jutland, on Sept. 25, 1644. He became in 1662 the pupil and amanuensis of Erasmus Bartholinus at Copenhagen. In 1671 he assisted J. Picard to determine the position of Tycho Brahe's observatory (Uraniborg, on the island of Hveen). In 1672 he went to Paris with Picard, and spent nine years on observations at the new royal observatory and hydraulic works at Versailles and Marly. After a scientific mission to England (1679), on which he met Newton, Halley and Flamsteed, he returned to Copenhagen in 1681 as royal mathematician and professor of astronomy in the university. He also held several public offices, including that of mayor (1705). He died at Copenhagen on Sept. 23, 1710.

Roemer is remembered as the discoverer of the finite velocity of light. which was suggested to him by his observations on the eclipses of Jupiter's moons. The first noteworthy transit instrument was in 1690 erected at his house. He also set up at the university observatory an instrument with altitude and azimuth circles. and an equatorial telescope. He also built and equipped the "Tusculan" observatory at Vridlosemagle, near Copenhagen. His observations perished in the great fire of Oct. 21, 1728, except those discussed by J. G. Galle in *O. Roemeri triduum' observationum astronomicarum a. 1706 institutarum* (Berlin, 1845).

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ROENTGEN, DAVID (1743–1807), German cabinetmaker to Queen Marie Antoinette, was born at Herenhag on Aug. 11, 1743, and died at Wiesbaden on Feb. 12, 1807. He was the eldest son of Abraham Roentgen, who in 1750 moved to Neuwied, on the Rhine near Coblenz, where he produced furniture of outstanding quality, often decorated with inlay work of ivory and other material, much of it for the courts of German princes. David Roentgen learned his trade in his father's workshop and succeeded to the business in 1772, his father continuing as a partner until 1784. His father's firm having already achieved renown in Germany, the son won European reputation after he had displayed his furniture in Paris in 1779 and secured King Louis XVI, Queen Marie Antoinette and other members of the French court as customers. Roentgen was appointed cabinetmaker to the queen and in 1780 was granted admission as master (*maître ébéniste*) to the trade corporation of Paris cabinetmakers, a fact which made it possible for him to keep in Paris a stock of the furniture manufactured at Neuwied. In this fashion he was able to compete with such great French cabinetmakers of the period as Jean Henri Riesener and others. King Frederick the Great of Prussia and Empress Catherine II of Russia were also customers of Roentgen. The latter, after Roentgen's first visit to St. Petersburg in 1783, bought great quantities of his furniture. When in 1795 the French Revolutionary armies threatened to cross the Rhine, Roentgen evacuated his establishment and moved his stock of furniture farther inland. While he never succeeded in starting production again, former apprentices of his whom he had helped to establish in Berlin (David Hacker) and in Brunswick (Christian Harder) were successful in their enterprises.

Roentgen had begun his career by continuing and developing the style of furniture his father had introduced. His so-called French style is characterized by furniture of curved outline sometimes decorated with rich carvings. His "English" cabinetwork is based on elements dating from the early years of George III and occasionally influenced by Thomas Chippendale. Both types of furniture are frequently decorated with rich inlay work of outstanding charm and elegance made up of a variety of woods, some tinted and composed to form figural and floral compositions. often in the *chinoiserie* manner. Between 1775 and 1780 Roentgen's previous style is altogether abandoned and rigid. classical forms are introduced, the effect of which is often based on the contrast of mahogany with rich bronze appliqués. The Roentgen workshop indulged in mechanical devices which made appear or disappear drawers and mirrors by pressing on hidden releases. Peter Kinzing was the mechanical genius who invented many of these tricks and provided clockworks. Furniture by Roentgen is in most large museums in Europe, at the Metropolitan Museum of Art in New York and at the Art Institute of Chicago.

See Hans Huth, *Abraham und David Rontgen und ihre Neuwieder Werkstatt* (1938). (Hs. H.)

ROERICH, NICHOLAS KONSTANTIN (1874–1947), Russian painter of Scandinavian origin, established his reputation with pictures of Russian prehistoric life and the wanderings of Vikings. He was born in St. Petersburg on Sept. 27, 1874. After beginning with realistic pictures. his manner evolved under the influence of the Byzantine icon and of oriental art toward a purely decorative and monumental style. He studied the technique of ancient Russian frescoes and his wall paintings for the Kazan railway station at Moscow, representing combats between Russian? and Tatars, are his most important work. He executed a number of works for the theatre: for the Russian ballet he painted the scenery in *Prince Igor;* for Stanislavsky the setting of *Peer* Gynt. He wrote the libretto and designed the scenery and costumes for *The Rite of Spring,* for which Igor Stravinsky composed the music. After the Russian Revolution of 1917 he settled successively in the United States and in India. More than 1,000 of his works are in the Roerich museum, New York, and in other famous galleries. He died Dec. 13, 1947, in Kulu, East Punjab.

ROERMOND, a town in the province of Limburg, the Netherlands, on the right bank of the Maas at the confluence of the Roer. and a junction station 28 mi. by rail N.S.E. of Maastricht. Pop. (1957 est.) mun. 25.840. The old fortifications were dismantled and partly converted into promenades. A bridge across the Roer, dating from 1771, connected Roermond with the suburb of St. Jacob. Roermond was the seat of a Roman Catholic episcopal see. The Romanesque minster church dates from the first quarter of the 13th century. In the middle of the nave is the tomb of Gerhard III, count of Gelderland, and his wife Margaret of Brabant. It was formerly the church of a Cistercian nunnery, and in modern times was elaborately restored. The cathedral of St. Christopher is also of note; on top of the tower (246 ft.) a copper statue of the saint was erected. The interior was adorned with paint-

ings by Rubens, Jacob de Wit (1695–1754) and others. The old bishop's palace became the courthouse, and the old Jesuits' monastery a higher-burgher school. Woollen, cotton, silk and mixed stuffs, paper, flour and beer are manufactured there. Roermond suffered damage during World War II.

ROGATION DAYS, in the Calendar of the Christian Church, the three days before Ascension Day. Their observance, by fasting and chanting litanies in procession, was introduced by St. Mamertus, bishop of Vienne (d. *c.* 475), and was ordered throughout France by the first Council of Orleans in 511. Leo III. (pope 795–816) introduced rogation days, but without fasting, at Rome. The custom had spread earlier into the English Church, where it was confirmed in 747 by the Council of Clovesho. After the Reformation the processions gradually ceased to be ecclesiastical in England, and now survive only in the perambulation of the parish boundaries on or about Ascension Day.

See also PROCESSION and LITANY.

ROGER (d. 1181), archbishop of York, known as Roger of Pont l'Evêque, was a member of the household of Theobald. archbishop of Canterbury, where he quarrelled violently with another future archbishop, Thomas Becket. In 1148 he was appointed archdeacon of Canterbury, and soon afterwards chaplain to King Stephen, who sent him on an errand to Rome in 1152; then in Oct. 1154 he was consecrated archbishop of York in Westminster abbey. When Henry II. entered upon his struggle with Becket he secured the support of Roger, and having been appointed papal legate in England, the archbishop visited Pope Alexander III. and the French king, Louis VII., in his master's interests. In June 1170 he crowned the king's son Henry, in spite of prohibitions from the pope and from Becket, and for this act he was suspended. He quarrelled with Richard, the new archbishop of Canterbury, about the respective rights of the two archiepiscopal sees, until 1176, when the king arranged a truce; and he was constantly endeavouring to assert his supremacy over the Scottish church. He died at York on Nov. 21, 1181.

ROGER (d. 1139), bishop of Salisbury, was originally priest of a small chapel near Caen. The future King Henry I., who happened to hear mass there one day, was impressed by the speed with which Roger read the service, and enrolled him in his own service. Roger, though uneducated, showed great talent for business, and Henry, on coming to the throne, almost immediately made him chancellor (1101). Soon after Roger received the bishopric of Salisbury. In the Investitures controversy he skilfully managed to keep the favour of both the king and Anselm. Roger devoted himself to administrative business, and remodelled it completely. He created the exchequer system, which was managed by him and his family for more than a century, and he used his position to heap up power and riches. He became the first man in England after the king, and was in office, if not in title, justiciar. He ruled England, while Henry was in Normandy, and succeeded in obtaining the see of Canterbury for his nominee, William of Corbeil. Duke Robert seems to have been put into his custody after Tinchebrai. Though Roger had sworn allegiance to Matilda, he disliked the Angevin connection, and went over to Stephen, carrying with him the royal treasure and administrative system (1135). Stephen placed great reliance on him, on his nephews, both bishops and on his son Roger, who was treasurer.

Roger himself had built at Devizes a splendid castle. He and his nephews seem to have secured a number of castles outside their own dioceses, and the old bishop behaved as if he were an equal of the king. At a council held in June 1139, Stephen found a pretext for demanding a surrender of their castles, and on their refusal they were arrested. After a short struggle all Roger's great castles were sequestrated. This quarrel with the church, which immediately preceded the landing of the empress, had a serious effect on Stephen's fortunes. Roger died at Salisbury in December 1139. He was a great bureaucrat, and a builder whose taste was in advance of his age. But his contemporaries were probably justified in regarding him as worldly, ambitious, avaricious, unfettered by any high standard of personal morality.

See Sir J. Ramsay's *Foundations* of *England,* vol. **ii., and** J. H. Round's **Geoffrey *de Mandeville.***

ROGER I. (1031–1101), ruler of Sicily, was the youngest son of Tancred of Hauteville. Arriving in Southern Italy soon after 1057, he shared with Robert Guiscard the conquest of Calabria, and in a treaty of 1062 the brothers apparently made a kind of "condominium" by which each was to have half of every castle and town in Calabria. Robert now commissioned Roger to reduce Sicily, which contained, besides the Muslims, numerous Greek Christians subject to Arab princes who had become all but independent of the sultan of Tunis. In May 1061 the brothers crossed from Reggio and captured Messinz. After Palermo had been taken in January 1072 Robert Guiscard, as suzerain, invested Roger as count of Sicily, but retained Palermo, half of Messina and the north-east portion of the island. Not till 1085, however, was Roger able to undertake a systematic crusade. In March 1086 Syracuse surrendered, and when in February 1091 Noto yielded the conquest was complete. Much of Robert's success had been due to Roger's support. Similarly the latter supported Duke Roger, his nephew, against Bohemund and other rebels, in return for which the duke surrendered to his uncle in 1085 his share in the castles of Calabria, and in 1091 the half of Palermo.

At the enfeoffments of 1072 and 1092 no great undivided fiefs were created, and the mixed Norman, French and Italian vassals owed their benefices to the count. No feudal revolt of importance therefore troubled Roger. Politically supreme, the count became master of the insular Church. While he gave full toleration to the Greek Churches, he created new Latin bishoprics at Syracuse and Girgenti and elsewhere, nominating the bishops personally, while he turned the archbishopric of Palermo into a Catholic see. The Papacy granted to him and his heirs in 1098 the Apostolic Legateship in the island. Roger was tolerant towards Arabs and Greeks, allowing to each race the expansion of its own civilization. In the cities the Muslims, who had generally secured such terms of surrender, retained their mosques, their kadis, and freedom of trade; in the country, however, they became serfs. He drew from the Muslims the mass of his infantry, but the Latin element began to prevail with the Lombards and other Italians who flocked into the island in the wake of the conquest, and the conquest of Sicily was decisive in the steady decline of Mohammedan power in the western Mediterranean. Roger, the "Great Count of Sicily," died on June 22, 1101, and was buried in S. Trinità of Mileto. His third wife, Adelaide, niece of Boniface, lord of Savona, gave him two sons, Simon and Roger, of whom the latter succeeded him.

See E. Caspar, *Roger II. und die Gründung der normannisch-sicilischen Monarchie* **(Innsbruck,** 1904). (E. Cu.)

ROGER II. (1093–1154), king of Sicily, son of the preceding, began to rule as count in 1112, and from the first aimed at uniting the whole of the Norman conquests in Italy. In 1127, Roger claimed the Hauteville possessions, and the overlordship of Capua, for which Richard II. in 1098 had sworn homage to Duke Roger, in virtue of a promise made by William, the late duke of Apulia. The union of Sicily and Apulia, however, was resisted by the subjects of the duchy itself, and by the pope at Capua (Dec. 1127) who preached a crusade against the claimant, setting against him Robert II. of Capua and Ranulf of Alife, or Avellino, brother-in-law of Roger. The coalition, however, failed, and in August 1128 Honorius invested Roger at Benevento as duke of Apulia. The baronial resistance, backed by Naples, Bari, Salerno and other cities, whose aim was civic freedom, also gave way, and at Melfi (Sept. 1129) Roger was recognized as duke by Naples, Capua and the rest. He at once began to enforce order in the Hauteville possessions, where the ducal power had long been falling to pieces. For the binding together of his states the royal name seemed essential, and the death of Honorius in February 1130, followed by a double election, seemed the decisive moment, While Innocent II. fled to France, Roger supported Anacletus II. The price was a crown, and on Sept. 27, 1130, a bull of Anacletus made Roger king of Sicily. He was crowned in Palermo on Dec. 25, 1130.

This plunged Roger into a ten years' war. Bernard of Clairvaux, Innocent's champion, built up against Anacletus and his

"half heathen king," a coalition joined by Louis VI. of France, Henry I. of England and the emperor Lothar. Meanwhile the forces of revolt in South Italy drew to a head again, and on June 24, 1132, the king was defeated at Nocera by Ranulf. Nevertheless, by July 1134, he forced Ranulf, Sergius, duke of Naples, and the rebels to submit, while Robert was expelled from Capua. Meanwhile Lothar's contemplated attack upon Roger had gained the backing of Pisa, Genoa and the Greek emperor, all of whom feared the growth of a powerful Norman kingdom. In February 1137 Lothar moved south and was joined by Ranulf and the rebels; in June he besieged and took Bari. At San Severino, after a victorious campaign, he and the pope jointly invested Ranulf as duke of Apulia (Aug. 1137), and the emperor then retired to Germany. Roger, freed from the utmost danger, recovered ground, sacked Capua and forced Sergius to acknowledge him as overlord of Naples. At Rignano the indomitable Ranulf again utterly defeated the king, but died in April 1139, leaving none to oppose Roger, who subdued the rebels pitilessly.

The death of Anacletus (Jan. 25, 1138) determined Roger to seek the confirmation of his title from Innocent. The latter, invading the kingdom with a large army, was skilfully ambushed at Galuccio on the Garigliano (July 22, 1139), and on July 25 the pope invested him as "Rex Siciliae ducatus Apuliae et principatus Capuae."

Roger, now become one of the greatest kings in Europe, made Sicily the leading maritime power in the Mediterranean. A powerful fleet was built up under several "admirals," or "emirs," of whom the greatest was George of Antioch, formerly in the service of the Muslim prince of El Mehdia. Mainly by him a series of conquests were made on the African coast (1135–53) which reached from Tripoli to Cape Bona. The second crusade (1147–48) gave Roger an opportunity to revive Robert Guiscard's designs on the Greek Empire. George was sent to Corinth at the end of 1147 and despatched an army inland which plundered Thebes. In June 1149 the admiral appeared before Constantinople and defied the Basileus by firing arrows against the palace windows. The attack on the empire had, however, no abiding results. The king died at Palermo on Feb. 26, 1154, and was succeeded by his fourth son William.

Personally Roger was of tall and powerful body, with long fair hair and full beard. With little of Robert Guiscard's personal valour, he yet showed to the full his uncle's audacity, diplomatic skill and determination. It is Roger II.'s distinction to have united all the Norman conquests into one kingdom and to have subjected them to a government scientific, personal and centralized. The principles of this are found in the Assizes of the kingdom of Sicily, promulgated at Ariano in 1140, which enforced an almost absolute royal power. At Palermo Roger drew round him distinguished men of various races, such as the famous Arab geographer Idrisi and the historian Nilus Doxopatrius. He maintained a complete toleration for the several creeds, races and languages of his realm; he was served by men of the most diverse nationalities.

Contemporary authors are: Falco of Benevento, Alexander of Telese, Romuald of Salerno and Hugo Falcandus, all in the *Scrittori e cronisti napoletani*, ed. Del Re, vol. i. *See* also E. Caspar, *Roger II. und die Grundung der normannisch-sicilischen Monarchie* (Innsbruck, 1904). (E. Cu.; X.)

ROGER OF HOVEDEN or HOWDEN (*fl.* 1174–1201), English chronicler, was, to judge from his name and the internal evidence of his work, a native of Howden in the East Riding of Yorkshire. But nothing is known of him before the year 1174. He was then in attendance upon Henry II., by whom he was sent from France on a secret misson to the lords of Galloway. In 1175 he again appears as a negotiator between the king and a number of English religious houses. In 1189, he was a justice of the forests in the shires of Yorkshire, Cumberland and Northumberland. About the year 1192 he began to compile his *Chronica*, a general history of England from 732 to his own time. Up to the year 1192 his narrative adds little to our knowledge. From that time, however, Hoveden is an independent and copious authority. Both on foreign affairs and on questions of domestic policy he is unusually well informed. He is particularly useful on points of constitutional history. His work breaks off abruptly in 1201. Probably his death should be placed in that year.

See W. Stubbs's edition of the *Chrdnica* (Rolls Series) and the introductions to vols. i. and iv. This edition supersedes that of Sir H. Savile in his *Scriptores post Bedam* (1596).

ROGER OF WENDOVER (d. 1236), English chronicler, whose *Flores Historiarum* is the fullest narrative source for the reign of Henry III, was probably a native of Wendover, Buckinghamshire. He became a monk of St. Albans, Hertfordshire, and later prior of the cell at Belvoir, Leicestershire, but was found guilty of wasting the endowments and deposed. His latter years were passed at St. Albans where he died on May 6, 1236. He was the first of the important chroniclers who worked in the scriptorium there. The *Flores Historiarum*, which begins at the Creation and extends to 1235, becomes of fully original value from the beginning of Henry III's reign and contains the sinister, savage, portrait of King John, which Matthew Paris later exaggerated in his *Chronica Majora*, which incorporated and continued the *Flores Historiarum*.

The *Flores Historiarum* survives in Douce Manuscript 207 (*c.* 1300; Bodleian library, Oxford) and Cotton Manuscript Otho B v (*c.* 1350; British museum, London). Matthew Paris' *Chronica Majora* was edited by H. R. Luard, 7 vol., Rolls series (1872–80). H. O. Coxe edited the *Flores*, 447 and after, 5 vol., English Historical society (1841–44), and H. G. Hewlett, 1154 and after, 3 vol., Rolls series (1886–89).

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(R. V.)

ROGERS, HENRY DARWIN (1808–1866), U.S. geologist. was born at Philadelphia, Pa., on Aug. 1, 1808. At the age of 21 he was chosen professor of chemistry and natural philosophy at Dickinson college. Pennsylvania. After holding this post for three years, he went to Europe and took up the study of geology. Subsequently he was engaged for 22 years in the state surveys of Pennsylvania and New Jersey, his reports on which were published during the years 1836–41. In 1842 he and his brother WILLIAM BARTON ROGERS (1805–82), who had been similarly occupied in Virginia, brought before the Association of American Geologists and Naturalists their conclusions on the physical structure of the Appalachian chains and on the elevation of great mountain chains. The researches of H. D. Rogers were elaborated in his final *Report on Pennsylvania* (1858), in which he included a general account of the geology of the Cnited States and of the coal fields of North America and Great Britain. In 1857 he was appointed professor of natural history and geology at Glasgow. One of his later essays (1861) was on the parallel roads of Lochaber (Glen Roy), the origin of which he attributed to a vast inundation. He died at Glasgow, May 29, 1866.

ROGERS, JAMES EDWIN THOROLD (1823–1890), English economist whose fame rests on his study of agriculture and prices, was born at West Meon, Hampshire, in 1823, and educated at King's college. London, and Magdalen hall, Oxford. In 1846 he was ordained and became a curate in Oxford. Subsequently he resigned his orders. Although he was a classical scholar, his friendship with Richard Cobden (*q.v.*) led him to study economics. In 1859 he became professor of statistics and economic science at King's college, London, a post he filled till his death. From 1862 he was also Drummond professor of political economy at Oxford. In 1866 he published the first two (of eight) volumes of his *History of Agriculture and Prices in England*, a masterly record upon which his reputation mainly depends. An acquaintance with Cobden and John Bright (*q.v.*) led Rogers to take an active part in politics: he represented Southwark in parliament 1880–1885, and Bermondsey 1885–86, as an advanced Liberal. His latter years were mainly spent as professor of political economy at Oxford, where he died on Oct. 12, 1890. Rogers did much to promote the historical study of economics. His most important publications are: *Manual of Political Economy* (1868); an edition of Adam Smith's *Wealth of Nations* (1869); *Cobden and Modern Political Opinion* (1873); edited *The Speeches of J. Bright* (1868);

Six Centuries of Work and Wages (1884); and *The First Nine Years of the Bank of England* (1887). (D. F. Dd.)

ROGERS, JOHN (c. 1500–1555), English Protestant martyr, born at Aston, near Birmingham, was educated at Pembroke Hall, Cambridge, where he graduated B.A. in 1526. Six years later he was rector of Holy Trinity, Queenhithe, London, and in 1534 went to Antwerp as chaplain to the English merchants. Here he met William Tyndale, under whose influence he abandoned the Roman Catholic faith, and married an Antwerp lady. After Tyndale's death Rogers pushed on with his predecessor's English version of the Old Testament, which he used as far as 2 Chronicles, employing Coverdale's translation (153j) for the remainder and for the Apocrypha. Tyndale's New Testament had been published in 1526. The complete Bible was put out under the pseudonym of Thomas Matthew in 1537; it was printed in Xntwerp, and Richard Grafton published the sheets and got leave to sell the edition (1,500 copies) in England. Rogers had little to do with the translation, but he contributed some valuable prefaces and marginal notes. His work was largely used by those who prepared the Great Bible (1539–40), out of which in turn came the Bishop's Bible (1j68) and the Authorized Version of 1611. After taking charge of a Protestant congregation in Wittenberg for some years, Rogers returned to England in 1548, where he published a translation of Melanchthon's *Considerations of the Augsburg Interim.* In 1550 he was presented to the crown livings of St. Margaret Moyses and St. Sepulchre in London, and in 1551 was made a prebendary of St. Paul's, where the dean and chapter soon appointed him divinity lecturer.

On the accession of Mary, Rogers preached at Paul's Cross commending the "true doctrine taught in King Edward's days," and warning his hearers against "pestilent Popery, idolatry and superstition." Ten days after (16th August 1553), he was summoned before the council and bidden to keep within his own house. In January 1554 Bonner, the new bishop of London, sent him to Newgate, where he lay with John Hooper, Laurence Saunders, John Bradford and others for a year. On January 22, 1555, Rogers with ten others came before the council at Gardiner's house in Southwark, and held his own in the examination that took place. On the 28th and 29th he came before the commission appointed by Cardinal Pole, and was sentenced to death by Gardiner for heretically denying the Christian character of the Church of Rome and the real presence in the sacrament. He met his death on the 4th of February 1jjj at Smithfield. He was the first Protestant martyr of Mary's reign, and his friend Bradford wrote that "he broke the ice valiantly."

ROGERS, JOHN (1627–1665?), English preacher, a Fifth Monarchy man, second son of Nehemiah Rogers, a royalist and Anglican clergyman, was born at Messing, Essex; he studied medicine at King's college, Cambridge. In the quarrel between the army and the parliament Rogers sided with the army, and he was one of the first to join the Fifth Monarchy movement. He approved of the expulsion of the Long Parliament, but the establishment of the Protectorate at once threw the Fifth Monarchy men into antagonism. Rogers addressed a warning letter to Cromwell, and attacked him from the pulpit on Jan 9. 1654 His house was searched and his papers seized. and Rogers then issued another denunciation against Cromwell, *Mene, Tekel, Perez: a Letter lamenting over Oliver Lord Cromwell.* On March 28, on which day he had proclaimed a fast for the sins of the rulers, he preached a violent sermon against the protector. He was arrested in July. He confronted Cromwell with great courage when brought before him on Feb. 5, 1655, and was imprisoned successively at Windsor and in the Isle of Wight, being released in Jan. 1657. He returned to London, and. being suspected of conspiracy, was again imprisoned by Cromwell in the Tower (Feb. 3–April 16. 1658). On the protector's death and the downfall of Richard Cromnell, the ideals of the Fifth Monarchy men seemed nearer realization, but Rogers was engaged in political controversy with Prynne and became a source of embarrassment to his own faction, which endeavoured to get rid of him by appointing him "to preach the gospel" in Ireland. On the outbreak of Sir George Booth's royalist insurrection. however, he became chaplain in Charles Fairfax's regiment, and served throughout the campaign. He was imprisoned in Dublin in Jan. 1660 by order of the army faction and released subsequently by the parliament. At the Restoration he withdrew to Holland, studied medicine at Leyden and Utrecht, where he obtained his M.D. in 1662. He was admitted to the degree of M.D. at Oxford in 1664, and is supposed to have died soon afterwards.

Besides the above pamphlet, Rogers wrote in 1653 *Ohel or Beth-shemesh, a Tabernacle for the Sun,* in which he attacked the Presbyterians; *Sagrir, or Doomesday drawzng nzgh,* from his new standpoint as a Fifth Monarchy man, *Challah, the Heavenly Nymph* (1653); *Dod, or Chathan; the Beloved or the Brzdegroom going forth for his Bride* . . . (1653); *Prison-born Morning Beams* (1654); *Jegar Sahadutha* . . . (1657); *Mr. Prynne's Good Old Cause stated and stunted 10 Year ago* . . . (1609); Διαπολιτεία a *Christtan Concertatzon* (1659); *Mr. Harrington's Parallel Unparalleled* (1659); *A Vindication of Sir H. Vane* (1659); *Dtsputatio Medica Inauguralis* (1662).

Authorities.—Ed. Rogers, *Life and Opinions of a Fifth Monarchy Man* (1867), compiled from Rogers's own works; Wood, *Athenae Oxonienses and Fasti; Calendars of State Papers (Domestic).* See also "English Ancestry of Washington," *Harper's Magazine,* xxi. (1891); "John Rogers of Purleigh," *The Nation,* vol. 53 (1891).

ROGERS, JOHN (1829–1904), U.S. sculptor, creator of a popular series of small groups illustrating literary, historical and humorous subjects, the so-called "Rogers groups." was born in Salem. Mass.. Oct. 30, 1829. He was largely self-taught although he did work for a brief time in the studio of the English sculptor Benjamin Spence in Rome. In 1859 he settled in New York: Eight thousand copies of his most popular group, "Coming to the Parson," were sold, and it is estimated that the total number of groups sold came to about 80,000. Rogers also made portrait busts; the equestrian statue of Gen. John F. Reynolds in Philadelphia. Pa., and the statue of Pres. Abraham Lincoln in Manchester. N.H. The small plaster "Rogers groups" were reproduced from bronze master models. A large collection of these bronzes was acquired by the New York Historical society. New York city, which also has the Rogers family portraits and papers. He died in New Canaan. Conn , July 26. 1904. (A. T. G.)

ROGERS, ROBERT (1731–1795), American frontier soldier, was born at Methuen, Mass., and in 1739 removed to Starktown (now Dunbarton), N.H. During the Seven Years' War he raised and commanded a force of militia, known as Rogers's Rangers, which won wide reputation for its courage and endurance in the campaigns about Lake George. He took part in Wolfe's expedition against Quebec and in the Montreal campaign of 1760. Afterwards he was sent by Gen. Amherst to take possession of the north-western posts, including Detroit. He was again in the West in 1763 during the Pontiac uprising, accompanying Dalyell's expedition and participating in the battle of Bloody Bridge. Soon after he went to England and in 1765 published in London a *Concise Account of North America* and his *Journals* of service in the Seven Years' War. In 1766 was published *Ponteach: A Tragedy,* one of the first American dramas, supposedly also written by Rogers. He further laid before the king a memorial proposing to lead an overland expedition from the Mississippi river to the Pacific ocean. This was refused him but instead he was given command of the north-west post of Llichilimackinac. From here in 1766 he sent out on his own initiative, under Captains Tute and Carver, the first English expedition to explore the upper Mississippi and Great Lakes region, but it failed to penetrate to the Pacific as intended. Rogers's ambitions caused him to be tried for treason but he was acquitted. He again went to England to retrieve his fortune but was unsuccessful. During the Revolutionary War he came to America but was regarded as a loyalist spy. He then openly joined the British and organized and commanded the Queen's Rangers which saw service in operations around New York city. Later he organized the King's Rangers, but the command was taken by his brother, James Rogers, and Robert Rogers returned to England, where he lived in obscurity until his death in 1795.

There is a scholarly biography by Allan Nevins of 172 pages in the Caxton Club edition of *Ponteach* (Chicago, 1914). *See* also F. Parkman, *Montcalm and Wolfe* (Boston, 1884).

ROGERS, SAMUEL (1763–1855), English poet, was born at Newington Green, London, on July 30, 1763. His father,

Thomas Rogers, was the son of a Stourbridge glass manufacturer, who was also a merchant in Cheapside. Thomas Rogers had a place in the London business, and married Mary Radford, daughter of his father's partner, becoming himself a partner shortly afterwards. On his mother's side Samuel Rogers was connected with the Noncomformist divines Philip and Matthew Henry, and it was in Nonconformist circles at Stoke Newington that he was brought up. He was educated at private schools at Hackney and Stoke Newington. Samuel Rogers entered the banking business in Cornhill, but his delicate health necessitated long holidays, during which he met the literary society of the day in Edinburgh as well as in London. He had already published a volume of verse when his *Pleasures of Memory* was printed in 1792. This poem may be regarded as the last embodiment of the poetic diction of the 18th century. Here is carried to the extremest pitch the theory of elevating and refining familiar themes by abstract treatment and lofty imagery.

In 1793 his father's death gave Rogers the principal share in the banking house in Cornhill, and a considerable income. He left Newington Green in the same year and established himself in chambers in the Temple. In his circle of friends at this time were "Conversation" Sharp and the artists Flaxman, Opie, Martin Shee and Fuseli. He also made the acquaintance of Charles James Fox, with whom he visited the galleries in Paris in 1803, and whose friendship introduced him to Holland House. In 1803 he moved to 22 St. James's Place, where for 50 years he entertained all the celebrities of London. Flaxman and Stothard had a share in the decorations of the house, which Rogers had almost rebuilt, and now proceeded to fill with pictures and other works of art. His collections at his death realized £50,000. An invitation to one of Rogers's breakfasts was a formal entry into literary society, and his dinners were even more select. His social success was due less to his literary position than to his powers as a conversationalist, his educated taste in all matters of art, and no doubt to his sarcastic and bitter wit, for which he excused himself by saying that he had such a small voice that no one listened if he said pleasant things. Above all, he seems to have had a genius for benevolence. "He certainly had the kindest heart and unkindest tongue of any one I ever knew," said Fanny Kemble. He helped the poet Robert Bloomfield, he reconciled Moore with Jeffrey and with Byron, and he relieved Sheridan's difficulties in the last days of his life. Moore, who refused help from all his friends, and would only be under obligations to his publishers, found it possible to accept assistance from Rogers. He procured a pension for H. F. Cary, the translator of Dante, and obtained for Wordsworth his sinecure as distributor of stamps.

Rogers played the part of literary dictator in England over a long period. He made his reputation by *The Pleasures of Memory* when Cowper's fame was still in the making. He became the friend of Wordsworth, Scott and Byron, and lived long enough to give an opinion as to the fitness of Alfred Tennyson for the post of poet laureate. Alexander Dyce, from the time of his first introduction to Rogers, was in the habit of writing down the anecdotes with which his conversation abounded. From the mass of material thus accumulated he made a selection which he arranged under various headings and published in 1856 as *Recollections of the Table-Talk of Samuel Rogers, to which is added Porsoniana.* Rogers himself kept a notebook, in which he entered impressions of the conversation of many of his friends—Charles James Fox, Edmund Burke, Henry Grattan, Richard Porson, John Horne Tooke, Talleyrand, Lord Erskine, Sir Walter Scott, Lord Grenville and the duke of Wellington. They were published by his nephew William Sharpe in 1859 as *Recollections by Samuel Rogers;* and *Reminiscences and Table-Talk of Samuel Rogers, Bunker, Poet, and Patron of the Arts, 1763–1855* (1903), by G. H. Powell, is an amalgamation of these two authorities. Rogers held various honorary positions: he was one of the trustees of the National Gallery; and he served on a commission to inquire into the management of the British Museum, and on another for the rebuilding of the houses of parliament.

Rogers's later works are *An Epistle to a Friend* (Richard Sharp) (1798); *The Voyage of Columbus* (1810); *Jacqueline* (1814), a narrative poem; *Human Life* (1819) and *Italy* (1822–28). Rogers was in Italy in 1814 and again in 1820, when he visited Byron and Shelley at Pisa. The 1828 edition of *Italy* was not a success. But in an enlarged form the poem was republished in 1830, and in 1838 a sumptuous edition of *Poems* was brought out. Rogers declined the laureateship in 18jo when upon the death of Wordsworth it was offered him. He died in London on Dec. 18, 1855.

See P. W. Clayden, *The Early Life of Samuel Rogers* (1887) and *Rogers and his Contemporaries* (2 vols., 1889).

ROGERS, WILL (WILLIAM PENN ADAIR ROGERS) (1879–1935), U.S. humorist and motion-picture actor, writer of a newspaper column famous for its homespun humour and for its good-natured but extremely sharp criticism of contemporary men and affairs, was born Nov. 4, 1879, at Oologah, Indian Territory (now Oklahoma). Utilizing the rope twirling and lassoing he learned on his father's ranch, he began a career as a rope-throwing cowboy in steer-roping contests, Wild West shows and vaudeville. In 191j, appearing in Ziegfeld's *Midnight Frolic* in New York, he introduced a humorous political commentary into his act. This developed into a newspaper column, syndicated weekly in 1922 and daily in 1926. Rogers also wrote a series of books in a similar vein, including *The Cowboy Philosopher on Prohibition* (1919), *Illiterate Digest* (1924) and *There's Not a Bathing Suit in Russia* (1927). Rogers was equally successful as a motion-picture actor. His films included *A Connecticut Yankee* (1931), *State Fair* (1933) and *David Harum* (1934). With Wiley Post he was killed in a plane crash in Alaska on Aug. 15, 193j. (M. S. BY.)

ROGERS, WILLIAM (1819–1896), English clergyman and educational reformer, was born in London on Nov. 24. 1819, and died there on Jan. 19, 1896. He was ordained in 1843, and in 1845 was appointed to St. Thomas' Charterhouse, where he remained for 18 years, throwing himself passionately into the work of education of his poor and often criminal parishioners. He began by establishing a school for ragamuffins in a blacksmith's abandoned shed, and he gradually extended its scope until schools were provided throughout the parish. In 1863 he became rector of St. Botolph's, Bishopsgate, and at Bishopsgate Rogers tackled the middle-class schools. He believed in secular education. To the cry against "godless education," Rogers replied. "Hang theology; let us begin," earning the nickname of "Hang-theology Rogers." Rogers reconstructed Edward Alleyn's charity at Dulwich and founded the Bishopsgate institute.

ROGIER, CHARLES LATOUR (1800–1885), Belgian statesman, descended from a Belgian family settled in the department of the Nord in France, was born at St. Quentin on Aug. 17, 1800. His father, an officer in the French army, perished in the Russian campaign of 1812; and the family moved to Liége, where the eldest son, Firmin, held a professorship. Charles, after being called to the bar, founded, in collaboration with his lifelong friends, Paul Devaux and Joseph Lebeau, the journal *Matkieu Laensberg* (afterwards *Le Politique),* which by its ardent patriotism and its attacks on the Dutch administration soon acquired a widespread influence. When the insurrection of 1830 broke out at Brussels, Rogier put himself at the head of 150 Liégeois, and inscribing on his banner the motto, "Vaincre ou mourir pour Bruxelles," he obtained arms from a local factory, and marched upon the capital. Here he took his place at once among the leaders of the revolutionary party. His influence saved the town hall from pillage on Sept. 19.

On the 25th a *commission administrative* was formed, of which Rogier became president. The energetic measures of this body and of its successor, the *gouvernement provisoire,* soon freed the greater part of the country from the Dutch troops. Rogier was sent in October to suppress an outbreak among the colliers of Hainaut, and then as delegate of the provisional government to Antwerp, where the citadel still held out for Holland. He arranged an armistice, and reorganized the entire administration of the city. He sat for Liége in the National Congress, voted for the establishment of an hereditary monarchy, and induced the congress to adopt the principle of an elective second chamber. In the long-drawn debates on the bestowal of the crown he ranged himself on the side of Louis Philippe: but when Louis Philippe de-

clined the crown on behalf of his son, Rogier voted with the majority for Leopold of Saxe-Coburg.

In June 1831 he was appointed governor of the province of Antwerp, a post rendered exceptionally difficult by the continued presence of Dutch troops in the citadel. In October 1832 he was made minister of the interior in the Goblet-Devaux cabinet. During his office he carried, in the teeth of opposition, a law that established in Belgium the first railways on the continent of Europe, and thus laid the foundation of her industrial development. Owing to dissensions in the cabinet, he retired in 1834, together with Lebeau, and resumed the governorship of Antwerp. On Lebeau's return to power in 1840, Rogier became minister of public works and education. His education proposals were defeated by the Clerical party, and on the resignation of the ministry in 1841, Rogier gave his support to a compromise measure, which passed into law in 1842. He led the Liberal party in Opposition till 1847, when he formed a cabinet in which he held the ministry of the interior. He carried out a liberal policy which enabled Belgium to escape the general revolutionary movement of 1848.

Rogier retired in Oct. 1852, but was brought back into office by the liberal reaction of 1857. He again became president of the council and minister of the interior in a cabinet of which Frère-Orban was the most conspicuous member. The first important measure passed by the ministry was one for the fortification of Antwerp. In 1860 the fear of French designs on the independence of Belgium led to a movement of reconciliation with Holland, and inspired Rogier to write his poem "La Nouvelle Brabançonne." In 1861 Rogier exchanged the ministry of the interior for that of foreign affairs. He achieved a diplomatic triumph in freeing the navigation of the Scheldt, and thus enabling Antwerp to become the second port on the mainland of Europe. Defeated at Dinant, he sat for Tournai from 1863 till his death. In 1868 Rogier finally retired from power. He continued, however, to take part in public life, and was elected president of the extraordinary session of the chamber of representatives in 1878. From this time his age, his devoted patriotism and the unassuming simplicity of his life made him the idol of all classes. He died at Brussels on May 27, 1885, and was accorded a public funeral.

See T. Juste, *Charles Rogier, 1800–1885, d'après des documents inédits* (Verviers, 1885).

ROHAN, the name of one of the most illustrious of the feudal families of France, derived from that of a small town in Morbihan, Brittany, and claimed connection with the ancient sovereigns of Brittany. Hercule de Rohan, duc de Montbazon (1568–1654) served Henry III. and Henry IV. against the League, and was made by Henry IV. governor of Paris and the Isle of France, and master of the hounds. His grandson, Louis de Rohan-Guéménée, the chevalier de Rohan, conspired with the Dutch against Louis XIV. and was beheaded in Paris in 1674. In the 18th century the Soubise branch of the family furnished several prelates, cardinals and bishops of Strasbourg, among others the famous cardinal de Rohan, the hero of the affair of the diamond necklace. René de Rohan, seigneur of Pontivy and Frontenay, of the Gié branch, commanded the Calvinist army in 1570, and defended Lusignan with great valour when it was besieged by the Catholics (1574–75). His son Henry, the first duke of Rohan (*q.v.*), had an only child, Marguerite de Rohan, married in 1645 to Henri Chabot. The property and titles of Henry de Rohan thus passed to the Chabot family, which under the name of Rohan-Chabot produced some distinguished soldiers and a cardinal archbishop of Besançon.

ROHAN, HENRI, Duc de (1579–1638), French soldier, writer and leader of the Huguenots, was born at the château of Blain, in Brittany, in 1579. His father was René II., count of Rohan (1550–86). Henri appeared at court and in the army at the age of sixteen, and was a special favourite with Henry IV., after whom, failing the house of Condé, he might be said to be the natural chief of the French Protestants. Having served till the peace of Vervins, he travelled for some time. On his return to France he was made duke and peer at the age of twenty-four, and two years later (1603) married Marguerite de Béthune, the duc de Sully's daughter. He fought from time to time in the royal army, and it was not till the decree for the restitution of church property in the south threw the Bearnese and Gascons into open revolt that Rohan appeared as a rebel. His ability and constancy contributed to the happy issue of the war for the Huguenots, and brought about the treaty of Montpellier (1623). Rohan renewed the war when the compact of Montpellier was broken. Again a hollow peace was patched up, but it lasted but a short time, and Rohan undertook a third war (1627–29), the first events of which are recounted in his celebrated *Memoirs*. After the peace he made his way to Venice, where his hosts wished to make him their general-in-chief, a design not executed owing to the peace of Cherasco (1631). At Venice he wrote his *Memoirs;* at Padua, *Le Parfait Capitaine*. Rohan returned to the French service, and was entrusted with the war in the Valtelline (1633). But Rohan was still considered dangerous to France, and was soon again in retirement. At this time he wrote his *Traité du gouvernement des treize cantons*. Rohan fought another Valtelline campaign, but without the success of the first, for the motives of France were now held in suspicion. The unfortunate commander retired to Geneva and thence went to the army of Bernhard of Saxe-Weimar. He received a mortal wound at the battle of Rheinfelden on Feb. 28, 1638, and died at the abbey of Konigsfeld, canton Berne, on April 13.

Rohan's *Mémoires sur les choses qui se sont passées en France*, etc., rank amongst the best memoirs of the 16th and 17th centuries. The first three books which deal with the civil wars appeared in 1644; the fourth, containing the narrative of the Valtelline campaigns, not till 1758. His famous book on the history and art of war, *Le Parfait Capitaine*, appeared in 1631 and subsequently in 1637 and 1693 (*see* also Quincy, *Art de la guerre*, Paris, 1741). The *Memoirs* may be conveniently found in the collection of Michaud and Poujoulat, vol. 19.

See Fauvelet de Foix, *Histoire du Duc Henri de Rohan* (1667); Schybergson, *Le Duc de Rohan et la charte du parti protestant en France* (1880); Biihring, *Venedig, Gustaf Adolf, und Rohan* (Halle, 1885); Laugel, *Henri de Rohan, son rôle politique et militaire* (1889); Veraguth, *Herzog Rohan und seine Mission in Graubünden* (Berne, 1894); and Shadwell, *Mountain Warfare*.

ROHAN, LOUIS RENÉ EDOUARD, Cardinal de (1734–1803), prince de Rohan-Guéménée, archbishop of Strasbourg, a cadet of the great family of Rohan, was born at Paris on Sept. 25, 1734. After taking orders, in 1760, he was nominated coadjutor to his uncle, Constantine de Rohan-Rochefort, archbishop of Strasbourg, and he was also consecrated bishop of Canopus. But he preferred the gaiety of Paris to his clerical duties, and had political ambitions. He joined the party opposed to the Austrian alliance, which had been cemented by the marriage of the archduchess Marie Antoinette to the dauphin. This party was headed by the duc d'Aiguillon, who in 1771 sent Prince Louis on a special embassy to Vienna to find out what was being done there with regard to the partition of Poland. Rohan arrived at Vienna in Jan. 1772, and made a great noise with his lavish fêtes. But the empress Maria Theresa was implacably hostile to him; not only did he attempt to thwart her policy, but he spread scandals about her daughter Marie Antoinette, laughed at Theresa, and shocked her ideas of propriety. On the death of Louis XV. in 1774, Rohan was recalled from Vienna, and coldly received at Pads; but in 1777 he was made grand almoner, and in 1778 abbot of St. Vaast. In 1778 he was made a cardinal on the nomination of Stanislaus Poniatowski, king of Poland, and in the following year succeeded his uncle as archbishop of Strasbourg and became abbot of Noirmoutiers and Chaise-Dieu.

In an attempt to procure reinstatement at court he fell into the hands of the comtesse de Lamotte, the notorious Cagliostro and others, whose actions form part of the "affair of the diamond necklace" (*see* Diamond Necklace, Affair of the). Rohan certainly was led to believe that his attentions to the queen were welcomed, and that his arrangement by which she received the famous necklace was approved. He was the dupe of others, and at the trial in 1786 his acquittal was received with enthusiasm, and regarded as a victory over the court and the queen. He was deprived, however, of his office as grand almoner and exiled to his abbey of Chaise-Dieu. He was soon allowed to

return to Strasbourg, and was elected to the states-general. As a prince of the church in Jan. 1791 he refused to take the oath to the constitution, and went to Ettenheim, in the German part of his diocese. He spent what wealth remained to him in providing for the poor clergy of his diocese who had been obliged to leave France; and in 1801 he resigned his nominal rank as archbishop of Strasbourg. On Feb. 17, 1803, he died at Ettenheim.

ROHILKHAND, a tract in Uttar Pradesh, republic of India. The name is associated with the Rohilla tribe, but historically refers to an area almost coincident with the modern division of Bareilly (*q.v.*), for which it is now the official title. This division has an area of 11.705 sq.mi. and a population (1961) of 8,505,041. It comprises the districts of Bareilly, Bijnor, Budaun, Moradabad, Shahjahanpur and Pilibhit, and the district of Rampur (*q.v.*), formerly a princely state, but fully absorbed into Uttar Pradesh in 1950. The Rohillas trace their ancestry to Sardar Daud Khan, an Afghan adventurer, whose adopted son annexed a large area north of the Ganges and was created a nawab by the Delhi emperor. He died in 1749, and the family split up into a number of petty chiefs. In 1774 (see BIJNOR) the Rohilla power was broken by a confederacy of the British and the nawab of Oudh. The state of Rampur was left under the sovereignty of Nawab Faizullah Khan and the rest of Rohilkhand was annexed to Oudh. The division was ceded to the East India company in 1801.

ROHLFS, CHRISTIAN (1849–1938), German Expressionist painter and graphic artist, was born at Niendorf, Dec. 22, 1849, the son of a north German peasant. He studied at the Weimar academy where he stayed on as teacher. There. his landscape painting first developed toward a very personal Impressionism. In 1901 Rohlfs became a teacher in the drawing school of the Folkwang museum in Hagen, a centre of European art. After 1927 he divided his time between Hagen and Ascona, Switz. In his Expressionist views of Soest cathedral and in the flower pieces he painted when he was an old man, he dissolves form into transparencies of colour and light, transmuting substance into the energy of emotion. He died in Hagen, Jan. 8, 1938.

See Peter Selz, German Expressionist Painting (1957); Paul Vogt, *Christian* Rohlfs (1958). (P. H. S.)

ROHTAK, a town and district of Punjab state, India. The town. which is of great antiquity. became the headquarters of a British district in 1824. It is 44 mi. N.W. of Delhi. Pop. (1951) 71,902. It is an important trade centre, with factories for ginning and pressing cotton.

The DISTRICT OF ROHTAK has an area of 2,329 sq.mi. It is situated on the level tableland between the Jumna and Sutlej rivers, and the northern areas are watered by the Rohtak and Butana branches of the Western Jumna canal; but the greater part of the central plain is entirely dependent upon the uncertain rainfall. The population in 1961 was 1,416,915.

ROKITANSKY, KARL, FREIHERR VON (1804–1878), Austrian pathologist and pioneer in the science of pathological anatomy, was born at Koniggratz, Bohemia. on Feb. 19, 1804. He studied medicine at Prague and Vienna, where he was appointed professor extraordinary of pathological anatomy in 1834. He became president of the Vienna Academy of Sciences in 1869 and was named Freiherr in 1874.

Rokitansky was the first to detect bacteria in the lesions of malignant endocarditis and to differentiate between lobar and lobular pneumonia. He first described acute dilatation of the stomach (1842) and left a classic account of the pathologic appearance in acute yellow atrophy of the liver (1843), which became known as Rokitansky's disease. He described and defined the bronchial and pulmonary complications of typhoid as bronchotyphus and pneumotyphus and completed René Laennec's picture of emphysema of the lungs by describing the microscopic appearances. In obstetrics and orthopedics he is credited as the first to describe spondylolisthetic deformities (1839). His Handbuch der *pathologischen* Anatomie (1842–46, Eng. trans: 1849–52) was an important work.

Rokitansky, who made more than 30,000 post-mortems during his life, was one of the chief founders of the Vienna school of pathological anatomy. He was also active in the legislature, where he favoured the Liberal party and became speaker of the house. He died in Vienna, July 23, 1878.

ROLAND [ROLAND DE LA PLATIÈRE], **JEAN MARIE** (1734–1793), French statesman, was born at Thizy on Feb. 18, 1734. After working as a clerk, he joined a relative who was inspector of manufactures at Amiens, and himself rose to inspector. In 1780 he married Jeanne Manon Phlipon (1754–93), famous as Madame Roland. About 1785 the Rolands moved to Lyons. A correspondence sprang up with J. P. Brissot and other friends of the revolution in Paris, and in 1791 the Rolands settled there. Jean Roland became a member of the Jacobin club. Madame Roland's salon soon became the rendezvous of many leaders of the popular movement, above all of F. N. L. Buzot. In person Madame Roland was attractive though not beautiful; her ideas were clear and far-reaching, her manner calm and her power of observation extremely acute.

On March 23, 1792, Roland was appointed minister of the interior. As a minister of the crown Roland exhibited a bourgeois brusqueness of manner and a remarkable combination of political prejudice with administrative ability. The decrees against the emigrants and the nonjuring clergy still remained under the veto of the king. A letter was penned by Madame Roland and addressed by her husband to Louis. It remained unanswered. Thereupon, in full council and in the king's presence, Roland read his letter aloud. It contained many and terrible truths as to the royal refusal to sanction the decrees and as to the king's position in the state; but it was inconsistent with a minister's position, disrespectful if not insolent in tone. Roland's dismissal followed. He then read the letter to the assembly; it was ordered to be printed, became the manifesto of disaffection and was circulated everywhere.

After the insurrection of Aug. 10, Roland was recalled to power, one of his colleagues being G. J. Danton, but he was dismayed by the progress of the revolution. He was above all a provincial, and was soon in opposition to the party of the Mountain. He was hostile to the insurrectional commune of Paris, and proposed transferring the government to Blois; he attacked Robespierre and his friends. His neglect to seal the iron chest discovered in the Tuileries, which contained the proofs of Louis XVI's relations with the enemies of France, led to the accusation that he had destroyed a part of these documents. Finally, in the trial of the king he demanded, with the Girondists, that the sentence should be pronounced by a vote of the whole people, and not simply by the convention. He resigned office on Jan. 23, 1793, two days after the king's execution.

The Rolands remained in Paris. Once Madame Roland appeared personally in the assembly to repel the falsehoods of an accuser, and secured acquittal. But violence succeeded violence, and early on the morning of June 1, she was arrested and imprisoned in the Abbaye. Roland himself escaped secretly to Rouen. Released for an hour from the Abbaye, Madame Roland was again arrested and thrown among the horrors of Sainte-Pélagie. Finally, she was transferred to the Conciergerie. In prison she won the affections of the guards, and was allowed the privilege of writing materials and the occasional visits of devoted friends. She there wrote her *Appel à l'impartiale postérité,* those memoirs which display a strange alternation between self-laudation and patriotism, between the trivial and the sublime. On Nov. 8, 1793, she was guillotined. Before her execution, she bowed before the clay statue of Liberty erected in the Place de la Révolution, uttering her famous apostrophe—"0 Liberty! what crimes are committed in thy name!" When Roland heard of his wife's condemnation, he wandered several miles from his refuge in Rouen; maddened by despair and grief, he wrote a few words .expressive of his horror at those massacres which could be inspired only by the enemies of France, protesting that "from the moment when I learned that they had murdered my wife I would no longer remain in a world stained with enemies." He affixed the paper to his breast, and unsheathing a sword-stick fell upon the weapon, which pierced his heart, on Nov. 10, 1793.

Madame Roland's *Mémoires,* first printed in 1820, have been edited

among others by P. Faugère (1864), by C. A. Dauban (1864), by J. Claretie (1884), and by C. Perroud (1905). Some of her *Lettres inédites* have been published by C. A. Dauban (1867); C. Perroud published a critical edition of her *Lettres* (1900–02), and a new series (1767–80) in 1913–15. *See* also C. A. Dauban, *Étude sur Madame Roland et son temps* (1864); *V.* Lamy, *Deux femmes célèbres, Madame Roland et Charlotte Corday* (1884); *C.* Bader, *Madame Roland, d'après des lettres et des manuscrits inédits* (1892); A. J. Lambert, *Le mariage de Madame Roland, trois années de correspondance amoureuse* (1896); Austin Dobson, *Four Frenchwomen* (1890); articles by C. Perroud in the review *La Rdvolution française* (1896–99); *U.* Birch, *Madame Roland, a Study in Revolutzon* (1917).

ROLAND, LEGEND OF. The legend of the French epic hero Roland (transferred to Italian romance as Orlando) is based on authentic history. Charlemagne invaded Spain in 778, and had captured Pamplona, but failed before Saragossa, when the news of a Saxon revolt recalled him to the banks of the Rhine. On his retreat to France through the defiles of the Pyrenees, part of his army was cut off from the main body by the Basques and entirely destroyed. The incident is related in Einhard's *Vita Karoli* (cap. ix.; Pertz. ii. 448), where the names of the leaders are given. "In this battle were slain Eggihard *praepositus* of the royal table; Anselm, count of the palace; and Hruodland, praefect of the Breton march. . . ." The scene of the disaster is fixed by tradition at Roncevaux, on the road from Pamplona to St. Jean Pied de Port. The fiction of the 12 peers may possibly arise from a still earlier tradition. In 636–637, according to the *Chronicles* of Fredegarius (ed. Krusch, p. 159), 12 chiefs, whose names are given, were sent by Dagobert against the Basques. The expedition was successful, but in the valley of Subola, identified with Mauléon, near Roncevaux, the Duke Harembert, with other Frankish chiefs, was slain. Later fights in the same neighbourhood and under similar circumstances are related in 813 *(Vita Hludowici;* Pertz ii. 616), and especially in 824 (Einhard's *Annales;* Pertz. i. 213). These incidents no doubt served to strengthen the tradition of the disaster to Charlemagne's rearguard in 778, the importance of which was certainly magnified in popular story.

The choice of Roland or Hruodland as the hero probably points to the borders of French Brittany as the home of the legend. The exaggeration of a rear-guard action into a national defeat; the substitution of a vast army of Saracens for the border tribe mentioned by Einhard; and the vengeance inflicted by Charlemagne, where in fact the enemy escaped with complete impunity—all are in keeping with the general laws of romance. Charlemagne himself appears as the ancient epic monarch, not as the young man he really was in 778. There is evidence of a continuous tradition dating from the original event and, as Roncevaux lay on the route to Compostella, the many pilgrims who must have passed the site, from the middle of the 9th century onwards, may have helped to spread the story. Whether the actual *cantilena Rollandi* chanted by Taillefer at the battle of Hastings (William of Malmesbury, *De gestis regum angl.* iii. 242, and Wace, *Brut.* ii. 11, 8035 *seq.)* was any part of the existing *Chanson de Roland* cannot be stated, but the choice of the legend on this occasion by the trouvkre is proof of its popularity.

The oldest extant forms of the legend are: *(a)* chapters xix.–xxx. of the Latin chronicle, known as the *Pseudo-Turpin,* which purports to be the work of Turpin, archbishop of Reims, who died about 800, but probably dates from the 12th century; (b) *Carmen de proditione Guenonis,* a poem in Latin distichs; and *(c)* the *Chanson de Roland,* a French *chanson de geste* of about 4.000 lines, the oldest recension of which is in the Bodleian library, Oxford (ms. Digby, 23). It is in assonanced *tirades,* of unequal length, many of them terminated with the refrain *Aoi.* This ms. was written by an Anglo-Norman scribe about the end of the 12th century, and is a corrupt copy of a text by a French trouvkre of the middle of the 11th century. The poem, which was first printed by Francisque Michel (Oxford, 1837) is the finest monument of the heroic age of French epic.

The *Pseudo-Turpin* represents a different recension of the story and is throughout clerical in tone. It was the trouvkre of the *Chanson de Roland* who developed the characters into epic types; he invented the heroic friendship of Roland and Oliver, the motives of Ganelon's treachery, and many other details. The famous fight between Roland and the giant Ferragus appears in the *Pseudo-Turpin* (ch. xviii.), but not in the poem. The *Chanson de Roland* contains allusions to many events outside the narrative, some of which refer to *chansons* which are lost. Roland was variously represented by the romancers as the son of Charlemagne's sister Gilles or Berte and the knight Milon d'Anglers. The romantic episode of the reconciliation of the pair with Charlemagne through Roland's childish prattle *(Berte et Milon)* is probably foreign to the original legend. His *enfances,* or youthful exploits, were, according to *Aspremont,* performed in Italy against the giant Eaumont, but in *Girais de Viane* his first taste of battle is under the walls of Vienne, where Oliver, at first his adversary, becomes his brother-in-arms.

In the 12th century the *Chanson de Roland* was modernized by replacing the assonance by rhyme. Several mss. of this rhymed recension, sometimes known as *Roncevaux,* are preserved. The English romances of Charlemagne (*q.v.*) are mostly derived from late and inferior sources. It was in Italy that the Roland legend had its greatest fortune; Charlemagne and Roland appear in the *Paradiso* (canto xviii.) of Dante; the statues of Roland and Oliver appear on the doorway of the cathedral of Verona; and the French *chansons de geste* regularly appeared in a corrupt Italianized French.

BIBLIOGRAPHY.—For a complete bibliography of the editions of the various mss. of the *Chanson de Roland,* of the foreign versions, and of the enormous literature of the subject, *see* Léon Gautier, *Les Epopdes françaises* (2nd vol. iii. 1880) and the same author's *Bibliographie des chansons de geste* (1897). *See* also P. Boissonade, *Du Nouveau sur le Chanson de Roland* (1923). Among critical editions of the *Chanson* are those by Wendelin Foerster in the *Altfranz. Bibliotek,* vols. vi. and vii. (Heilbronn, 1883–86), and by E. Stengel *Das altfranzosische Rolandslied* (Leipzig, 1900, etc.). The most popular edition is *La Chanson de Roland* (Tours, 1872, and numerous subsequent editions), by Léon Gautier. L. Petit de Julleville published in 1878 an edition with the old French text, and a modern French translation in assonanced verse. There are English translations in prose by I. Butler (Boston, Mass., 1904); in verse by A. Way and F. Spencer (1895); and "in the original measure" by C. S. Moncrieff (1919). Consult further *G.* Paris, *Hist. poét. de Charlemagne* (reprint, 1905), and *De Pseudo Turpino* (Paris, 1865); P. Rajna, *Le Origini dell 'epopea francese* (Florence, 1884) and *Le Fonti dell' Orlando Furioso* (2nd ed. Florence, 1900); F. Picco, *Rolando nella storia e nella poesia* (Turin, 1901); G. Paris, "Roncevaux," in *Légendes du moyen âge* (1903), on the topography of the battlefield.

ROLANDSECK, (Ober-winter) a village in the Rhineland-Palatinate, Ger.. situated on the left bank of the Rhine, 8 mi. above Bonn. with a station on the railway Cologne-Coblenz. The place consists almost entirely of villas and is a favourite summer resort. Behind it lie the ruins of the castle.

ROLL. Primarily the word "roll" is used of a piece of writing material, such as parchment or paper, which is rolled up for the purpose of convenient storage or handling, in which form it represents an early stage in the evolution of the book, an example being the Rotulus or Rodl of Joshua of *c.* 700 in the Vatican library. By extension it became the name for any document kept in this form as an official record, and hence for any register, record, catalogue or official list. "The Rolls" was the name of the building where the records of the chancery court, a division of the English high court of justice, were kept, the keeper of which was the master of the rolls (*q.v.*), now the title of the third member of the English supreme court of judicature.

The word is used in this sense for the list of those admitted as qualified solicitors, whence the phrase "to strike off the rolls" of removal by the court of a solicitor for offenses or for delinquencies.

In architecture, a "roll" or "scroll" molding is one resembling a section of a roll or scroll of parchment with the end overlapping; a "roll and fillet" molding is a section of a cylindrical molding with a square fillet running along the centre of the face.

ROLLAND, JOHN (*fl.* 1560), Scottish poet, appears to have been a priest of the diocese of Glasgow, and to have been known in Dalkeith in 1555. He is the author of two poems, the *Court of Venus* and a translation of the *Seven Sages.* The former, which was printed by John Ros in 1575, may have been written before 1560. The latter was translated from a Scots prose version.

The *Court of Venus* was edited *by* Walter Gregor (1884). The *Seven*

Sages was printed in 1578, and reprinted by David Laing (1837).

ROLLAND, ROMAIN (1866–1944), French man of letters, was born at Clamecy. Nièvre, on Jan. *29, 1866.* From *1889–91* he was a member of the French school in Rome, and in *1895* became professor of art history at the Ecole Normale Supérieure. Later he was appointed professor at the Sorbonne, where he introduced the study of the history of music. He produced many critical and historical works, among them *Les origines du théâtre lyrique moderne, Histoire de l'opéra en Europe avant Lulli et Scarlatti* (1895), *Des causes de la décadence de la peinture italienne* (1895), *Le théâtre du peuple* (1901), besides studies on *Millet* (1902), *Beethoven (1903)* and *Michel-Ange* (1906), *Les Tragédies de la foi, Saint Louis, Aert, Le Triomphe de la raison (1913).* His most famous work. however, is the romance of *Jean-Christophe* (1904–12), the biography of a German musician. It is in three series, *Jean-Christophe, Jean-Christophe à Paris* and *La Fin du Voyage,* and appeared in 10 volumes *(1904–1912).*

When World War I broke out Rolland became unpopular in France because of a series of articles published in the *Journal de Genève* during Sept. and Oct. *1914.* These were subsequently published in book form under the title *Au-dessus de la mêlée.* Although his reputation in France suffered from his political views, it increased abroad, and the performances of *Danton* and *Le 14 juillet,* which with *Les Loups* and *Le Jeu de l'amour et de la mort* belong to his *Théâtre de la Revolution* (1909), caused a furore in Berlin. His aork *Mahatma Gandlzi (1924)* is an impassioned defense of the Indian leader. His later works include. *Colas Breugnon (1918); Les précurseurs (1919); Clerambault, Pierre et Luce (1919); Voyage musical aux pays du passé (1919); Liluli (1919).* In *1922* appeared the first volume of a series entitled *L'Ame Enchantée.* To this series belong *Annette et Sylvie* (1922), *L'Été* (1924), *Mère et Fils* (1927), *Beethoven the Creator (1929).* Rolland received the Nobel prize for literature in *1915.* He died in Vezelay, France, Dec. *30, 1944.*

ROLLE OF HAMPOLE, RICHARD (*c.* 1300–1349), early English mystic and author of mystical and ascetic tracts. The *Officium et Miracula,* prepared after his death by Cistercians of Yorkshire in anticipation of his canonization (which was never effected), provides the most certain information about his life: many apparently autobiographical passages in his own writings are cloudily expressed. Rolle nas born *c. 1300* at Thornton, Yorkshire. and was sent to the University of Oxford by Thomas Neville. archdeacon of Durham, but, dissatisfied with the subjects of study and the disputatiousness, left without a degree. There is no evidence that he ever went to the Sorbonne, or took priest's orders. Against the wishes of his family, Rolle established himself as a hermit on the estate of John Dalton of Pickering, but later moved to other hermitages, and probably always led a wandering life, rousing some opposition but winning much admiration. He kept in touch with a number of religious communities in the north and seems to have become spiritual adviser to the nuns at Hampole, in south Yorkshire, before his death there on Sept. *29, 1349.* His influence and reputation lived to the Reformation.

It is often difficult to distinguish his writings from those of his many followers. *The Pricke of Conscience,* formerly ascribed to him, has been denied him by 20th-century scholars. Among the genuine works is a number of scriptural commentaries of which that on the Psalms is the most important. Two distinct versions exist: one in Latin, the other written in English at the request of Margaret Kirkby, a recluse at Anderby, Yorkshire. His range of reading is wide: he draws on Gregory, Anselm, Bernard, Peter Lombard, the Victorines. Bonaventura; his knowledge of the Bible is profound. Among his Latin treatises, *Melos Amoris* is something of an *apologia* offered to his detractors. *Incendium Amoris* most comprehensively presents his doctrine which, though in the main conforming with the usual mystical theology of the late middle ages, has some emphases and terms of its own. Throughout his diffuse and repetitious writings the life of contemplation and solitude is exalted. Strict physical self-control is urged, but spiritual progress consists in the development of love of God. This life of love is consummated in mystical union, which is considered to be self-authenticating. Rolle's method is essentially a concentration and directing of the affections toward the person of Christ, nith a resulting experience of intense joy. In *Melos,* ch. ix, and *Incendium,* ch. xv, he provides notable accounts of rapture, which he invariably refers to in terms of *calor, dulcor, canor* ("fire, sweetness and song"). The terms suggest the quasi-physical accompaniment of his own mystical experiences.

His English writings on similar themes, handled more simply, include *Ego dormio* for a nun at Yedingham, Yorkshire, the *Commandment of Love to God* for a Hampole nun and the *Form of Perfect Licing,* for Margaret Kirkby again. Rolle's literary importance lies in these contributions to the vernacular stream of devotional prose for women readers. His English prose style is much commended: it is lively, persuasive, highly figured. The verse ascribed to him has more fervour than grace. Although he had mastered scholastic style. his Latin prose is usually fantastically rhetorical, exhibiting a curious syntax, a rich, obscure vocabulary and heavy alliteration and assonance.

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(G. SD.)

ROLLER, one of several old world birds, especially the common roller *(Coracias garrulus),* so called from its way of occasionally rolling in its flight, after the fashion of a tumbler pigeon. It is widely though not numerously spread over Europe and western Asia in summer. breeding as far north as the middle of Sweden, but retiring to winter in Africa. It is seen almost every year as a straggler in the British Isles. Except the back, scapulars and tertials, which are bright reddish-brown. the plumage of both sexes is blue (of various shades, from pale turquoise to dark ultramarine) tinted in parts with green. The bird is purely insectivorous.

Coracias forms the type of the family Coraciidae, allied to the bee eaters (Meropidae) and kingfishers (*q.v.*) (Xlcedinidae). in the order Coraciiformes. There are *16* species, found throughout Europe. Asia and Africa. The oriental roller or dollarbird *(Eurystomzrs orientalis)* ranges from southern Siberia to Australia.

ROLLER SKATING. The roller skate and the sport of roller skating having been traditionally accredited to an unknown Hollander who during the early 18th century created crude devices that could be attached to his shoes in the manner of ice skates. The first record of roller-skate manufacture is by Joseph Merlin of Huys. Belg. A contemporary described "a pair of skaites" as being among Merlin's many inventions while he was living in London shortly after 1760. Other early roller skates include the French *patin-à-terre* and the German *Erdschlittschuh* (both terms meaning literally "ground skate"). each about *1790.* Several attempts were made to improve upon the traditional four-wheeled roller skate by aligning the wheels after the fashion of the ice skate blade and in numerous other ways. None proved satisfactory, and further manufacture of the product adopted the earliest idea, still the design of modern roller-skate equipment.

During the 19th century considerable trial and error went into the search for an action device that would allow its user to perform upon curved strokes (again similar to the action of the "rocker style" ice skate) and thus take better advantage of the force of gravity in keeping a firm and upright balance. Until the invention of the now common cushioned truck for roller skates by James L, Plimpton of Medfield. Mass., in *1863,* roller skating was not widely popular; the sport was simply too difficult to master. Plimpton patented his rocking skate that year, and the first great roller skating craze swept the United States and western Europe. The first of the large roller-skating rinks was opened in New York that year, and the first organized roller skating was developed.

Shortly before Plimpton's rocking skates appeared, the composer Giacomo Meyerbeer had written into his opera *Le Prophkte* an ice-skating scene, which was performed on the stage on roller skates. The opera was a great success and the skating scene became famous. In 1849 the choreographer and composer, Paul Taglioni wrote a ballet, "The Skaters," again depicting an ice-skating scene, again performed on roller skates. In spite of the difficulties in performing upon the earlier roller skates. a U.S. ballet master, Jackson Haines, who had mastered ice-skating techniques with the application of ballet technique, turned his attention to roller skating; beginning in 1864 he captivated all who saw him perform. His interpretations became the foundation for what is known as the "international style" of skating on both ice and rollers, and his influence is still felt. One of the unusual positions in spinning is officially named after Haines.

Roller-skate wheels (or rollers) became the next subject of research. In the early skates Turkish boxwood had been widely used. The ball-bearing wheel, patented by Levant M. Richardson in 1884, required a better substance, and during succeeding years maple and then a fibre were introduced.

Throughout the years a variety of surfaces have been used for roller skating. However, nothing has provided a better floor than the fine, close-grained wood of the American sugar maple, preferably from trees grown in the northlands of Maine, Michigan, Wisconsin and Minnesota.

A variety of sports are available to the roller-skating enthusiast. Roller speed skating was a highly skilled and well-attended event during the first quarter of the 20th century. Gradual growth of roller skating as a participant sport during the early 1930s brought about in the U.S. the organization of a large and permanent association, the United States Federation of Amateur Roller Skaters. This was one of the first to be completely separated from the control of and linkage with the ice-skating sport. In England the two sports have been tied together for nearly 100 years. There has been gradual organization throughout the world, but however extensive the organizing efforts, only a very small fraction of all roller skaters belong to the associations. *See* also ICE SKATING.

(R. D. MA.)

ROLLI, PAOLO ANTONIO (1687–1765), Italian poet and librettist who played a leading part in the italianization of taste in 18th-century London, was born in Rome on June 13, 1687, the son of an architect. As a young man he studied with Gian Vincenao Gravina; and in 1715 he went to England as the protégé of Lord Thomas Pembroke. Soon after his arrival Rolli was appointed Italian master to the royal household; and during a sojourn lasting for some 30 years (1715–44) he wrote many cantatas and operatic libretti which were set to music by Bononcini *(Astarto),* Handel (*Il Floridante*) and Porpora *(Arianna in Nasso).* Rolli is best remembered however as the author of innumerable *endecasillabi,* odes and *canzonette* in which he aspired to recapture the rhythms of Catullus and the light-hearted charm of Anacreon. His other works include a translation of *Paradise Lost* (1735), *Marziale in Albion* (published posthumously 1776) and editions of the Italian classics.

Rolli died at Todi on March 20, 1765.

See his *Liriche,* ed. by C. Calcaterra with an important introduction and bibliography (1926); T. Vallese, *Paolo Rolli in Inghilterra* (1938).

(D. M. WE.)

ROLLING MILL, an establishment where metal, especially iron and steel, is rolled into plates and bars of various sections. *See* IRON AND STEEL: *Rolling Mills;* SHEETS, IRON *AND* STEEL; TIN PLATE AND TERNEPLATE.

ROLLS, CHARLES STEWART (1877–1910), English pioneer motorist, aviator and motorcar manufacturer, technical managing director of Rolls-Royce, Ltd., was born in London on Aug. 27, 1877, the third son of Lord Llangattock. He was educated at Eton and at Trinity college, Cambridge, graduating in mechanical and applied sciences. Rolls owned and drove a car prior to the Locomotives on Highways act of 1896, commonly called the "Emancipation" act, and in the early days he drove George V and Queen Mary when they were prince and princess of Wales. He drove his own 12 h.p. Panhard car in the Thousand Miles trial of 1900 and took part in many of the early long-distance European classic races. In 1902 he started in business as a motor dealer, and in 1906 his firm merged with the company of Sir Frederick Henry Royce to form Rolls-Royce Ltd. Rolls was the first man to fly across the English channel and back nonstop, in 1910, but on July 12 of that year he was killed in a flying accident at Bournemouth, Hampshire.

See L. Meynell, *Rolls: Man of Speed* (1953). (ST. J. C. N.)

ROMA, in ancient Roman religion, the city of Rome personified and later worshiped as Dea Roma. She was first revered simply as the genius or guiding spirit of the city and from this came to be worshiped as a goddess. Like emperor worship, the worship of Roma flowered first in the provinces. She had temples in Asia Minor as early as the 2nd century B.C. (Tacitus, Annals, iv, 56), often in association with other deities (*e.g.,* Tyche, Greek goddess of fortune; *cf.* Fortuna). From the time of Augustus the worship of Roma and the emperor in association became widespread outside Rome, but it was not until the time of Hadrian that Roma was recognized officially with the construction of a temple of Venus and Roma on the Velia. Her representations are numerous. Her head, symbolic of the Roman state, appears continuously on republican coins. In the empire she is a goddess with the symbols of war, victory and plenty.

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(R. B. LD.)

ROMAINS, JULES (1885–). French poet and novelist, was born on Aug. 26, 1885, at St.-Julien-Chapteuil in the Ardèche. He entered the Ecole Normale Supérieure in 1906, and graduated in philosophy in 1909. His claim to fame is principally based on his position as one of the heads of the unanimist school of writers (Arcos, Vildrac, Duhamel, Chennevière and others). Romains' work falls into three categories: poems, novels and plays. The most important of his books of verse, *La Vie unanime* (1908), deals with what may be called the spiritual life inherent in the various groups of humanity. The *Odes et Prières* (1913) and *L'Ode gênoise* (1925) should also be mentioned. Some of his novels, such as *Les Copains* (1913), owe their merit to a sort of Rabelaisian verve and truculent jollity. Others are in a loftier style. *Mort de* quelqu'un (1910) traces the brief survival of a dead man in the society in which he had lived, and how he gradually fades out of memory. The dramatic works of Jules Romains include farces, the best of which is probably *Knock* (1925), dramatic prose poems, such as *L'Armée dans la ville* (1911) and *Cromedeyre-Ee-Vieil* (1920), and the tragedies *Le Dictateur* (1926) and *Jean le Maufranc* (1927). He went to the U.S. in 1940 and returned to France in 1945. He wrote an epic work in 27 volumes, *Les Hommes de bonne volontk* (Eng. trans. in 14 vol., 1932–46). (G. ML.; X.)

ROMAN, a city of Rumania, in the region of Bacău, on the main line from Czernowitz to Galatz, and on the left bank of the river Moldava, 2¼ mi. W. of its junction with the Sereth. Pop. (1960 est.) 31,882. Roman has been the seat of a bishop since 1401. Its seminary dates from 1402. There are old churches, including a cathedral, built in 1541.

ROMAN ARCHITECTURE refers to the architecture of the community of ancient Rome on the Tiber, as well as to that of the empire that spread from Britain to Mesopotamia, from the 5th century before Christ to the 4th century after Christ. Roman architecture was almost as complex as the Roman empire itself; it was influenced by a multitude of geographic, climatic, political, economic, social and cultural factors. The cohesive factor through all the differences was the Roman character, which possessed the talent and felt the necessity to organize in large and complex terms, politically or architecturally or otherwise.

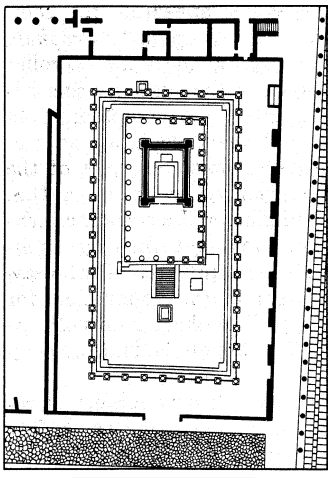
(For a discussion of the architecture of classical Greece, from which many of the elements of Roman architecture were derived, *see* GREEK ARCHITECTCRE. The impact of Roman architecture on succeeding cultures is discussed in BYZANTINE ARCHITECTURE and ROMANESQUE ARCHITECTURE. *See* also ARCHITECTURE and ROME: *The Ancient City.)*

Our knowledge of Roman architecture derives primarily from extant remains scattered throughout the area of the empire. Some are well preserved, others are known only in fragments and by theoretical restoration. Another source of information is the vast store of records, including dedicatory and other inscriptions on public works. Especially important is the book on architecture by Vitruvius who lived about the time of Christ. His book *De Architectura* is a handbook for Roman architects and covers almost every aspect of architecture, but it is limited, since it was based on Greek models and was written at the beginning of the more creative phase of Roman architecture, in the period of the empire.

HISTORY

Roman monumental architecture emerged around the 6th century B.C. as an Italic style, closely related to that of the Etruscans (*q.v.*). The Capitoline temple in Rome, built about this time, resembled Etruscan buildings at Signia, Orvieto, Veii and elsewhere, in resting on a podium with a triple cella, the broad low Etruscan porch and characteristic terra-cotta adornment. The Capitolium at the Roman foundation of Cosa, in the 3rd century, was similarly conceived. The forms, plastic and spatial, had evolved locally in a tradition of wood and terra cotta, though even at this time there was a slight Greek influence.

From about 200 B.C. to about A.D. 50, the rise of republican Rome and the increasing contacts with Greece resulted in a Greek influence strong enough to control the plastic forms and even to modify the spatial effects. A temple at Gabii, perhaps of the 3rd century, and the temple of Apollo at Pompeii of around 120 B.C., had approximately the Greek single-cella peripteral plan; the latter retained the Italic podium and open porch, and had pronounced modifications of the Greek Ionic order. Buildings like the temple under S. Nicola in Carcere (*c.* 31 B.C.), the round building by the Tiber (*c.* 31 B.C.), the Temple of Fortuna Virilis (*c.* 40 *B.C.*), all in Rome, show the height of the hellenizing movement. But the slightly later Augustan temples of Concord, Castor and Pollux in the Roman forum, and Mars Ultor in the Forum of Augustus had a native freedom of arrangement of the limited spaces. and highly elaborated moldings, particularly in the entablature, where new forms, mostly floral, were lavishly displayed in finely worked, full masses, and consoles became increasingly important.



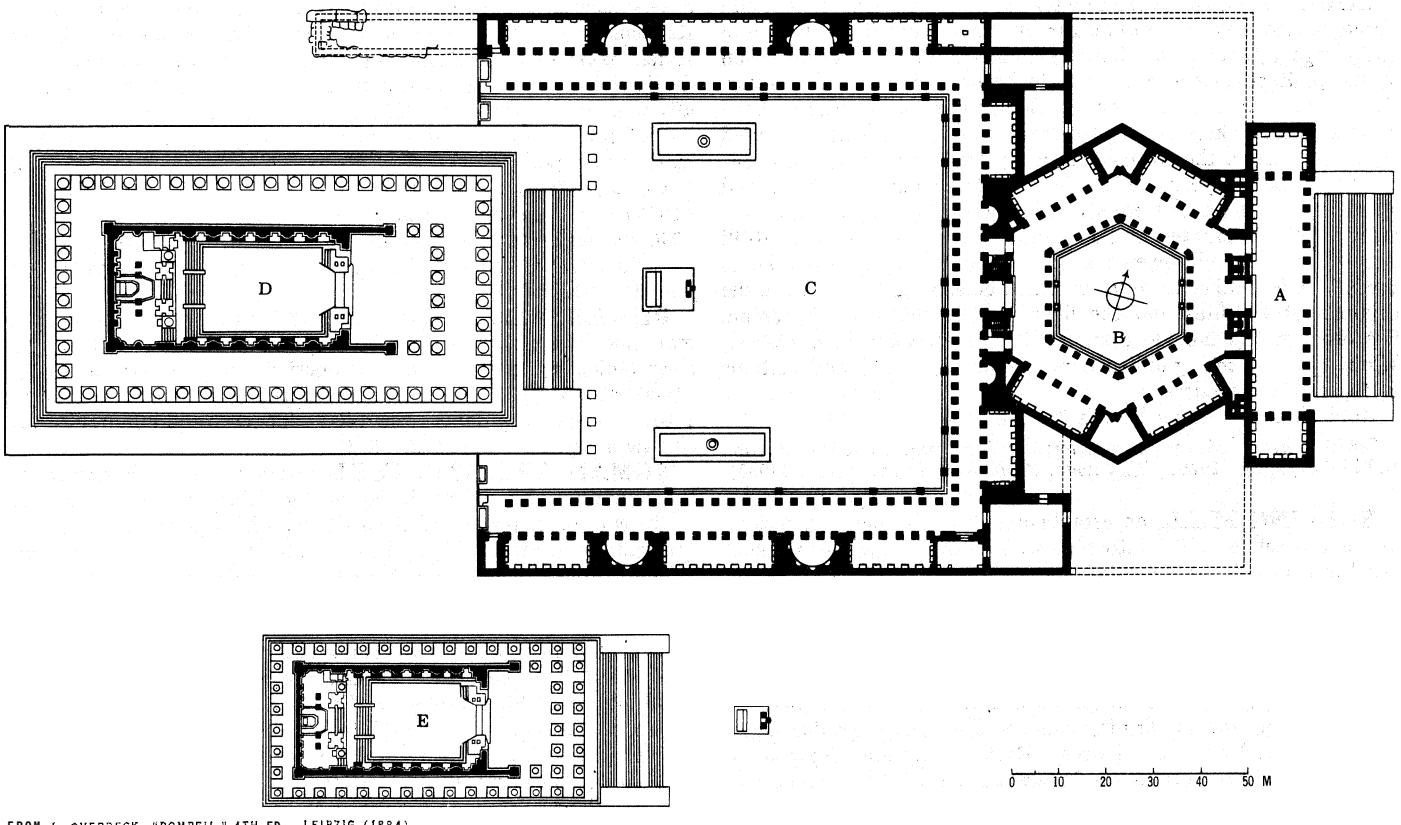
FROM J. OVERBECK, "POMPEII," 4TH ED., LEIPZIG (1884)

FIG. 1.—PLAN OF THE TEMPLE OF APOLLO, POMPEII

During this period the more peculiarly Roman concepts developed chiefly in secular architecture. The Stabian baths at Pompeii, perhaps as early as 120 B.C., were already composed in vaulted spaces, though quite compactly and with little of the later freedom and spaciousness. In some buildings, like the Carcer and Tullianum of about 100 *B.C.* and the Tabularium, about 78 B.C., arches and concrete were basic, though hellenizing orders were used for ornament. The small theatre at Pompeii was built about 75 B.C. with the Roman interior forms already established but with no monumental exterior. The Theatre of Marcellus (*c.* 11–10 *B.C.*). however, had the high external façade with orders and arches blended, which became standard. The basilica, even of the 1st century, was experimental.

The beginning of Roman influence outside Italy is evidenced by theatres and amphitheatres at Arles and Nîmes. perhaps as early as 30 B.C.; by the Maison Carrée at Nîmes about 16 B.C.; and by small buildings in Greece and Syria, about the turn of the century.

Around the middle of the 1st century A.D. there was a surge of development of spatial composition. The orders and other ornament inherited from Greece were increasingly modified and elaborated in nonfunctional perspective effects, and other kinds of



FROM J. OVERBECK, "POMPEII," 4TH ED., LEIPZIG (1884)

FIG. 2.— PLAN OF THE GREAT COMPLEX AT BAALBEK

(A) Propylaea, (B) Forecourt, (C) Great Court, (D) Temple of Jupiter, (E) Bacohus or Atargatis Temple

ornament and spatial configurations gained importance. Of course many buildings like the Colosseum (A.D. 75–82) preserved a more conservative character, but with the baths and palaces of Nero began the series of imperial compositions of grand, elaborate spaces. The movement came to a climax under Trajan and Hadrian (c. 98–138): in the Forum of Trajan and the great complex at Baalbek; the Pantheon; the villa of Hadrian at Tivoli, with its intricate composition of enclosed spaces and interrelated buildings and of interior and exterior vistas.

Through the 2nd and 3rd centuries countless buildings were erected in cities and towns all over the empire, in part under imperial patronage, in part by local enterprise. The provincial huildings had great individuality, but the more ambitious usually followed the influence of the capital. The forms evolved by about A.D. 140 were followed conventionally for the next 50 years—and longer—but from about A.D. 200 to the age of Constantine, there was a growing trend toward increased majesty and less emphasis on material substance. Even before the end of the 2nd century deep cutting with sharply contrasting light and shadow had begun to detract from the impression of the solid forms in carved ornament; in the arches of Septimius Severus (c. A.D. 200) light and shadow alone formed the design, not the masses of the forms of the motifs. Especially in Africa illogical composition of the elements of entablatures robbed them of structural significance. In the palace of Diocletian (c. A.D. 300) extensive use of arched colonnades, free and blind—even, as at the main gate, on consoles—emphasized the movement rather than the mass. The sheer faces of some wall surfaces, like those of the towers flanking the gates, became, with a minimum of structural articulation, austere geometric forms. Experimentation and elaboration in vaulting, as in the Temple of Minerva Medica (c. A.D. 260), was toward making the supports lighter structurally and aesthetically. Compared to the Baths of Caracalla (c. A.D. 215), the Basilica of Maxentius (c. A.D. 310–320) was more simple and concentrated, increasing its sense of elemental vastness and permanence, whereas in contrast to the Pantheon its shape and ornament is less tangible.

Finally, evolving into the early Christian art to come, the Constantinian mausoleum of Sta. Costanza. with its dome resting on a drum supported on arches on a circle of pairs of slender columns, and its ambulatory vaults smooth and sheathed with mosaic, already was striving to suggest the independence of roof and space from material support.

BUILDING TECHNIQUES

Building Materials.—The material employed around Rome in the earliest buildings was tufa, a volcanic rock of varying hardnesses, some soft enough to be worked with bronze tools. Later other harder volcanic stones were used such as peperino and the stone from the Alban hills. Under the later republic and the empire the most important stone for building was travertine, a limestone quarried mainly at Tibur (Tivoli). An example of the use of travertine is the exterior of the Colosseum.

The use made by the Romans of marble was mainly decorative. It was applied in slabs to brick and concrete walls, and set in cement. It was used for pavements either in slabs cut and arranged in patterns, or as mosaic. Under the empire a great demand arose for coloured marbles and such stones as porphyry, granite and alabaster, which were imported from various parts of the empire. The abundant use of these marbles is well illustrated by the remains of the Flavian palace on the Palatine and of Hadrian's villa at Tivoli.

Unburned bricks faced with stucco were used especially for private houses under the republic. Of these, naturally, very few remain. Under the empire kiln-baked bricks and tiles were the most common facing for concrete. They were never used to build a whole wall in the modern manner but merely as a protective skin. These bricks or tiles were almost always used in triangular shapes. Large tiles about two feet square called bipedales were employed as bonding courses. (See also BRICKWORK.)

The use of stucco over unbaked brick and over coarse stone was prevalent from the earliest times in Greece, Sicily and Italy. It served as a protection against the weather and also as a finish. Later it was used over brick and concrete. It was often made of lime, sand and fine marble dust and some would take a high polish or fine molding. Thus it became the usual ground for decoration especially in the interiors of houses. Examples of its use abound at Pompeii, and at Rome in the House of Livia, in Nero's Golden house and others. Another material the use of which was mainly decorative is bronze. Doors, grilles, panels of ceilings, etc., were made of it.

For their concrete the Romans used pozzuolana, of which there are extensive beds at Pozzuoli, near Naples, and also around Rome. It is a fine chocolate-red volcanic earth, which when mixed with lime forms an excellent natural hydraulic cement that will set well even under water. With this cement was mixed an aggregate of broken tufa, travertine, brick or even marble, pumice stone being used in vaults after the 1st century A.D. to lighten the weight. It was used in all the great imperial buildings (*e.g.*, Pantheon, Baths of Caracalla and Basilica of Maxentius). The new forms of architecture that were developed by the use of this material spread all over the Roman empire, although in the provinces other, often weaker, kinds of concrete were used.

Construction.—Walls were built of ordinary masonry or of concrete (faced or unfaced). While there are several examples of early stone walling without courses (cyclopean and polygonal) especially in some towns (*e.g.*, Norba, Praeneste, near Rome), most of the stone walls existing were built of squared blocks laid in regular courses as headers and stretchers (opus quadraturn). The blocks of stone in these walls are fairly large, 2 ft. by 4 ft. or more, and were often held together by iron cramps fixed in lead.

Concrete walls, except below ground, were always faced. They are divided into types according to the kind of facing used. (1) Opus quadraturn, *i.e.*, ordinary stone walling, was used as a facing for concrete, especially for important public buildings under the earlier empire (*e.g.*, exterior of the Colosseum). (2) Opus *incertum* was the most common facing for ordinary concrete walls of the 2nd and 1st centuries B.C. The face of the concrete was studded with three-inch to four-inch irregularly shaped pieces of stone, usually tufa. (3) Opus *reticulatum* came into vogue in the 1st century B.C. and remained until the time of Hadrian. The construction was like that of opus *incertum* but the pieces of stone were pyramid shaped with square bases set diagonally and wedged into the concrete walls. (4) Brick- and tile-faced concrete (so called opus *testaceum*) was by far the most common material for walling under the empire. Triangular tiles were used with their points turned into the concrete and their long sides showing, thus giving the appearance of a wall built of thin bricks. Bonding courses of bipedales were employed at intervals of two or three feet. (5) Mixed brick and stone facing (called opus *mixtum*) was popular under the later empire and especially under Diocletian.

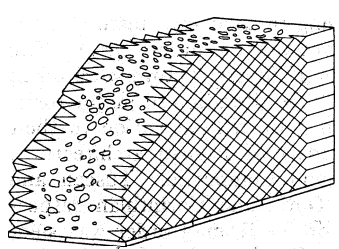


FIG. 3.—DRAWING SHOWING OPUS RETICULATUM TYPE OF WALL CONSTRUCTION

Other kinds of supports included columns and piers. Columns were usually of stone and often monolithic; occasionally small columns were of brick covered with stucco. Piers, too, were often of stone, but those serving as primary support for large vaults were usually of concrete.

Columns and piers both bore horizontal architraves or, from the 2nd centur, B.C. (later for columns), arches. These occurred in gates, bridges and aqueducts as well as colonnades and doors and other openings. Not only round but segmental and flat arches were used freely. The discovery of concrete enormously facilitated the spread of arch construction. Concrete arches were faced with stone or tile voussoirs.

The vaults used by the Romans were simple geometrical forms: the barrel vault, the intersecting (groined) barrel vault and the segmental vault. By the 1st century B.C. extensive systems of barrel vaulting were employed (*e.g.*, in the substructions of the

Tabularium in Rome, the Temple of Hercules at Tivoli and others. When set the concrete vault exerted no thrust. The surfaces of the vaults were tile faced or covered with stucco. A fine example of Roman vaulting is the Basilica of Maxentius.

The construction of the dome (*q.v.*) naturally follows that of the vault. Here again the fact that the concrete dome was a dead weight without thrust simplified the problem. Tie ribs of brick were used and sometimes relieving arches, as in the case of the Pantheon where the facing bricks were laid horizontally. At the crown of the dome was a brick ring. Characteristic of imperial Roman design was the elaboration of complex forms of domes to fit multilobed ground plans.

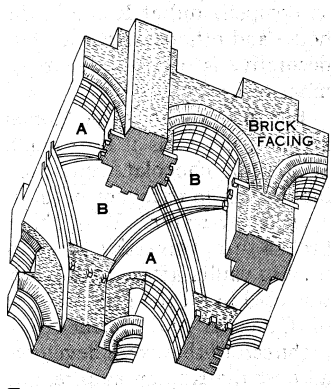


FIG. 4.—ROMAN CROSS VAULT FROM THE PALACE OF SEPTIMIUS SEVERUS, THE PALATINE. ROME (3RD CENTURY)
(A) Brick groin ribs; (B) concrete filling

Most monumental buildings were erected for public use and the income, if any, from rents or fees went to the public treasury. Many of these, however, were built by wealthy individuals and given to the community in a form of voluntary but well-recognized income tax. Construction was done by state agencies or private contractors, employing slave or free labour. Techniques and crafts were highly developed, though machines were simple and powered by men or animals.

Design.—The pervasive Roman predilection was for spatial composition, for organization of lines and surfaces and masses and volumes in space. In this the Romans differed from their predecessors in the ancient Mediterranean world, and however freely they used the elements of earlier styles, in Rome or in the provinces, they recast them according to their own taste.

Their most conspicuous inheritance was the order (*q.v.*). The columns and their associated motifs of superstructure were taken directly from Greek tradition, with little alteration of major form, although the Romans did use them with little attention to their internal logic. There were five orders of Roman architecture: Tuscan, Doric, Ionic, Corinthian and Composite. Tuscan and Composite were modifications of Doric and Corinthian respectively. In general the proportion of the Roman order was slenderer than that of the corresponding Greek order and there was a tendency toward greater elaboration. Columns were often unfluted, but the faces of the entablature, left plain in Greek work, were covered with decoration.

The Doric order almost invariably had a base molding that was probably taken from the Etruscan Doric or Tuscan column. Examples of Roman Doric are to be found in the Tabularium (78 B.C.) and in the lowest order of the Colosseum (A.D. 79) where it was used in conjunction with the arch. The Temple of Hercules at Cori (c. 80 B.C.) is one of the few known Roman Doric temples.

The Ionic order was used in some temples and public buildings and the number of isolated capitals found suggests that it had a certain vogue in private homes. Notable examples of this order are the Temple of Fortuna Virilis, the second orders of the Theatre of Marcellus and the Colosseum, Trajan's forum at Rome and various buildings at Pompeii.

The Corinthian order was by far the most popular with the Roman builder. It was popular for its richness and for the ease with which it could be used in any position resulting from the identity of the four faces of the capital. The columns removed (by Sulla) from the temple of Zeus Olympios at Athens were the model, but the whole order became progressively elaborated in detail and showed a tendency toward sharp contrasts of light and shadow. Examples of this order are seen at the temples of Mars Ultor and of Castor and Pollux (the latter is one of the most beautiful examples in Roman architecture) in Rome, the Temple of Vesta at Tivoli, Agrippa's portico to the Pantheon and the third order of the Colosseum.

The Composite capital is really a Corinthian capital with the tendril at the corner replaced by an Ionic volute. Examples of this capital are to be found on the triumphal arches of Titus and Septimius Severus and the Baths of Diocletian. (See also CAPITAL.)

Although these forms were taken bodily from Greek architecture their real use in Roman design was wholly different. In Roman work columns came to carry arches as well as architraves, permitting more varied linear patterns, wider intercolumniations and greater freedom in articulating spatial forms. Moreover, columns were used not only as primary supports but also as detached columns and pilasters, together with other projecting elements and recessed niches of all kinds, so as to modulate the sheer face of wall or pier into a composition of mass and volume in depth, supplementing the larger forms of the main volumes. Realistic or fanciful architectural compositions were even painted on some walls to give an illusion of the same effecr. So, too, carved moldings, cornices, etc., were designed with deep interplay of mass and volume.

In terms of primary architectural forms, Roman design from its first emergence from the Italic and Etruscan traditions favoured temples with spacious porches, like the Temple of Apollo at Pompeii. The very elevation of the podium poses the temple in the surrounding volume. with external spatial relationships established by the special approach and enclosing colonnades. In imperial architecture the design of the temple precinct, forum, thermae, etc., was normally conceived as a complex of variously formed spaces related to variously formed masses; even landscaping was incorporated, as, conspicuously. at Tivoli and Praeneste. Interiors of smaller houses as well as of grand structures were designed in terms of vistas through variously shaped rooms of varying qualities of illumination. There was a powerful. even rigid final dominant of axial symmetry, but against this was exploited richly every kind of spatial form in some highly developed system of organization.

TYPES OF BUILDING

Temples.—The Roman temples differed in many important respects from those of the Greeks. For the comparatively low stylobate with its three steps all round, the Romans substituted a high platform or podium with a flight of steps on the entrance faqade. Greek temples were isolated from other buildings and almost always faced east and west; those of the Romans were turned to all points of the compass, their orientation being governed by their relation to other buildings. This resulted in an increased emphasis on the entrance faqade, with an increased depth to the portico. The cella was wider and the colonnade that surrounded the Greek temple was often reduced to a row of engaged columns or pilasters along the cella walls, except on the entrance front. In some cases the cella was vaulted in concrete and might have an apsidal end (*e.g.*, the so-called Baths of Diana at Nîmes and especially the double Temple of Venus in Rome). The best preserved example of a Roman temple now existing is that known as the Maison Carrée at Nimes. Among the most important temples of which remains exist are those of Fortuna Virilis, Mars Ultor, Castor and Pollux, Concord and Antoninus and Faustina in Rome; in Italy, the Temple of Minerva at Assisi and the temples at Pompeii; and in Syria, the temples of Bacchus at Baalbek and of the Sun at Palmyra.

Among the most important circular temples are those of Vesta and Mater Matuta in Rome, Vesta at Tivoli, Rome and Augustus on the Acropolis at Athens, and Venus at Baalbek, which has detached Corinthian columns joined to the cella walls by a segmental architrave. The greatest circular temple and in many respects the most important Roman building is the Pantheon (*q.v.*). It consists of a rotunda 142 ft. 6 in. in diameter surrounded by concrete walls 20 ft. thick, in which are alternate circular and rectangular niches. Light is admitted through a central opening about 28 ft. across, at the crown of the dome. In front is a portico which originally belonged to a temple built by Agrippa, re-erected when the rotunda was built under Hadrian, A.D. 120–124. The

rotunda and the dome are among the finest examples of Roman concrete work. The construction is strengthened by immense relieving arches and piers of brick set above one another in the thickness of the walls. The interior was lined with precious marbles, the coffers of the dome were decorated with bronze rosettes and the dome itself was covered externally with bronze plates. (See also TEMPLE ARCHITECTURE.)

Tombs.—The large Roman tomb consisted of an earth mound or tumulus surrounded by a ring of masonry rising usually to a considerable height. Few of the type now exist, the most notable being the tomb of Cecilia Metella on the Via Appia and the mausoleum of Hadrian, now the castle of St. Angelo. The smaller tombs, in particular those of the columbarium (*q.v.*) type are usually underground, though there is sometimes an upper story (often in the shape of a small temple in antis) built of brick, from which steps lead down to the tomb proper. There is a line of such tombs just outside Rome along the Via Appia and also along the Via Latina and such a cemetery has been found under the church of St. Peter in Rome. Examples of Roman funeral monuments of various kinds exist along the Street of Tombs at Pompeii and in the provinces (*e.g.*, at Palmyra, Jerusalem and Petra).

Forums and Markets.—A principal focus of Roman life anywhere was the forum. This was a place or space in which important business might be conducted. In a small community most business would be conducted in a forum, though gradually special buildings were built on the periphery for particular activities, civic, commercial, religious. Characteristically such a forum was lined in part with small one-room shops built in long, low buildings, sometimes with colonnades.

A city might have more than one forum, for special reasons. Conspicuous examples are the imperial forums in Rome itself, of which the Forum of Trajan is the most developed example. It consisted of a colonnaded square with great hemicycles on the

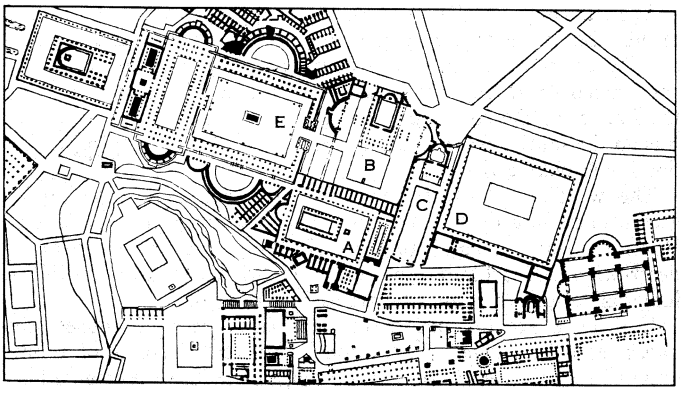


FIG. 5.—PLAN SHOWING IMPERIAL FORUMS AT ROME
(A) Julius Caesar, (B) Augustus, (C) Nerva, (D) Vespasian, (E) Trajan

sides and the tremendous Ulpian basilica lying across one end; beyond the basilica was a library with the commemorative Column of Trajan in the central court, and beyond this a (slightly later) temple in another colonnaded square. (See also GOVERNMENTAL ARCHITECTURE.)

Architecturally and functionally distinct from the forum, though superficially similar, is the *macellum*. This was not a square, but a market building consisting of shops around a colonnaded court. Great warehouses, called horrea, were another kind of market building.

Basilicas.—The basilica (*q.v.*) was a large covered hall for the holding of courts of justice and for banking and other commercial transactions. On the forum at Rome are the Basilica Julia on the south side and the Basilica Aemilia on the north side. both of which had a central hall and side aisles. The Basilica Ulpia in Trajan's forum was similar in plan but had at either end semicircular halls which served as law courts. The fourth and greatest of the basilicas was that begun by Maxentius and finished by Constantine, *c.* A.D. 313. This huge building covered 7,000 sq.yd. and followed in construction and plan the great hall of the Roman baths. The vaults over the bays on the north side are still to be seen overhanging without support, a striking testimony to the marvelous cohesion and enduring strength of Roman concrete. The basilica at Pompeii is an example of the simpler type general in the provinces.

Baths.—By the end of the republic, baths (balneae) had become a recognized feature of Roman life. Under the empire their numbers increased until at the beginning of the 4th century A.D. they numbered 1,000 in Rome alone. They were of the type of the Turkish bath with rooms at different temperatures. Remains of these ordinary establishments are common throughout the empire. The Stabian baths at Pompeii are the best preserved.

The imperial thermae were more than baths. They were immense establishments of great magnificence with facilities for every gymnastic exercise, with halls to which resorted philosophers, poets and rhetoricians and those who wished to hear them. The earliest of these thermae were those built by Agrippa c. 21 B.C. Others were built by Nero, Titus, Trajan, Caracalla, Diocletian and Constantine. The best preserved are the Baths of Caracalla, which covered an area about 1,000 ft. square, and those of Diocletian with accommodation for 3,200 bathers. Parts of the latter are now occupied by the church of Sta. Maria degli Angeli and by the Museo delle Terme. The remains of these two great establishments are among the most impressive examples of Roman concrete construction. (See also BATH.)

Theatres, Amphitheatres, Circuses.—The Roman theatres differed in several respects from the Greek. The auditorium was not excavated and the walls surrounding stage and seating were continuous, the entrance to the orchestra being by vaulted passages. As the chorus played no part in the Roman theatre the orchestra or dancing space became part of the auditorium. The facade behind the stage was elaborately adorned with architectural fantasies.

The only theatre in Rome of which any remains exist is that of Marcellus built by Augustus (c. 11–10 B.C.) but there are numerous examples throughout the Roman empire especially in Asia Minor. The theatre at Orange, France, is the best preserved example. Others of importance are those at Taormina in Sicily; Pompeii and Ostia in Italy; at Termessus, Alinda, Aizani, Aspendus in Asia Minor; the Odeon of Herodes Atticus at Athens. The Odeon of Agrippa in Athens was a good example of a completely enclosed music hall.

The largest and most important amphitheatre (*q.v.*) of Rome was the Colosseum (*q.v.*) built by the emperors Vespasian, Titus and Domitian in A.D. 72–80 on the site of Nero's lake. It is a huge ellipse about 620 ft. by 513 ft. covering six acres and shows remarkable skill in planning. It had seating accommodation for about 45,000 spectators, and its 80 entrances were so arranged that the whole building could be cleared in an incredibly short time. The whole is built of concrete, the exterior being faced with travertine and the interior with precious marbles that have long since disappeared. Other important amphitheatres are those at Capua, Pompeii, Pozzuoli, Verona, Pola, Arles, Nimes, etc.

The circus (*q.v.*) was essentially a racecourse, lined, ideally, with tiers of seats along each side and curving around one end, with the opposite end squared off and provided with arrangements for chariots to enter and draw up for the start. Down the middle ran a barrier, on which judges and referees might perform their functions. Since it was the largest facility for watching some function the circus was used for other spectacles than racing, such as, traditionally, for the burning of the Christians by Nero.

Streets, Arches, Gateways.—Characteristic of Roman towns were colonnaded avenues for main lines of traffic; even secondary streets were sometimes lined with colonnades for protection from weather. Such avenues were sometimes adorned with ornamental arches. Often these served simply to dramatize or punctuate the implied movement of the avenue. A triumphal arch (*q.v.*) was sometimes erected to commemorate an important event or campaign, often isolated rather than spanning a roadway. The triumphal arches of Septimius Severus at Rome and of Trajan at Ancona are accessible only by flights of steps and the archways themselves are too narrow for ordinary use. The triumphal arch

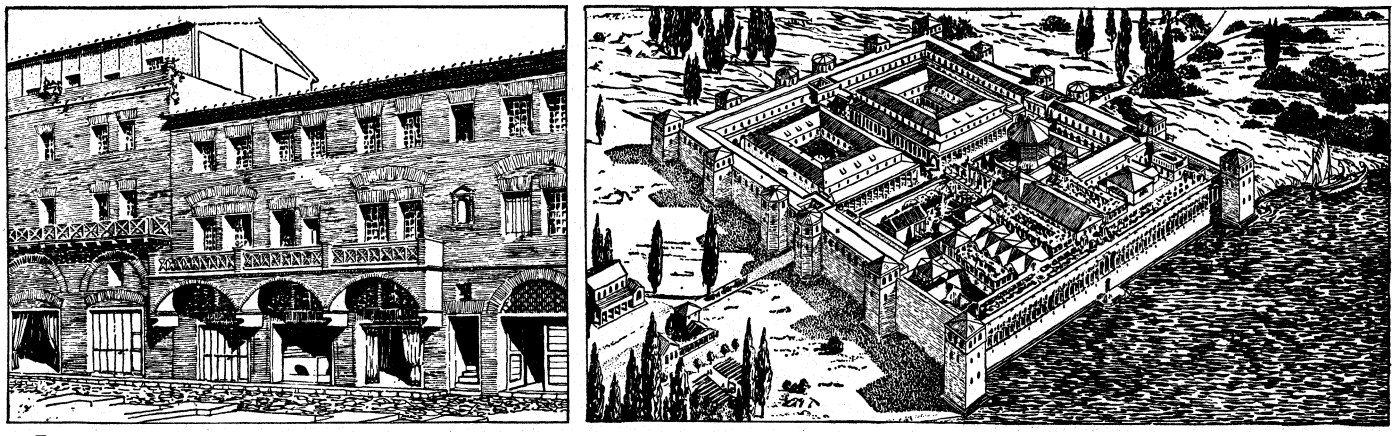


FIG. 6.— (LEFT) RESTORED VIEW OF A STREET OF SHOPS AND TENEMENTS IN OSTIA AND (RIGHT) OF THE PALACE OF DIOCLETIAN AT SPALATRO
(Service portions of the palace are at left and top, the palace proper below and to the right facing the Adriatic)

was usually decorated with columns and bas-reliefs of the chief events it commemorated and was frequently surmounted by a group of sculpture. The most important of these arches are the Arch of Titus (*c.* A.D. 81) commemorating the capture of Jerusalem, the arches of Septimius Severus and Constantine in Rome and Trajan's arches at Benevento and Ancona. There are several other triumphal arches in the provinces, notably those of Tiberius at Orange, of Augustus at Susa and Caracalla at Tebessa. Others exist at Rheims, Pola, Timgad and Maktar.

The monumental city gate while sometimes serving a commemorative purpose differs from the arch in being part of the defenses of the city. Of these gates one of the most famous and best preserved is the Porta Nigra at Trier. (See also *MONUMENTS AND MEMORIALS.*)

Bridges and Aqueducts.— The bridges (*q.v.*) and aqueducts (*q.v.*) of the Romans rank among their greatest monuments. They knew the principle of siphon conduits, but the conduit elevated to grade on arches or even tiers of arches was often cheaper for them and always more spectacular. The most famous examples of Roman aqueducts are the Pont du Gard at Nîmes, the aqueducts at Tarragona and Segovia in Spain, and those which crossed the Campagna bringing water to Rome.

There are not many of the larger Roman bridges now remaining. The best preserved is that built by Augustus and Tiberius at Rimini. The finest is that across the Tagus at Alcantara in Spain.

Domestic Architecture.— Private houses, even palaces, were usually of the style that emphasized interior courts and gardens rather than external façade; this tradition was even maintained so far as possible in northern Europe and Britain, where elaborate arrangements for heating had to be added. In the native Mediterranean climate, however, construction tended to be light and open rather than compact and imposing.

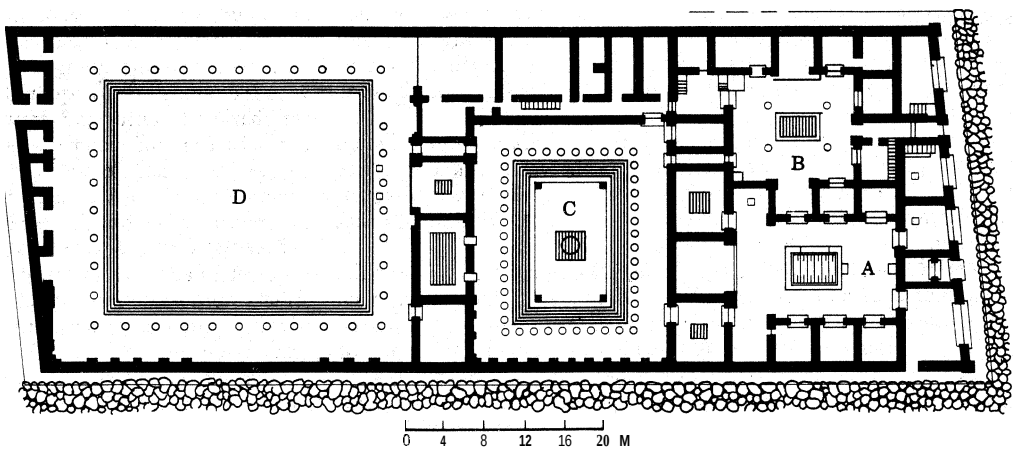
Even the palaces of the Caesars in Rome consisted essentially of series of gardens and, considering their purpose, relatively unmonumental buildings, spread somewhat casually over the Palatine hill. Augustus himself bought and enlarged the house known as the House of Livia which still exists. Tiberius built a palace on the northwest side of the hill. Another palace was built on the southeast corner of the hill by Claudius or Nero. The central space was covered by the palace of the Flavians, Domitian with his architect Rabirius being responsible for a magnificent suite of state apartments and for the sunken garden called the *hippodromus*. Hadrian extended the palace toward the forum. Septimius Severus raised a huge structure overlooking the Circus Maximus, partly on top of Hadrian's work and partly on an artificial platform supported on arches, finishing it with his Septizonium. Of the famous Golden House of Nero on the site now covered by the Baths of Titus, the Colosseum and the Basilica of Maxentius. very little remains.

The villa of Hadrian at Tivoli, begun about A.D. 123, was another sumptuous imperial residence with parks and gardens on a large scale. There are remains of great brick and concrete structures and the unevenness of the site necessitated large terraces and flights of steps. All the buildings are Roman in style and method of construction, though with Greek names.

The palace of Diocletian at Spalato (Split), to which he retired on his abdication in A.D. 305, combined a palace with a fortress and was truly monumental. It consisted of an immense rectangle surrounded on three sides with walls guarded by towers and on the fourth, to the south, protected by the sea. The palace itself was on the south side with a great gallery 520 ft. long with 51 windows overlooking the sea.

The word villa pertains to an estate, complete with house, grounds and subsidiary buildings. There are very few remains of Roman villas; our chief authority is Pliny, who gave a detailed description of his Laurentine villa. Hadrian's villa at Tivoli, an imperial residence, cannot be treated as typical.

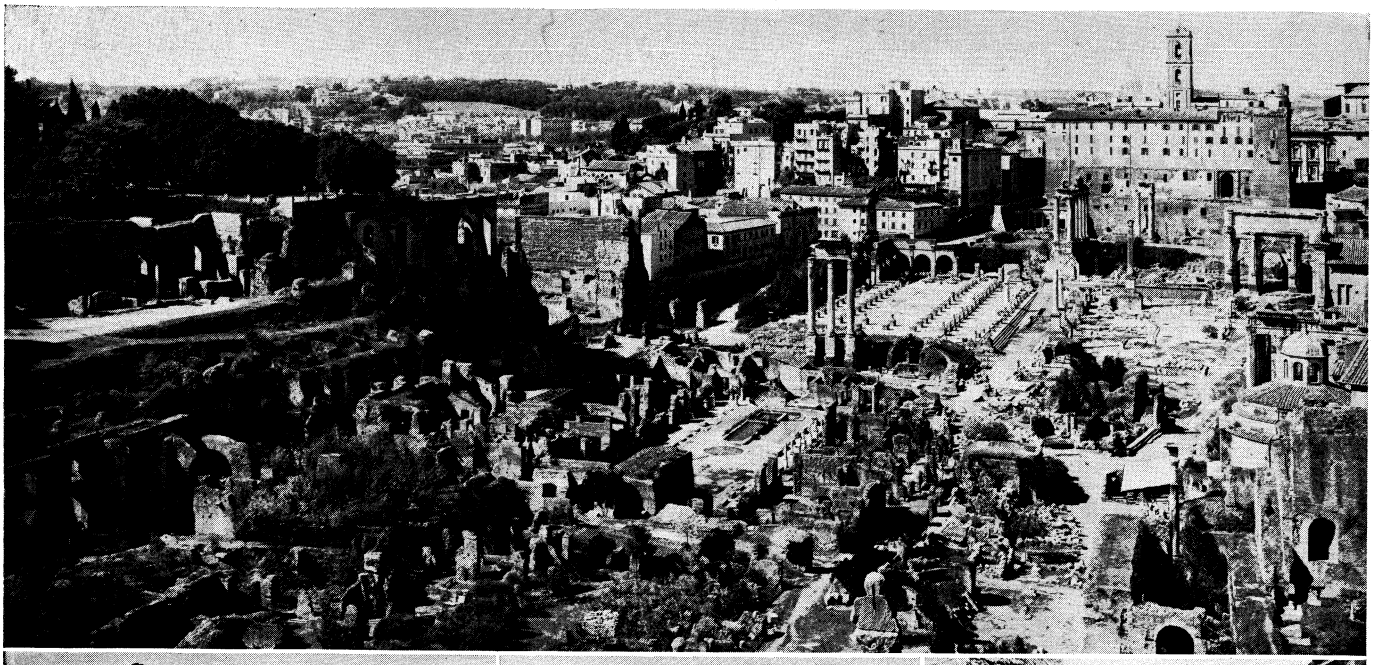
In Roman architecture there were two types of houses, the *domus* and the *insula*. The *domus* consisted of suites of rooms grouped round a central hall or atrium, to which were often added further suites at the rear grouped round a colonnaded court or peristyle. The atrium, a rectangular room with an opening in the

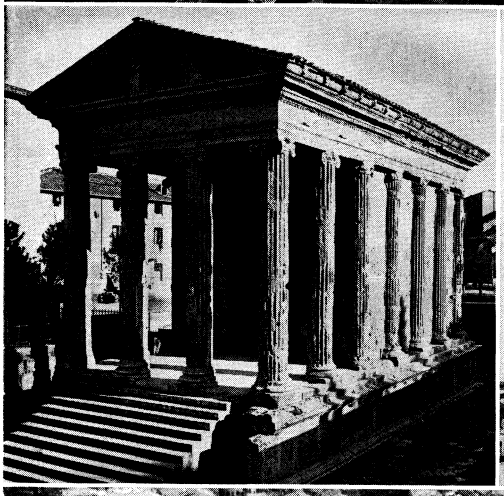


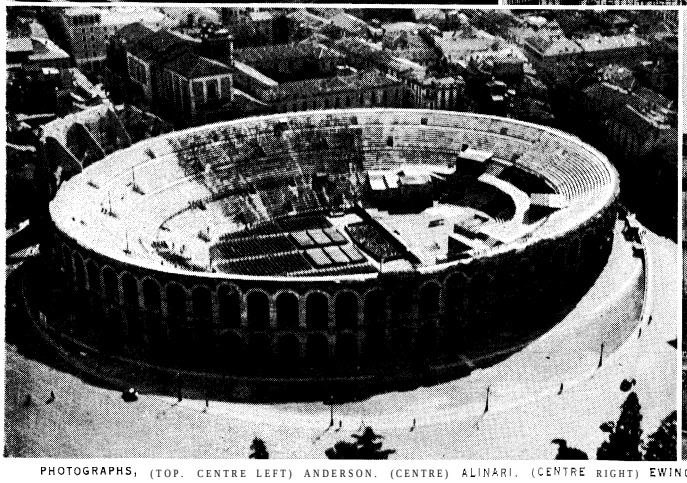
FROM J. OVERBECK, "POMPEII," 4TH ED., LEIPZIG (1884)

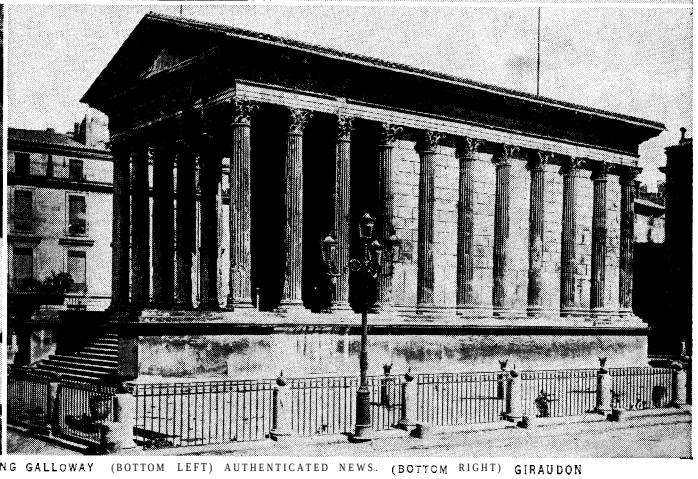
FIG. 7.— PLANOF THE "HOUSE OF THE FAUN." POMPEII
(A) Tuscan Atrium, (B) Tetrastyie Atrium, (C) Peristyle, (D) Peristylar Garden

ROMAN ARCHITECTURE









PHOTOGRAPHS, (TOP. CENTRE LEFT) ANDERSON. (CENTRE) ALINARI. (CENTRE RIGHT) EWING GALLOWAY (BOTTOM LEFT) AUTHENTICATED NEWS. (BOTTOM RIGHT) GIRAUDON

ARCHITECTURE OF ANCIENT ROME

Top: General view of the Roman Forum, looking toward the Capitol. At the upper right is the Arch of Septimus Severus; to its left, at a right angle, are the remaining columns of the Temple of Saturn, and in front of this the ruins of the Basilica Julia. Three columns (near centre of picture) of the Temple of Castor and Pollux remain; in front of these is the House of the Vestals. At far left is Part of Palatine hill, with the remains of buildings of Imperial Rome

Centre left: Temple of Fortuna Viriiis, Rome; c. 40 B.C.

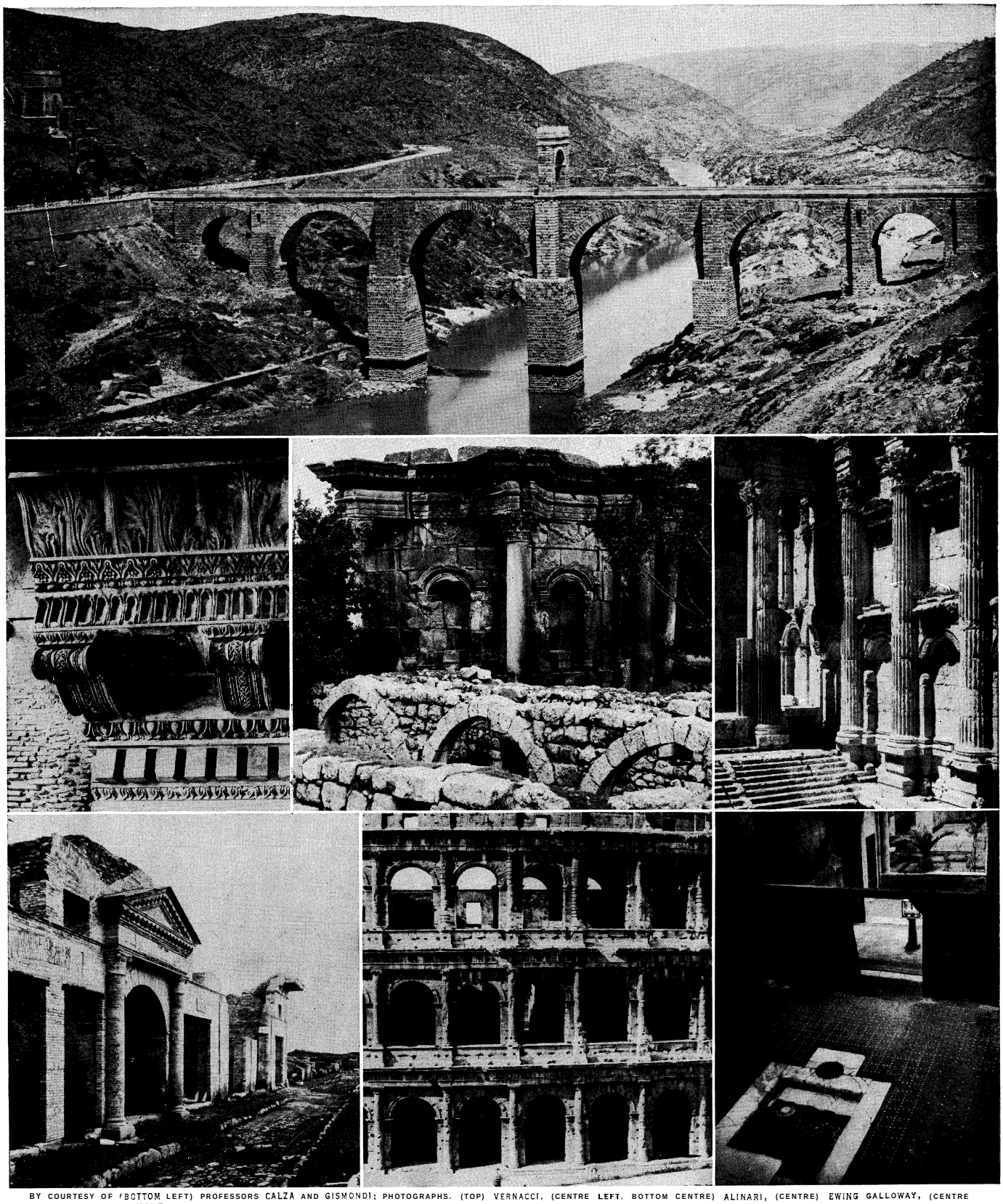
Centre: Trajan's arch, Ancona, It.; 115 A.D.

Centre right: Temple of Minerva, Assisi, It.: 1st century B.C.

Bottom left: Amphitheatre at Verona, it.; 1st century A.D.

Bottom right: Temple known as the Maison Carrée, Nimes, Fr.; 16 B.C.

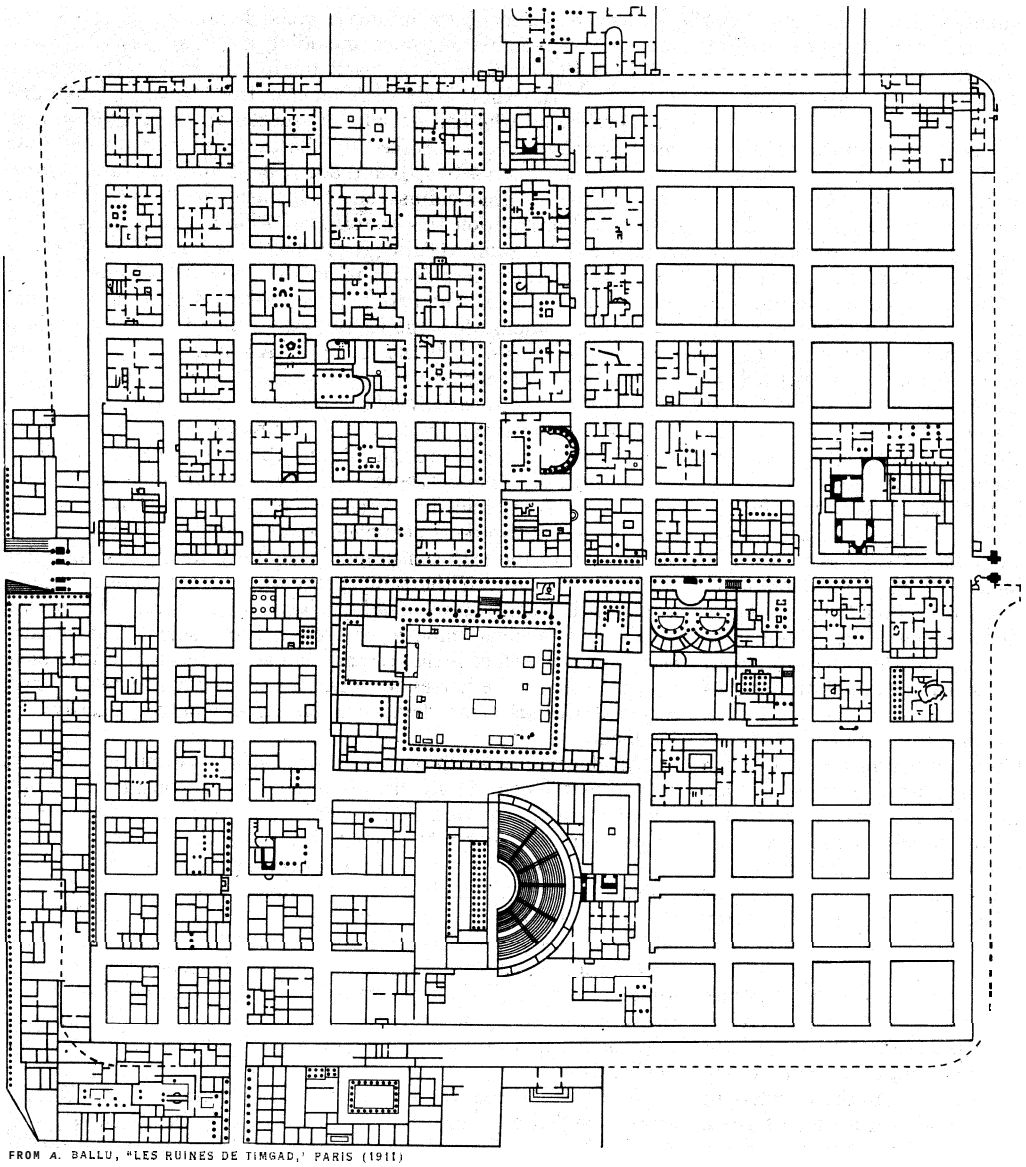
ROMAN ARCHITECTURE



BY COURTESY OF (BOTTOM LEFT) PROFESSORS CALZA AND GISMONDI; PHOTOGRAPHS. (TOP) VERNACCI, (CENTRE LEFT, BOTTOM CENTRE) ALINARI, (CENTRE) EWING GALLOWAY, (CENTRE RIGHT) FOTOTECA UNIONE, ROME, (BOTTOM RIGHT) FROM E. NASH, "ROMAN TOWNS"; REPRODUCED BY PERMISSION OF THE AUTHOR

BUILDINGS OF THE ROMAN EMPIRE IN ITALY AND ABROAD

Top: Bridge across the Tagus river, Alcantara, Spain; 2nd century A.D.
Centre left: Detail of the entablature of the Temple of Concord, Rome; 7 B.C. to A.D. 10.
Centre: Temple of Venus, Baalbek, Lebanon; 3rd century A.D.
Centre right: North side of the cella of the Temple of Bacchus. Baalbek
Bottom left: Street in Ostia, Italy. The city was founded about the 4th century B.C. The houses are mostly of the 3rd century A.D.
Bottom centre: Detail from a wall of the Colosseum, Rome, showing the use of three of the Roman Orders (from the bottom) Doric, Ionic and Corinthian; 1st century A.D.
Bottom right: Interior of a house at Herculaneum, showing wooden walls, atrium and tablinium; 1st century B.C.



FROM A. BALLU, "LES RUINES DE TIMGAD," PARIS (1911)

FIG. 8.— PLAN OF THE TOWN OF TIMGAD IN NORTH AFRICA

roof to the sky, and its adjoining rooms, was the peculiarly Roman element; the peristyle, or patio garden, was Greek or oriental. There were few windows on the street, light being obtained from the atrium or peristyle. The *domus,* as exemplified at Pompeii and Herculaneum (*qq.v.*) has long been regarded as the typical Roman house.

In Rome itself, however, very few remains of the *domus* have come to light, the chief examples being the House of the Vestal Virgins on the forum and that of Livia on the Palatine.

From Latin writers it has long been known that there were in Rome great blocks of flats or tenements to which the term *insulae* was applied. Excavations at Ostia (*q.v.*) have revealed the design of these blocks. Planned on three or four floors with strict regard to economy of space they depended on light from the exterior, as well as from a central court. Independent apartments had separate entrances with direct access to the street. Since Ostia was a typical town of the 1st and 2nd centuries A.D. and was almost a suburb of Rome itself, it is supposed that *insulae* at Rome would present similar features.

The street front of either *domus* or *insula* might be lined with shops.

(See also HOUSE.*)*

Town **Planning.**—Vitruvius clearly indicated that the Romans were keenly aware of the fundamentals of town planning, *i.e.,* the location of the city and its parts in terms of necessities, climate, functions and the like. When a new town was established such considerations were energetically examined.

A characteristic Roman plan, either inherited from early Italic towns or developed in the discipline of army camp engineering, was used. The over-all plan was square, with main avenues bisecting the sides and intersecting at the centre. The rest of the streets were in checkerboard grid.

At or near the centre was the forum; theatres, baths and other structures were located according to the site.

Long-established communities, which had developed by accretion rather than by plan, were often gradually brought, under Roman influence, within some approximation of this scheme, sometimes with considerable subtlety. Often, however, as in Rome itself, the scale and topography prevented the achievement of any fully logical order. In general, colonnades lined the important streets; water was conveyed to spectacular ornamental fountains or to practical neighbourhood basins from reservoirs fed by aqueducts (in some climates cisterns were necessary); many large sewers collected waste water from the street if not from private homes; also building codes were devised and enforced.

The layout of a whole town can be most easily seen in some of the towns in north Africa (*e.g.,* Timgad, Tebessa, Thuburbo Maius), where there has been little or no subsequent building to modify the original lines of the plan. See also *CITY* PLANNING.

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(H. C. BR.; M. BRA.; R. L. SN.)

ROMAN ARMY. In the long life of the ancient Roman army, the most effective and long-lived military institution known to history. we may distinguish four principal stages. (1) In the earliest age of Rome the army was a national or citizen levy such as we find in the beginnings of all states. (2) This grew into the Republican army of conquest, which gradually subdued Italy and the Mediterranean world. A citizen army of infantry, varying in size with the needs of each year, it eventually developed into a mercenary force with long service and professional organization. This became (3) the Imperial army of defence, which developed from a strictly citizen army into one which represented the provinces as well as Italy. and was a garrison rather than a field army. Lastly, (4) the assaults of the Barbarian horsemen compelled both the creation of a field force distinct from the frontier garrisons and

the inclusion of a large mounted element, which soon counted for much more than the infantry. The Roman army had been one of foot soldiers; in its latest phase it was marked by that predominance of the horseman which characterized the earlier centuries of the middle ages.

So far as we can follow this long development in its details, it was continuous. So unbroken, indeed, is the growth that many of the military technical terms survived in use from epoch to epoch, unchanged in form though deeply modified in meaning, and ordinary readers often miss the diversity which underlies this seemingly unchanged system. The term *legio*, for example, occurs in all the four stages above outlined. But in each its significance varies. Throughout, it denoted citizen-soldiers; throughout, it denoted also a force which was chiefly, if not wholly, heavy infantry. But the setting of these two constant features varies from age to age. In the first period legio was the "levy," the whole host summoned to take the field. In the second period it was not the whole levy, but one of the principal units into which developing organization had divided that levy; the "legion" was now a body of some 5,000 men—the number of "legions" varied with the circumstances, and the army included other troops besides citizens, though they were for the most part unimportant. In the third or Imperial age there were many legions (indeed, a fixed number) quartered in fixed fortresses; there were also other troops, numerous and important, if not yet so formidable as the legionaries. Finally, the legions became smaller units, and the other troops of the army, notably the cavalry, became the real fighting-line of Rome. (See LEGION.)

First Stage.—The history of the earliest Roman army is, as one might expect, both ill-recorded and contaminated with much legend and legal fiction. We read of a primitive force of 300 riders and 3,000 foot soldiers, in which the horseman counted for almost everything. But the numbers are clearly artificial and invented, while the pre-eminence accorded to the cavalry has no sequel in later Roman history. We reach firmer ground with the organization ascribed to Servius Tullius. In this system the army included all citizens from 17 to 60 years of age, those under 47 for service in the field, the older men for garrison duty in Rome. The soldiers were grbuped at first by their wealth—that is, their ability to provide their own horses, armour, etc.—into cavalry, heavy infantry, a remainder which it would be polite to call light infantry, and some artificers. The heavy infantry counted for most. Armed with long spears and divided into the three orders of hastati, principes and *triarii* (the origins and real senses of these names are lost), they formed a phalanx, and charged in a mass, while the cavalry protected the wings. The men were enrolled for a year—that is, for the summer campaign; in the autumn, like all primitive armies, they went home.

Second Stage.—From this Servian army a series of changes which we cannot trace in detail produced the Republican army of conquest. Our ancient authorities ascribe the chief reforms to the half-legendary Camillus (*q.v.*), who introduced the beginnings of pay and long service, improved the armour and weapons, abolished the phalanx and substituted for it an open order based on small subdivisions (maniples), each containing two centuries.

Whatever the truth about Camillus, some such reforms must at some time have been carried through, to convert the Servian system into the army which was engaged for nearly three centuries (from 350 B.C.) in conquering Italy and the world. This army broke in succession the stout native soldiers of Italy and the mountaineers of Spain and overthrew the trained Macedonian phalanx. Once only did it fail—against Hannibal. (See PUNIC WARS.) But not even Hannibal could oust it from entrenchments, and not even his victories could permanently break its moral. Much of its strength lay in the same qualities which made the Puritan soldiers of Cromwell terrible—the excellent character of the common soldiers, the rigid discipline, the high training. Credit, too, must be given to the genius of Scipio Africanus and to the more commonplace capacities of many fairly able generals. But the organism itself deserves attention, and, as it chances, we know much about it, mainly from Polybius. Its elements were three:—

(A) The principal unit was the legion, generally a division of 4,500 men—3,000 heavy infantry, 1,200 lighter-armed (velites), 300 horse—though sometimes including as many as 6,000 men. The heavy infantry were the backbone of the legion. They were levied from the whole body of Roman citizens who had some private means and who had not already served 16 campaigns, and in effect formed a yeoman force. For battle they were divided into 1,200 hastati, 1,200 principes and 600 triarii: all had a large shield, metal helmet, leather cuirass, short Spanish thrusting and cutting sword, and in addition the hastati and principes each carried two short heavy throwing spears (*pila*), while the triarii had ordinary long spears. They were drawn up in three lines: (1) hastati, (2) principes, (3) triarii; the first two were divided into ten maniples each (of 120 men, when the legion only counted 4,500), the third into ten maniples of half the strength. According to the ordinary interpretation of our ancient authorities, the maniples were arranged in a chess-board fashion (quincunx), the idea being that the front row of maniples could retire through the intervals in the second row without disordering it, and the second row could similarly advance. The procedure in fighting seems to have been simple: the front line discharged a volley of *pila* and rushed in with the short sword—a sequence much like the volley and bayonet charge of the 18th century—and if this failed, the second line went in turn through the same process; the third line of triarii, armed with spear instead of *pilum*, formed a reserve. The velites, armed with javelins, came to be used as skirmishers. The cavalry seem to have been of little account—a natural result if, as we have reason to think, the horses were small and stirrups were not used. Scipio Africanus alone developed his cavalry into a decisive instrument.

The officers of the legion consisted of: (a) Six tribunes, in part elected by the comitia, in part appointed by the consuls, and holding command in rotation. They were either veteran officers, sometimes even ex-magistrates, or young noblemen beginning their career. (b) Sixty centurions, each commanding one century, or, rather, a pair commanding each maniple. They were chosen by the tribunes from among the veteran soldiers serving at the time and were arranged in a complicated hierarchy, by means of which a centurion might move upwards till he became *primus pilus*, senior centurion of the first maniple of triarii, the chief officer of that rank in the legion. (c) There were also standard-bearers and other under-officers, for whom reference must be made to specialist publications.

(B) Besides the legions, composed of citizens, the Roman army included contingents from the Italian "allies" (socii), subjects of Rome. These contingents appear to have been large; in many armies we find as many socii as legionaries, but we are ignorant of details. The men were armed and drilled like the legionaries, but they served not in legions but in cohorts, smaller units of 400–500 men, and their conventional positions seem to have been on the wings of the legions. They were principally infantry, but included also a fairly large proportion of cavalry.

(C) Besides legionaries and socii, the Roman army included non-Italian troops of special kinds, Balearic slingers, Numidian horsemen, Rhodians, Celtiberians and others: at Trasimene, for example (217 B.C.), the Roman army included 600 Cretan archers. The numbers of these auxilia varied; probably they were not numerous till the later days of the Republic.

Composition and Size *of* Armies in the Second Stage.—According to the general practice, each of the two consuls, if he took the field alone, commanded an army of two legions with appropriate socii. If the two consuls combined their forces, commanding the joint force in rotation (as often occurred), the total would be—according to our authorities—four legions, each of 4,200 infantry, the same number of "allied" infantry (in all 33,600 infantry), 1,200 legionary cavalry and about 3,600 "allied" cavalry = 38,400 men. Such, for example, was the Roman army at Trebia (218 B.C.), where (says Polybius) there fought 16,000 legionaries and 20,000 allied infantry. The total number of men in the field could be increased; we even hear of 23 legions serving at one time in the Second Punic War. Just before this war, in 225 B.C., the total man-power of Rome was reckoned at three-quarters of a million, of which about 65,000 were in the field and 55,000 were in a re-

serve at Rome; of the total, 325,000 were Roman citizens and 443,000 (apparently a rough estimate) were allies. The battle order in normal circumstances was simple. In the centre stood the legionary infantry: on each side of that was the allied infantry: on the wings the cavalry. But sometimes the legions were held in reserve and the brunt (and honour) of the fight was left to the allies. Frequently the attack was begun by one wing, as by Caesar at Pharsalus. At Ilipa in Spain Scipio surprised his enemy by a last hour variation of the accustomed order. Putting his Spanish auxiliaries in the centre, his Roman troops on the wings, he "re-fused" his centre and attacked with both wings.

Development from the Second Stage to the Third.—Towards the end of the Republic many changes began to work themselves out in the Roman army. If Camillus began the system of pay and long service, it was effectually developed by long foreign wars in Spain and in the East. Moreover, the growth of Rome as a wealthy state tended to wreck the old theory that every citizen was a soldier, and favoured a division of labour between, *e.g.*, the merchant and the military, while the increasing complexity of war required a longer training and a more professional soldier. In consequence, the old restriction of legionary service to men with some sort of private property was abolished by Marius about 104 B.C. and the legionaries now became wholly proletariate and professionals. By a second change, also connected with the name of Marius, the legion was reorganized as a body of 6,000 men in 60 centuries, divided into ten cohorts instead of (as hitherto) into 30 maniples; the unit of tactical action thus became a body of 600 instead of 120. This was probably an adaptation within the legion of the system of cohorts already in use for the contingents of the *socii*. Soon after, the extension of the Roman franchise to all Italians converted allies and subjects into citizens, and the socii into legionaries. A fourth change abolished the legionary cavalry and greatly increased the auxilia (C., p. 396).

Third Stage.—The Imperial Army of Defence.—The evils of the Civil Wars (49–31 B.C.) furnished the first emperor, Augustus with both the opportunity and the necessity for reforming the army. Disorganization had reigned for 20 years. It was needful to restore loyalty and system alike. Augustus did this, as he did all his work, by adapting the past: yet there is some truth in the view that his army reforms were his greatest and most original work. The main lines of his work are simple. The Imperial army consisted henceforward of two classes or grades of troops, about equal in numbers if unequal in importance. The first grade was the legions, recruited from Roman citizens, whether resident in Italy or in the provinces. The second grade was formed by the auxilia, recruited from the subjects (not the citizens) of the Empire in the provinces, organized in cohorts and alae and corresponding somewhat to both the socii and the auxiliaries (B, C, above) of the Republican army. There were also in Rome special "household" troops (see PRAETORIANS), and a large body of vigiles who were both fire brigade and police.

Details of Troops.—(A) The legion of the Empire was what Marius had left it—6,000 heavy infantry divided into ten cohorts: Augustus added only 120 horsemen to serve as despatch-riders and the like. The supreme command was no longer in the hands of the six tribunes. According to a practice which had sprung up in the latest Republic it was in the hands of a *legatus* legionis, deputy of the general (now of the emperor, commander-in-chief of the whole army) and a man usually of senatorial rank and position. The six tribunes assisted him in theory; in practice they were now little more than young men of good birth learning their business or wasting their time. The real officers of the legion were the 60 centurions, men who (at least in the early Empire) generally rose from the ranks, and who knew their work. The senior centurion, *primus pilus*, was an especially important officer, and on retirement frequently became praefectus castrorum, "camp adjutant," or obtained other promotion. Below the centurions were under-officers, standard-bearers, *optiones*, clerks and the like. The men themselves were recruited from the body of Roman citizens (though we may believe that birth-certificates were not always demanded). During the 1st century Italy, and particularly north Italy, provided the bulk of the recruits. After A.D. 70, recruiting in Italy for the legions practically ceased and men were drawn from the Romanized towns of the provinces. After Hadrian, each province seems to have supplied most of the men for the legion (if any) stationed in it, and so many sons of soldiers born during service (castrenses) flocked to the army that a military caste almost grew up. The term of service was, in full, 20 years, at least in theory, but recruiting was voluntary and when men were short discharges were often withheld. On discharge the ex-legionary received a bounty or land: many coloniae (municipalities) were established in the provinces by certain emperors for the special purpose of taking discharged veterans—according to a custom of which the first instances occur in the late Republican age. On the whole, the legionary was still the typical "Roman" soldier. If he was no longer Italian, he was generally of citizen birth, and always of citizen rank, and his connection with the Empire and the Government was real. Each legion bore a number and a title (*e.g.*, II. Augusta, III. Gallica). The custom of using such titles and numbers can be detected sporadically in the late Republic, and many titles and numbers then borne by legions passed on into the Empire with the legions themselves. As Augustus gradually became master of the world, he found himself with three armies, his own and those of Lepidus and Antony; from the three he chose certain legions to form his new standing army, and he left these with the titles and numbers which they had previously borne, although that concession resulted in three legions numbered III. and two numbered IV., V., VI. and X. respectively. Similar titles and numbers were given to legions raised afterwards either to fill up gaps caused by disaster or to increase the army.

(B) Besides the legions Augustus developed a new order of auxilia. Auxiliaries (as is said above) had served occasionally in the Republican armies since about 250 B.C., and in the later Republic large bodies of them had been enlisted in the armies of contending generals. Thus Caesar in Gaul enrolled a division of native Gauls, free men but not citizens of Rome, which ranked from the first in all but legal status as a legion, the "Alaudae," and in due course was formally admitted to the legionary list (legio V.). But this use of non-citizens had been limited in extent and confined in normal circumstances to special troops such as slingers or bowmen. This casual practice Augustus reduced, or rather extended, to system, following in many details the scheme of the Republican socii and veiling the novelty under old titles. Henceforward, regiments of infantry (cohortes) or cavalry (alae), 500 or 1,000 strong, were regularly raised (apparently, by voluntary recruiting) from the non-citizen populations of the provinces and formed a force almost equal in numbers (and ultimately much more than equal) to the legions. The men who served in these units were less well paid and served longer than the legionaries; on their discharge they received a bounty and the Roman franchise for themselves, their wives and children. They were commanded by Roman *praefecti* or tribuni, and were no doubt required to understand Roman orders; they must have generally become Romanized and fit for the citizenship, but they were occasionally (at least in the 1st century A.D.) permitted to retain tribal weapons and methods of fighting and to serve under the command of tribal leaders, who were at once their chiefs and Roman officers. These auxiliaries provided both the whole of the archers, etc., and nearly the whole of the cavalry of the army; they also included many foot regiments. A peculiar arrangement (to which no exact parallel seems to occur in any other army) was that a cohort of 500 men might include 380 foot and 120 horse and a cohort of 1,000 men or 760 foot and 240 horse (cohors equitata), and an *ala* might similarly include a proportion of foot (ala peditata). Each regiment bore a number and a title, the latter often derived from the officer who had raised the corps (ala Indium, raised by one Julius Indus), or, still more often, from the tribe which supplied the first recruits (cohors VII. Gallorum, cohors *II. Hispanorum* and the like). To what extent recruiting remained territorial is uncertain: after the 1st century, probably, the territorial names meant in most cases very little.

Composition of Armies and Distribution of Troops in the Third Stage.—If the system of legions and auxilia in the early Empire was novel, the use made of them was no less so. The later Repub-

lic offers to the student the spectacle of large field armies, and though it also reveals a counter tendency to assign special legions to special provinces, that tendency is very feeble. Augustus ended the era of large field armies: he could not afford to leave such weapons for future pretenders to the throne. By keeping the Empire within set frontiers, he developed the counter tendency. That policy exactly suited the military position in his time. The early Roman empire had not to face — like modern empires — the danger of a war with an equal enemy, needing the mobilization of all its national forces. From Augustus till A.D. 250 Rome had no conterminous foe from whom to fear invasion. Parthia, her one and dangerous equal, was far away in the East and little able to strike home. Elsewhere, her frontiers bordered more or less wild barbarians, who might often harass, but could not do serious harm. To meet this there was need, not of a strong army concentrated in one or two cantonments, but of many small garrisons scattered along each frontier, with a few stronger fortresses to act as military centres adjacent to these garrisons.

Accordingly, a system grew up under Augustus'and his immediate' successors whereby the whole army was distributed along the frontiers or in specially disorderly districts (such as northwest Spain) in permanent garrisons. On the actual frontiers and on the chief roads leading to them were numerous cohorts and *alae* of auxiliaries, garrisoning each its own *castellum* of 3–7 acres in extent. Close behind the frontiers, or even on them, were the 25 legions, each (with a few exceptions of early date) holding its own fortress (castra stativa or hiberna) of 50–60 acres. Details varied at different times. Sometimes, where no Rhine or Danube helped, and outside enemies were many, the frontier was fortified by a wall of wooden palisades (as in part of Germany; see LIMES GERMANICUS) or of earth or stone (as in Britain, see **BRITAIN**: *Roman* Britain), or the boundary might be guarded by a road patrolled from forts planted along it (as in part of Roman Africa). The result was a frontier guard covering Britain and Europe from the German ocean to the Black sea, and the upper Euphrates valley, and the edge of the Sahara south of Tunis and Algeria and Morocco, while the wide Empire within saw little of its soldiers.

Change from the Third Period to the Fourth. — Two principal causes brought gradual change to the Augustan army. (1) The pax Ronzana brought such prosperity to many districts that they ceased to provide sufficient recruits. The Romans, like the British in India. had more and more to look to uncivilized regions and even beyond their borders. Hence comes, in the 2nd century and after, a new class of numeri or cunei or vexillationes who used (like the earlier auxiliaries) their national arms and tactics and imported into the army a more and more non-Roman element. This tendency became marked in the 3rd century and bore serious fruit at its close. (2) The old days of mere frontier defence were over. The barbarians began to beat on the walls of the Empire as early as A.D. 160: about A.D. 250 they here and there got through. and they came henceforward in ever-growing numbers. Moreover, they came on horseback, bringing new tactics for the Roman infantry to face, and they came in masses. We may doubt if any military system could have permanently stayed this series of human tides. But the Empire did what it could. It enlisted barbarians to fight barbarians, and added freely to the non-Roman elements of the army. It increased the relative strength of its cavalry and began to organize a distinct field force.

Fourth Period. — The results are seen in the reforms of Diocletian and Constantine the Great (A.D. 284–circa 320). New frontier guards, styled limitanei or *riparienses*, were established, and the old army was reorganized in field forces which accompanied or might accompany the emperors in war (comitatenses, palatini). The importance of the legions dwindled; the chief soldiers were the mercenaries, mostly Germans, enlisted from among the barbarians. New titles now appear, and it becomes plain that in many points the new order is not the old. The details of the system are as complicated as all the administrative machinery of that age. Here it is enough to point out that the significance of such officers and titles as the dux and the comes (duke, count) lies ahead in the history of the middle ages, and not in the past, the history of the Roman army itself.

War Office, General Staff. — Under the Republic we do not find, and indeed should not expect to find, any central body which was especially entrusted with the development of the army system or military finance or military policy in wars. Even under the Empire, however, there was no such organization. The emperor, as commander-in-chief, and his more or less unofficial advisers doubtless decided questions of policy. But the army was so much a group of provincial armies that much was left to the chief officers in each province. Here, as elsewhere in the Empire, we trace a love if not for Home Rule, as least for Devolution. There was, however, a central finance office in Rome for the special purpose of meeting the bounties (or equivalent) due to discharged soldiers. This was established by Augustus in A.D. 6. (F. J. H.; X.)

ROMAN ART. There are at least five different ways in which Roman art can be defined: (1).The term might be restricted to works produced in or near Rome itself, which reflect specifically the national life and traditions of the city or the exploits of its citizens and rulers. (2) "Roman art" and "art in Rome" might be treated as convertible terms, including all imported works which mirror the effect of foreign contacts and ever-widening horizons on thought and taste in the metropolis. (3) The phrase might be extended to cover works of art that were made in, or imported into, Italy as united under Roman hegemony. (4) The phrase might be stretched to denote all works of art produced in. or brought into, the predominantly Latin-speaking countries of the western Roman empire. (5) "Roman art" may mean nothing less than the artistic output of the entire world dominated by ancient Rome. The art of the Greek-speaking provinces may justly be described as "east Roman." where existing Hellenistic traditions not merely survived conquest by Rome but gained fresh vigour and scope through incorporation into its system. It is in this fifth and widest sense that the term "Roman art" will be used in this article. As regards chronology, "Roman" is taken as covering a period extending to c. A.D. 500; in respect of content. the word includes works of Jewish and Christian subject matter, indistinguishable in style from their pagan contemporaries and often borrowing some of their motives.

The Romans themselves did not, it seems, have an innate and spontaneous capacity for art. Such works of art as were made in. or imported into, Rome during the periods of the monarchy and the early republic were produced almost certainly by Greek and Hellenized Etruscan artists, or by their imitators from the cities of central Latium; while throughout the later republican and the imperial epochs all the leading masters at least and many of the lesser craftsmen had Greek names and were Greek, or at any rate Greek-speaking, by extraction. References in ancient literature and the signatures of artists preserved in inscriptions leave no doubt on this point. According to tradition, the earliest image of a god made in Rome dated from the 6th century B.C. period of Etruscan domination and was the work of Vulca of Veii. The magnificent terra-cotta statue of Apollo found at Veii may give some notion of its character, while the celebrated bronze figure of the wolf in the Conservatori museum, Rome, is generally assigned to the same Veientine school. In the 5th, 4th and 3rd centuries, when Etruscan influence on Rome was declining and Rome's dominion was spreading through the Italian peninsula, contacts with Greek art were no longer chiefly mediated via Etruria, but were made directly through Campania and Magna Graecia; the paintings and the "idealizing" statues of gods and worthies that are mentioned in literature as executed in the capital during this period were clearly the works of visiting or immigrant Greek artists. The plundering of Syracuse and Tarentum at the end of the 3rd century marked the beginning of that flow of Greek art treasures into Rome which continued for several centuries and played a leading role in the aesthetic education of the citizens.

It was therefore to Greek artists that the Romans turned when, in the course of the 3rd century, they first apparently became aware of the potentialities of works of art for the visual expression of their own political, social and religious life and history. Greeks designed the dies for the silver coinage that Rome inaugurated in 269 to circulate through Italy, with types that displayed an ever-increasing richness and variety of style and content, par-

ticularly during the later 2nd and 1st centuries B.C., until the close of the republican epoch. Six documentary paintings depicting events from Roman history between 264 and 168 are known from literary sources. These events were, for the most part, military victories; the pictures themselves were ephemeral affairs shown at triumphs and on other public occasions to the Roman populace; and the artists who produced them were very probably Greeks, since in 158 L. Aemilius Paulus, the victor at Pydna, employed Metrodorus, a painter from Athens, to execute the topical pictures exhibited in Rome for his Macedonian triumph, and Demetrius, an Alexandrian "place painter," was in Rome in 164. The fragment of a historical wall painting with scenes from the Samnite wars, found in a family tomb on the Esquiline, probably dating from the 3rd century B.C. (in the Conservatori museum). may give some idea of the nature of these early triumphal pictures. Literature shows that by the middle of the 2nd century B.C. the Roman forum was thronged with honorific statues of Roman magistrates which, although none of them has survived. may be assumed to have been carved or cast by Greeks, since no native Roman school of sculptors of that time is known. And it is significant that the earliest account of Roman realistic portraits of private individuals is that contained in Polybius' description of the ancestral *imagines* ("masks") displayed and worn at patrician funerals — a description written about the middle of the 2nd century B.C., when the tide of Greek artistic influences was sweeping into Rome and Italy from countries east of the Adriatic, where a highly realistic late-Hellenistic portrait art, that sometimes depicted Roman or Italian subjects, had already blossomed.

The first appearance of the three art forms that expressed the Roman spirit most eloquently can be traced back to the Hellenistic age. These forms are realistic or veristic portraiture, in which every line, crease and wrinkle. and even blemishes were ruthlessly chronicled; the continuous. or "film," style in narrative art of all types; and the three-dimensional rendering of atmosphere, depth and perspective in relief work and painting. Of these three art forms there is no evidence in the early art of pre-Hellenistic central Italy, and it would be safe to guess that if Rome had not met them in the homelands of Greek art it would never have evolved them in its great art of imperial times. But Rome's own contributions to art, if of a different order, were vitally important. Its historical aims and achievements furnished late-Hellenistic artists with a new setting and centre, new subjects, new stimuli, a new purpose and a new dignity. Rome provided the external circumstances that enabled the sculptors, painters and other craftsmen to exploit on a much more extensive scale than before artistic movements initiated in the Hellenistic world, and Rome became a great new patron of art and a great new wellspring of inspiration and ideas. Thus Roman art is the child of the marriage of two traditions — one. the Hellenistic art tradition and the sculptural branch of that tradition in particular, the other. the political, social, religious and psychological tradition of Rome.

SCULPTURE

The Last Century of the Republic. — The ancestral *imagines*, or funerary masks, made of wax or terra cotta. had become extremely individualized and realistic by the middle of the 2nd century B.C. The source of this realism is in the impact on Rome of late-Hellenistic veristic iconography; although this use of masks was rooted in ancient Roman social and religious practice, there is no basis for the statement that the Romans and Etruscans had. from early times, been in the habit of producing death masks proper. cast directly from the features of the dead. It was undoubtedly their funerary customs that predisposed the Romans to a taste for portraits. But it was not until *c.* 100 B.C. that realistic portraiture, as an art in its onn right, appeared in Rome as a sudden flowering. and to that time belong the first beginnings of the highly realistic and veristic heads, busts and statues of contemporary Romans, in marble, stone or bronze. that have actually survived. The coin portraits of public men, whose names and dates are recorded, greatly assist in determining the chronological sequence of the large-scale likenesses, the earliest of which can be attributed to the period of Sulla. The veristic style reached its climax in the stark, dry, linear iconographic manner of c. 75–65 B.C., which expressed to perfection current notions of the traditional Roman virtues; of this manner the marble head of an elderly veiled man in the Vatican is an outstanding illustration. After that, an admiration for the earlier phases of Greek art came into fashion in the west, and verism, was toned down at the higher social levels by a revival of mid-Hellenistic pathos and even by a classicizing trend that was to stamp itself upon Augustan portraits. Meantime, in sepulchral custom, the ancestral bust had become an alternative to the ancestral mask, a development exemplified in a togate marble statue of a man carrying two such busts in the Museo Capitolino Nuovo; while the portrait busts and figures on the numerous stone and marble grave *stelai,* characteristic of the late-republican epoch, proclaim the persistence of veristic tastes in middle-class and humbler circles. Furthermore, there are some 1st-century B.C. portraits which suggest that the making of death masks proper (a sophisticated and essentially nonprimitive idea) was occasionally practised at this time. None of the vividly veristic Etruscan portraits, such as the bronze orator *(Arrzngatore)* at Florence and the terra-cotta married pair on the lid of a well-known ash chest at Volterra, is earlier than c. 100 B.C.; works of that type must be reckoned as provincial imitations of the new metropolitan, 1st-century B.C. portrait style.

There are no narrative reliefs from Rome that can confidently be assigned to a pre-1st-century B.C. period. The only definitely dated 2nd-century B.C. relief depicting an episode from contemporary Roman history, the frieze with the battle of Pydna on L. Aemilius Paulus' victory monument at Delphi, was worked in 168 in Greece. The most familiar republican example of this form of art as practised in the west is the frieze decoration, partly in the Louvre, Paris, and partly at Munich. from the so-called "Altar of Ahenobarbus," which has been shown to have no sure connection either with an altar or with any of the Ahenobarbi. The Louvre section gives a matter-of-fact and accurate representation of the Roman census ceremonies, while the Munich section depicts a marine procession of Neptune and Amphitrite with their train. Assuming that the two scenes belonged to the same monument. as the identity of their dimensions and material suggests, the most attractive theory of them is that they adorned the temple of the nymphs in the Campus Martius, when it was restored after its burning by Clodius in 57 B.C. That temple was the *archivium* of the census. while the nymphs were equated with the nereids and associated with Neptune; this would be an early and striking instance of that juxtaposition of Hellenistic and Roman motives, of human and divine persons and of mythology and history which was to characterize imperial state reliefs throughout their development. Fragments of a marble frieze, presenting successive scenes from Roman legendary history. were recovered from the Basilica Aemilia in the Roman forum and reconstructed before World War II. The subjects include the building of a city, probably of Rome itself. the rape of the Sabine women and the punishment of Tarpeia, and although there is no evidence for determining its date with certainty, the frieze could have been carved for the basilica's rebuilding between 54 and 34 B.C. Funerary narrative sculpture of the late republic is exemplified in the monument of the Julii at St. Rémy (Glanum), France. The base of this structure carries four great reliefs with battle and hunt scenes that allude. not only to the mundane prowess of the family, but also to the "other-worldly" victory of the souls of the departed over death and evil. since figures of the deceased. accompanied by personifications of death and victory, merge into one of the battle scenes. It is possible that these highly pictorial reliefs were partly based on lost Hellenistic monumental paintings. Southern Gaul had direct connections with Greek lands east of the Adriatic.

The Augustan Age. — The hallmark of the portraits of Augustus is a naturalistic classicism. The rendering of his features and of the forking of his hair above the brow is individual. But the emperor is consistently idealized and never shown as elderly or aging The marble statue from Livia's villa at Prima Porta (in the Vatican). which presents him as addressing. as it were. the whole empire, is the work of a fine Greek artist who, while adopt-

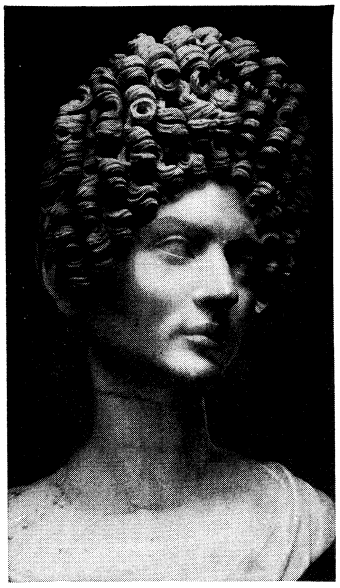
ing the pose and proportions of a classical Hellenic statue, understood completely what Augustus meant to Rome. On the ornate cuirass the princeps' aims and achievements are recorded symbolically in a series of figure groups, among which that of the restoration of the Roman standards by a Parthian to Mars occupies the central place. A marble portrait statue found on the Via Labicana represents the emperor as heavily draped, veiled and in the act of sacrificing as Pontifex Maximus; while a bronze head from Meröe in the Sudan (in the British museum, London), the work of a Greco-Egyptian portraitist, depicts him as a Hellenistic king. Of the female portraits of the period, one of the most charming is the green basalt head (in the Louvre) of the emperor's sister, Octavia, with the hair dressed in a puff above the brow and gathered into a bun behind—a popular coiffure in early Augustan times. The noblest, in many respects, of all the Roman public monuments that were adorned with sculpture is the Ara Pacis Augustae, founded in 13 B.C. and dedicated four years later. It stood in the Campus Martius and has been restored, with different orientation, not far from its original site; and in the harmonious blending, on its reliefs of Luna marble, of contemporary history, legend and personification, of figure scenes and decorative floral motives, it set a standard of distinction which no later work outrivalled. The altar proper was contained within a walled enclosure, measuring about 11½ by 10½ m., with entrances on east and west. On the upper part of the external faces of the south and north precinct walls ran a frieze representing the actual procession of Augustus and members of his family, of lictors, priests, magistrates and of the Roman people on the altar's foundation day (July 4, 13 B.C.) to its chosen site, where sacrifice was offered in thanksgiving for the emperor's recent return to Rome from the provinces. On either side of the western entrance were Augustus' prototype Aeneas sacrificing on his "home-coming" to the promised land of Italy and, since Augustus was also hailed as Rome's second founder, the suckling of the twins, Romulus and Remus, by the she-wolf. The eastern entrance was flanked by the personification of Italia with children on her knees, and by that of Roma. On the exterior of the walls, beneath all these figure scenes, was a magnificent dado filled with a naturalistic pattern of acanthus, vine and ivy, perhaps the translation into marble of a gorgeous carpet or tapestry used in the ceremony; while the swags of fruit and flowers that decked the interior faces of the precinct walls may represent real swags that were hung on the temporary wooden altar erected for the foundation sacrifice. The procession was continued in a much smaller frieze on the inner altar, from which figures of the vestal virgins and of the sacrificial victims and their attendants have been preserved. Delightful studies of imperial and other children and such homely incidents as conversations between persons taking part in the procession introduce an element of intimacy, ihformality and even humour into this solemn act of public worship. The Ara Pacis in fact sums up all that was best in the new Augustan order—peace, serenity, dignity without pompousness, moderation and absence of ostentation, love of children and delight in nature. The style of the altar's floral decoration strongly suggests that the sculptors who carved it were Greeks from Pergamum.

The **Julio-Claudian** Period.—The somewhat cold, precise and academic portraits of Tiberius and Gaius show little further development, but it was probably from her son's principate that the finest of Livia's monumental portraits date. A seated statue of the empress, found at Paestum with a seated figure of Tiberius (in Madrid), shows her with hair simply waved from a central parting, an aquiline nose and the smooth brow and rounded cheeks of quite a young woman, although she was 72 when her son succeeded. The likeness of Antonia, Augustus' niece, is known from posthumous portraits dating from the reign of Claudius. These show her with a coiffure even simpler than Livia's and sometimes wearing the *tutulus* ("woolen fillet") appropriate to her office of priestess of Divus Augustus, as in the case of her colossal portrait head, the so-called "Juno Ludovisi," in the Roman National museum. Portraits of Agrippina I, of Agrippina II, who again occasionally wears the *tutulus* as priestess of Divus Claudius, and of the latter's rival Messalina display more elaborate hair-styles. In Claudius' portraits fine, plastic modeling is combined with a realistic rendering of the subject's angular nose, sagging cheeks, clumsy neck and double chin; while those of Nero reveal an exuberant, idealizing treatment that matches his philhellenic interests. Of historical sculpture of this period relatively little has survived. Fragments of processional and sacrificial scenes, somewhat reminiscent of the Ara Pacis carvings (walled up in the Villa Medici on the Pincio) may have come from the Ara Pietatis Augustae which Claudius dedicated in A.D. 43. The "Jupiter-Column" set up in Nero's honour at Mainz (Mogontiacum) in Roman Germany, with figures of gods and personifications carved in relief on its base and shaft, is the only existing public monument which can be connected with that bizarre ruler.

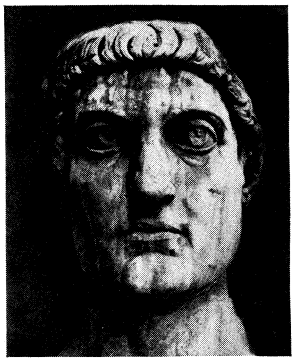
The **Flavian** Period.—In Vespasian's portraits something of the old, dry, relentless verism returned. This can be observed in his striking likeness on one of the two historical reliefs that were unearthed in Rome near the Palazzo della Cancelleria just before World War II. A similarly sketchy and impressionistic handling of the hair is found on Titus' portraits, whereas Domitian affected a more pictorial hairdo in imitation of the coiffure introduced by Nero. Still more picturesque are the female hair styles of the time, which display piles of corkscrew ringlets or of tight, round curls. The Cancelleria reliefs date from the close of Domitian's reign and depict respectively Vespasian's *adventus* and reception in Rome in A.D. 70 and Domitian's *profectio*, under the aegis of Mars, Minerva and Virtus, for one of his northern wars. They are worked in a two-dimensional, academic, classicizing style that is in marked contrast with the vivid, three-dimensional rendering of space and depth with brilliant interplay of light and shade on the panels of the arch of Titus in the Roman forum. Those familiar reliefs, which present two excerpts from Titus' Jewish triumph, were carved in the early 80s. The late-Domitianic classicizing manner appears again in the frieze of the Forum Transitorium, which Nerva completed. This conflict of relief styles within the Flavian period is but one illustration of the ceaseless, unpredictable ebb and flow of different aesthetic principles throughout the history of imperial art.

The Age of **Trajan.**—In portraits of Trajan the deepening of the bust, already seen in the later Flavian period, was carried a stage further; there is a new fluidity in the molding of the face; in the hair, which is plastered down across the brow, there is a partial revival of the late republican linear style. Aesthetically, one of the finest known likenesses of the emperor is a marble head in the Ostia museum; while on his monumental column there is a series of less idealized and probably more faithful renderings of his features. The coiffures of Trajanic ladies are, if anything, even more elaborate and extravagant than those of their Flavian predecessors.

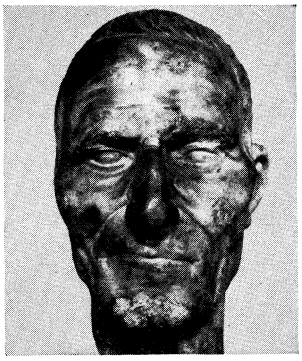
The reliefs of Trajan's column, illustrating the two Dacian wars of 101–102 and 105–106 and winding up the shaft in a spiral band of Parian marble, one metre wide, is generally recognized to be the classic example of the continuous method of narration in Roman art. The scenes develop like a film, merging into one another and interlocking without any lines of demarcation between them, apart from an occasional tree that serves to punctuate the flowing text; while Trajan appears again and again in different situations, activities and costumes. A statuesque figure of Victory separates the histories of the two wars. There are 23 spirals and about 2,500 figures. But a high level of technical accomplishment is maintained throughout, and the interest and excitement of the theme never flag. Since the figures of men and animals had to be distinguished from a distance, they are inevitably overlarge in proportion to their landscape and architectural settings; and in order to avoid awkward empty spaces along the upper edges of the band and to preserve an allover, even, tapestrylike effect. the background figures in the scenes are reared in bird's-eye-view perspective above the heads of those in the foreground. These carvings must be visualized as once brightly painted, with weapons and horse trappings added in metal. The sources of the scenes were probably wartime sketches made by army draftsmen at the front, but the fusing together of those isolated pictures into a single scroll was the work of a single master artist, perhaps Apol-



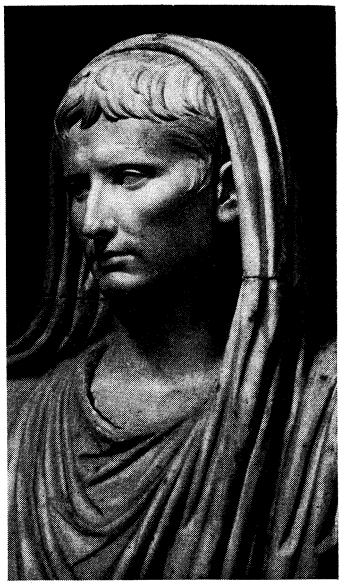
Woman of the Flavian period (last half of 1st century A.D.); marble. Capitoline museum, Rome



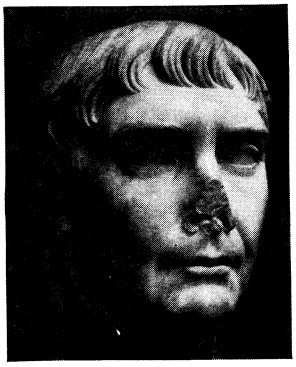
Constantine I (288?–337); marble. Conservatori museum, Rome



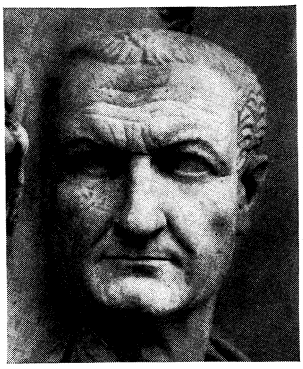
Portrait in death-mask style of 1st century B.C.; marble. Archaeological museum, Turin



Augustus as *Pontifex Maximus;* head of a marble statue. National museum, Rome



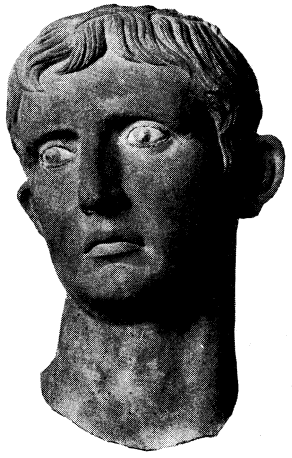
Trajan (53–117); marble. Ostia museum



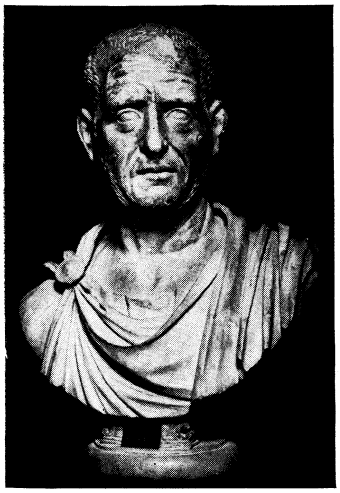
Vespasian (9–79); from a marble Domitianic relief. Vatican museum, Rome

Hadrian (76–138); bronze found in the Thames river, London. British museum

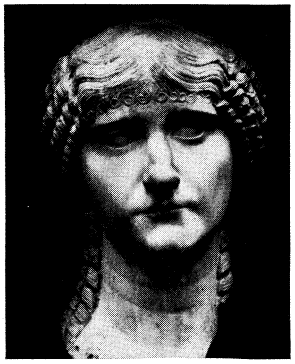
An emperor of the 4th or 5th century A.D.; bronze. Near Church of S. Sepolcro, Barletta



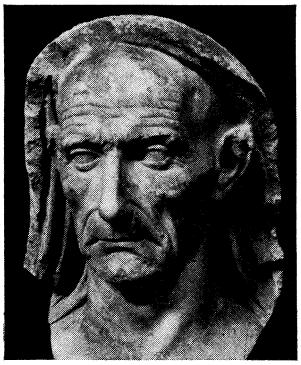
Augustus; bronze found at Meroe, Sudan. British museum



Trajan Decius; marble, about 249–53. Capitoline museum, Rome



Agrippina the Younger (16–59); marble. Ny Carlsberg Glyptotek, Copenhagen



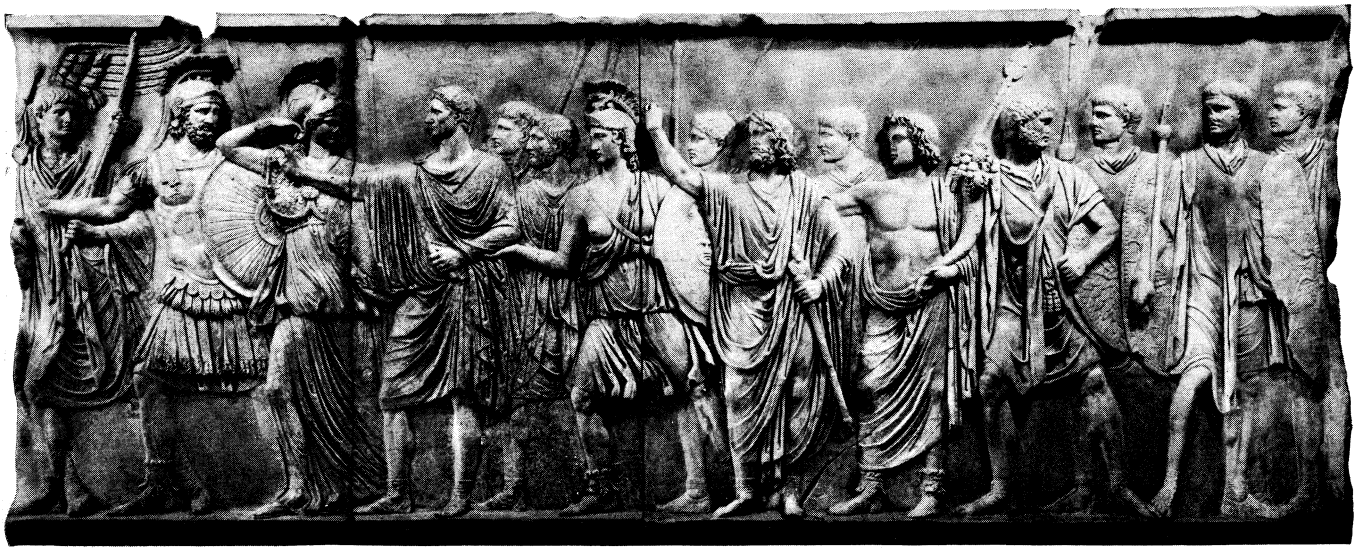
Head of a priest; marble, about 75–65 B.C. Vatican museum, Rome

Commodus (161–192) represented as Hercules; marble. Conservatori museum, Rome

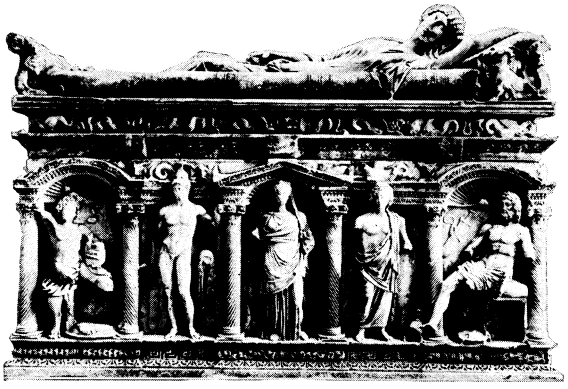
PORTRAITS IN MARBLE AND BRONZE

BY COURTESY OF (TOP ROW, SECOND LEFT) BRITISH SCHOOL, ROME. (TOP ROW, THIRD LEFT) DEUTSCHES ARCHAOLOGISCHES INSTITUT ROM, (SECOND ROW, THIRD LEFT) ARCHIVES OF PHOTOGRAPHI, VATICAN MUSEUM. (CENTRE LEFT; CENTRE RIGHT) TRUSTEES OF THE BRITISH MUSEUM, (BOTTOM ROW, SECOND LEFT) NY CARLSBERG GLYPTOTEK, COPENHAGEN; PHOTOGRAPHS (TOP LEFT) CESARE FARAGLIA, (TOP RIGHT) ALINARI, (SECOND ROW, SECOND LEFT) RICHTER. (BOTTOM LEFT, BOTTOM, THIRD LEFT; BOTTOM RIGHT) S. A. ANDERSON

ROMAN ART

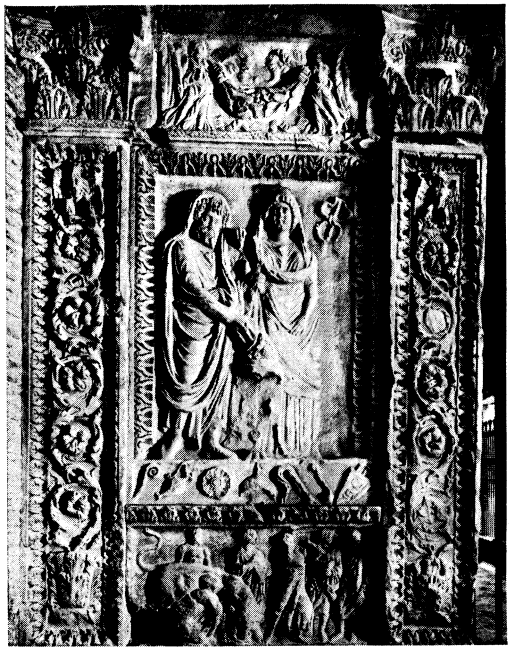


Scene showing the *profectio* (setting out) of **Domitian** (51–96) ; found near the **Palazzo della** Cancelleria, Rome. Vatican museum



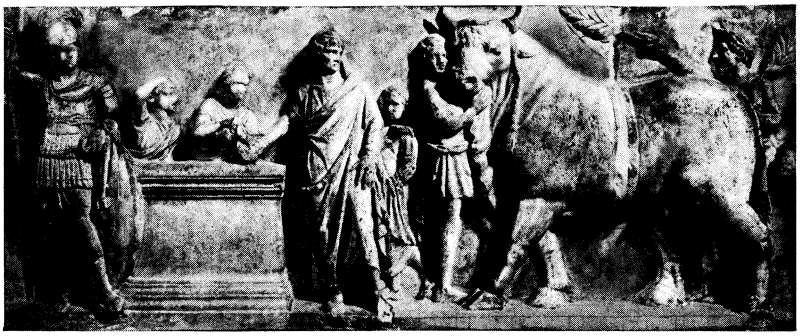
Marble-columned sarcophagus of the middle of the 2nd century. Town hall, **Melfi, Italy**

Relief depicting the rain-god from the **column** of Marcus Aurelius, Rome



Portraits in relief of Septimius **Severus** and his wife Julia Domna making sacrifice. Porta Argentariorum, Rome

Grave monument of the Gessii family, 2nd half of the 1st century B.C. Museum of Fine Arts, Boston

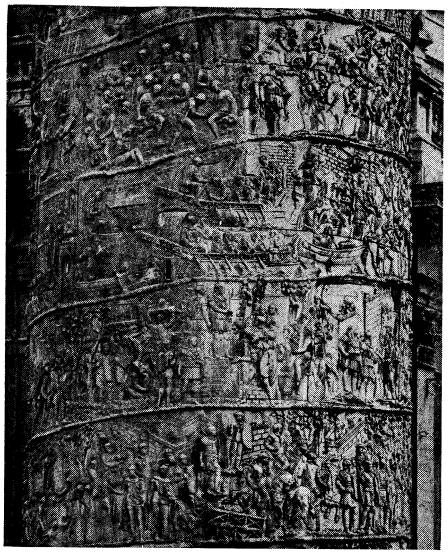


Section of a marble frieze of the middle of the 1st century B.C. showing sacrificial ceremonies. The Louvre, Paris

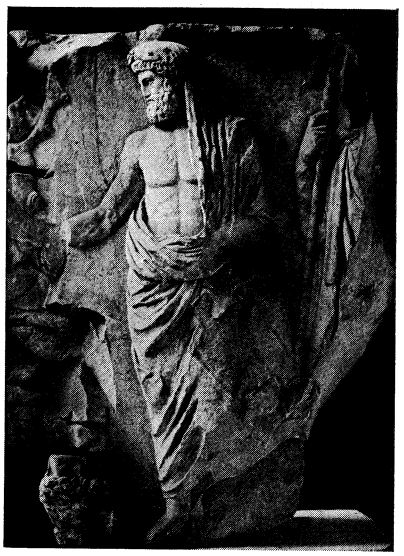
MARBLE RELIEFS

BY COURTESY OF (TOP) ARCHIVES OF PHOTOGRAPHY, VATICAN MUSEUM. (CENTRE LEFT) DEUTSCHES ARCHAEOLOGISCHES INSTITUT ROM. (SECOND ROW RIGHT) A.B.A. COMUNE ROME. (THIRD ROW RIGHT) MUSEUM OF FINE ARTS. BOSTON; PHOTOGRAPHS, (BOTTOM LEFT, BOTTOM RIGHT) ALINARI

Hadrian and his heirs. Found at **Ephesus.** In the Kunstiiistorisches museum, Vienna



Section of **Trajan's** column, Rome, showing the Dacian war

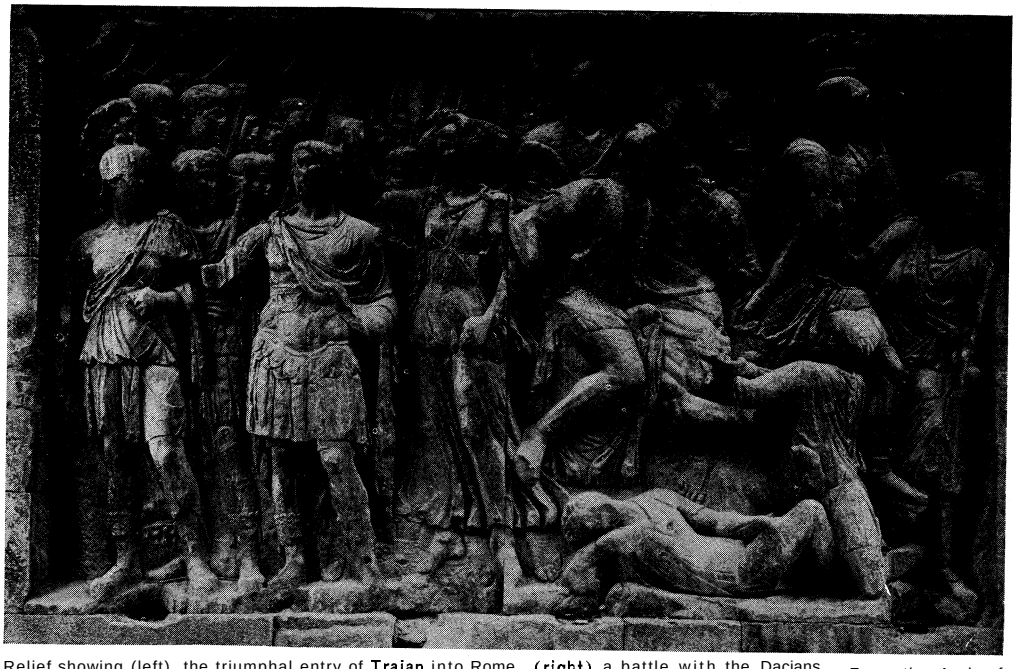


Part of a relief from the *Ara Pacis Augustae* (altar of peace) showing the sacrifice of Aeneas. National museum, Rome

Relief of the 1st century B.C. from the Basilica Aemiiia in the Forum Romanum, showing the building of a city. Forum museum, Rome

The triumphal entry of **Septimius Severus** and his sons into Leptis Magna. From the **Severan** arch, **Leptis** Magna, **Tripolitania** (Lebda, Libya)

Antinoüs (d. 130) shown as **Silvanus;** found near the site of Lanuvium (near Rome). Istituto dei Fondi Rustici, Rome

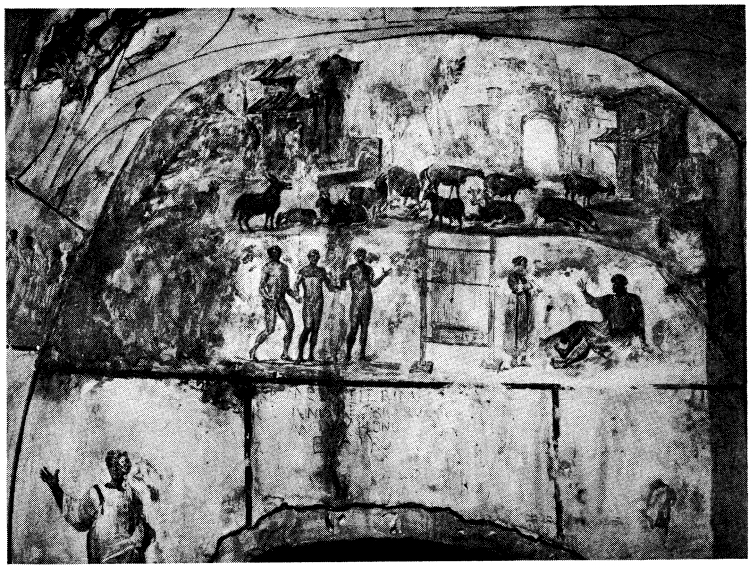


Relief showing (left) the triumphal entry of **Trajan** into Rome, **(right)** a battle with the Dacians. From the Arch of Constantine, Rome

MARBLE RELIEFS

BY COURTESY OF (TOP LEFT) KUNSTHISTORISCHES MUSEUM. VIENNA. (CENTRE LEFT) DEUTSCHES ARCHÄOLOGISCHES INSTITUT ROM, (BOTTOM LEFT) ARTURO OSIO. PHOTO BY RENATO SANSAINI; PHOTOGRAPHS, (TCP CENTRE. CENTRE RIGHT, BOTTOM RIGHT) ALINARI, (TOP RIGHT) ED. CHAUFFOURIER

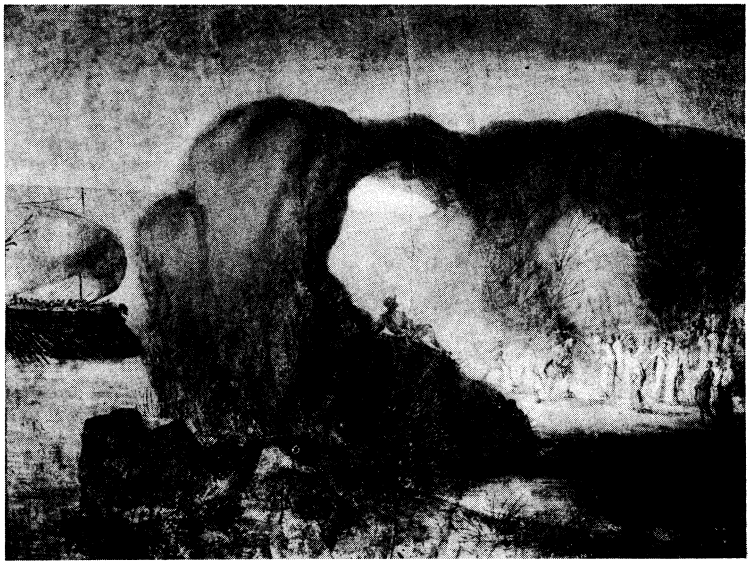
ROMAN ART



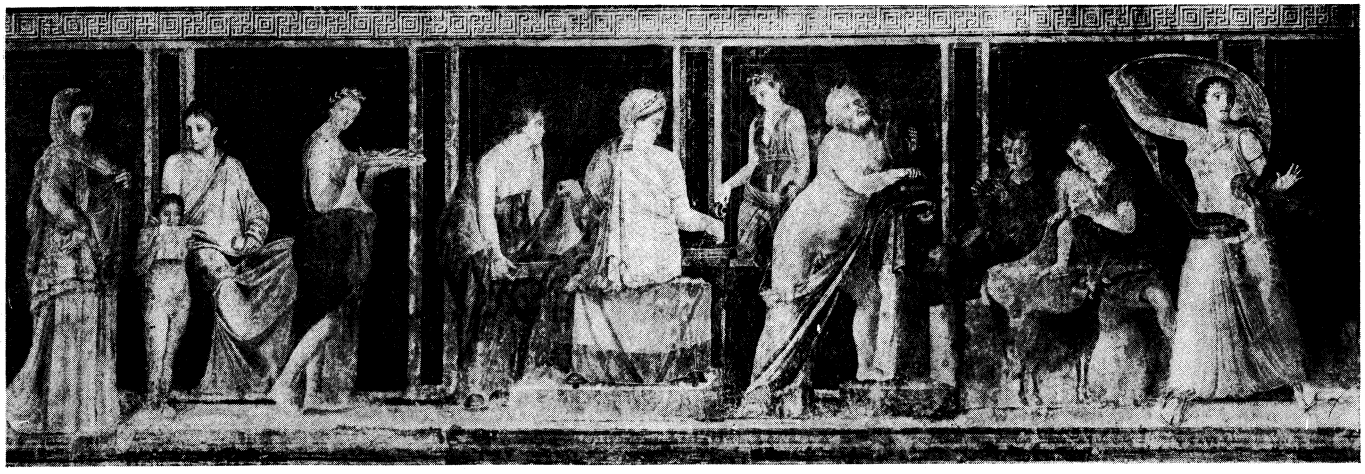
Gnostic painting of the early 3rd century A.D. showing a scene from the ***Odyssey.*** Hypogeum of the Aurelii, Viale Manzoni, Rome

Family portrait-group of the 4th century; painted on glass. Civic museum, Brescia

Portrait of Septimius Severus and his family: painted on wood. Staatliche museum, Berlin



Section of a landscape painting showing scenes from the ***Odyssey;*** 1st century B.C. Vatican library

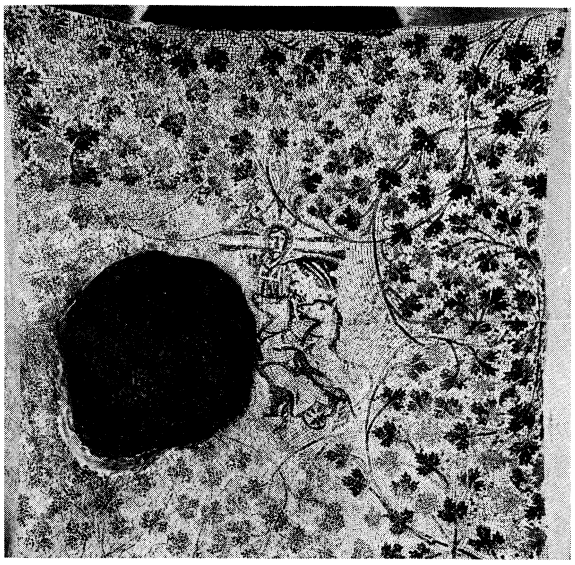


Painted frieze of the 1st century B.C. showing the Bacchic initiation of a bride. Villa of the Mysteries, Pompeii

PAINTING

BY COURTESY OF (CENTRE LEFT) STAATLICHE MUSEEN ZU BERLIN: PHOTOGRAPHS, (TOP LEFT, TOP RIGHT, CENTRE RIGHT, BOTTOM) ALINARI

Fountain niche of the late 2nd or early 3rd century A.D. from Ostia, showing the god Silvanus; glass-paste mosaic. Lateran museum, Rome



Vault mosaic depicting Christus-Heiios; middle of the 3rd century. Tomb of the Julii, Vatican necropolis

Section of a floor mosaic showing scenes from the *Aeneid.* Originally from the baths of a Roman villa at Low Ham, Somerset, Eng. In the Taunton museum, Somerset

Wall mosaic of the 4th century in polychrome marble intarsia (*opus sectile*) from the basilica of Junius on the Esquiline. Palazzo del Drago, Rome

Floor mosaic of the 4th century showing the hunting and transport of wild beasts for the arena. Roman villa near Piazza Armerina, Sicily

MOSAICS

PHOTOGRAPHS. (TOP LEFT) ALINARI, (TOP RIGHT) RENATO SANSAINI, (CENTRE RIGHT) S. BROWN, (BOTTOM LEFT) A.B.A. COMUNE ROMA, (BOTTOM RIGHT) A. BALBO

ROMAN ART

Gold **patera** (shallow bowl) of the early 3rd century A.D. found at Rennes, Fr. **Bibliothèque** Nationale, Paris

Sardonyx cameo portrait of Claudius (10 **B.C.–A.D. 54). Royal** collection, **Windsor** castle

Bronze face mask from a sports helmet of the 2nd or 3rd century A.D., found at Straubing, Bavaria. In the Straubing **museum**

Castor ware pot from Colchester, Eng. Colchester and Essex museum

Silver Bacchic dish of the 4th century A.D., found at Mildenhall, Suffolk. British museum

Stucco relief of the 2nd century A.D. depicting ***Terra Mater.*** Tomb of the Valerii, Vatican necropolis

Silver **scyphus** (goblet), probably of the **Augustan** period, found at Hoby, Denmark. National museum, Copenhagen

Silver statuettes of Roma and **Constantinopolis**, 4th century A.D. British **museum**

Ivory diptych with a double portrait of Honorius, 5th century. Cathedral treasury, Aosta, **Italy**

Le Grand **Camée** de France, a sardonyx **showing** Divus **Augustus** above and Tiberius enthroned as Jupiter below. **Bibliothèque** Nationale, Paris

METALWORK AND MINOR ARTS

lodorus of Damascus, who designed the whole complex of Trajan's forum. basilica and column. The interior of the shaft contains a spiral staircase and the column, dedicated in 113. was intended primarily as a lookout post for vieuing Trajan's architectural achievements—his forum and its adjacent markets. to accommodate which he sliced away the slope of the Quirinal hill; secondly, as a war memorial. when the relief bands were added and an eagle was to top the capital; and thirdly, as Trajan's future tomb. crowned by his statue (which was replaced by that of St. Peter) and containing the funerary chamber for his and his consort's ash urns.

To the last years of Trajan's reign or to the early years of that of his successor should be attributed the four horizontal panels that adorn the main passageway and the attic ends of the arch of Constantine. If fitted together they would form a continuous frieze of three main scenes which are, from left to right. an imperial *adventus*, a battle and the presentation to the emperor of prisoners and the severed heads of captives by Roman soldiers. The fact that the enemy is clearly Dacian, that the Roman soldiers are all clean-shaven and that the lictors on the left wear the Trajanic hair style, combined with the close resemblances betneen this frieze and that of the column. leaves no room for doubt that these sculptures were made between *c*. 115 and 120. perhaps for the temple of Divus Trajanus and Diva Plotina which was erected by Hadrian just to the north of the column. The presence on this frieze of chain-mail corselets, never seen on Trajan's column, seems to indicate that that type of armour. so common under the Antonines. first came into use in late-Trajanic or early-Hadrianic times. These reliefs depict, not realistic fighting. as do those of the column, but a kind of ideal or dramatized warfare, with the emperor himself participating in the mêlée and the soldiers wearing plumed and richly embossed parade helmets; the scenes melt into one another with total disregard of spatial and temporal logic. A third example of Trajanic monumental sculpture is the relief decoration of the arch at Beneventum, spanning the new Via Trajana and completely covered on passageway, pylons and attics with pictorial slabs, the subjects of which are arranged to carry out a carefully balanced and nicely calculated order of ideas. Those on the side facing the city and on one wall of the passageway present themes from Trajan's policy and work for Rome and Italy; those on the side toward the country and on the other wall of the passagenay allude to his achievements abroad. With two exceptions. where a pair of scenes forms a single picture, each panel is a self-contained unit, and these reliefs already show something of the classicizing, two-dimensional character of Hadrianic nork. Indeed. it seems likely that, although the arch itself was either decreed or dedicated in 114–115. some of the panels in which Hadrian is given a peculiar prominence were not carved until the early years of the latter's principate. The frieze of the great, circular Tropaeum Trajani, set up in the Dobruja (Rumania) to commemorate the Dacian victories, contains a series of metopes carved with figure scenes in an unbelievably naive, flat and linear style that betrays the hands of army artists of provincial origin.

The Age of **Hadrian.**—In the iconography of the age of Hadrian, certain Hellenizing features. the wearing of a short Greek beard by the males and the adoption by the females of a simple, classicizing coiffure,are harmonized nith new experiments. The depth of the bust increases, there is greater plasticity in the modeling of the face, the men's curly hair and beards are pictorially treated and the irises and pupils of the eyes are marked in. Many marble portraits of the emperor survive from all over the empire, but of his likenesses in bronze only one is extant—the colossal head recovered from the river Thames in London, torn from a statue erected in the Roman city and probably the work of a good Gaulish sculptor. The portrait statues of Hadrian's Bithynian favourite. Antinous, reveal a conscious return in the pose and proportions of the body to classical Greek standards, combined with a new emotionalism and sensuousness in the rendering of the head. The exquisite relief in Rome of Antinous-Silvanus is signed in Greek by Antonianus of Aphrodisias in Asia Minor.

The monumental reliefs of Hadrian's day cannot vie with those of his predecessor's. The most interesting and perhaps the earliest of them are the two familiar horizontal slabs once exposed in the Roman forum but later transported to the shelter of the curia. Both carry on one side similar figures of the victims for the Suovetaurilia sacrifice and different historical scenes on the other side, in the one case. Hadrian doling out the *alimenta* ("poor relief") to Roman citizens in the presence of a statuary group of Trajan and Italia with children, in the other case, the burning of debt registers. At one end of each of these scenes is carved a figure on a base of Marsyas, whose statue in the forum may once have been in part enclosed by the panels. In the background of both historical pictures are carved in low relief various buildings in the Roman forum that can be identified. The two scenes display the characteristically Hadrianic two-dimensional style, as do also three large panels in the Conservatori museum, with the emperor's head restored and depicting an imperial *adventus*, an *adlocutio* and an apotheosis respectively—somewhat rigid. academic works. The eight medallions gracing the arch of Constantine give pleasantly composed and lively, if Hellenizing, pictures of sacrifice and hunting, in some of which can be recognized Antinous accompanying the emperor, whose portraits have been recut as likenesses of Constantine the Great and of his colleague Licinius. Finally, the historical reliefs found at Ephesus (now in Vienna)—one of the very few examples of provincial state reliefs that have survived—may be claimed as late-Hadrianic (not as of the period of Marcus Aurelius, to which many critics have assigned them). The most important of these Ephesian carvings shows a group of four imperial personages. who can be identified as Hadrian, his heir Antoninus Pius and the latter's adopted sons, Marcus Aurelius and Lucius Verus. The panels would, then. date from between Pius' adoption by Hadrian in Feb. 138 and the latter's death in the July of that year. Pius had been a popular proconsul of Asia, and the unorthodox representation of him in this relief as Hadrian's equal and colleague. unthinkable in Rome, could have passed muster on a provincial monument. The most imposing of the other panels of the series carries an imperial apotheosis—Divus Trajanus in full military costume mounting the chariot of the sun-god for his journey heavenward. Some fragmentary battle scenes may be excerpts from Trajan's Dacian or eastern wars. reflecting glory on his adopted son, Hadrian, and succeeding generations. In Rome and Italy during the second quarter of the 2nd century inhumation began to supersede cremation as a method of disposing of the dead, and Hadrian's reign saw the beginnings of the long line of carved sarcophagi that constituted the most significant class of minor sculptures down to the close of the ancient Greco-Roman world.

The **Antonine** and **Severan** Periods.—Portraits of Antonine imperial persons, of which the bronze equestrian figure of Marcus Aurelius on the Capitol and the great marble bust of Commodus-Hercules in the Conservatori museum are perhaps the most arresting examples, display a treatment of hair and beard, deeply undercut and drilled. that grew ever more pictorial and baroque as the 2nd century advanced. This produced an impression of nervous restlessness that contrasts with the still. satin smoothness of the facial surfaces, particularly in the iconography of Commodus. To all this picturesqueness Septimius Severus added yet another ornamental touch—the dangling, corkscrew forelocks of his patron deity, Serapis. The female hair styles of the time are characterized, first by a coronal of plaits on top (Faustina I), next by rippling side waves and a small, neat bun at the nape of the neck (Faustina II, Lucilla) and then by stiff, artificial. "permanent" waving at the sides and a flat, spreading "pad" of hair behind (Crispina, Julia Domna).

Of the state reliefs of this epoch the earliest are on the base (in the Vatican) of the lost column set up in honour of Antoninus Pius and Faustina I. The front bears a dignified, classicizing scene of apotheosis: a powerfully built winged figure lifts the emperor and empress aloft. uhile two personifications, Roma and Campus Martius, witness their departure. On each side is a *decursio*, or military parade, in which the riders farthest from the spectator appear, not behind the foot soldiers, but high above their heads —a remarkable instance of the bird's-eye-view perspective carried

to its logical conclusions. All the figures in these side scenes are disposed on projecting ledges, a device employed again about 20 years later on Marcus Aurelius' column Eleven rectangular sculptured panels, similar to those on Trajan's arch at Beneventum but displaying greater crowding of figures, livelier movement and a pronounced effect of atmosphere and depth, depict official occasions and ceremonies in the career of Marcus. Three are in the Conservatori museum, the other eight are on the attics of the arch of Constantine. They may have been carved for two triumphal arches (a 12th panel being lost) or for some single monument. The contrast between the reliefs of Marcus' column, put up under Commodus, and those of its Trajanic predecessor measures the change of mood that the Roman world experienced during the course of the 2nd century. The diminished proportions of the squat. doll-like figures, their herding together in closely packed, undifferentiated masses, their angular, agitated gestures and the stress laid throughout on the horror and tragedy of war, suggest that the empire is facing an unknown future with diminished security and that man is at the mercy of some unaccountable power, of which the awe-inspiring winged, dripping figure, brooding above the famous rainstorm episode, represents the supreme embodiment. Again, in the imperial *adlocutiones* that punctuate this frieze, where the emperor stands in a strictly frontal pose high above the heads of his audiences, can be seen the first attempts at externalizing in art the concept of the ruler as a transcendental being. The content of these spiral bands is Marcus' German wars of 173–175 and 177–180.

The spirit of the times is reflected no less vividly in the carved sarcophagi. with their crowded compositions, seething movement, brilliant highlights and deep wells of shadow. Their themes—familiar myths, battles, hunts. marriages, etc—allude allegorically to death and the destiny of the soul hereafter. Meanwhile, the classicizing, statuesque tradition is maintained in the late 2nd- and early 3rd-century columned sarcophagi, originating in the workshops of Asia Minor but freely imported into, and sometimes imitated in, Rome and Italy. On such pieces single figures, or small groups of figures, occupy the niches between the colonnettes. Among the most impressive examples is the great sarcophagus at Melfi, in Apulia, Italy, with a couch-shaped lid. on which the figure of a girl lies prostrate in the sleep of death.

The novel features that have been noted in the reliefs of the Marcus column were worked out more completely in those of the official monuments set up in Septimius Severus' honour, both in Rome and abroad. The three-way arch that stands at the northern end of the Roman forum was erected in 203 to commemorate both the emperor's Parthian victories and his *decennalia* (the conclusion of his first ten years of rule). Large-scale flying Victories and groups of Roman soldiers and Parthian captives occupy respectively the spandrels above the central passage and the column bases on both faces of the arch; while above both the side passages on either face are scenes from the campaigns. There are masses of small, crowded figures, arranged in superimposed registers in laterally spreading pictures. which in the extensive use of bird's-eye-view perspective recall the spiral bands of the Trajan and Marcus columns. They, too, were doubtless based on military artists' sketches and may represent permanent versions of the public paintings of the eastern wars which, so Herodian says, Septimius exhibited in Rome. The small but richly ornamented Ports Argentariorum, dedicated in the Velabrum in 204 to Septimius and his family by the bankers and wholesale cattle dealers of the capital, carries two major sculptured panels. one of which shows Septimius and his Syrian wife. Julia Domna, sacrificing at a tripod. This composition is strictly tno-dimensional and the figures are arranged in stiff, hieratic, frontal poses. They express no interest in the rite which they profess to be performing, but gaze out into the distance as though in search of the spectators' homage The figure of Septimius' younger son Geta which nas once in the group, was removed after his murder by his elder brother Caracalla who now appears alone in the second major panel, from which the figures of his wife Plautilla and of her father Plautianus were likewise obliterated at the time of their disgrace and deaths. But of all Septimius' state reliefs the most interesting are those found fallen from the four-way arch that was set up in his birthplace, Leptis Magna in Tripolitania, to commemorate his visit to that city c. 203. On the attics were four long, friezelike scenes. of which the most impressive depicts the triumphal entry into the town of the frontally-posed emperor and his sons. The other attic panels, one of which portrays the proclamation of Caracalla as his father's colleague (*dextrarum innctio*) in the presence of Julia Domna and representatives of Leptis, and most of the minor panels from the inner faces of the piers, refer to ceremonies held at Leptis on the same occasion. But one pier carried a great vertical picture of the siege of an oriental city, with the defenders at the top and the attackers climbing up. as it were. from below in mounting series—a magnificent example of the bird's-eye viewpoint. Flying Victories filled the spandrels and on the outer faces of the piers were groups of strangely elongated captives and flat pilasters carved from head to foot with peopled vines scrolls, deeply undercut and drilled—a very distinctive type of design. which recurs on the pilasters that are grouped on either side of the apses of the Severan basilica at Leptis. The handsome inhabited floral scrolls. on pilasters, and the heads carved on brackets, that adorned the Hadrianic baths at Aphrodisias in Caria, are so remarkahly similar to the scrolls from the arch and basilica and to the heads from the Severan forum at Leptis, that there can be little doubt that sculptors from Asia Minor nere imported to carve these great Severan buildings in the African emperor's native city.

The Third and Fourth Centuries.—A new tension between naturalism and schematization marks the history of late-antique portraiture. In likenesses of Alexander Severus (222–235) the facial planes are simpiified, while all the tumbling curls of the 2nd-century baroque have been banished in favour of a skullcap treatment of the hair and sheathlike rendering of the beard. Toward the middle of the 3rd century. under Philip the Arabian (244–249) and Decius (249–251), this clipped technique in hair and beard is combined with a return to something of the old, ruthless realism in the depicting of facial furrows. creases and wrinkles. For a time Gallienus (253–268) reinstated the baroque curls and emotional expression, but in the later decades of the century the schematic handling of hair, beards and features reappears. Finally. in the clean-shaven heads of Constantine the Great and his successors of the 4th and early 5th centuries the conception of a portrait as an architectonic structure comes to stay and the naturalistic, representational art of the Greco-Roman world is exchanged for the hieratic, transcendental style that was the hallmark of Byzantine and medieval iconography. The hair is combed forward on the brow in rigid, striated locks, and the eyes are unnaturally enlarged and isolated from the other features as the channels through which the soul communicates with a higher power. The face is now so formalized that the identification of any given portrait becomes a problem. The colossal bronze emperor at Barletta, for example, has been given the names of several different rulers of the late 4th and early 5th centuries. Throughout these centuries the favourite female coiffure shows a plait or twisted coil of hair carried across the back and top of the head from neck to crown, while under Constantine there was a brief revival of the two Faustinas' styles.

Throughout the 3rd and 4th centuries carved sarcophagi carry on the story of relief work. Aesthetically, the most notable 3rd-century example is the allover tapestrylike battle piece (in the Ludovisi collection in the Roman National museum) probably made for Decius' son Hostilianus. One of the main interests of this field of art, as regards content, lies in the Christian sarcophagi, which are in style and in technique indistinguishable from their pagan counterparts. During the 3rd century their themes are still allusive and symbolic. but with the peace of the church under Constantine Biblical subjects of a very varied range are openly depicted. Of 3rd-century state reliefs in Rome virtually nothing has survived. The narrow historical friezes that were carved de *novo* for the arch of Constantine, completed for his *decennalia* celebrations in 315, show dwarfish. dumpy, niggling figures. Both these reliefs and those of the slightly earlier arch of Galerius at Salonika look as though they had been worked by artists whose

experience had been confined to the production of small-scale sculptures. The last examples of Roman carving are the reliefs on the base of the obelisk of Theodosius in the Hippodrome at Constantinople, where the emperor and members of his court, ranged in rigid, hieratic poses. watch the shows. S o original portions are extant of the spiral relief bands that entwined the columns of Theodosius and Arcadius in Constantinople, in imitation of the Roman prototypes.

PAINTING AND MOSASCS

Wall Painting. — Evidence for painting in Rome and Latium before the 1st century B.C. is virtually confined to the fragment. described above. of a historical tomb painting from the Esquiline, to the literary accounts of triumphal pictures, already mentioned and to the record by ancient writers of the names of three painters each of whom worked in a temple — Fabius Pictor in the temple of Salus in Rome at the end of the 4th century; Pacuvius, the dramatist and a native of Brundisium, in the temple of Hercules in the Forum Boarium in Rome during the first half of the 2nd century; and Lycon, an Asiatic Greek, in the temple of Juno at Ardea in the late 3rd or early 2nd century. Of the nature of the work of these three artists no idea can be formed.

At Pompeii during the 2nd century B.C. the interior walls of private houses were decorated in the so-called "masonry" or "incrustation" style; *i.e.*, by the imitation in painted stucco of veneers of *crustae* ("slabs") of coloured marbles. But in the second half of the 1st century B.C. there suddenly appeared in Rome and in the Campanian cities a brilliant series of domestic mural paintings of the so-called "second style," the aim of which was to deny the walls as solid surfaces confining the room space. This was sometimes done by covering the whole area of the walls with elaborate landscapes, in which depth. atmosphere and light are rendered in a highly pictorial, illusionistic manner. Such are the famous Odyssey paintings, found in a Roman house on the Esquiline (now in the Vatican), consisting of a continuous flow of episodes that unfold, filmlike, beyond a colonnade of pilasters with vertical. bird's-eye-view, perspective and the human figures strictly subordinated to their settings. At other times there appears the representation of a great park or garden. filled with trees, shrubs. flowers and birds. with no pilasters in the foreground to interrupt the prospect and with no human figures to distract attention. as in the case of the room from Livia's villa at Prima Porta (transferred to the Roman National museum). The paintings in this style are so highly developed that it seems unlikely that they suddenly sprang into being at this time in Rome and Italy without any Hellenistic precursors. Nevertheless. no late-Hellenistic paintings at all like them have come to light in Greek lands, and they constitute what is perhaps the most original and interesting western Roman-age contribution to ancient art. Possibly Hellenistic painted stage sets were, in part at least. their models; Vitruvius mentions three types of back scenes, tragic, comic and satyric, which seem to be reflected in the paintings from a room in the Villa of Fannius Synistor (or of L. Herennius Florus) at Boscoreale near Pompeii. Again. the triumphal "place paintings" may have played a certain role in this development.

The celebrated frieze of life-size figures. depicting the Dionysiac initiation rites and prenuptial ordeals of a bride, in the so-called *triclinium* of the Villa of the Mysteries (or Villa Item) outside the Herculaneum gate of Pompeii, also belongs to the "second style." There the walls are denied by the device of substituting for them a narrow stage on which the ritual is carried out before a drop scene of continuous painted panels. But the commonest "second-style" paintings are known as architectural and show a threefold horizontal division of the wall into dado, central area and cornice, combined nith a triple vertical scheme of design which consists of a large central panel (in the main, intermediate horizontal area). framed by flanking columns and a pediment, and of two smaller panels on either side. The central panel, and often the lateral panels as well. are views seen through nindows that break through the walls and link the spectator nith the world outside. as in the house of Augustus on the Palatine. In the "third style." which covers most of the Xugustan period, the central panel picture on a wall is no longer thought of as a scene through a window, but as a real picture hung on or inserted into a screen, or woven into a tapestry. which partially conceals an architectural vista behind it The columns, entablatures, etc . are completely unreal and so complicated that this form of the "second style" is sometimes dubbed ornate The "fourth style" nhich runs from the close of the Augustan age to the destruction of the Campanian cities in A.D. 79, is less homogeneous than its predecessors and exhibits three main variants — first. a soberer more realistic architectural design, but still with a central screen or tapestry partly covering a retreating vista; second. an architectural setout that imitates a *scaena* ("stage background"): and third, a method (sometimes known as "intricate") by which the whole surface of the wall is covered with a flat, white, neutral ground that is painted with an all-over, latticelike pattern of fantastic architectural elements, arabesques, grotesques small figure motifs or small panels containing pictures. This third type of "fourth-style" painting came into vogue at Pompeii between the earthquake of A.D. 63 and the catastrophe of 79, and one of its most impressive exponents is the Golden House of Nero in Rome.

The subjects of the panel pictures of the "second," "third" and "fourth" styles are for the most part drawn from Greek mythology. Some of them recall the literary descriptions of famous classical Greek and Hellenistic paintings or shon motifs which suggest that their originals were painted on the Greek mainland or in Asia Minor. It is certain that many masterpieces of Greek painting did make their way to Rome as the booty of Roman generals of republican days, and wall painters could have studied them at first hand. But often those artists must have had to rely only on sketches of the celebrated pictures, and it is not known how faithfully the Roman and Campanian murals reproduce the prototypes. Other panel pictures present scenes from contemporary religious ritual, while a few show themes from Roman legend. Frequently, in the case of the Greek mythological subjects and of those taken from rustic religious cult the artist had produced landscape with figures, as in the Odyssey frescoes. not figures with landscape. as on Trajan's column. These late-republican and early-imperial set pieces are competently executed, remarkably vivid and extremely naturalistic. But, with a few exceptions. they reveal that the principles of a single vanishing point, on which all receding lines converge. and of unified lighting from a single source of illumination. either were not understood by the Roman-age painters, or did not interest them.

The flat. uniform background of the last phase of the "fourth style" remained a constant feature of mural painting in houses, tombs, temples and other religious shrines throughout the 2nd, 3rd and 4th centuries. The decoration which stands out against that ground takes the form of latticelike, allover floral, etc., patterns. as in many pagan tombs; of small groups of figures, or of figure panels, spread out at intervals across the field, as in the Christian catacombs of Roine: of a mixture of large human figures and extensive scenes nith small-scale figures, as in the early 3rd-century Hypogeum of the Aurelii on the Viale Manzoni in Rome, the interesting painted content of nhich is Gnostic or crypto-Christian; of large scenes with relatively big figures, such as the group of marine deities in the 2nd-century Rcman house under the church of SS. John and Paul on the Caelian, the late 2nd- or the early 3rd-century leopard hunt on the south wall of the *frigidarium* of the hunting baths at Leptis Magna, or the early 3rd-century Biblical scenes from the Christian baptistery at Dura Europos on the river Euphrates The walls of the main assembly room of the early 3rd-century synagogue in the last-mentioned city are covered nith an exceptional series of great self-contained figure panels, arranged side by side in superimposed registers with no intervening tracts of empty background between them.

In the case of Roman tombs the cross- or barrel-vaulted ceilings. where preserved. carry out normally the painted decoration of the walls, shoaing either a latticelike scheme of small ornamental motives or a series of small, spaced-out, figured panel pictures. At Trier in 1945–46 were found the remains of a flat, coffered ceiling with panels of painted plaster from an early 4th-century imperial hall that was destroyed to make room for the

first Christian basilica built on the site of the present cathedral. Large portions of eight painted panels are preserved. Four depict female busts, three of them nimbed, which may be either personifications or portraits of members of the royal family; while the other four show pairs of dancing or sporting cupids. As the skillful modeiing and lively naturalism of these figures shorn. Roman painting could maintain a high level of achievement in late-antique times.

Floor Mosaics.—Few categories of works of Roman art can show more surviving examples than can that of mosaic pavements. *Opus tessellatum*, made of *tesserae* ("cubes") regularly disposed in geometric designs, and *opus sectile*, in which the floor consists of a polychrome intarsia of marble fragments, larger than *tesserae* and generally forming abstract or stylized floral patterns, cannot be discussed in detail here. But *opus vermiculatum*, where figure pictures and naturalistic floral compositions are produced by small and subtly shaped *tesserae*, is almost a branch of painting, in which stone or marble or, in later times, glass paste replace the liquid medium. This type of work appeared in Italy during the 2nd century B.C. and was directly inspired by such late-Hellenistic mosaics as those unearthed in the royal palace of the Attalids at Pergamum and in private houses on the island of Delos, and from Italy it spread rapidly through the empire. Sometimes these floor mosaics are large, self-contained, panel pictures. of which an early example, of the late 2nd, or early lst, century B.C., is the well-known Alexander mosaic (in Naples) from the House of the Faun at Pompeii. It depicts the battle of Issus and probably represents fairly faithfully a late 4th-century monumental painting. This was the work of a master mosaicist, as were also many of the small mosaic pictures or *emblemata*, which were often mounted on marble or terra-cotta trays and transported, at first from east Mediterranean workshops to Italy, and later from Greek and Italian centres of production to the provinces, where they were inserted into surrounds of geometric patterns laid by inferior local craftsmen. The master mosaicists themselves often traveled far afield to execute *emblemata* or large designs on the spot, as their signatures testify. The subjects of mosaic pictures cover an extensive range—Greek myths (the most popular). Roman legends, Nilotic and other landscapes, scenes from natural history, portraits of famous characters, personifications, topics inspired by the games and shows, by the hunting field, by rural life and by religious ritual, and naturalistic running scrolls of acanthus, vine and ivy. A most remarkable discovery is that of the pavements in the 4th-century country villa near Piazza Armerina, Sicily. These form the largest continuous area of Roman mosaic floors known and include a vast scene, in a corridor 70 yd long, of the hunting, capturing and transport of wild birds and beasts for display in the arena. The most important and the richest dated series of floor mosaics, running from the early 2nd to the 6th century, is that unearthed, mainly in private houses, at Antioch-on-the-Orontes in Syria. The floor mosaics of the 4th-century Christian basilica at Aquileia display an interesting mixture of Christian, pagan and neutral themes.

Wall and Vault Mosaics.—Wall and vault mosaics that have survived are relatively rare. The earliest and best-preserved examples are those adorning fountains in the courtyards of houses at Pompeii and Herculaneum. These show brilliant polychrome designs, with a lavish use of glass-paste *tesserae* and borders of natural shells. But in the House of Neptune and Amphitrite at Herculaneum most of one wall of the internal courtyard has been turned into a species of *nymphaeum*, with a central rounded niche flanked by two rectangular niches and the whole facade overlaid by an exquisite glass-paste mosaic depicting naturalistic vine sprays, hunting scenes and festoons of fruit and foliage. A curved fountain niche of late 2nd- or early 3rd-century date, found in a Mithraeum at Ostia (in the Lateran museum), bears a glass-paste mosaic figure of Silvanus, nimbed and equipped with pruning knife and dog, seen against a blue background. From Pompeii and Herculaneum there are a few mosaic panel pictures, mythological in content, that were set on malls; while part of a wall panel representing a harbour, found on the Quirinal, is in the Conservatori museum.

The number of pre-5th-century vault mosaics known to have survived has considerably increased. At Ostia the semidome and arch soffit of a large niche in the House of the Seven Sages are faced with polychrome mosaic worked in delicate and naturalistic plant designs. Somewhat fragmentary, but still impressive, mosaic figures—a nymph suckling a kid. a triton and a crocodile in a Nilotic landscape—appear in the semidome of the east plunge in the *frigidarium* of the hunting baths at Leptis Magna. In the mausoleum of the Julii in the necropolis beneath St. Peter's. Rome, are the earliest Christian vault and wall mosaics known, dating from about the middle of the 3rd century and worked in glass-paste *tesserae*. Their subjects are the divine angler, Jonah and the whale, the good shepherd and Christus-Helios in his chariot, with a great, spreading vine linking together the four pictures. All these are comparatively new finds, and there is quite a number of lesser fragments of vault mosaics that cannot be described here. The familiar mosaic decoration on the vault of the circular ambulatory in the church of Sta. Costanza in Rome contains a curious mixture of subjects disposed in large, rectangular panels; these mosaics, once held to be an instance of the early Christian use of pagan or neutral art motifs, have been shown to belong to the late 3rd- or early 4th-century pagan shrine or mausoleum that the building originally was, before it was converted to Christian purposes. The 4th-century Christian mosaic from the apse of old St. Peter's in Rome, and the 5th-century Christian wall and vault mosaics at Ravenna and in the church of Sta. Maria Maggiore in Rome, while ranking as Roman, cannot be described here.

Finally, mention must be made of figured wall panels of brightly coloured *opus sectile*, such as that with a beast fight in the Ostia museum and those showing beast fights, Hylas and the nymphs and the decorative group of horsemen and a frontal chariot, which came from the 4th-century basilica of Junius Bassus on the Esquiline (in the Palazzo del Drago at the Quattro Fontane).

Painted Portraits.—Roman portrait painting comes but a short way behind portrait sculpture in excellence of execution and in its superbly realistic style. One of the earliest extant examples of this art is the group of Terentius Neo and his wife, from Pompeii (in the Naples museum). Both figures recall the celebrated mummy portraits from the Fayum in Egypt, painted in encaustic, the technique by which the colours were mixed with liquid wax and fixed by heat, and ranging in date from the Flavian period to the 3rd century. A circular portrait group of frontal figures painted on wood, probably in Egypt (now in Berlin), shons Septimius Severus, Julia Domna. Caracalla and Geta, the elder (so it seems) of the two boys having been subsequently washed out. Particularly attractive are the portraits of the gold-glass medallions ahich, in the exquisite refinement of their treatment. may be compared to modern miniatures. The medallion at Brescia, dating from the 4th century and carrying the portrait group of a mother with her boy and girl, is a veritable masterpiece; while some of the portraits of Christians in the same medium and found, for the most part, in the catacombs, continue the best traditions of Roman veristic iconography.

Book Illustration.—That book illustration existed in the late-Hellenistic world can be inferred from some of the so-called "Megarian" bowls, imitations in clay of gold or silver vessels and ranging from the 3rd century B.C. to the 1st century A.D. These often bear on their exteriors scenes in relief from literary texts which are sometimes accompanied by Greek quotations. They must, in part at least, have served as models for the Roman age artists. and this art is heard of in Rome comparatively early—the 700 pictures, for example, illustrating Varro's 15 books of *Imagines* and a portrait of Virgil prefixed to an edition of his poems. The miniatures in the famous codex of the *Iliad* in the Ambrosiana library, Milan, were probably painted at the end of the 5th or beginning of the 6th century, but reflect pictures of the 3rd. 2nd and even 1st century; as do also those of the codex of Virgil in the Vatican (No. 3225), written *c.* 400. The miniatures in the second great Virgilian illustrated codex in the Vatican (No. 3867 "Romanus"). written *c.* 500, are still Roman in spirit, if less classical in style; the tenacious influence of Graeco-Roman painting can be clearly traced in the illustrations to such early Byzantine books as the Vienna Dioscurides (written in 512), the Vienna Genesis

(6th-century) and the Vatican Joshua *rotulus* (10th-century). A most remarkable, if aesthetically crude, mid-4th-century mosaic pavement, found in a Romano-British villa at Low Ham, Somerset, and showing scenes from the first and fourth books of the Aeneid, undoubtedly reflects the illustrations in some Virgilian codex.

STUCCO WORK

Of the minor forms of sculpture none is more attractive than the art of modeling, in relief or in the round, in fine, white stucco. Decorative stucco work was cheaper and easier to produce than carving in stone or marble, soft and delicate in texture and equally elegant whether left white or gaily painted. It mas used at all levels of society. in public as well as in private buildings. In domestic architecture it was a useful alternative or accessory to painting; here it is sufficient to recall such examples as the pure white and exquisite vault decoration, showing ritual scenes with small-scale figures, of the late-republican or early-imperial house near the Villa Farnesina in Trastevere (in the Roman National museum); the handsome pairs of large white griffins, framed in acanthus scrolls against a vivid red ground, in the late republican House of the Griffins on the Palatine; and the frieze depicting the story of the Iliad, in white figures on a bright blue background, in the House of the Cryptoporticus or Homeric house at Pompeii. For the use of this technique in palaces the figure work in Domitian's villa at Castel Gandolfo in the Alban hills can be cited; it can be found on public buildings, in the Stabian and forum baths and in the temple of Isis at Pompeii; while the most lovely and extensive stucco relief work in a semiprivate shrine is that in the underground basilica near the Porta Maggiore, Rome, where the scenes all allude to the world beyond the grave, to the soul's journey to it and to its preparation for it in this life. Some of the best surviving stuccoes are in tombs—in the tomb of the Innocentii and the tomb of the Axe under the church of S. Sebastiano on the Via Appia; in the tomb of the Valerii and the tomb of the Pancratii on the Via Latina. in the latter of which stucco work is most attractively combined with painting in the flat; and in the tomb of the Valerii under St. Peter's, Rome, where the interior walls of both the main and subsidiary chambers are almost completely covered with recesses, niches and lunettes containing stucco figures. The whole effect is most impressive, and the Vatican tomb of the Valerii must be reckoned as a locus *classicus* for the study of this delightful and all too scantily represented branch of Roman art.

MINOR ARTS

Decorated Metalwork.— The Roman taste for costly silverware. with figured or floral relief decoration, is attested by the elder Pliny and by the numerous surviving pieces. Among the earliest-known examples in a Roman context is the cantharus ("goblet") with myrtle sprays, discovered at Alesia in one of Julius Caesar's siege trenches of 52 B.C. The treasure from Boscoreale containing 108 pieces (of which 102 are in the Louvre) and that of 118 pieces. which had been packed away in a strongroom in the House of Menander at Pompeii (now in the Naples museum), obviously antedate the disaster of A.D. 79. The former treasure contains two scyphi ("cups," in the Rothschild collection in Paris) with scenes from contemporary Augustan history. The latter comprises not only cylindrical cups and canthari of the early-imperial period, but also late-Hellenistic scyphi, perhaps dating from as early as the late 2nd century B.C., one pair being signed by Apelles. Probably belonging to the Augustan period are a number of the pieces in the two treasures found respectively at Berthouville, Normandy (in the Bibliothèque Nationale. Paris), and at Hildesheim, Germany (in Berlin), although the former hoard includes some objects that may well be later, while the latter also contains some earlier Hellenistic works; to the Augustan epoch should again probably be attributed the two scyphi that came to light at Hoby, near Copenhagen, signed by Cheirosophos and depicting the ransoming of Hector and the story of Philoctetes. A round *patera* ("dish") from Aquileia (in Vienna), portrays a Julio-Claudian emperor as the "new Triptolemus." Of the British museum silver pieces found in France, the Chatuzanges and Chaource treasures probably date from the 2nd century A.D.; whereas the Seasons bucket (situla) from Tourdan, near Vienne, often described as Augustan, and the treasure from Caubiac, near Toulouse, display the superficially naturalistic classicism combined with a certain clumsiness and faultiness in drawing that is the hallmark of 4th- and 5th-century Roman decorated metalwork. It is. indeed, to this late-antique period that some of the most spectacular and interesting extant silver pieces and hoards belong. As regards the single pieces, special mention should be made of the silver-gilt *patera* found at Parabiago, Italy (in the Antiquities department, Milan), with scenes relating to the cult of Cybele and Atys; of the rectangular lanx ("dish") recovered from the river Tyne and in the duke of Northumberland's collection, which depicts Apollo, Artemis, Leto, Athena, etc., on the island of Delos, where Julian the Apostate sacrificed in 363; of the *missorium* ("circular dish") at Madrid, portraying Theodosius enthroned in the midst of his court; and of the silver-gilt *missorium* discovered at Cesena, Italy, the central medallion of which shows a group of persons picnicking *al* fresco, above, and a groom leading out a horse from its stable, below. Of the late hoards, four are in the British museum. These are the Esquiline treasure, which includes the bridal casket presented to a Christian lady, Proiecta, on the occasion of her marriage to Secundinus, and four statuettes of city-personifications; the Carthage treasure. partly Christian; the cache of pieces from Coleraine, Ireland; and the Mildenhall treasure from Suffolk, also containing some Christian objects. but of which the most outstanding items are pagan—the great Oceanus dish, nearly two feet in diameter, and the two smaller dishes with Bacchic figures, completely classical in style and virtually free from the late-antique designer's usual defects of draftsmanship. The hoard from Traprain Law, Scotland, comprising both pagan and Christian pieces, is in the National Museum of Antiquities, Edinburgh. Where precisely the Roman silversmiths' workshops were located is not known, but the great Mediterranean cities—Rome, Alexandria, Antioch and Ephesus—and also some of the leading Gaulish cities were certainly centres of this art and the master craftsmen often traveled in the service of their patrons.

Of the goldsmith's art one example only can be cited—the *patera* from Rennes (in the Cabinet des Médailles, Paris). The central scene is the drinking contest between Hercules and Bacchus, encircled by a frieze containing a Bacchic procession; the outer zone of decoration consists of 16 inset *aurei,* of which the obverse portraits of emperors and empresses from Hadrian to Caracalla are exposed to view and date it in the early 3rd century.

Decorated bronze objects of the Roman age include vessels of various types, mounts for chariots, horse harness and domestic furniture and also brooches, which in the northwestern areas of the empire were often inlaid with polychrome enamel. Of particular interest are the pieces of decorated bronze armour used by gladiators, legionaries on parade and, above all, the auxiliary horsemen of the Roman army when taking part in the sports or tournaments described by the Hadrianic writer Arrian. Examples of the face-mask-visor helmets worn by horsemen on those occasions are especially impressive and have come to light in many regions of the empire, notably in Britain, Germany, the Danubian countries and northern Syria. Remarkable finds were made at Straubing, Bavaria, in 1950.

Ivories and Wood Carving.— Ivory was a popular material for minor sculpture. It was worked both in the round and in relief and in such forms as small portraits, figurines, caskets, such as that at Brescia (5th-century) and furniture ornaments, of which the carved plaques composing the "Cathedra of Maximianus" at Ravenna (probably 5th-century) provide a notable instance. The consular and other diptychs (see DIPTYCH) are one of the most distinctive types of ivory relief work in the 4th and 5th centuries. Among them are such masterpieces that kept alive the traditions of Hellenistic carving as the diptych of the Symmachi and Nicomachi (of which one leaf is in the Victoria and Albert museum, London, the other in the Cluny museum, Paris) and some outstandingly fine examples of late antique portraiture, for instance, the Probus diptych at Aosta with the double portrait of Honorius, the Felix diptych in Paris (dated 428) and that of Boethius, consul in 487, at Brescia. Of wood carving one example must suffice—

the panels with Biblical scenes on the 5th-century door of the church of Sta. Sabina on the Aventine.

Gems, Cameos, **etc.**—Many types of carving in precious stones were practised by Roman-age craftsmen, and it is to them that the credit goes for the great majority of the *intaglios* which have survived from ancient times. The widespread taste for *intaglios* is witnessed to by the large numbers of existing glass-paste imitations reproducing their subjects, which include portraits of both imperial and private persons, and a large variety of divine and mythological groups and figures, personifications. animals, etc. Many bear the signatures of Greek artists. But the most impressive series of Roman gems consists of the great cameos, cut in different stones and representing imperial persons. Among the earliest of these pieces are the Blacas cameo of onyx in the British museum. portraying Augustus in the guise of Jupiter with aegis; the Gemma Augustea, a sardonyx in Vienna and the Grand Camée de France, a sardonyx in the Bibliothèque Nationale. which were probably carved under Gaius and respectively present the apotheosis of Augustus and of Tiberius. the latter nith Divus Augustus also; and the sardonyx cameo of Claudius with Jupiter's aegis in the royal collection at Windsor castle. Late antique examples of the craft are the rectangular sardonyx in the city library at Trier, portraying Constantine I and members of his house, and the onyx in the Rothschild collection in Paris with busts of Honorius and Maria.

Other varieties of carving in precious stones are represented by the miniature head of a girl in the British museum, wearing the hair style of Messalina and Agrippina II, which is cut in *plasma* (root-of-emerald); the onyx vase at Brunswick, possibly of the 1st century, depicting an emperor and empress, as Triptolemus and Demeter; and the late antique Rubens vase in the Walters Art gallery, Baltimore, carved in honey-coloured agate and decorated on the front and back with a naturalistic vine and nith the head of a Pan, cupped in acanthus, on either shoulder.

Figured Glass.—Closely akin to cameos and vessels cut in precious stones are their substitutes in opaque "cameo glass," worked in two layers, with the designs standing out in white against a dark-blue or bright-blue background. To this class belong the Blue vase from Pompeii (in the Naples museum), aith vintaging Cupids; the Auldjo vase (in the British museum) with an exquisitely naturalistic vine; and the celebrated Portland vase, also in the British museum. the scenes on which, recently interpreted as the dream of Atia, mother of Augustus, more probably depict myths relating to the afterlife. Similar imitations of carving in precious stones are the late antique *diatreta* ("cage cups"), the decoration of nhich is cut back from the outer surface of the mold-cast blank. This "openwork" ornamentation sometimes represents the crisscross meshes of a net, while on other vessels it consists of an elaborate figure scene, the design in either case being very deeply undercut and. for the most part, only connected with the background by short shanks of glass. Of the figured examples the most spectacular surviving specimens are the dark-blue *situla* with a hunting scene in the treasury of St. Mark's. Venice, and the dull-green cup presenting the story of Lycurgus (the Rothschild vase in the British museum). Of the other types of glass with figured decoration, the molded cups with gladiatorial and circus scenes are characteristic of the early imperial period, while the 4th-century glass-worker's craft is represented by vessels with cut or incised designs, the subjects of which are chariot races, hunting and Bacchic scenes and. in the case of the Christian pieces, episodes from the Old and New Testaments. Among the most important centres of glass production under the empire were Syria, Alexandria and the Cologne region.

Figured Pottery.— The figured terra-cotta tablewares *(terra sigillata— a* term often incorrectly stretched to cover plain wares) were cheaper versions of the costly decorated silveraares. During the last century of the republic and in the early decades of the 1st century of the empire, Arretium (Arezzo) was the most flourishing centre of the manufacture of a fine type of red-gloss pottery. As the signatures on the pots reveal, the Italian firms often employed Greek and oriental craftsmen, and the mythological and floral themes of the vessels' molded ornamentation owe much to the inspiration of Hellenistic art. From shortly before the middle of the 1st century A.D. onward, the markets enjoyed by the Italian fabrics were captured by the products of potteries now established in southern, central and eastern Gaul. These manufactured cheaper, more mass-produced and aesthetically inferior red-gloss and black-gloss wares, popularly known as "Samian." some varieties of which continued into the 4th century. The decoration of the Gaulish pots was, for the most part, molded; but some vessels carry applied motifs made in individual molds; while others show designs incised to counterfeit cut glass. Yet another type of ornament was carried out in the *en bavbotine* technique, by which relief work was produced by trailing liquid clay across the surface of the pot. As regards the content of the decoration, themes from daily life were added to the traditional subjects based on Greco-Roman mythology and on natural history; and it is the *en barbotine* hunt cups, of which the leading centre of production was at Castor. Northamptonshire, that are the highlight of the native Romano-British potter's craft. A late-antique class of red-gloss pottery, knonn as late A ware, with scenes in relief from Greek mythology and from the Roman spectacles and shows, was manufactured in some southern Mediterranean area. probably in Egypt.

Coins and Medallions.— Lastly, a brief allusion must be made to the die-sinker's art, closely linked aith that of the gem engraver. The imperial portraits displayed on coins throughout the period of the empire, and on medallions from the early 2nd century onward. provide a continuous iconographic series that can rank nith the best works of the portrait sculptors. Many of the reverse designs, beginning nith those of the late republic, show figure scenes and single figures treated with the utmost delicacy and finish. Especially noteworthy for their pictorial character are the reverse types of the large 2nd-century bronze medallions, with themes from Greek mythology, Roman legend and contemporary Roman history. The reverse designs of some of the late 3rd- and 4th-century gold and silver presentation pieces illustrate most conspicuously the high standards of craftsmanship to which the late antique could still attain. For interest of content few medallions can rival the large gold multiple, found at Arras, which Constantius Chlorus struck in 296 to commemorate his entry into London after defeating the usurping "British emperor" Carausius. *See* also Index references under "Roman Art" in the Index volume.

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ROMAN CATHOLIC CHURCH. The word "ecclesia" appears in the New Testament 106 times: twice in its ordinary Greek sense of the assembly of the city-state of Ephesus, once of the community of the Israelites at Sinai and on all other occasions of the society or Church of Christ. whose members were called Christians first at Antioch. St. Paul uses the word both of local societies. "churches" of Judaea, Asia, Galatia, Macedonia, the Thessalonians or in Philemon's house (as he speaks of "them of Laodicea"), and also of the "whole Church of God." In Matt. xvi, 18. Christ answers St. Peter's confession, "Thou art Christ, the Son of the living God." by saying. "Thou art Peter: and upon this rock I will build my church." In Matt. xviii. 15–20, He defines what may be called ecclesiastical jurisdiction: "If thy brother shall offend against thee . . . tell the church. And if he will not hear the church, let him be to thee as the heathen and publican; . . . whatsoever you shall bind upon earth, shall be bound also in heaven: and whatsoever you shall loose upon earth. shall be loosed also in heaven. Again I say to you, that if two of you shall consent upon earth, concerning anything whatsoever they shall ask, it shall be done to them by my Father who is in Heaven. For where there are two or three gathered together in my name, there am I in the midst of them." In tracing the origin of the church back to the apostles, Catholic theologians also cite as the most mature and conscious definition of the Apostolic Church the following passage in the Epistles to the Ephesians and Colossians: ". . . the Kingdom of the Son of His love: in whom we have our redemption, the forgiveness of our sins; who is the image of the invisible God, the firstborn of all creation; for in Him were all things created in the heavens and upon the earth . . . all things have been created through Him and unto Him; and He is before all things and in Him all things consist. And He is the head of the Body, the Church." (Col. i, 13–18). "To sum up all things in Christ . . . and He put all things in subjection under His feet and gave Him to be head over all things to the Church which is His Body, the fullness of Him that filleth all in all" (Eph. i, 10, 22–23).

This organic unity of Christ, "the fullness of the godhead bodily," with the church "which is his body" is the essence of Catholic ecclesiology. In Christ, according to Roman Catholic doctrine, the godhead assumed human nature: the nature of man is united in Christ with the nature of God. and the church is therefore the divine organism. But the nature of man implies a historical and instituted existence on earth. "By the very fact of being a body," said Leo XIII, "the church is visible." Its existence, institution and operation are therefore sacramental. It is the mystery of the incarnate godhead perpetually realized and available in all time and for all the purpose of the divine incarnation. There can be but one such church and, as it is historical and instituted on earth, there can be but one church visible on earth. As it is divine as well as human, it contains and consummates the whole divine creation, "the Church triumphant, the Church suffering and the Church militant: and is the fullness [*pleroma*] of Him that filleth all in all." Hence it is holy and catholic. Its institution is simultaneously divine and human. Historically and therefore upon the authority of its divine Founder, this church is the church of His apostles. It is apostolic and its apostolicity is its perpetual attribute. Within the compass of its sacramental purpose it is infallible. in the sphere of faith (*i.e.*, man's apprehension of God) and in the sphere of morals (*i.e.*, man's essential relation with God and man). This infallible authority. Catholic theologians point out, is not to be confounded in any sense with "power": it is the infallible authority of knowledge which is of the essence of the union of man with God—knowledge not achieved as in the natural sciences externally by observation, hypothesis and experiment, but inherent and essential as God knows Himself and His creature and the nature of the unity which He wills and accomplishes. The effectual operation of this entire sacrament, the vital activity of the divine organism, is known as grace.

Grace is the universal operation of the church. It is the initiation, process and fulfilment of the divine activity of redemption by which God unites His creatures organically with Himself and endows them thus with His own vitality. This universal grace or sacrament is effectually realized and defined in seven sacraments, acts of God in and through the divine organism by which the divine life is bestowed and the organic union is accomplished and sustained. In the Eucharist "under the appearances of bread and wine, Jesus Christ Himself is contained, offered and received." It is the whole act of redemption, the sacrifice—that is, the making holy—of the whole universe in the person of Christ, "the most divine gift emanating from the depth of the heart of the Redeemer 'with desire desiring' this wonderful union with men which was especially designed to spread everywhere the life-giving fruit of His redemptive work" (Leo XIII, encyclical Mirae caritatis, 1902). Baptism is the initial reception of the human being into the body of Christ. Confirmation given to members of an age to recognize and will their membership is the sacrament of moral maturity. Marriage is the sacrament which sustains in Christ human generation and family life. Penance restores the union with God when it has been injured or broken by sin. Holy Order creates and sustains the whole institution of priesthood and episcopacy by which the divine organism lives and functions on earth. Thus the penitent confesses his sin to Christ, who hears, judges and absolves him by means of the human priest, and the sacrifice of Calvary is contemporary with all times as the same sacrifice is offered by the same High Priest employing successive generations of men ordained by Him for that purpose. The passage or expectation of death is sanctified by the sacrament of extreme unction. Thus the whole earthly life of every human being is organized in the body of Christ, and the whole organization of the church exists to realize that divine-human community. The history of the church cannot be understood unless its nature and function as the

divine-human organism, wholly divine and wholly human and indissolubly one, is first recognized.

St. Luke ends his account of St. Paul's apostolate at Rome with the words "This salvation of God is sent unto the Gentiles." St. Paul himself explains the significance of that climax in the Epistle to the Galatians. As a Jew turning to the Gentiles he must claim that the old dispensation has been superseded and that to be "in Christ" (a phrase repeated six times in this Epistle and constantly used thereafter by St. Paul) is to belong to "the Jerusalem that is above" in which "there can be neither Jew nor Greek." It was only by the act of God that the sanctities and exclusions of the old law could be at once fulfilled and superseded, and hence the same authority which united Jew and Gentile realized the purpose of history. "If ye are Christ's then are ye Abraham's seed, heirs according to promise." In the Epistle to the Ephesians written probably from Rome this doctrine of divine consummation becomes explicit, "a dispensation of the fullness [*pleroma*] of the times, to sum up all things in Christ. . . . for he is our peace who made both one and brake down the middle wall of partition . . . that he might create in himself of the twain one new man, so making peace, and might reconcile them both in one body unto God through the Cross." "So then ye are no more strangers and sojourners but ye are fellow citizens with the saints and of the household of God, being built upon the foundation of the apostles and prophets, Christ Jesus himself being the chief comer stone: in whom every building fitly framed together groweth into a holy temple in the Lord." (T. S. GY.)

This article is divided into the following sections and divisions:

I. ORGANIZATION

The Catholic Church is governed by a hierarchy of bishops with the pope as bishop of Rome at the head (see PAPACY). Under him patriarchs, archbishops and other greater prelates are possessed of various local jurisdictions over the bishops of their respective provinces. The church teaches that the origin of all this varied jurisdiction must be sought in the authority given by our Lord Himself, and recorded for us in the Gospels. Just as no man, not even an apostle or the chief of the apostles, could institute a sacrament, so it was not in the power of man alone to originate the fundamental organization of the church. Christ Himself before He ascended into heaven left the church an organized body, with a system of rule that could indeed be developed indefinitely to meet the constant changes which must inevitably occur as the centuries passed. but which in its fundamental principles must remain unchanged to the end of the world.

The bishop of Rome, who as head of the whole church acquired later on the exclusive title of "pope," was also the sole patriarch of the west, while Alexandria and Antioch governed most of the east. In the 5th century two other bishops attained to the patriarchal rank. Constantinople as being the seat of the empire and civil capital of the world, and Jerusalem as the cradle of the church. Under these was a complicated and ever-varying system of jurisdictions of exarchs, metropolitans and archbishops, but the principle by which alone the whole system of subordination of one bishop to another can be justified, in view of the essential equality of all, can be found only in the special grant by our Lord of the primacy to St. Peter and the delegation of some share in that primacy to the rest of the hierarchy.

This principle, which was recognized even at Nicaea, is symbolized and expressed by the practice of sending the pallium by the pope to every archbishop in possession of jurisdiction. The pallium comes from the tomb of St. Peter, where a supply is kept in readiness, and symbolizes and conveys such share in the Petrine primacy as belongs to the particular office. Until an archbishop has received his pallium from the pope, he cannot exercise any archiepiscopal jurisdiction, though he is possessed as soon as he is fully appointed of all the jurisdiction which belongs to him as bishop of his own diocese.

In 1960 the number of Catholics in the world was estimated at about 538,000,000, governed by about 1.500 archbishops and bishops, each in his own diocese.

A. THE CURIA

As the pope has the care of the whole church (that is, of many millions of Catholics spread throughout the world), there is need for an extensive and detailed organization at Rome adequate to cope with the varied questions that arise. This organization is called the Curia. (See CURIA ROMANA for details.)

Cardinals. — At the head of the Curia is the College of Cardinals whose members form the supreme senate of the church and are the pope's direct advisers. Historically the cardinals are the occupants of the "suburban" sees, known as cardinal bishops; the incumbents of the principal parishes of Rome, known as cardinal priests; and a number of cardinals who are the successors of the seven deacons responsible in early times for the more secular details of administration and who are known as cardinal deacons. But these ranks are distinct from the orders of the church and the cardinal priests are always bishops, half their number being the occupants of various important sees and nonresident in Rome, while the cardinal deacons in the 20th century are always priests.

The cardinal secretary is, so to speak, the prime minister of the pope. It is his office to deal with all political affairs, and especially all diplomatic relations with the separate countries and governments. From his department depend the nunciatures and delegations which represent the Holy See abroad, and it is with him that the ambassadors from foreign countries to the Holy See do their business.

Congregations. — The work of the Curia is done by 11 permanent departments, called congregations, each with a cardinal at its head. These comprise: (1) the Holy Office; (2) the Congregation of Ceremonies; (3) the Consistorial Congregation, dealing with the appointment of bishops and other dignitaries, with the erection and division of dioceses and with episcopal administration; (4) the Congregation of the Eastern Church, dealing with the Uniates (see below); (5) the Congregation of Rites; (6) the Congregation of Seminaries and Universities; (7) the Congregation of Sacramental Discipline; (8) the Congregation for Religious, dealing with the affairs of regular orders; (9) the Congregation of the Council, dealing with the summoning and management of councils and also regulating parish priests. benefices and property; (10) the Congregation for the Propagation of the Faith, for missionary organization; and (11) the Congregation for Extraordinary

Affairs. The Congregation for the Fabric of St. Peter's is supernumerary.

Offices.—Some of the ordinary routine business of the church is carried on by the offices; these, however, had declined in importance by the 20th century. They are: (1) the Chancery. which has little to do apart from the sending out of papal bulls; (2) the Dataria. dealing with those benefices the appointment to which is reserved to the Holy See; (3) the Apostolic Camera, which once controlled the affairs of the papal states and now has the care of the property of the Holy See; and (4) the Office of Briefs (sent to princes) and of Latin Letters.

Tribunals.— The tribunals, which control the judicial functions of the Curia, are. (1) the Sacred Penitentiary, handling matters of conscience; (2) the Sacred Rota, formerly the chief court of the papal states, now the court of appeals from bishops' courts to the Holy See, consisting of ten judges who sit generally in threes but for important cases in greater numbers; (3) the Apostolic Signatura. the supreme court of appeal, consisting of six cardinals and their assistants, to which an appeal lies from the Sacred Rota.

B. THE LATIN RITE

The great majority of Catholics are those of the Latin rite; *i.e.*, those who use the Roman liturgy and generally have used it without interruption since the establishment of a Christian church in their country; there are local variations of little significance. The following paragraphs describe the hierarchical system of the Latin rite.

1. Archbishops.— Besides their own episcopal jurisdiction over their own dioceses. these greater prelates, whatever their title. have a provincial jurisdiction over their "suffragan" bishops. This jurisdiction is one strictly limited by law, the presumption being always in favour of the bishop and against the archbishop. It is attached to the office and therefore is "ordinary" jurisdiction and affects the suffragan' bishops immediately and the faithful of their dioceses through them. The extent of this jurisdiction varies considerably in different localities and is everywhere less extensive than in former years. It is the archbishop's duty to summon his comprovincials to the provincial synod, which need be done only once every 20 years, and in that synod he presides of right, though his vote counts for no more than that of any other bishop. If the suffragan bishop has neglected to carry out the canonical visitation of his diocese, the archbishop may visit, after obtaining permission from Rome, and has full power of redressing abuses. When any one of the suffragan sees becomes vacant it is generally the duty of the archbishop to see that the cathedral chapter elects a vicar capitular to carry on the administration of the diocese during the vacancy. An appeal lies from the court of any one of the suffragan bishops to that of the archbishop, and where the rights of the bishop are involved he may hear cases from that bishop's diocese as a court of first instance. Appeals from his own diocesan court, which formerly had to be taken to the Holy See, are heard by some one bishop selected by the archbishop for that purpose once for all and approved by the Holy See. The archbishop has always the right of pontificating in any church in his province and may bless the people, grant 100 days' indulgence and have the cross carried before him in the church. He may not, however, except when he holds a visitation. perform any other acts which imply jurisdiction.

2. Bishops and Dioceses.—The bishop and the diocese form the most essential part of the church's organization, being of divine institution under the primacy of the pope.

Bishops.—A bishop is nominated under different conditions in different parts of the world, but even after he has been thus canonically nominated he has no power until that nomination has been confirmed by the Holy See. Once this confirmation has been given and has been communicated to his cathedra1 chapter he has full possession of all episcopal jurisdiction, though he can do no acts involving the power of order, such as ordaining clergy or confirming children, until he has been consecrated. His jurisdiction is ordinary, limited by restrictions imposed by the Holy See, but independent of his people and even of his clergy. In certain important matters he is bound to seek the advice of his cathedral chapter, though he is not usually bound to follow it. He is bound to make a visit ad *limina* ("to the thresholds"; *i.e.*, to the graves of St. Peter and St. Paul at Rome) to the Holy See at stated intervals to report on the state of his diocese. His authority over his diocese is fourfold: (1) teaching, with authority over all schools, and the right of superintending all the publications of the faithful and especially of the clergy within his diocese; (2) *legislative,* in which his power is strictly limited by the common law and by all existing laws which have wider scope than the bounds of his own diocese. though he can dispense from all diocesan laws; (3) *judicial,* whereby he is judge of first instance in all cases that belong to the ecclesiastical tribunal. can in the internal forum reserve to himself the absolution from certain sins and can enforce his sentences of ecclesiastics by suspending them from their functions; (4) administrative, whereby he can nominate, subject to any local rights of patronage, to all benefices in his diocese, can oblige ecclesiastics to undertake special work (though he can not force the care of souls upon them if they are unwilling) and has authority over all ecclesiastical property, so that none can be alienated or sold without his consent. But in nothing is his power unlimited: he is always subject to the precepts of canon law.

The Cathedral Chapter.—In the general regulations of his diocese the bishop must conform to the general laws of the church and must not do anything which would impair the general unity of church government. He has as his constitutional council, to assist him in the work of government, the canons of his cathedral chapter. The cathedral itself is the church in which he has his seat (cathedra), and this he cannot choose at will, the pope reserving to himself the right of erecting a church to be a cathedral, as well as that of instituting a chapter. Generally, of course, the bishop finds both already established and in existence. The appointment of individual canons is generally in the hands of the bishop, though the appointment of dignitaries in the chapter is often reserved to the Holy See. As the chapter constitutes the diocesan senate, the bishop is bound to convene it and to ask its consent or advice in important matters. In some matters which touch diocesan rights or affect diocesan property. its consent is necessary and the bishop cannot validly act without it. In other matters, though the advice of the chapter must be asked. the bishop is not bound to act upon the counsel tendered. When the see is vacant by the death or resignation of the bishop, the chapter succeeds to his ordinary jurisdiction. but not to any jurisdiction that was personal to himself. Within eight days after the vacancy the chapter must elect a vicar capitular. to whom the whole administration of the diocese immediately passes. In the Cnited States and elsewhere: where cathedral chapters are not yet constituted, a body of diocesan consultors has generally to be appointed by the bishop, and he is bound to ask the advice of these consultors on important matters, though they have not the power of vetoing his action.

The Vicar-General.—The bishop generally appoints one or more priests to assist him. deputing to them with a certain universality of power all his own jurisdiction within the diocese, so that the vicar-general is his alter ego, and no appeal lies from the one to the other. By virtue of this general mandate the vicar-general exercises ordinary jurisdiction throughout the diocese in the bishop's name. This jurisdiction however, being dependent on that of the bishop, ceases at the bishop's death, or with the cessation of the bishop's own jurisdiction. The office of a vicar-general ceases also with his own death or resignation, or with the withdrawal of his vicarial mandate, which last, horvever, can be taken from him only for a grave cause, allowing of an appeal to the Holy See.

The Diocesan *Chancery.*—This is the office through which the ordinary and routine work of the diocese is carried on. At its head is the chancellor. His duties are to carry on the official correspondence of the diocese and to see that records are duly kept. He can be removed by the bishop, but by the vicar capitular during a vacancy only with the consent of the whole chapter.

The Parish.—Where the full organization of the church is in force. the diocese is subdivided into parishes covering the whole ground. Each parish should have its own church and be under its own pastor, having care of souls and irremovable except

for grave cause. But where the full organization is not in force, there are quasi parishes, with pastors who do not possess the full rights of parish priests. The bishop can alter the boundaries of parishes, erect new ones or join two together where there is just cause for so doing. He is bound, however, first to ask the counsel of the chapter, though he is not bound to follow it.

The pastor of a properly constituted parish has ordinary jurisdiction. His rights within the parish are regulated by canon law and include the faculties of preaching, celebrating Mass, hearing confessions and administering the sacraments, though he can delegate this authority. Where the parish is too large to be administered by one priest, assistant priests are sent by the bishop to help him. These assistants are appointed by the bishop (though in some places the parish priest has the right of nomination) and are removable by him, but only for just cause. Their jurisdiction is delegated and they receive their faculties from the bishop.

If the parish priest is ill or incapacitated for any reason, the bishop must send a coadjutor to fill his place and in like manner will appoint an administrator of the parish during a vacancy.

3. Vicars Apostolic.—In districts where the ordinary hierarchy of the church has not yet been established and there are no proper dioceses erected, the Holy See governs directly by means of a delegate who has received episcopal consecration to a titular see and who has the title of vicar apostolic or prefect apostolic. The main difference between the two is that the vicar apostolic is bound to make the visit *ad limina* at certain intervals, while the prefect apostolic is not. They are not diocesan bishops and therefore have no cathedral and no chapter, and all their powers are delegated and not ordinary. Otherwise they enjoy as a rule all the powers that bishops have by canon law in their own dioceses. They have no vicar-general, though they can give special faculties to individual priests to enable them to assist in the rule of the district, and as they have no chapters they are bound to nominate three or more of their leading priests to act as counsellors. There are vicariates apostolic, prefectures apostolic and "missions."

C. THE UNIATE RITES

All that has been written so far about the local organization of the Catholic Church applies only to the western church and the Latin rite, which include the vast majority of Catholics But there are also a number of so-called Gniate churches in full communion with the Holy See but organized separately. These do not represent, as is often thought, any sort of compromise or intermediate position between western Catholicism and the various schismatic or heretical churches of the east. All the Cniate churches accept the full Catholic faith and are in matters of doctrine absolutely at one with Rome. They all accept the full primacy of the Holy See and are subject to its supreme jurisdiction. Each Uniate church retains its old privileges and represents the church of its district or country as that church would have been had the schism never occurred. In no case, however, has the succession from the ancient hierarchy been preserved, but a new hierarchy has been instituted from Rome, with the old titles and privileges and with the preservation of the ancient rite. The object aimed at by Rome in instituting a Uniate church is not the latinizing of the ancient rites but the union of hearts in the one faith and under the one primacy of the Holy See.

Religion in the east has always been far more a matter of nationality than it has in the west. It has been found impossible, therefore, to carry out the strict system of territorial jurisdiction which obtains everywhere in the west. In the east the churches are distinguished rather by nationality, by languages and by rite than by locality, and in consequence there is a system of interpenetrating jurisdictions. There are, for instance, seven patriarchs of Antioch. Of these, three are schismatic, but four are in communion with the Holy See: the Latin patriarch, whose position is merely titular (originating during the crusades) and who resides in Rome; the Melchite patriarch, the Maronite patriarch and the Syrian patriarch. These last three have jurisdiction over the Catholics of their own rite only.

The Uniates in Europe are more or less directly subject to the general system of the Catholic Church. Those in Asia and Africa, however, since the rights of the patriarchates have been preserved, enjoy greater autonomy, being ruled by the Holy See mainly through their respective patriarchs. (A. S. BA ; X.)

1. The Byzantine (Greek Catholic or Graeco-Slavonic **Rite).**—Uniates of this rite represent churches that maintain, in their various languages, the liturgy of Constantinople a-hile acknowledging the doctrinal and hierarchical supremacy of the Holy See. The most important of these churches is the Ruthenian: this includes an archbishopric of Lwow (with suffragan bishoprics at Przemysl and Stanislawow) and bishoprics of Uzhorod, of Presov (under the Holy See), of Hajdudorog (under the Latin archbishop of Esztergom) and of Krizevci (under the Latin archbishop of Zagreb). The important dates for its union with Rome are those of the synod of Brest-Litovsk (Brzesc; 1596) and of the submission of Lwow (1700). New persecution came to the Greek Catholics after World War II when the Soviet authorities ruthlessly followed policies designed to tear them from union with the See of Rome.

The Rumanian Uniates have an archbishopric (Alba Iulia and Fagaras, established in 1701) with four suffragan bishoprics. The Russian Uniate archbishopric (Mogilev, with four suffragans) was subjected to a compulsory latinization under the tsar Alexander II. There are Catholics of Byzantine rite, however, in Greece, Bulgaria and Turkey. The Italo-Greek (Albanian) Church in Calabria and Sicily has the bishoprics of Lungro (founded in 1919) and Piana, both under Latin archbishoprics.

Of the Byzantine rite also are the Melchites (or, more properly, Melkites) of Syria, Lebanon, Jordan and Egypt, whose liturgy is in Arabic. They are so much to be distinguished from the Europeans of the Byzantine rite, however, that the term "of the Melchite rite" is now used of them. Their name, meaning "king's men," was originally a term of disparagement bestowed by their Monophysite fellow countrymen on those oriental Christians who remained loyal to Constantinople and therefore to the eastern Roman emperor's ("king's") religion after the council of Chalcedon (451). Their change from the Byzantine allegiance to the Roman is generally dated at 1724, when the patriarch Athanasius Dabbas acknowledged the Holy See on his deathbed; but his Catholic successor, Cyril VI Tanas, was deposed, and it was not until 1834, after the Egyptian invasion of Syria, that a Catholic patriarch was returned in the person of Maximus III Mazlum (confirmed by Rome in 1836). The Melchite patriarch of Antioch resides at Ain Traz in Lebanon. There are archbishops of Aleppo, of Beirut and Jebeil, of Bostra and Hauran, of Damascus (two suffragans), of Emesa, of Tyre (four suffragans) and of Jordan.

2. The Armenian Rite.—Uniates of this rite use a liturgy adapted from that of the Gregorian (Monophysite) Armenian Church. Their connection with Rome is sometimes dated from 1198; but a stronger movement of union began with the Dominican missions in the 14th century, although the specifically Armenian hierarchy was not established until the middle of the 18th. The patriarch of Cilicia resides at Bzommar near Beirut. There are archbishoprics of Mardin, of Sebaste (Sivas) and Tokat, of Aleppo, of Constantinople and of Lwow; bishoprics of Isfahan, of Beirut and of Alexandria, as well as 12 bishoprics in Turkey; and also churches in Greece and in Rumania. The Mechitarists (*q.v.*) of Venice are Armenian Uniates.

3. The Coptic Rite.—The Uniate church of this rite, in Egypt, in Ethiopia and in Eritrea, is drawn from the Coptic Church of the Egyptian Monophysites and has a liturgy in the Coptic language. The Catholic Coptic patriarchate of Alexandria was founded in 1895. There are suffragan bishoprics of Hermopolis Magna and of Thebes.

4. Syriac Liturgies.—Whereas the provenance of the Byzantine, the Armenian and the Coptic rites of Uniates is easily understood, that of the various Syriac rites may require some preliminary explanation. Historically, there are two sources: the East Syrian, Assyrian or Nestorian *Liturgy of the Apostles Addai and Mari;* and the West Syrian, Jacobite or Monophysite *Liturgy of St. James.* The former gave rise to two Uniate rites, the Chaldaean and the Syro-Malabarese; the latter to three, the Syrian, the

Maronite and the Syro-Malankarese. However, a classification here by East Syrian and West Syrian groups would involve difficulties of nomenclature and a misleading fusion of distinct bodies. The rites will therefore be introduced separately.

The Chaldaean Rite.—The Uniates of this rite, mainly in Mesopotamia and Kurdistan, use the Liturgy of Addai and Mari and have also a Syriac vernacular. Union with Rome is dated at 1551, when John Sulaka led the first group of converts from Nestorianism, and at 1680, when Joseph of Amida (Diarbekr) led the second. The patriarch of Babylon resides at Mosul, and there are archbishoprics of Keruk and of Urmia and eight suffragan bishoprics.

The *Syro-Malabarese* Rite.—Catholics of this rite represent those Christians of St. Thomas (see THOMAS, SAINT) who nere converted to the Roman allegiance by the Portuguese at the synod of Diamper (Udayamperur, in Cochin) in 1599. They use a form of the Liturgy *of* Addai and Mari, as their antecedents were Nestorian. The archbishopric of Ernakulam has suffragan bishoprics of Changanacheri, of Kottayam and of Trichur.

The Syrian Rite.—The term "of the Syrian rite," though in a general sense applicable to several churches, is used specifically to designate Uniates using the Syriac Liturgy of St. James, with certain formulas in Carshuni (Arabic written in Syriac), and representing Christians formerly of the Jacobite persuasion who were united with Rome in 1646. Their patriarch of Antioch resides at Mardin in Turkey, and there are archbishops of Damascus, of Emesa, of Baghdad and of Mosul, as well as four diocesan bishoprics.

The Maronite Rite.—The Maronites (*q.v.*) of Lebanon represent a community which was probably at first Monothelite, originating after the council of Constantinople in 680–681. Though they renounced Monothelitism in 1182 and were united with Rome until the end of the Latin kingdom of Jerusalem (1187). the connection was subsequently broken and not permanently resumed until 1736. As the Syrian Uniates, they use principally the Liturgy of St. James and formulas in Carshuni. Their patriarch of Antioch has authority over bishops of Aleppo, of Beirut, of Cyprus, of Damascus. of Heliopolis, of Jebeil and Batrun (Botrys). of Sidon, of Tripoli and of Tyre.

The *Syro-Malankarese* Rite.—When the Dutch in 1663 put an end to the Portuguese domination of Malabar, numbers of the Malabarese abandoned the Roman connection (see above, The Syro-Malabarese Rite) but, instead of reverting to Nestorianism, accepted in 1665 a Monophysite bishop from' the Jacobite patriarch at Mardin. In 1930, therefore, when some of these Jacobites were united with Rome again. the Liturgy of St. James was retained. The archbishopric of Trivandrum (established in 1932) has a suffragan bishopric at Tiruvalla. (X.)

II. HISTORY

The human institution that is the fullness of the godhead bodily was to be governed on earth by a sacramental sovereign as agent or representative, the apostle or "vicar" of Christ. That this "vicar of Christ" should be the bishop of Rome belongs to the "logic of history"; and, in the faith that "the Word which is God. became flesh and dwelt among us," history assumed a validity not realized before or elsewhere. If, in "the fullness of time. God sent forth His Son born of a woman," He selected the Roman imperium as the historical circumstance of that incarnation. Rome was not merely the metropolis of that humanity but the seat of an actual and formative sovereignty beyond comparison more effective and significant than that of any other imperial city. Here if anywhere the City of God must encounter the "fullness of manhood bodily." Within a generation of the death of the apostles, Roman legions had destroyed the temple at Jerusalem. Less than a century later the tradition of St. Peter's presence in Rome was. as Louis Duchesne (*q.v.*) stated. "precise and universal." Duchesne further declared that Dionysius of Corinth in Greece, Irenaeus in Gaul, Clement and Origen in Alexandria and Tertullian in Africa all referred to it, that in Rome itself Caius. about 200, pointed out the tomb of the apostles. that by the 3rd century popes built on their title of successors of St. Peter and that their right to this title is nowhere denied. Clement (c. 97) thinks it natural for the church in Rome to address a letter of advice to the church in Corinth upon the outbreak of an "execrable and godless schism." Ignatius of Antioch apostrophizes the Roman Church with a series of titles such as he addresses to no other. It is above all "a church presiding in charity, maintaining the law of Christ, and bearer of the Father's name." At his martyrdom he asks for the prayers of the Roman Church for the church in Syria since "Jesus Christ alone will be their bishop, together with your charity." (Ancient Christian *Writers,* vol. i, tr. J. A. Kleist, Newman Press, Westminster. Md., 1946.) Irenaeus, who came from Asia Minor and wrote Greek in southern Gaul, and whose work found an immediate public in Egypt, was world-conscious and belonged to a world community not only as a theologian but as a subject of the Roman empire.

The city of the Caesars and of the senate and people of Rome was the seat of the apostles; it was also the city of martyrs and heretics. Persecution and heresy contributed to the mature self-consciousness of the church. The offense of Christianity as defined by Trajan (c. 112) was of the nature of treason—otherwise harmless. The greatest persecutions, those under Decius (250–253), Valerian (257–260) and Diocletian (303–311), were virtual acts of war against "a sovereignty within a sovereignty" which seemed to threaten the empire. The danger would have been as real as it seemed but for the peculiar combination of faith and morals which enabled Christians to "dwell on earth as citizens of heaven" (Epistle to Diognetus). They could thus pray for the emperor's welfare while they denied his divine title (Cyprian). "They obey the established laws, yet their conduct goes beyond those laws"; and "Exposed to the wild beasts to make them renounce the Lord, are they not seen to remain invincible?" (Epistle to Diognetus). Origen's confidence that Christ is stronger than the emperor, the army and the senate and people of Rome was inevitably and essentially Christian. The organic unity of the church was vigorous and visible in ceaseless missionary activity at every level of society and in every province. Christians nursed the sick, visited the prisoners, found employment for the idle and cared for the poor, orphans, widows and slaves. All this, inspired and confirmed by a naïve sense of divine presence, omnipotence and justice. gave the church not only authority over the whole life of its rapidly multiplying membership but an independence of imperial sanctions. Half the interval between Nero and Constantine was persecution, and Diocletian had reason to complain that Christians did not fear death. The martyrs were not only the army of the church: they made explicit what the Christian faith had always implied, a totally new conception of the majesty of the human being as such and of human institutions. Constantine may have been a mystic, but he was certainly a political realist. Paganism died of its unreality. Julian's attempt to revive it in revolt against a corrupt and heretical Christianity (361–362) was no more than an adventure of sentiment and ideology.

Meanwhile the church defined its faith and established an orthodoxy. Definition is not, in the Catholic view, identical with the faith, but it is the means by which the faith becomes incarnate and available in the world and, as such, is implied in and authorized by the incarnation of God. It is thus conditioned by the "fullness of time" and is given to the church by the same authority that created the church, when and as the purpose of redemption and the existence of the church require it. So given it is infallible and final; but it is also the conclusion of a stage in the history of the church on earth, and its enunciation is prepared by a period of questions and uncertain or inadequate or controversial answers. The New Testament, whose canon was fixed c. 120, and the formulary known as the Apostles' Creed, used for the instruction of catechumens at the beginning of the 3rd century, both reveal the doubts and questions which assailed the primitive Christian. The Gospels and the Acts were historical documents; the creed is a catalogue of facts. As against the Jews, the apostolic church proclaimed an eschatology which was no longer a promise but a present reality. As against the docetism and gnosticism which represent the perennial reluctance to accept the faith as a fact, the New Testament and the creeds emphasized the event

and the institution. Gnostic theories—those of Cerinthus. Valentinus, Basilides. Carpocrates and others—were not and did not claim to be histories. They were cosmological myths and speculations, ingenious and sometimes profound metaphysical guesses, against which the primitive church affirmed the supernatural history and, in doing so. realized its own divinely appointed form and existence Fact implied revelation; revelation implied authority and tradition; and all implied the presence on earth of God in the person of Christ and in the Holy Spirit who informed the Holy Catholic Church. Irenaeus (c. 186) finds the authority in "the tradition of the great and ancient church known to all men which was founded and constituted by the most glorious apostles Peter and Paul. by its traditions and its faith announced to all men and descended through the succession of its bishops to us, we confound all those who gather where they ought not" (*Adversus haereses,* iii, 381). Irenaeus. who wrote against the Valentinians, gave also an account of all the principal heresies down to his time. Justin wrote, besides his *Apology,* a *Syntagma* against all heresies, which is lost. Hippolytus in his *Syntagma* attacked 32 heresies. Epiphanius in the 4th century catalogued 80 heresies in the *Panarion.* "The Jewish strain in Christianity with its abomination of the Gentile worships and its assumption that they connoted immorality; the links of community to community which prevented unfettered development; the hierarchic system; the principle of apostolic authority and apostolic tradition; the numerical preponderance of folk with the *foi du charbonnier* [*i.e.,* "implicit faith"] prevented what would in effect have been the absorption of Christianity in Graeco-Roman culture." (A. D. Nock, *Cambridge Ancient History,* vol. xii, p. 446.)

A. FROM CONSTANTINE TO CHARLEMAGNE

Imperial conversion brought into the church all the problems of the empire. Of these the most urgent was the pagan habit of toleration expressed in the Edict of Milan (313), issued in the name of Licinius and Constantine, that "everyone may have licence to worship whatever he pleases." Such toleration came to the Christians as relief. but imperial protection raised the old question of Christ and Caesar in a new, subtle and dangerous form. It not only threatened to confound the church with imperial administration but exposed the faith to the speculative ingenuity and dispute endemic in paganism. These two secular problems coalesced to make theology the subject of party strife. The teaching of Arius, according to whom the Logos was a creature not divine but free, mutable and adopted as Son of God in prevision of his merits, revived the ancient reluctance of the philosophical pagan to accept the incarnation as a fact and relieved the Arian of the revelation and authority which faith in the supreme mystery demanded and presupposed. It was a rationalization not apostolic or holy or catholic, and the Christians who adopted it ceased to be Christian. At the council of Nicaea (325) the word *homoousios* ("consubstantial"), accepted to affirm the deity of Christ against the Arians, was probably suggested by Roman legates. Eusebius, bishop of Nicomedia, who had learned his theology from Lucian of Antioch, used the heresy of his fellow-student Arius as an occasion of intrigue. Without disputing the decrees of the council of Nicaea he devised an imperial formula to comprehend Arians and Catholics and gained the support of Constantine and Flavius Julius Constantius (337–361) for a policy which seemed to promise imperial peace and actually promoted ecclesiastical dissension. This policy not only raised Arian bishops to most of the eastern sees but meant also constant secret interference *a latere* by bishops in the jurisdiction of their brother bishops, the employment of imperial prefects and police in the enforcement of partisan decrees and the habit of using theological formulas not to define the faith but as instruments of ecclesiastical diplomacy. Thus by the carefully packed council of Tyre (335) Athanasius mas deposed on frivolous charges and an Arian, George of Cappadocia, raised with the aid of imperial police to the see of Alexandria. At Antioch in 341 an assembly of roo bishops issued an ambiguous formulary denying that they were followers of Arius but evading the Nicene Creed. Finally, in 359, imperial pressure enforced a similar evasion on the whole episcopate, both western and eastern, at the councils of Ariminum and Selencia. In 360 the formula was accepted which "with a little complaisance Athanasius and Aetius might have repeated together"; and in 361 Constantius was succeeded by Julian, and Arian victory by pagan reaction.

Rome and the west remained comparatively free from the heresy and policy of the east. No longer head of the empire, Rome was still head of the church; the decline from its imperial status emphasized its ecclesiastical independence. The bishop's residence was established on the Caelian hill in the ancient house of the Laterani. owned by Fausta, the emperor's wife; and there Pope Miltiades held a council in 313. A basilica was raised, the existing church of the Lateran. Athanasius, exiled from Alexandria, visited Rome in 339. His news of Antony, Pachomius and the desert fathers kindled among wealthy Romans an interest in ascetic and monastic life which bore fruit in the next generation; and before Pope Julius and a council of 50 western bishops he was acquitted of the charges which had led to his deposition at the council of Tyre. The eastern bishops, who had asked to be invited to this council in Rome, nevertheless declined the invitation when it came. To their ultimatum requiring him to choose betueen Athanasius and themselves, Pope Julius replied that it was natural to hear complaints of bishops who said that they had been unjustly deposed; that in the absence of accusers he had examined the only available evidence, which they had themselves supplied at the council of Tyre; and that he was concerned not with trifling stories but with the unity of the church (340).

1. Eastern Schisms.——Roman theology had not generated the controversial and speculative subtleties which divided the east. A schism left by persecution, between those who had endured and those who compromised with the pagans, had occasioned some disorder which was soon overcome. A greater schism, that of the Donatists, rent the diocese of Carthage. To the historian its main interest lies in its effect upon Augustine, who during 16 years of controversy matured his conception of the Catholic Church. From 413 to 426 he was writing *The City of God.* He was baptized by Ambrose in 387. Two years earlier Jerome (c. 340–420) had retired to Bethlehem to complete his translation of the Bible (Vulgate). Ambrose, born at Trier about 340, son of the prefect of Gaul, became prefect of Upper Italy in 369 and, on the death of Auxentius (nho had accepted the confession of Ariminum), was appointed bishop of Milan. So complete was the popular acclaim that the bishops accepted it as a sign of divine will, as it was certainly human prudence. One of the best of Roman governors thus became one oi the greatest of Christian bishops. His most significant task was to resist the inclination of the empire to control the church. A little younger than Ambrose, his friend Theodosius was made Augustus in 379 and in 380 was baptized a Catholic. In 381 he summoned a council to Constantinople (the second general council). Ambrose at the same time presided over a council at Aquileia. Both condemned Arianism; Theodosius decreed that "all beliefs contrary to the faith clearly taught by the pontiff Damasus and by Peter, bishop of Alexandria, were heresy." He ordered all church property to be restored to the orthodox and named the bishops who were to be so accounted. The council also declared that "the bishop of Constantinople shall have the pre-eminence of honour after the bishop of Rome, for this city is the new Rome," thus founding ecclesiastical dignity on imperial status. Rome rejected this principle. In 383 Theodosius convoked a meeting of Catholic and Arian leaders, and upon its failure issued another edict, never strictly enforced, forbidding heretical worship public and private. So in Milan, Ambrose refused to allow a single Arian church even for Justina. The murder of Gratian and the advance of Maximus through Gaul and Italy called Theodosius to the west, where, after the defeat and death of Maximus, he resided for nearly three years at Milan. Valentinian II also lived there, likewise under the personal influence of Ambrose. The bishop proclaimed and maintained the principle that "the emperor is within the church, not over the church," a principle repeated by Pope Leo I (the Great) after the council of Chalcedon (451): *"Alia tamen ratio est rerum secularium, alia divinarum; nam praeter illam petram quam Dominus*

in *fundamento posuit, stabilis* erit *nulla constructio.*" (As to the distinction between divine and secular authority, it was thus stated, that God's authority is the firm, rocklike foundation, complete and perfect, without need of further strengthening to maintain it.)

Pope Leo was called upon to state once more and in uncompromising terms the fact in which and by which the Catholic Church exists. The heresy at Chalcedon was that of the Monophysites. who declared that there was but one nature in Christ, the divine — another form of the perennial desire to evade the central Christian dogma. The pope's definition, acclaimed by the council as "the voice of Peter," was an uncompromising statement of the fact:

Following, then, in the footsteps of the holy fathers, we all teach in harmony that the Son and our Lord Jesus Christ are one and the same, one and the same perfect in godhead, the same perfect in human nature, true God and true man, the same made of a rational soul and body, consubstantial with the Father according to His godhead, consubstantial nith us according to His human nature. made in all things like us without sin according to His godhead begotten of His Father before all ages; the same in these last days for us and for our salvation born according to human nature of the Virgin Mary, the Mother of God; one and the same to be acknowledged as Christ the Son, the Lord, the only begotten, in two natures not removed by reason of their union, but rather the characteristics of each preserved united together in one person and subsistence, not divided nor shared among tno persons but one and the same: Son, Only-begotten, God, Word, Lord, Jesus, Christ, as the prophets before had said of Him, as He Himself taught us and as the creed of the fathers has handed down to us.

In that statement, there is obviously no attempt to placate human reason and no appeal to human experience. Words are used to command a rational submission of faith to a fact which transcends reason. It is the voice of original authority, not a resultant explanation; foundation. not superstructure — "the stone which the Lord laid as a foundation." Man is whole, is perfectly and eternally human in Christ who is Very God. Nothing can violate the distinction between God and man. The incarnation does not violate but transcends it. and it is thus not an evolution but the consummate act of transcendent godhead which the church announces and embodies. It purports to be a statement of the atonement and sacrifice in which human nature is restored to perfect unity with divine or absolute being. It is announced and accepted as fact by the Roman bishop, "the voice of Peter," at the council of Chalcedon. Thus by the 5th century the church is fully conscious of itself as the issue of that supernatural union, wholly human, wholly divine. From that position there could be no retreat.

2. Fall of the Roman Empire. — The fall of the western empire (476) completed the isolation of the Roman see. Arianism, expelled from the empire, had been established meanwhile among the Goths of the Danube by Ulphilas (Wulfila; d. 383), appointed their bishop by Eusebius of Nicomedia. He taught a Gothic Christianity in the Gothic language, inventing an alphabet and translating the Scriptures. Untrammelled by orthodoxy, this faith needed no apostolic see and was adopted by Goths, Suebi, Burgundians, Vandals and Lombards as a kind of national religion. Gradually the west had been subdued by conquest and infiltration to these races: Africa to the Vandals. Spain to the Suebi and Visigoths. Gaul to the Visigoths and Burgundians. The Avars wasted Pannonia, the Slovenes Styria, Carinthia and Carniola. The Croats and Serbs established themselves south of the Save. Italy was defended by a barbarian army under the Herulian Odoacer, a Catholic, until his defeat and death in 493 at the hands of Theodoric the Ostrogoth, an Arian. who ruled Italy from Ravenna with conspicuous ability and tolerance with the advice of the Catholics Boethius (480–524) and Cassiodorus (*c.* 490–*c.* 585). After Theodoric's death (526) Italy mas conquered by the Catholic emperor Justinian's armies (535–554) under Belisarius and was until the 8th century officially a province of the Byzantine empire under the exarch of Ravenna. The Lombards conquered northern Italy and established themselves at Pavia. At once subject to repeated attacks from the Franks and extending their own conquests in Italy. the Lombards, unlike the Goths. had neither genius nor opportunity for peace. Thus when Gregory I the Great became pope he succeeded to what might be described as "the grave of the deceased Roman empire." He had been praetor and then monk and had lived three years in Constantinople as the nuncio of Pelagius II seeking imperial aid against the Lombards. As Roman and as pope, he saw the world as a whole. Lawyer and judge by training, monk, bishop and apostle by vocation, he realized the creative and redemptive possibilities of the papacy and of the Catholic Church at the moment when outside it and apart from its supernatural certainty all civilization in the west was dead beyond hope of resurrection.

3. Episcopacy and Monasticism. — During the next six centuries the function of the church was to create Christendom, and its chief instruments in this work were episcopacy and monasticism. During Gregory's pontificate the Arian rulers of the Lombards in Italy and of the Visigoths in Spain were baptized Catholics. In j97 his mission of 40 monks landed in Kent under Augustine, "their abbot made bishop, with my permission, by the bishops of Germany and aith their assistance conducted to that nation at the limit of the world." A century earlier (496) Clovis with 3,000 Franks had been baptized by Remigius, bishop of Reims, and was exhorted by Avitus, bishop of Vienne, to spread the faith among the barbarians "corrupted by heretical doctrines." Clovis had respected the property, person and advice of bishops even as a pagan, and he owed his conversion partly to the prudence which recognized in them the virtual rulers of Gaul. He broke the power of the Visigoths at Vouillé near Poitiers and extended his dominion to the Pyrenees, everyahere requiring Arians to become orthodox and restoring their churches after their reconsecration. In Paris, the seat of his government, he built and dedicated a basilica to the Holy Apostles. In the 5th century the monk St. Severinus, a friend of Odoacer, established the authority of personal sanctity over the peoples of the upper Danube. During the 7th. 8th and 9th centuries the Croats were Christianized by Roman missionaries; the Bavarians of Upper Austria by St. Rupert of Worms, who founded a see and a monastery at Salzburg (c. 700) that Charlemagne made an archbishopric (798); Moravia by the Greek monks Methodius and Cyril (Constantine); and Bohemia by its prince, whom St. Methodius baptized (871). Prague became a see in 973. The Magyars, who had withstood a succession of missions from east and west, were at length converted under Stephen I. who established the metropolitan see of Esztergom (Gran) and founded the monastery of Pannonhalma near Gyor Szent Marton (Martinsberg) with five other houses and was crowned with the golden crown sent by Pope Silvester II on the Feast of the Assumption, 1001.

Monasticism was the Christian equivalent of the imperial army, the means by which the church subdued and enlisted, colonized and administered the new peoples and revived or defended the old. The first western monk, St. Martin of Tours (c. 316–c. 400). was a Pannonian, born of pagan parents and bred a soldier; he secured his discharge in order to renounce the world. Under St. Hilary of Poitiers (c. 300–*c.* 368). himself a convert. Martin established a monastery at Ligugé and another at Marmoutier on the banks of the Loire. As monk and bishop of Tours he devoted himself to an ascetic discipline and to the conversion of pagans. Other monastic communities gathered at Marseilles (St. Victor) and at Lérins (St. Honoratus or Honoré) whence another St. Hilary was appointed bishop of Arles (426). St. Patrick visited Lérins and Marmoutier before setting out on his mission to Ireland, for which he was consecrated by Germanus. bishop of Auxerre. About 480 was born St. Benedict of Nursia (*q.v.*), whose *Regula monachorum* or "Rule for monks" (c. 515) became the pattern of all western monasticism. "For thee. therefore, whosoever thou be, my words are intended who, giving up thy own will, dost take the all-powerful and excellent arms of obedience to fight under the Lord Christ, the true King." In that conception of service and society lay the seeds of the rivalry between natural and supernatural sovereignty which appeared full-grown in the 11th and 12th centuries. (See also BENEDICTINES.)

A few years older than the Digest of Justinian (who was certainly acquainted with it), the Rule established a discipline and constitution and regulated a liturgical society with impersonal precision. It represented the religious as the Institutes repre-

sented the civil society. The Rule required self-surrender rather than self-abnegation. Rased on long monastic experience and devotion to the person of Christ (who is to be seen and served in the abbot and in all the brethren, in strangers who visit the monastery and in all its life and work), it was the perfect instrument for creating centres of Christian society above all in rural and pagan territory and for reforming the religious communities of the west. Thus a rational economy, moral training and education in the arts of peace developed about the altars of the church and were available to transform the secular barbarity of war and heroic solitude into Christian civilization. The Irish monk St. Columban, whose rule followed the older pattern of extreme austerity, established four houses for men and two for women in Gaul. His disciple Gallus founded St. Gall on the shores of Lake Constance. Columban died at Bobbio, which he founded as a mission to the Arian Lombards and equipped with books, the nucleus of the most famous of mediaeval libraries. Cassiodorus. Theodoric's minister. attempted in 53j to found a Christian academy in Rome and, failing this, established a house at Squillace in Calabria (Vivarium) with a library for which he composed his two handbooks on divine and liberal learning. "But for the existence of such a sanction for literary culture, it is quite possible that, with the exception of Virgil. no Latin classic would have reached us in a complete form" (Montague James, *Cambridge Medieval History*, vol. iii, p. 486).

The greatest single achievement of monastic missions was the conversion of Britain. Thanks to Gregory I and Augustine. English monasticism mas Benedictine. The Benedictine abbey at Canterbury was the metropolitan church. The influence of this type of mission was apparent at once. It created a culture. introduced the Roman alphabet and inspired a literature first in Latin and then in the vernacular. It acquired lands and rights which were recorded in documents and, as its teaching influenced custom, it codified the laws, as Bede says, *"justa exempla Romanorum,"* after the model of Roman justice. The fact that England unlike Gaul, Italy and the lands of the continental barbarians, had nothing but pagan custom and a rudimentary civilization gave the monks a more complete victory.

The attachment of English Christianity to the Roman see was the stronger as Gregory I was the apostle of the English; and Christianity without imperial tradition and Roman law was free to develop with and through indigenous custom. Benedict Biscop (q *v*) is said to have made seven pilgrimages to the tomb of the apostles. He visited Lérins. On the third journey he brought with him Theodore of Tarsus and Abbot Adrian of Naples, both monks who brought a knowledge of Greek and an infectious love of learning (668). Aldhelm (*c.* 640–709), trained at Malmesbury and Canterbury, abbot of Malmesbury and bishop of Sherborne, architect, Latin scholar and English poet, represents the first fruits of this English culture, whose greatest figure is Bede (*c.* 673–735). His contemporary St. Boniface or Wynfrith (d. 754), a monk of Exeter, carried the mission with the sanction of Pope Gregory II and the help of Charles Martel into Bavaria, Thuringia. Friesland. Hesse and Saxony. He established eight bishoprics and founded many monasteries, above all Fulda, where he hoped to die. He reformed the work of Irish monks with Roman and Benedictine discipline. In 747 he was appointed primate of his great province of Mainz. In 751 he consecrated Pippin, who with the authority of Pope Zacharias had been elected king of the Franks and in imitation of the English kings wished to be anointed. St. Boniface finally resigned his see and went to preach the faith to the Frisians. by whom he was martyred (754).

4. The Rise of Temporal **Power.**—Meanwhile, in the civilized east the Christological discussion continued. The pope, though a subject of the (Byzantine) emperor, was head of the church, and the east, always divided in faith, had always been uncertain in ecclesiastical submission. The churches of Egypt and Syria, strongholds of Monophysite theology and jealous for the dignity of Alexandria, had refused the decision of the council of Chalcedon. The emperor Zeno tried an accommodation, the *Henoticon* (481). Justinian, a Macedonian Catholic, in the controversy of the "Three Chapters" (553), forced the aged Pope Vigilius to attend the fifth general council at Constantinople and to assent to the condemnation of Theodore of Mopsuestia. Theodoret and Ibas, three writers who had been accused and acquitted of Nestorian heresy at Chalcedon. The emperor Heraclius tried the formula known as Monothelitism, which ascribed one "active energy" to the Saviour, translated by the Latin bishop as "one will"; and Pope Honorius, mistaking the question, professed himself willing to assent. Pope Martin I (649–653) refused this concession and was exiled by the emperor Constans II (641–668) to the Crimea. The sixth general council (680) vindicated Martin I, condemned Monothelitism and criticized Honorius. Nevertheless, in 692 the council *in Trullo* (Quinisext) was deliberately anti-Roman, and Pope Sergius, arrested at the orders of Justinian II, was saved only by force from the imperial officer. Finally the emperor Leo III the Isaurian (717–740) had initiated his campaign of iconoclasm in 725, the most unpopular and unnecessary of reforms, enforced by persecution and confirmed by the council of Hieria in 753. The schism endured until 843.

But the emperor, if he was willing to force the Roman bishop to submit in matters of doctrine. was quite unable to defend his Roman subjects from their enemies in the flesh. It mas out of long Roman experience that Pope Zacharias (741–752) answered Pippin's question concerning kingship that the king should be he who really has power to rule. Neither Roman nor Byzantine sovereignty had been bound by a doctrine of legitimacy: the prince was the guardian of law and peace. In Rome the bishop and the people were bound together by ties of faith, history and administration. The walls, defenses, aqueducts, food, hospitals, finance, justice and religion were in the bishop's charge. Not only the city but the west as a whole was in need of defense. In 711 Spain and Sardinia had fallen to the Arabs. Sicily was frequently raided by Saracens, who exacted tribute from Syracuse. In 732, at Poitiers, Charles Martel broke the Moslem invasion! saved Aquitaine and established his title as defender of Christendom. Thus. when, in 751, the Lombard Aistulf seized Ravenna, threatened Rome and meditated the conquest of Italy, Pope Stephen II (752–757), having appealed in vain for help to the emperor, turned to Pippin. He journeyed into Francia, crowned Pippin at St. Denis and, returning to Italy with the army of the Franks, received Ravenna from Pippin, who destroyed the Lombard forces (756). Charles the Great completed the conquest by capturing Pavia (772–774).

Thus the pope became a sovereign prince. His "temporal power" was the consequence of an inevitable severance of west from east, of the barbarian and Moslem invasion and of his apostolic function to maintain the faith as against the heresies and schisms which were endemic in the eastern imperial system and to evangelize the pagans of the west. Gregory I, reminding bishops that they were the salt of the earth and that, above all else. men expected of them the salvation of souls, said that "nevertheless even now there are no worldly affairs which priests do not administer" *(Liber regulae pastoralis,* 59j). Pippin, son of Charles Martel, brought up by the monks of St. Denis and consecrated by St. Boniface, held much the same conception of episcopacy.

Charles the Great. after 800, was not only Augustus but "crowned of God, great and peace-bringing emperor who rules the Roman empire and who by the grace of God is king of the Franks and Lombards." He read St. Augustine's *De civitate Dei* and, admitting that the old Roman empire was the *civitas terrena* ("the earthly city"), regarded himself as governor under the Emperor of Heaven of the City of God. For 30 years (772–804) he made holy war on the pagan Saxons, and when he died in 814 his empire, extending from the Elbe to the Pyrenees, from the English sea to the Tiber. was united in so far as it was Christian. His school under Alcuin of York (735–804) was the cultural centre of this empire. Louis I the Pious, crowned at Reims by Stephen IV (816), co-operated with Pope Paschal I in his desire to convert the Danes. The archbishop of Reims. the bishop of Cambrai and a mission of monks under Anskar spread the faith about the mouth of the Elbe. A monastery was founded at Korvey (822) and a bishopric at Hamburg (831). In 826 the Danish prince Harold

with many hundred followers was baptized at Mainz. Meanwhile, St. Benedict of Aniane, having reformed the monasteries of Aquitaine. was brought to advise Louis on the moral reform of the kingdom and was established in a monastery at Xachen. Under his influence the rule of St. Benedict was imposed on all monastic houses in the Frankish kingdom.

B. THE FORMATION OF CHRISTENDOM

At the death of Louis the Pious (840) the natural divisions of the empire and local needs, attachments and traditions were reasserted. The idea of empire derived from Rome, taught by Alcuin of York and realized by the genius of Charlemagne, receded. The invasion of the Normans or Northmen intensified the confusion of dynastic war. Based in Flanders, they ravaged Saxony, the Rhineland and France, burned Cologne, Rouen, Paris and Aachen, captured Trier, besieged Orléans, seized Bordeaux and advanced to Toulouse. They sacked the monasteries and completed the destruction of towns and communes surviving from Roman times. The Edict of Mersen (847) commanding every man to serve a lord only defined the actual situation; feudal organization was partly. if not mostly, a defense against the anarchy the Normans left behind. In 876 they settled in Normandy. Two centuries of war thus isolated and established the church in the west as the one continuous, unifying and civilizing institution and (as it were) defined its double function of evangelizing and civilizing mankind.

This isolation of the west was emphasized by the schism of Photius in Constantinople during the pontificate of Nicholas I (858–867). The elevation of Photius, a layman, to the patriarchate and the deposition of Ignatius, his predecessor. were uncanonical. On the other hand. the interference of the Roman legates in the newly founded Bulgarian church was perhaps unlawful. The *Filioque* question (the double procession of the Holy Ghost) was used mainly as an occasion. though the theological difference between east and west is implied in the dispute. As always, the west was more simply and uncompromisingly Trinitarian and laid greater emphasis on the incarnation with its consequent exaltation of the church. Nicholas I, a canonist and political realist, advanced from the traditional Gelasian doctrine of "two swords" to that which foreshadowed the papal doctrine of Hildebrand. To the emperor Michael III he wrote that, whereas the emperor needed the pope in religion. the pope had no need of the emperor in temporal matters. At the same time (86 j) he demanded obedience from Charles the Bald and even quashed a judgment of the great archbishop Hincmar of Reims and declared that what the pope decides all must observe. For a century, however, the Roman see, lacking temporal protection, suffered from its temporal status. The Roman nobles, the house of Spoleto, the counts of Tusculum and the kings of Germany made and unmade popes in a succession down to John XII, deposed by Otto the Great in 963.

Weakness at the centre encouraged and exaggerated the centrifugal tendencies revealed in the wide, half-civilized rural areas that were exposed to waves of pagan and barbarian invasion. The urban organization of the church in the Roman empire was not suited to this scattered and insecure continent. The church needed an imperial idea and the co-operation of temporal powers. During the 10th century the house of Saxony laid the foundations of the mediaeval empire, Cluny revived monasticism and the canon law was gradually developed; and these three factors, together with intensified theological controversy, prepared the great reform of the 11th century, which was initiated by a reformed papacy.

1. Foundation of the Mediaeval Empire.—Otto the Great (912–973), occupied during the first 25 years of his reign in uniting the German peoples and defending them against Hungarians, Slavs and h'ormans, was crowned emperor in 962 by Pope John XII in Rome and thereafter was employed in restoring order in Italy. He founded a metropolitan see at Magdeburg, whose first archbishop, Adalbert. monk of Trier and abbot of Weissenburg, had been missionary to the Russians. Bishoprics were founded also at Oldenburg and Havelberg (946), at Prague (976), at Olomouc (Olmutz; for Moravia) and at Odense (for Denmark; 980). In 936 St. Unni of Bremen undertook a mission to Scandinavia, where he died. The second bishop of Prague, St. Adalbert, who baptized St. Stephen of Hungary. left his see in defiance of papal and imperial injunction to preach the Gospel to the Poles and Russians, by whom he was martyred in 997. The frontier churches of Bohemia, Hungary and Poland looked to Rome rather than to Germany; and Pope Gregory V (996–999), cousin and chaplain of Otto III, revived the missionary tradition of the Holy See but fell a victim of city faction prompted by local nobles. At his death, Otto III appointed the Frenchman Gerbert of Aurillac (Silvester II, 999–1003). Silvester dreamed of an empire independent of the German kings which should embody a world faith and a world culture. Like other learned men he underestimated local ties and traditions, and like other Frenchmen he failed to realize the needs of German administration. Simony he counted the greatest evil in the church. But it was much more than the "sin of Simon Magus": in France it mas, indeed, a corruption which was the result of generations of insecurity strengthening the hands of unscrupulous lords; in Germany it was rooted in Teutonic and feudal custom and continued by social and economic necessity.

The spread of Christianity among remote and barbarous peoples implied local autonomy and the adaptation of ancient pagan administrative custom. Churches were built. maintained and possessed by their chiefs. The mission church was virtually autonomous; its priest was the vassal and servant, often the kinsman, of the local landowner and protected by the local saint. Clovis, the champion of orthodoxy, accepted this arrangement. In 794 the council of Frankfurt allowed churches to be given or sold so long as they were maintained. Hincmar of Reims (c. 805–882), monk, canonist and archbishop, approved the principle and wished only to reform the abuses. Bishops were imperial and royal ministers. often viceroys. The most pious of emperors, St. Henry II, employed them in every function of government and insisted on his right to appoint bishops and to control or approve episcopal elections. Bishops trained in the imperial chancery were indispensable in the administration of the empire. Pope Leo IX (1048–54) was related to Henry III and had been employed as soldier and diplomat in the imperial service. The Holy See was constantly subject to imperial interference and protection, and the great reformer, though elected at Rome, was Henry III's nominee. Thus at every level—parochial, episcopal, papal—the question awaited decision whether the church was in effect a holy, catholic and supernatural institution appointing its own bishops and priests upon its own authority or (in the language of a later age) part of the body politic.

The system evolved by nature was subject to natural corruption. The emperor Conrad II and King Philip I of France made a traffic of bishoprics. But deeper than these abuses mas the question presupposed in all movements of reform of the true function of Christian priest and bishop. Councils repeatedly forbade lay interference in parochial benefices (Ingelheim, 948; Augsburg, 952; Seligenstadt. 1023; Bourges, 1031). Linked with this question was that of clerical celibacy, since a married clergy was tied by natural duties and interests to worldly affairs. Marriage implied inheritance and tended to absorb the clergy in local and feudal tenancies and obligations. At the council of Pavia (1018) Benedict VIII (1012–24) denounced clerical marriage mainly on the ground that church property should not be exploited for priests' families. But there was also the question of sexual morality and the traditional attitude of the church to virginity. Celibacy was admired by Tertullian, recommended by Eusebius, required by Cyril of Jerusalem and said to be the general practice by Jerome. Epiphanius said that the church "does not admit even sub-deacons to live in marriage and beget children." Two popes, Siricius (384–399) and Innocent I (402–417), had condemned clerical marriage. Six councils in Carthage, Spain and Gaul required continence of married clergy. The Theodosian code pronounced the children of priests illegitimate. Celibacy was a tribute to the supernatural and sacramental vocation and as such was bound up with the supernatural and sacramental body which

the confusion and expansion of the 9th and 10th centuries tended to obscure.

2. Revival of Monasticism. — Monks were the exemplars and instruments of the supernatural society. It was their business to live in "the course of these declining times" as in and for the "solid estate of eternity." Monasticism (*q.v.*) was in essence a lay movement, and the multiplication of monasteries and the constant succession of monastic reforms was evidence of the hold of the Catholic faith on the lay population. In 910 William I the Pious, count of Auvergne and duke of Aquitaine, founded Cluny. Odo of Cluny reformed Fleury and then. invited to Rome by Alberic, reformed the monasteries in and about the city and Monte Cassino. The reform spread through northern Italy and France. Cluny became the head of an order whose 300 houses, subject to the abbot of Cluny and exempt from all other authority but that of the pope, were organized in ten provinces extending from Spain to Poland. Cluny, "a spiritual field where earth and heaven meet" (Pietro Damiani), trained Urban II and Paschal II. It not only revived liturgical discipline and the Benedictine rule but realized on a world scale the practical order and common prudence of Benedictine monasticism. At the same time, Gerard of Brogne in Flanders and Dunstan of Glastonbury (d. 988) in England initiated monastic reform. In Italy St. Romuald founded the order of Camaldoli (*c.* 1012). In Normandy Herluin founded Bec (c. 1040), which under Lanfranc and St. Anselm became one of the great schools of Europe. There Pope Alexander II, Ivo of Chartres and Theobald of Canterbury received their training. The last wave of monastic reformation produced the Carthusian order founded by St. Bruno (1084) and the Cistercian founded by Robert of Molesme (1098). St Bernard with the 30 companions entered Citeaux in 1112 and with 12 monks founded Clairvaux in 1115. He was the "greatest of the monks" and one of the greatest preachers of the middle ages.

3. Development of Canon Law. — Canon law (*q.v.*) derives from the Scriptures, conciliar canons, papal decrees and traditions and customs of the church. In the west it developed later and more slowly than in the east. In 774 Charlemagne received from Pope Adrian I a collection of canons and decretals accepted at the council of Aachen (802) by the Frankish church. Under the see of Toledo the Spanish church possessed a larger collection including canons of Greek, African, Gallic and Spanish councils and papal decretals. In the 9th century also appeared the collection of "false decretals" whose forgery was not detected until the 15th. This collection, containing both real and spurious decretals, circulated in Spain. Italy, France and even England but was not much used in Rome till the 11th century. Collections made by Burchard of Worms (1012–23) and Ivo of Chartres (c. 1040–1116), Lanfranc's pupil at Bec, prepared the way for Franciscus Gratianus' great work. Gratianus, or Gratian, a Camaldulian monk of Bologna, produced the *Decretum* (1139–41), a systematic treatise (Concordia *discordantium canonum*) in three parts dealing with (1) sources of law and ecclesiastical persons; (2) jurisdiction, procedure, property and marriage; and (3) consecration, sacrament and liturgy. During the 12th and 13th centuries five compilations were added. Gregory IX added the decretals of popes since the Decretum which were compiled by the Dominican Raymond of Peñafort. Later decretals were collected by Boniface VIII (1298) and Clement V (1314); and the Extravagantes (decretals not included in previous compilations) brought the law down to Sixtus IV (1484). These together formed the *Corpus juris* canonici ("body of canon law"), of which a definitive edition was issued by Gregory XIII in 1582.

4. Theological Controversy. — St. Augustine developed his doctrine of the church against the Donatists (*q.v.*) and his doctrine of grace against Pelagius (*q.v.*), but both doctrines were already full-grown. and the fundamental reason for his exposition lay in the need of the man Augustine, a sinner in need of grace and the citizen of a dying civilization in need of the City of God. In other words, the power and permanence of Augustinian theology was the result of his factual presentation of man as man in relation to his Maker and Saviour. The west, untroubled by the complicated disputes and theological parties of the east, developed its theology in simple and universal terms, not as a theory so much as a faith. At the council of Orange (529) under Pope Boniface II the Semi-Pelagians were condemned: "If anyone shall say that by the prevarication of Adam it was not the whole man . . . that was changed for the worse but that, while his soul's free will remained untouched, his body alone became the victim of corruption, such a man is misled by the errors of Pelagius." The question of predestination and depravity was raised in the 9th century by Gottschalk, a monk of Fulda. whose doctrine of a double predestination was condemned by Hrabanus Maurus of Mainz and Hincmar of Reims. But the doctrine of grace developed more surely and continuously as the doctrine of the Eucharist, and here also the church insisted on the reality of the sacrifice. For Ambrose it is Christ Himself who offers the sacrifice and changes the elements into His body and blood. For Augustine the church presents itself as a whole and living sacrifice. Gregory says that the daily offering of Christ's body and blood avail for salvation and that by this means "the lowest things are united to the highest, things earthly are joined to things divine and the visible and invisible become one." In the 9th century Paschasius Radbertus, monk and abbot of Corbie, wrote a treatise De *corpore* et sanguine *Domini*, which in 844 he presented to Charles the Bald, emphasizing the fact of the real change into the body and blood of Christ and equating the daily sacrifice with daily redemption. Another monk of Corbie. Ratramnus, at the same time described the sacrifice as "spiritual" and discussed the relation of "figure" and "truth" in a work afterward attributed to Johannes Scotus Erigena and condemned during the Berengarian controversy at Vercelli in 1050. Berengarius, *scholasticus* and archdeacon of Tours (d. 1088), outlined his doctrine in a letter to Lanfranc, and in 1080 Lanfranc set forth the orthodox doctrine in his book De *corpore* et *sanguine* Dontini.

The Christology of the western church was settled at Chalcedon. The Adoptionist heresy of Felix, bishop of Urgel (c. 783–799), and Elipandus of Toledo (d. 808) was condemned at Narbonne (791) and Regensburg (792) and answered by Alcuin of York, who said that the sonship of Christ is not of nature but of person: the divine and human natures are united in the person of the Son. During these centuries the west developed the devotion to the Virgin Mary defined at the council of Ephesus (431) and at Constantinople (553). "If anyone shall say that the holy. glorious and ever-virgin Mary was only in a certain sense and not most truly the Mother of God, or that she was so in some merely relative way as though it were simply a man that was born and not the Word of God that became incarnate and was born of her, or shall refer, as some do, the birth of the man to God the Word only in the sense that the Word was with the man nhen he was born . . . let him be anathema." In the 4th century St. Gregory of Nazianzus had written that "if anyone does not believe that Holy Mary is the Mother of God, such an one is a stranger to the godhead"; and in the early 8th century St. John of Damascus (c. 676–c. 754) eloquently proclaimed the doctrine of her bodily assumption. Pope Sergius I decreed that the litanies be held on the four feasts of Our Lady, and Pope Leo IV gave the feast of her "Falling Asleep" a vigil and octave. It is mentioned in Adrian I's sacramentary and commanded in the laws of Alfred. The devotion to the Mother of God became articulate and instituted as the doctrine of the incarnation was defined. The same uncompromising refusal to adapt the central mysteries of the faith or to modify them in the interests of rationalization appears through all the centuries of Christological dispute and social chaos. The sacrifice is a real sacrifice, the Saviour really present, the incarnation the real fullness of the godhead bodily, the church the really divine-human community and its head the real and effective sovereign, vicar of Christ.

5. Papal Reform. — This realism, the mark of Christian orthodoxy, is the heart of the work of St. Anselm (1033?–1109). His use of the ontological argument is thus the opposite in emphasis of the Cartesian: its essence is the emphasis on existence. His *Cur* Deus homo starts from divine justice, and his argument presupposes its absoluteness. Faith is the foundation of reason. The same unyielding realism of faith was expressed in the papal reform

initiated by Leo IX (1048–54): "The head of the entire discipline of the church is in that place where Peter, the summit and cardinal member of the apostles. waits for the blessed resurrection of his flesh in the last day." Leo IX had learned administrative method in the imperial service and his episcopal duty in a poor diocese. During the first two years of his pontificate he held 12 councils. He travelled to Reims, to Mainz and as far as Hungary, organized the papal chancery to sustain a large correspondence, employed legates like Adalbert of Bremen and Humbert of Moyenmoûtier and created a college of cardinals. He dreamed of the reunion of east and west. He brought to Rome young Hildebrand (Gregory VII), who had known the city's disorders as a boy and who devoted the remaining 40 years of his life to the reform. Stephen IX (Frederick of Lorraine) was already dying when he left Monte Cassino for the chair of Peter, but in his few months he consecrated the monk St. Pietro Damiani (Peter Damian) cardinal bishop of Ostia, secured the co-operation of cardinals and Roman burghers to ensure the canonical and independent election of his successor and enjoined upon them to await the return of Cardinal Hildebrand, then in Germany. Stephen was no sooner buried than the Roman nobles proved his wisdom by electing an antipope whom the cardinals excommunicated, appointing the Burgundian bishop of Florence, Nicholas II. At his death (1061) the struggle came to a head between the reforming cardinals and the bishops of Lombardy led by Milan. The cardinals elected Anselm of Lucca. Lanfranc's pupil at Bec, as Pope Alexander II. But it was only after bloodshed and an appeal to the German court at Augsburg, and even then at the risk of his life, that Alexander began his pontificate. Nevertheless, the reform was already visibly changing the relations between church and state.

Gregory VII (1073–85), who as monk, deacon, cardinal and pope served this cause for 40 years, was perhaps alone in his vision of all its meaning as. after 1072 (when Pietro Damiani and Adalbert of Bremen died), he was the sole survivor of Leo IX's circle of reformers. For him the battle was no longer limited to simony and celibacy. Likened by his contemporaries to the prophet Elijah, he was disinterestedly certain that the pope is the voice and speaks with the authority of Peter and claimed absolute authority over the souls of Christians without misgiving and without arrogance. Italian, not German, a monk trained in the service of the papacy, elected by cardinals and acclaimed by the people of Rome, he had never been a bishop until he mas made pope. As legate he had seen the church in France and Germany with the eyes of central authority. The arch-chancellor of the empire, who was also archbishop of Mainz, complained that Pope Alexander II had dealt directly with his suffragans of Prague and Olomouc instead of dealing through their archbishop. Liemar of Bremen refused to act at the orders of papal legates without consulting the German episcopate. Secular clergy revolted against a decree of celibacy. Only the Saxon bishops supported the pope, and that because they were opposed to the emperor. In 1075 Gregory revealed his determination: he suspended the archbishop of Bremen and the bishops of Bamberg, Speyer. Strasbourg and three Italian sees and threatened five imperial councillors with excommunication. Henry IV, the German king, having subdued the Saxons, was free to attack the pope. In 1076, at a council of German bishops held at Worms, he declared Gregory deposed and the north Italian bishops declared their agreement. Gregory then deposed and excommunicated the German and Lombard bishops who had signed Henry's letter, declared Henry deposed and excommunicated and his subjects absolved of their allegiance. The effect of this open clash was Henry's defeat and isolation, which he saved from complete disaster by submitting to Gregory at Canossa. There he did penance and awaited absolution. which Gregory gave in duty as a priest. The absolution disconcerted the papal party in Germany which had elected Rudolph of Swabia king in Henry's room. But now Gregory, who was not a partisan, remained neutral. Three years of civil war ended with the victory and death of Rudolph and the excommunication of Henry, who marched on Rome and mas crowned by Guibert of Ravenna (the antipope Clement III). Gregory. "having loved righteousness and hated iniquity died in exile" at Salerno, the guest or prisoner of Robert Guiscard, the Norman king of southern Italy. In France, his campaign against simony and clerical marriage had been more successful. In England, Lanfranc carried out his policy but with a characteristic independence. "Our island," he said in a letter refusing to side with the emperor, "has not yet disavowed Gregory VII nor given judgment whether it ought to obey Clement III." In Spain, Gregory claimed temporal as well as spiritual authority and induced the Spanish church to institute the *Ordo Romanus*. He sent legates to Poland and claimed Hungary as the gift of St. Stephen to St. Peter.

Urban II (1088–99) inherited Gregory's exile and carried on his work. A monk of Cluny and a canonist, he had been employed as legate in Germany to organize the papal party. More firmly than Gregory he maintained the opposition to lay investiture and required free and lawful election of bishops. Deprived at first of his centre at Rome, he held a number of councils. At Clermont (1095) he forbade clergy to do homage to laymen and proclaimed the first crusade (see CRUSADES), which, apart from its particular occasion and important results, inspired the first great movement of popular preaching. Urban employed permanent legates, encouraged appeals to Rome, graded the hierarchy and confirmed the privileges of monastic houses, exempting many of them from episcopal control. At the same time the emergence of an international school at Paris recovered scientific theology for western Christendom. William of Champeaux (c. 1070–1121) established the reputation of the cathedral school. Peter Abélard (1079–1142), who had studied under William, made it the most famous school in Europe and, using the *Organon* of Aristotle, laid the foundation of its tradition as a school of logic and philosophy. The university was the peculiar care and favoured nursling of Innocent III, who secured its independence. finally established by Gregory IX in 1231. At Paris the study of civil law was forbidden (1219) by Honorius III, perhaps in favour of Bologna, where it was well established (in succession to Ravenna and Rome) in the 11th century, and perhaps to ensure the study of theology at Paris. By the middle of the 13th century the schoolmen of Paris had access to original translations from the Greek of nearly all Xristotle's extant works. Forbidden by the legate, Robert de Courçon, in 1215 and again in 1231 and 1263, the physical and metaphysical works of Aristotle, together with the commentaries of Averroes, were nevertheless read and studied especially by the Dominicans Albertus Magnus and Thomas Aquinas, whose Aristotelian method was to become the orthodoxy of Catholic exposition. (See SCHOLASTICISM.)

At the fourth Lateran council (1215) Innocent III (1198–1216) published a definition of the faith which, after affirming the doctrine of the Trinity, the Incarnation and the Judgment, says:

There is moreover one universal Church of the faithful, outside which no man at all is saved, in which the same Jesus Christ is both the priest and the sacrifice, whose body and blood are truly contained in the sacrament of the altar under the species of bread and wine, the bread being transubstantiated into the body and the wine into the blood by the divine power, in order that, to accomplish the mystery of unity, we ourselves may receive of His that which He received of ours. And this thing, the sacrament to wit, no one can make (*conficere*) but a priest, who has been duly ordained, according to the keys of the Church, which Jesus Christ Himself granted to the apostles and their successors.

But the sacrament of baptism, which is consecrated in water at the invocation of God and of the undivided Trinity, that is of the Father, and of the Son and Holy Spirit, being duly conferred in the form of the Church by any person, whether upon children or adults, is profitable to salvation. And if anyone, after receiving baptism, has fallen into sin, he can always be restored *(reparari)* by true penitence.

Not only virgins and the continent, but also married persons, deserve, by right faith and good works pleasing God, to come to eternal blessedness (cited by Alexander Hamilton Thompson, Cambridge *Medieval History,* vol. vi, p. 635).

The last article of the definition quoted above refers to the Catharist or Albigensian heresy, which in the 12th and 13th centuries threatened large areas of Hungary, Germany, Italy and France. It rejected infant baptism, purgatory, the communion of saints, the use of images and the doctrine of the Trinity. Above all, the Cathars attacked the institution of marriage, which was the basis of all social custom and law, sacred and secular, in the west. Catharism was anarchy and heresy at once. It implied

the complete subversion of the social structure and the complete denial of the Christian faith. Its leaders. *perfecti,* admitted no obligation. moral or material. In Languedoc the crusades inaugurated by Innocent III against the heresy were eagerly supported by the French nobility (1209–44). At the same time the Inquisition was organized. Proposed at the council of Verona (1184) and established early in the 13th century, this court was designed to combine judicial procedure with propaganda. Under Gregory IX it was organized with specialist judges and advisers. Its activity varied with time and place. In England and Portugal it mas unknown. In Spain it was obsolescent during the 15th century but revived under Ferdinand and Isabella. In Germany its vigour waned between 1250 and 1350. It was most vigorous in France. As a rule its methods were laboriously and punctiliously just. though it could be misled and sometimes, as under Ferdinand and Isabella, was used for political ends. In an age whose most important industry was definition. in which social discipline and civilized living had still to be won. there could be no question of indifference. The enemies of faith were the enemies of man.

6. The Pattern of Catholic Humanism. — The 13th century was the age of an apostolate at every level of human life. The leaders of the movement were friars. orders initiated by laity (St. Francis') and the lower ranks of clergy (St. Dominic) under the immediate protection of the pope. In 1210 Innocent III sanctioned the Franciscan rule. In 1216 his successor. Honorius III (1216–27), took under his government and protection "the order of Master Dominic and Friars Preachers." The Franciscan movement was popular and spontaneous and as such reflected the social movement. the learning and the spiriruality which developed in centres of population. The Dominicans. a learned order from the beginning. were Augustinian canons called to preach by the spread of heresy and the demand for instruction in the faith. In Raymond of Peñafort. their third master general (1238–40) and confessor to Gregory IX, they produced the greatest canonist and constitutional lawyer of the age. The Swabian Albertus Magnus (*c.* 1200–1280), their regent master in Paris, "strove to make Aristotle intelligible to the Latins" and shares with his contemporary, Robert Grosseteste (1175–1253), bishop of Lincoln. the title of "father of modern science." His pupil Thomas Aquinas is still the "common doctor." the greatest teacher of the Roman Catholic Church. Leo XIII in the encyclical *Aeterni Pntris* (1879) required bishops "to restore the wisdom of St. Thomas and to spread it as far as possible for the safety and glory of the Catholic faith, for the good of society and for the increase of all sciences." It was the work not only of St. Thomas but of the 13th century as a whole to synthesize those three purposes.

In Paris, the metropolis of theological and philosophical controversy, and at the moment of the full recovery of Aristotelian method, St. Thomas (*see* AQUINAS, SAINT THOMAS) represents the arrival of scientific intelligence and the discovery by Christendom of the nature of man. His work is the first clear articulation of the full human confidence in human nature which in patristic and conciliar definitions, as in the earlier scholasticism of St. Anselm and in the preaching of St. Bernard. was still overshadowed by theological, controversial and ecclesiastical purpose. St. Thomas realized what neither pagan philosophy nor Christian theology had as yet clearly discerned, the naturalism of supernature, the divine right of man.

> The last end of man is the contemplation of truth. This alone is distinctive of his nature, and no other corporeal being shares it with him. Nor is there any end beyond it, for the contemplation of truth is an end in itself. Hereby man is united in likeness with superior spirits, because this alone oi human activities is an activity of God and the angels as u-ell. . . . And to this end all other activities seem to be directed. For perfect contemplation we require bodily health, which is secured by all such arts as are necessary to life. We require freedom from perturbation of the passions, a goal obtained by the moral virtues and by prudence. We require freedom from external perturbations, a freedom at which the entire organization of civil government aims. So, if you look at the matter rightly, all human occupations appear to be directed to the nerds of those who contemplate the truth. (Reprinted from the *Summa Theologica* with the permission of Benziger Brothers, Inc.. publishers and copyright owners.)

This coherence of economy, morals and politics in the contemplation of truth is the pattern of Catholic humanism, derived from Catholic faith in the union of human nature with the divine: by which the trial and error of subsequent history of Christendom is judged and to which man progresses and from which he falls.

7. Papal Authority. — Whether the claim of Nicholas I, Gregory VII and Innocent III to an effective sovereignty of Christendom was theoretically sound or not. the civilization of the west did in fact cohere in the church which cohered in the papacy. The papal victory of the 11th century, the development of law, theology and ecclesiastical order. had made the Holy See the centre of a judicial and administrative system not only more efficient than any other government but the basis of all government. It was the final court of appeal in international dealing. the source and standard of ministerial and judicial competence. The pope's authority was also popular and moral. Innocent III (*q.v.*), feudal suzerain of a large part of Europe, exercised also as head of the church a direct and real authority over its chief administrative officers, the bishops, and over the real religion of its people. He and his successors created the universities which trained public servants and presided over an international court in which every sovereign in Europe was prepared to plead. The distance between the papal and the imperial conceptions of government is illustrated in the 12th century by comparing the practical genius and personal ascendancy of Frederick I Barbarossa on the imperial side with the almost impersonal patience and judicial science of Alexander III on the papal. Both were just men, but. whereas Frederick conceived his office in terms of Otto the Great and Charles the Great, imposing peace on his vassals. making mar for the dream of a Roman empire and doing personal justice which made offenders tremble at his coming. Alexander III made decisions. worthy of Gratianus' pupil. which became part of the permanent system of canon law. The third Lateran council, with its successor under Innocent III, defined a conception of life and society which still endures. Frederick's use of the civil law and comparison of himself with Constantine and Justinian as lord of the world at the diet of Roncaglia (1158) was a soldier's romance which never became even plausible and was finally shattered by the Lombard cities at the battle of Legnano (1176). But even the Angevin Henry II of England was compelled like his Norman predecessors to submit to the authority of an order which needed no armament because it was inherent in the social structure.

C. THE CHURCH AND THE NATIONS

The converse was also true. The papacy reflected Christendom and reacted to the national. social and cultural revolution of the 13th and 14th centuries. Frederick II of Hohenstaufen was the first secular sovereign of the modern kind. He ignored without resenting the papal excommunication and was equally prepared to hand Germany over to the church (by the *privilegium* in *favorem principum ecclesiasticorum* of 1220), to make friends with the sultan of Egypt (1229) and to crown himself king in Jerusalem which he had sworn to protect. Having shocked German opinion with his harem and his Saracen bodyguard, he established a central court of justice (diet of Mainz, 1235j and attended the translation of the bones of St. Elizabeth of Hungary (canonized 1234) to Marburg. His greatest achievement, the constitution of Melfi (1231), drawn up in defiance of the pope. established an enlightened despotism in the Sicilian kingdom. His Cniversity of Naples, too, was a despotism governed by a royal chancellor. His friend and fellow-heretic Hermann of Salza used the Teutonic order to found the military state of Brandenburg (1230) which developed into the modern kingdom of Prussia.

France enjoyed peace and consolidation under Louis IX. who valued his throne as a means of making Christians. Provence was united to France in 1246 and the English expelled from all France save Gascony in 1259. The military adventures of the English Edward III and Henry V, picturesque rather than political, served, as did the wars of Burgundy and Armagnac, to confirm the French nationality which Louis XI (1461–83) centralized in the throne. By the 14th century the vernaculars of Italy, France. Spain. Germany and England were mature, their legal systems organized. They were aware of commercial rivalries and of national ambitions.

Feudalism was dying. The Italian cities of Venice, Florence and Milan were independent powers. The age of the crusades was passing; that of national states had arrived.

The Holy See reflected this revolution. It became the centre of Italian politics and international diplomacy, subject to international intrigue. Its judicial business was extended. From increasingly secular states it demanded increasing revenues. Nicholas III (1277–80) was a political realist; he accepted the situation in which every cardinal was the agent of a political interest. and he exalted his own family, the Orsini. His successor, Martin IV, a Frenchman, was the creature of Charles of Anjou. Honorius IV (Savelli) raised his family against the Orsini. Nicholas IV (Colonna) balanced the other t o. Then the cardinals sought to remedy the corruption and forced a hermit unacquainted with the world into the chair of Peter; Celestine V survived five months. was persuaded to abdicate and died in prison. His incompetence was less disastrous than the ability and ambition of his successor. When Boniface VIII, pursuing the logic of contemporary politics and Roman law to an extreme, forbade clergy to pay taxes to the secular government *(Clericis laicos,* 1296), Philip the Fair forbade the export of money from France. When Boniface claimed Scotland as a fief of the pope, Edward I annexed it to England. Both kings relied on their national assemblies, Edward I on the parliament of Lincoln (1301), Philip the Fair on the states-general (1302). Finally French troops seized and imprisoned the pope, who died in 1303. His successor Benedict XI denounced the outrage and died in a few weeks—of poison, it was said.

The next election took ten months and the next pope, Clement V, archbishop of Bordeaux, transferred his court to Avignon in 1309. The "Babylonish captivity" had begun *(see* PAPACY). Perhaps the most dramatic as it was the most shameful sign of the changed time was the suppression by Philip IV and Clement V of the Knights Templars (whose constitution had been drawn up by St. Bernard) after a trial of extorted confessions in which the slanders were dictated by Philip's agents and then confirmed by his victims under torture. The real offense of the Templars was that with the decline of the crusades they had taken to banking; a form of usury uhich evoked the resentment of their noble debtors and the greed of the king. The "Great Schism" which started in 1378 with the election of Robert of Geneva as Clement VII in opposition to the reigning Urban VI was the final tribute of the papacy to national rivalry. Nations bargained with one side or the other.

The doctrine which accompanied, explained and defended the new order was nominalism, uhich denied the reality of universals and declared it an "error to believe that there is something in reality besides the singular entity." Thus there is no such thing as the nature of man which could be defined and must be obeyed and which might be united to the divine nature in the person of Christ; there were only individual men, and the definition of human right and duty was promulgated and enforced by the prince. Nature and supernature, reason and revelation thus parted company. Natural science, whether legal, empirical or mathematical, could thus be rid of metaphysical assumptions and set free to handle facts and concepts each on its own terms. The prince was the source of rights and obligations and, in the words of John Wycliffe *(De officio regis,* 1379), was above human laws. The doctrine was expounded by those Franciscans who supported Louis the Bavarian (1314–47) in his claim to the empire as Louis IV. Marsilius of Padua and John of Jandun affirmed the absolute authority of the civil power *(Defensor pacis,* 1324). The papacy was a human institution which had usurped power. Henry of Langenstein and Conrad of Gelnhausen (1380) thought that a council is above the pope. Wycliffe's opinions, condemned in England, found a home at Prague and a more attractive apostle in John Huss, whose preaching in the Bethlehem chapel kindled the national imagination. Huss proclaimed the doctrine of Germany for the Germans. France for the French. Bohemia for the Bohemians. The council of Constance which condemned him adopted this principle at the suggestion of the bishop of Salisbury as the basis of voting and thereby defeated John XXIII's Italian majority. The conciliar movement (Pisa, 1409; Constance, 1414–18; Basle, 1431–38; *see* COUNCIL) represents an attempt to establish a parliament of Christendom or perhaps a league of nations. The decree *Frequens* declared that councils ought to be held every five years. At Basle the intention was even more explicit to make the pope the constitutional sovereign or nominal head of a Christendom whose national sovereigns were absolute.

The assembled doctors were not in a position to admit what was clear to the governments represented, that their authority was without foundation.

D. REFORM AND DEFINITION

Meanwhile the humanism of the Renaissance and a wide and increasing practice of mysticism intensified individual religion and magnified the individual person. At length the revolution broke. It is symbolized in three events. In 1517 Martin Luther nailed his theses on the door of the church at Wittenberg. In 1534 the Act of Supremacy proclaimed Henry VIII supreme head on earth of the Church of England, which he described as "part of the body politic"; in 1535 John Fisher. Thomas More and the London Carthusians were martyred. In 1543 was published the treatise *De revolutionibus orbium coelestium* of Nicolaus Copernicus. All three events in their several kinds were acts of revolt and signs of exodus into the unknown from the given and created world which Christianity presupposed. "It is not necessary," said Copernicus, "that hypotheses should be true or even probable. It suffices that they lead to calculations which agree with observations." "By reformation," said Luther, "I do not mean the reform of this human teaching and spirituality; I mean its complete and absolute abrogation." "The true significance of the Copernican revolution consisted not so much in displacing the world's centre from the earth to the sun as in implicitly denying that the world has a centre at all." (R. G. Collingwood, The *Idea of Nature* [Oxford, 1945]). In like manner the princes denied the organic unity of Christendom. The doctrine *Cujus regio, ejus religio,* "Let the religion of each state follow that of its prince"; (first announced at the Recess of Speyer, 1526) was adopted throughout Germany by the diet of Augsburg (1555) and then throughout Europe, Catholic and Protestant. In 1572 Catherine de Médicis answered the English protest against the St. Bartholomew massacre by proposing that Elizabeth I should use the same method with Catholics. In 1593 Henry of Navarre "bought Paris with a Mass." The supreme artist in this secular statecraft is Cardinal Richelieu.

1. The Counter-Reformation. — Reform of the church began under Leo X (1513–21). In Italy the Theatines (1524) were founded to reform parochial clergy. In 1526 Matteo de' Bassi founded the Capuchin branch of the Franciscans, and in 1530 the Barnabites were founded by St. Antonio Zaccaria. Paul III (1534–49) began the Counter-Reformation by appointing reformers—Giovanni Pietro Caraffa, Gasparo Contarini, Jacopo Sadoleto, Reginald Pole—to the sacred college. In 1536 they served with five others on a commission which urged the need for reform and did not spare the abuses. In 1534 St. Ignatius of Loyola and six others initiated the Society of Jesus (*q.v.*), established in 1540 by the bull *Regimini militantis ecclesiae.* In 1542, by the bull *Licet initio,* Paul III established the papal Inquisition under Caraffa's influence to supervise the whole church. Pius IV and Pius V enlarged its powers, and Sixtus V (1585–90) reorganized it as one of the Roman congregations. In 1545 a general council met at Trent, which was postponed indefinitely in 1547. It reassembled (1551–52) under Julius III and met again, finally, in 1563

Trent was nothing that Constance had been, everything that Constance was not. Constance had seen the triumph of nationalism; Trent ignored it. Constance made no definition of the faith; Trent made nothing else. Constance had deposed the pope; Trent left everything in his hands. Convoked at the will of Paul III and interrupted by war, Trent made no pretense of gathering or expressing the will of Europe. It reformed the church and accepted the world. It recovered the centre nhich the movement and confusion of powers had displaced and obscured. Its answer to the theology of the Reformation was an affirmation of the divine-

human unity: "In justification a person receives infused through Jesus Christ the remission of his sins, faith, hope and charity. For faith, unless there is added to it hope and charity. does not perfectly unite a person with Christ; nor does it make him a living member of His body; whence it is most truly said that faith without works is dead and unprofitable." *(See* TRENT, COUNCIL OF.)

The works were not lacking. The Counter-Reformation inaugurated above all an age of sanctity: the cardinal archbishop of Milan, St. Carlo Borromeo (1538–84); the Florentine priest St. Philip Neri (1515–95), whose Oratory founded in 1564 in Rome transformed the city; St. Francis of Sales (1567–1622), the most lovable of the doctors of the church, whose devout humanism and humane devotion influenced not only the Catholics of his century but Catholic and Protestant Christianity thereafter; St. Theresa of Avila (1515–82); St. John of the Cross (1542–91), the greatest of the mystics; and St. Vincent de Paul (1576–1660).

2. Establishment of the Jesuits. — Nothing like the apostolate of the Jesuits had yet dawned on the Christian imagination. Within two years of the society's foundation, St. Francis Xavier under the patronage of John III of Portugal established a mission at Goa and during his ten remaining years of life made thousands of converts in India. Malacca. Amboina, the Moluccas and Ceylon (where the king of Kandy and many of his subjects were baptized); he founded a mission in Japan and was on the point of entering China when he died. At the same time Alfonso Salmeron, afterward the colleague of Peter Canisius at Ingolstadt (1549), was sent to Ireland with orders from Paul III "to be all things to all men, constant in good deeds, and to uin souls by kindness." In 1542 the Jesuits were established in Bavaria. They were invited to Salzburg, to Mainz and to Osnabruck. Having carried the Counter-Reformation down the Danube and the Rhine, they Mere called to assist at Trent. They invaded Poland in 1570, England in 1580, Switzerland in 1586. In 1609 they took over the government of Paraguay and turned it into a perfect, almost too perfect, model of Christian social organization. In 1611 they arrived in Canada. Their Roman college. founded in 1551, was the mother of the greatest educational enterprise Christendom had ever known. In 1565 their College of Clermont was already disputing with the University of Paris, whose Gallican doctors had reason to fear their democratic and ultramontane doctrines. They were among the pioneers of patristic study. They quickly became and for two centuries remained the schoolmasters par excellence of Catholic Europe: their course of study laid down in 1585 and revised in 1599 survived until 1832. and among their pupils they number men who attained every variety of fame — Ferdinand II and Leopold I, Tilly and Wallenstein. St. Francis of Sales and St. John of the Cross, René Descartes and Molière. Pierre Huet and Jacques Bossuet, Pierre Bayle and Mazarin, Voltaire, Giovanni Vico and Denis Diderot. Placed under the direct command of the pope, they were the natural foes of national autocracy. At Trent they supported a doctrine of episcopal jurisdiction which placed national bishops under the see of Rome, as against jurisdiction by divine right, which would have established their national independence. Hence they stood opposed to the Gallican ambition represented by the Paris parliament, the university and the Bourbons. Confessors of popes and princes, they were exponents of the "rights of man"; Juan de Mariana's treatise *De rege et regis institutione* ("On kings and royal institution," 1599), dedicated to the future Philip III of Spain, lays its stress not on the legitimacy hut on the justice of the king. It offended public opinion above all in France by defending tyrannicide.

3. National Independence. — The splendour of French culture in the 17th century was the fruit of Catholic humanism and national self-consciousness. Gallicanism (*q.v.*) was another consequence of the union of church and nation The relations of the Gallican church with the Holy See were defined by the concordat of 1516. The same principles of Gallican independence were affirmed in Bossuet's articles in 1681 and spread in the 18th century to the rest of Catholic Europe. The Jansenists, whose doctrines were condemned in 1713 by Clement XI in the bull *Unigenitus,* joined the Gallican cause against the "ultramontane" influence of the Jesuits. In 1763, when the French Jesuits were being suppressed, Febronius (J. N. von Hontheim), auxiliary bishop of Trier and pupil of the Jansenist canonist Z. B. van Espen of Louvain, published his treatise *De statu ecclesiae et legitima potestate Romani pontificis* maintaining the subordination of the pope to general councils and the independence of bishops. Condemned in 1764, the book circulated throughout Catholic Europe. In 1769 the ecclesiastical electors jointly protested against "papal usurpation." Joseph II (on the death of Maria Theresa, 1780) carried out a Febronian policy in the Habsburg empire. In 1773 Clement XIV was forced by the governments of Portugal, France. Spain and Naples to suppress the Society of Jesus. By 1793 the French monarchy was dead, the aristocracy abolished and an egalitarian republic was preparing to establish the rights of man starting from the year I. The *Constitution civile du clergé* ("civil constitution of the clergy"; 1790) was a Gallican measure. The concordat of 1801 restored the terms of 1516.

During this century of anticlerical princes and antipapal bishops was founded the Feast of the Sacred Heart (1765), the order of the Passionists by St. Paul of the Cross (1694–1775) and the Redemptorists by Alfonso Maria dei Liguori (1696–1787).

E. THE CHURCH AFTER 1815

Napoleon passed as a storm and left Europe in ruins. Industrial revolution and economic determinism created a new absolute of natural necessity. The philosophers of reconstruction. idealist or utilitarian, were alike determinist. J. G. Fichte deified the state; G. W. F. Hegel identified God with history; T. R. Malthus and David Ricardo regarded man as the slave of natural forces. Determinism was presupposed in theories of *laissez faire* and of the absolute state, materialism loudly proclaimed by the apostles of revolution and unconsciously generated by the preoccupations of scientific industry and efficiency. Such were the elements and climate of liberalism. Joseph de Maistre opposed it; H. F. R. de Lamennais tried to capture it. In 1834, while Giuseppe Mazzini was founding Young Europe in the name of God and the people, J. B. H. Lacordaire drew crowds of young men to his lectures in Notre Dame with a similar message. In 1837 a German ultramontane movement under Joseph von Gorres sprang to life when the Prussian king imprisoned the archbishop of Cologne and other bishops for refusing to compromise on mixed marriages. Louis Veuillot founded *L'Univers religieux* as the organ of French ultramontanism in 1843. In 1843 also Vincenzo Gioberti's book *Del primato morale e civile degli Italiani* attempted to claim national sentiment for the church: he proposed that the pope should head a confederation of Italian states.

1. The Catholic Revival. — It was not through such political enmities and affinities that the Catholic revival took place. The attitude of the church puzzled its friends and enemies alike so long as they thought of it as a party or a policy, one among many contending for authority to solve political problems. The return of Pius VII from Fontainebleau to Rome was a triumph. Whole towns came out to do him honour; kneeling crowds lined the roads. It was a spontaneous gesture and expressed a piety deeper and older than the policies and theories which transformed European government. In 1848, when Europe was in revolution, Pius IX at Gaeta was visited by a priest who had begged his way from Subiaco whither he had walked a few months earlier from Pontigny, his purpose to ask the pope's approval (willingly bestowed) on the foundation of a religious house. Then he walked back to France and, in the forest near Sens, built a hut with chapel, kitchen and dormitory where, with two companions, he lived in extreme poverty according to the Benedictine rule. Four years later he died. The community, which had become the mother of seven others in France. Palestine and America, was driven from France in 1882, took over the ruins of Buckfast, Eng., and erected one of the most renowned of modern abbeys. This Jean Baptiste Muard was a child of peasants reared in poverty. So was Giovanni Bosco, whose work among the youth of Turin. begun in 1841, elicited the respect and won the support of the government and who founded the Salesian order which was approved in 1874. So was Jean Baptiste Vianney, who became the *curé* of Ars in 1818, and so was Giuseppe Sarto, who became Pope Pius X. In the fall

of the monarchies, the decay of aristocracies and the advance of secularism among the intellectuals, the revival of the church sprang from the devotion, the family life and the personal sanctity of the poor. Theirs was the mind which Pius IX. an indifferent politician and a great bishop, represented and understood. Poverty, chastity and obedience, the ancient prescription for the Christian life. were also the condition of social vitality and the answer of the Catholic people to the proletarian or capitalist theories of the secularist doctrinaires. They presuppose a universal humanity. But except as functions of a dismembered humanity, the politics and economics of power were meaningless, while for deity they substituted a religion of individual. national and class emancipation and enlargement. In 1848 this ancient adversary of the church appeared in Rome and demanded a liberal pope to lead a nationalist cause, Catholic Italy against Catholic Austria; the pope fled to Gaeta. The movement carried on these secularist assumptions mastered European politics. and the pope became the prisoner of the Vatican. In 1854 he defined the Immaculate Conception, the consummate affirmation of faith in human nature. Another statement of the same faith. sorely needed in the age of Nietzsche. appeared in the Vatican constitutions (1870): "The holy Church, our mother, holds and teaches that by the natural light of human reason, God, the principle and end of all that is, may be known with certainty through the medium of created things. . . . If anyone shall say that the only and true God, our Creator and Lord, cannot be known with certainty by the natural light of human reason, let him be anathema." At the moment of Bismarck's victory the pope defined the dogma of papal infallibility. Together with the dogma of the Immaculate Conception and the Dogmatic constitutions it defined the structure of Catholic humanity against the drift and scepticism of progress and power condemned in the syllabus of 1864. Forty years later Pius X began his pontificate, "taking courage in Him who strengtheneth us to proclaim that we have no other aim but that of restoring all things in Christ, so that Christ may be all in all" (E *Supremi apostolatus,* 1903).

2. The War of Ideologies. — The word ultramontane belongs to an age of territorial dominion. With the loss of the papal states it passed into history. The war of ideologies began. In 1872 Bismarck launched his *Kulturkamp* or "cultural struggle." In 1873 the May laws inaugurated a policy of nationalization. The Catholic bureau in the ministry of education was abolished. schools placed under state inspectors, seminaries under state control and, as the war proceeded, many of the bishops imprisoned. Rudolf Virchow, the radical. invented the name *Kulturkampf* to mark the real conflict not between church and state but between two civilizations fundamentally opposed. Resisted not only by Catholics and the centre but by the court. the conservatives and the Lutherans, the policy failed. By 1887 the *Kulturkampf* was over in Germany. It was beginning in France. The Italian governments of left and right, unable to cope with economic distress, suffered continual disorder, and the forces of communism and socialism increased. Leo XIII, who succeeded Pius IX in 1878, issued a series of encyclicals on social and political questions which were accepted through the whole church as a classical statement of its principles: *Inscrutabile Dei* (1878), on social evils caused by rejecting the church; *Quod Apostolici muneris* (1878), on socialism, communism. nihilism; *Arcanum divinae sapientiae* (1880), on marriage; *Diuturnum illud* (1881), on civil power; *Immortale Dei* (1885), on church and state; *Libertas* (1888), on liberty; *Sapientiae Christianae* (1890), on citizenship; *Rerum novarum* (1891), on the social order.

The French attack on the church, restrained after 1870, was brought to a head in 1900 in reaction to the ultramontanism of the army and in response to an intelligentsia of liberals and Freemasons. In 1901 the Law of Associations dissolved two-thirds of the religious houses in France. By 1904, 13,000 schools had been suppressed. In 1905 the government, having broken off relations with the Holy See, confronted the church with the alternatives of wholesale confiscation or subordination to the civil authorities. Pius X decided against subordination and himself consecrated 14 bishops in St. Peter's. Persecution united the "disestablished" church more firmly to the Holy See. The secularist and anti-clerical policy of the French government continued to World War I. "There are now no parties," said the president, "there is only immortal France." The government conceded to war what it denied to Christianity.

During the same period Austria was the scene of similar hostilities. *Los von Rom* ("away from Rome") and *Drang nach Osten* ("violence toward the east") together marked the drift of the Habsburg dominions from their ancient and central position in Catholic Europe. Catholics, suffering from the weakness of a large traditional majority, were divided. Josephism was still alive among the clergy and at court. The Germanic myth whose centre was neither Rome nor Vienna but Berlin was propagated among the German, liberal and anti-Catholic minority. The universities of Innsbruck, Vienna, Graz and Prague were agitated by the ideological war. A campaign of slander against the clergy raised a union of priests and lawyers in their defense (*Rechtschützverein*). A Catholic university at Salzburg was projected (1902). The *Piusverein* (1905) united the Catholic press, and at the Vienna congress (1905) it was declared that the "Catholic faith is the spiritual bond which unites the peoples of Austria." Pan-German deputies in the chamber demanded that the German provinces should join the empire of the Hohenzollerns as Lajos Rossuth and others in the 19th century had demanded separation for Hungary. With the outbreak of war in 1914 and the death of Francis Joseph in 1916 the Habsburg empire fell to pieces. The church and the Catholic faith remained.

3. The Struggle Against Materialism. — Between World Wars I and II the logic of determinism and power politics ceased to be national and became universal. The patriotism of the materialists perished and was succeeded by a materialism without frontiers or citizenship, which denied all obligations but those imposed by force and exacted by cruelty. The last acts of Benedict XV had been devoted to relief. Pius XI (1922–39), still urging relief, especially for Russia, instituted the Feast of Christ the King (1925). In 1931 he took up the theme of *Rerum novarum* in the encyclical *Quadragesimo anno* and against the fascist government reaffirmed moral freedom. Fascism. he said, was a "regime based on an ideology which amounts to a really pagan worship, the state." Two years later the struggle in Spain revealed the extent of the Russian revolution — "hatred of the Lord and His church nourished by groups subversive to any religious and social order as we have seen in Mexico and Russia." In 1937 he addressed his letter *Mit brennender Sorge* to the German bishops, denouncing the nazi regime; and in the encyclical *Divini Redemptoris* he denounced "the most persistent enemies of the church who from Moscow are directing the struggle against Christian civilization." In 1939 the next pope, Pius XII, broadcasted his five peace points, demanding the right to life and independence for all nations great and small, progressive disarmament, provision for revising treaties, the protection of minorities and the spirit of good faith. He broadcasted five points of a "new order based on moral principles" two years later and never ceased to confront the tide of racial degradation and massacre with pleas for justice and charity.

In the hemisphere dominated by the U.S.S.R. his voice could not be heard. The "iron curtain," a war frontier devised without consideration of human rights or needs by victorious powers, left eastern Europe and a great part of Asia at the mercy of a naïve necessitarianism, without faith in man or morals, to which "progress of science." in the words of *Pravda,* "all religions stand in direct contradiction." The 50,000,000 Catholics subject to this "progress" lived in a process of martyrdom. Their bishops were systematically deported, their schools controlled by Communists, their property confiscated and the unsubmissive "liquidated."

In 1949 the Congregation of the Holy Office decreed that it is unlawful for Catholics to enlist in or show favour to the Communist party, or to publish, write or read anything in support of the Communist doctrine and that any Catholic doing so must be denied the sacraments as an apostate from the Catholic faith.

Another decree of much deeper significance was the solemn proclamation on Aug. 15, 1950 by Pope Pius XII declaring and defining the Bodily Assumption of the Blessed Virgin Mary into heaven after her earthly life to be a dogma of the Catholic faith.

4. Activities of the Church. — In contrast with the destruction and unrest of secularized Europe, in which innumerable conflicts tended toward world war, the church was defined, consolidated and extended. Leo XIII commended Thomas Aquinas to all the bishops as the "master and prince of scholastic doctors" (Aeterni *Patris,* 1879), founded the Academy of St. Thomas in Rome (1880) and authorized a new edition of his works based on the edition of the Dominican pope, St. Pius V (1570). By 1906 the edition was complete. Pius X began the codification of canon law completed under Benedict XV in 1917. The study of philosophy and theology was ordered "to be carried on in seminaries according to the arguments, doctrines and principles of St. Thomas which they are inviolately to hold." In 1902 Leo XIII appointed a commission for biblical studies under four cardinals. Pius X imposed the study of Scripture on all seminaries (1906) and ruled (1907) that the commission should examine all important controversies relating to the Bible. He revived (1907) the nork of correcting the text of the Vulgate started under Pius IX by the Barnabite Fr. Vercollone; and in 1909 he founded the Biblical institute in Rome. In 1907 (*Pascendi* domznici gregzs) and again in 1910 (Editae saepe) he condemned "modernism," the "meeting place of all heresies." It is impossible to summarize the missionary activity of an apostolic church. Dominicans entered China in the 13th century; the Jesuits in the 16th were followed by Franciscans, Dominicans and Vincentians. The mission established by St. Francis Xavier in Japan (1549) had grown in 50 years to 300.000 members and then seemed by 1640 to be extinguished by a massacre. Yet in 186j Catholic missionaries discovered a surviving church of 30.000 who without priests or sacraments had maintained acknowledgment of the pope and devotion to Our Lady. In 1862 Pius IX canonized the Japanese martyrs. African missions started on the coast by Jesuits and Dominicans (1596. 1614) were revived in the 19th century by the Holy Ghost Fathers (1842), the Society for African Missions (1859), the White Fathers (1868) and the Society of St. Joseph (1866).

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5. United States. — Whatever may be the final verdict of history in regard to the ancient and fascinating Celtic tales of ocean wanderings in which St. Brendan and his companions figure so prominently, many historians of the Catholic Church in the new world have accepted some of these legends as an initial page in their chronicles. A well-documented study of the *Navigatio* Brendani and the land of promise with an exhaustive bibliography was published in the Catholic Historical Review, pp. 395–477 (Jan. 1921), by Joseph Dunn, head of the Celtic department of the Catholic University of America., The historical link between the alleged pré-Columbian discoveries of the new world and the mediaeval church in Greenland is found in the Norse sagas. The Norse church in mediaeval America attracted the attention of scholars as a result of the publication (1893) of the documents from the Vatican archives pertaining to the diocese of Gardar in Greenland. This first Catholic diocese in the new world was established about 112 j and had resident bishops until 1377. After this date until 1492, few of the incumbents of the see resided in Greenland. The letter of Pope Alexander VI (1493) appointing the last bishop says that "on account of the freezing of the sea no ship is supposed to have touched there during the past eighty years."

Of the three principal colonizing nations — Spain, France and England — the two former mere Catholic and the third began its voyages of discovery under a Catholic king. Henry VII. The first attempt to set up church organization in the newly discovered continent was the appointment in 1493 of Bernard Boyl, or Buil, as vicar apostolic of the "Indies." Bishop-Elect Boyl accompanied Columbus on his second voyage. His labours were of short duration and of no permanent value. In 1504 Pope Julius II appointed three bishops to Hispaniola (Haiti). but the Spanish crown refused to confirm their election and the sees were suppressed. Seven years later the permanent dioceses of San Domingo and Conception (Haiti) and San Juan (Puerto Rico) were established. The see of Santiago de Cuba, erected in 1522. was the ecclesiastical centre of the Spanish missions on the mainland until 1545, when the three provinces or archbishoprics — Lima, Mexico City and San Domingo—were erected by Pope Paul III. In 156j the parish of St. Xugustine, the first within the confines of the present United States, was founded as part of the diocese of Santiago. Thus, three-quarters of a century after the discovery by Columbus, the regular canonical life of the church was well established. Out of the archdiocese of Mexico City grew later the suffragan Mexican sees of Guadalajara, Durango, Linares and Sonora, which ruled the southwestern portion of the United States until the middle of the 19th century. One of the heroic chapters in American history is that on the Franciscan. Dominican and Jesuit missions of the southwest and in California.

The French explorers and colonizers of the 16th and 17th centuries were. with few exceptions, Catholics and were ably supported by missionary groups; among them were the Récollets, Jesuits. Sulpicians, Capuchins and the secular clergy. New France was erected into a vicariate apostolic in 1658. with Bishop François de Montmorency Laval at its head. The see of Quebec (1674) had spiritual jurisdiction over all the vast province of France in North America, including the wide-spreading valley of the Mississippi, together with Louisiana.

In the English colonies along the Atlantic coast, Catholicism was generally legally proscribed. The exceptions were: Maryland, from its foundation by the Catholic Calverts in 1634 until the Puritan uprising of 1650; Rhode Island: presumably from its settlement by Roger Williams in 1636 and historically from the charter of 1663; and Pennsylvania, founded by William Penn in 1682, where there is evidence of Catholics from its earliest settlement. Thus. according to Catholic historians. Maryland has the distinction of being the first English settlement where religious freedom was part of the common law (cf. Russell, *Maryland,* Land of Sanctuary [1907]). From 1634 to 1773 Jesuits of English and American origin ministered to the Catholics in Maryland. Pennsylvania and northern Virginia. After the suppression of the Society of Jesus (1773), the legal Corporation of the Roman Catholic Clergy continued to carry on missionary work, with Father John Lewis as superior. In 1784 Father John Carroll. who had won national reputation through his part in the commission to Canada (1776). was appointed prefect apostolic of the church in the United States. Six years later he became the first bishop of Baltimore, with jurisdiction over the entire church in

the new republic. There were at this time (1790) 25 priests and about 30.000 Catholics in the United States. In 1808 Baltimore became a province or archdiocese with suffragan sees at Boston, New York, Philadelphia and Bardstown, Ky. Ten years later, Archbishop Xmbrose Maréchal reported to the Holy See, that there were 52 priests and about 100.000 Catholics in the United States.

There is hardly any parallel in the history of Catholicism to the rapid growth of the church in the United States during the 100 years following the death of Archbishop Maréchal (1828)—from about 300,000 to about 20,000,000. By mid-20th century this number had increased to approximately 34,000,000.

Composition.—The church in the United States is made up of groups from every nation in the world, with the English-speaking peoples in the majority. Up to the middle of the 19th century, the Irish and the Germans furnished the greater quota of its adherents. Later the French-Canadians, Italians, Mexicans, Poles, Lithuanians. Slovaks, Hungarians and others added notably to the number. There is also an appreciable percentage of oriental Catholics—Greeks (Uniates), Syrians, Armenians, etc. 4 development after 1945 was the increase in the number of immigrants from the Spanish-speaking Commonwealth of Puerto Rico. By 19jj an estimated 374,000 Puerto Ricans, mostly Catholics. had sought more favourable employment opportunities on the mainland. largely in the New York area,

External Relations.—This almost unprecedented growth of a religious organization which had been subject to legal and political disabilities since the 16th century was hound to give rise to misunderstandings in a country so largely composed of Protestants. After the rise of the American republic several organized politico-religious movements were instituted for the purpose either of hindering the exercise of the franchise on the part of U.S. Catholic citizens-or of keeping Catholic Americans out of offices of public trust. Chiei among these were the American Protestant association (1829), the Native-American party (1837–44), the Know Nothings (1855–61), the American Protective association (1896) and later the Ku Klux Klan. Being under the protection of the constitution, and enjoying, the advantages of the common law, Catholicism did not meet with any official governmental opposition. All such political or religious anti-Catholicism was temporary or local and did not represent the more general attitude of U.S. citizens.

Internal *Development*.—The internal development of the church in the United States was of a uniform nature. Its doctrinal history offers little of importance. The church discipline in vogue is similar to that of the other churches of Catholicism. Unity of doctrine, of moral law and of liturgical observance is preserved by an intimate union with the see of Rome. The universal canonical legislation of the church as reorganized in the New Code of Canon Law (1918), the legislation by papal rescript, the decisions in contentious cases by the apostolic delegation at Washington, D.C.. and a certain number of customs and practices which grew up in the U.S. church formed the basis for its domestic relations. Every five years each U.S. bishop is expected to pay a visit to Rome (ad *limina Apostolorum*) and to make a report of the spiritual condition of his diocese. A system of diocesan synods provides for local unity among the bishops, clergy and laity. Each province is convened into provincial councils from time to time, and at greater intervals a national or plenary council is held. Three such councils were held (1852, 1866, 1884) at Baltimore. A graduate school of canon law was established at the Catholic University of America, Washington, D.C.

Administration.—The government of the church in the United States was represented in 1956 by the apostolic delegate in Washington, D.C., and by the heads of 26 archdioceses (including four cardinals) and of 105 dioceses. In a total Catholic population of 33,574,017 there were 48,349 priests and 159,545 sisters.

Education.—An outstanding factor in the internal development of the church in the United States was in the field of education. The 1956 biennial summary oi Catholic education, covering the school year 1953–54, showed that since 1920 the number of Catholic schools of all types had increased by 39%, the number of teachers had increased by 142% and the number of students by 110%. In that school year there were 4,176,673 pupils enrolled in 12,118 schools staffed by 131,713 teachers. These included 3,235,251 students in the elementary schools, 623,751 high school students and 281,999 in colleges or universities. In addition there mere 11,623 theological students in the major seminaries and 17,955 in the minor seminaries. Catholic higher education listed 31 universities, 51 four-year colleges for men. 118 four-year colleges for u-omen, two junior colleges for men and 21 junior colleges for women. This system was crowned by the establishment of the Catholic University of America at Washington, D.C., in 1887 by Pope Leo XIII and the U.S. hierarchy. Catholic school authorities estimated that more than $500,000,000 in local school taxes is saved to the public yearly, for the grammar and secondary level alone by the existence of the Catholic school system.

Press.—The decade after World War II witnessed significant growth in the Catholic press. Circulation of Catholic newspapers and magazines in the United States reached a record high of 22,669,394 subscribers, according to the 1956–57 Catholic Press Directory. This was an increase of 1,585,172 over the preceding year. In 1955 there uere 100 archdioceses and dioceses which had their own weekly publications, publishing local and diocesan information and official episcopal notices. These carry national and world-wide news of Catholic interest, provided in most part by the National Catholic Welfare News Service (NC), along with inspirational and editorial features Other publications, weeklies, monthlies or quarterlies, serve the needs of various categories of the Catholic reading public on a national scale

Catholic Church and *the* Negro.—It was estimated in 1956 that only 3% (476,000) of American Negroes are Catholic After World War II special effort went into this sector of the apostolate. Already in 1936 the Catholic University of America had opened its doors to Negro students for the first time. In the autumn of 1947 Archbishop Joseph E. Ritter of St. Louis, Mo., ordered desegregation in all the grammar and high schools of his archdiocese. This example, though it encountered hitter protests from some Catholics, was imitated by other bishops in the years followiug as the opportunity arose. As a result the Roman Catholic Church assumed an acknowledged position as a spokesman for interracial justice. In 1956 there were 664 priests engaged in the Negro missions, with 1,894 sisters. There were 29 Catholic Interracial councils in major cities of both north and south.

National Development—Students of the social and intellectual forces of Catholicism in the United States gave considerable attention to the development of the church along national lines Changes in the immigration policy of the country rendered this development possible. since it permitted the racial elements to be more easily assimilated to national ideals. Many agencies helped effect this general evolution, among them the Catholic Educational association, the National Conference of Catholic Charities, the Catholic Hospital association, the International Catholic Guild of Nurses, the Catholic Near East Welfare association, the Central Bureau of the Central-Verein, the American Catholic Philosophical association and the American Catholic Historical association. All these organizations were aided by the central bureaus of the National Catholic Welfare conference at Washington. National organization was also effected through such societies as the Holy Name society, the Knights of Columbus, the Daughters of Isabella and the Catholic Daughters of America, the National Federation of Catholic College Students and the International Federation of Catholic Alumnae. An annual meeting of the U.S. hierarchy is held in November at the Catholic University of America for the discussion of mooted points in church discipline and progress. The National Catholic Welfare conference is directed by an administrative committee of bishops, reporting annually at the aforesaid meeting. The National Catholic Rural Life conference also meets annually.

Mission Work.—Impoverishment and problems of reconstruction in Europe after World War II meant a heavier burden upon the Catholic Church in the United States for the support of the foreign missions. In the mid-1950s American Catholics contributed 70% of the funds collected through the Society for the Propagation of the Faith throughout the world. In its biennial report of 1956 the Mission Secretariate (Washington, D.C.) reported that 5,126 U.S. priests, brothers and sisters were labouring in overseas missions. Of these 38% were in Latin America and the West Indies and 23% in Asia.

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The literature of American Catholic history of general and special nature is large in extent. J. D. G. Shea's four volumes on the History of the Catholic *Church* in the United States (1886–92) is still the standard work. The Catholic Encyclopedia contains articles on practically every noteworthy aspect of American Catholic history prior to 1918 and is especially valuable for biographical sketches. R. F. Clarke, The Lives of the Deceased Bishops, 2 vol. (1872), is generally trustworthy, though inadequate. Statistics are given annually in the *Official* Catholic Directory. The extended bibliographies of American church history, found in Peter Guilday's Lije *of* Archbishop Carroll (New York, 1922) and his Life *and Times* of John England, First Bishop of Charleston, *1786–1842* (Beirut. 1927), as well as in V. F. O'Daniel's *Right Rev. Edward Dominic Fenwick, Founder of* the *Dominicans* in *the United* States (Washington. D.C., 1920), give a list of provincial, diocesan and corporative histories. See also T. O'Gorman, *A* History

of the Roman Catholic Church in the United States (New York, 1895); Theodore Maynard, *Story of American Catholicisnz* (New York, 1948); Peter Guilday, *History of the Councils of Baltimore, 1791–1884* (New York, 1932); Jesuit Relations, *Anzerican Catholic Historical Researches,* 73 vol. (1896–1901), ed. by R. G. Thwaites, and the condensation into two volumes by Edna Kenton (New York. 1925). *See* also "Catholic Historical Scholarship in the United States," in *Catholic Historical Review!,* 7:470–477 (Washington, D.C., 1927); J. P. Cadden, *Historiography of the American Catholic Church: 1785–1943* (Washington, D.C., 1944); J. T. Ellis (comp.), *Select Bibliography of the History of the Catholic Church in the United States* (New York, 1947); Theodore Roemer, *The Catholic Church in the United States* (St. Louis, Mo., 1950); J. T. Ellis. *The Life of James Cardinal Gibbons, Archbishop of Baltimore, 1834–1921,* 2 vol. (Milwaukee, Wis., 1952); James H. Moynihan, *The Life of Archbishop John Ireland* (New York, 1953); Colman J. Barry, *The Catholic Church and German Americans* (Milwaukee, Wis., 1953). (P. GU.; J. LAF.)

6. Roman Catholicism in England. — In England, the political emancipation of Roman Catholics was granted in 1829. A number of disabilities, however, remained.

The Catholic population of England and Wales was estimated at 452,000 in 1840. In the following 60 years it rose to 1,300,000, mainly because of Irish immigration. The Irish factor indeed became dominant, overshadowing the small property-owning group of English Catholics that had survived the persecution There were great social, intellectual and cultural differences between this group, the Irish Immigrants and the converts who entered the church in growing numbers after J. H Newman's reception (1845). In the 20th century, however, there was an increase of the Catholic middle classes, to which the dispersal, particularly since 1939, of formerly closely knit Catholic centres in northern England and the migration of industry southward contributed as much as the assimilation of the former immigrants. There were also Irish and European newcomers from the professional classes

When Pius IX terminated the regime of vicars apostolic and restored the English hierarchy in 1850 (under the first cardinal-archbishop of Westminster, Nicholas Wiseman, with 12 suffragan sees), there was an outburst of anti-Catholic agitation, resulting in the Ecclesiastical Titles act (1851). This threatened the new hierarchy with fines and loss of property, but was never enforced and was repealed in 1871. Until 1908 the Roman Catholic Church in England and Wales: regarded as a church in a missionary land, was under the jurisdiction of the Congregation for the Propagation of the Faith.

Meanwhile religious orders and their teaching revived: colleges or schools for boys were established by the Jesuits at Stonyhurst (1794) and at Beaumont (1861), by the Benedictines at Ampleforth (1802) and at Downside (1814), by the Dominicans at Woodchester (1851) and by the Rosminians at Ratcliffe college (1844); and the Oratorians were introduced by Newman at Birmingham (1847). Religious communities of women were likewise developed: for instance the Society of the Holy Child Jesus, founded by Cornelia Connelly for educational purposes in 1846. Anticlerical legislation in France under the Third Republic caused a fresh influx of religious communities into England.

Henry Edward Cardinal Manning's tenure of the archbishopric at Westminster (1865–92) was characterized by his interest in social problems: he mediated successfully in the dock strike of 1889 and exerted some influence on the publication of Pope Leo XIII's encyclical on social justice, *Rerum novarum.* There was a clash of temperaments between Manning and Newman, the latter suffering many disappointments. particularly in his efforts on behalf of Catholic higher education. Catholics were forbidden by the hierarchy to attend Oxford or Cambridge university until 1895.

By the beginning of the 20th century, Protestant feeling against the church had become far less outspoken, and Catholics were to be found in all walks of the national life. Politically, the Irish Catholic influence died away, and the Catholic vote, significant though it remained in the Labour party, never exerted a decisive influence. Under the direction of the hierarchy, however, Catholics would act with unanimity on such matters as legislation on the family and on divorce and on the school question (they had to bear an increasing burden of the costs for their own schools).

The English Catholic minority, notably the converts, was well represented in the fields of letters and of journalism. John Lingard, Lord Acton, David Knowles and Christopher Dawson became eminent as historians; Gerard Manley Hopkins, Francis Thompson and Hilaire Belloc as poets; Frederick Rolfe (Baron Corvo), Maurice Baring, Evelyn Waugh and Graham Greene as novelists; and G. K. Chesterton primarily as an apologist. Weekly periodicals flourishing in the 1950s included *The Tablet* (founded in 1840), *The Catholic Times* (1859), the *Universe* (1860) and the *Catholic Herald* (1894). At the same time the Jesuits were publishing the *Month* (1863; monthly), the Benedictines the *Downside Review* (1880; quarterly) and the Dominicans *Blackfriars* (1920; monthly).

In 1957 the Catholic population of England and Wales was estimated to number 3,292,000. It constituted a strong and respected Christian community in a secularized society.

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ROMANCE, originally a composition written in "Romance" language; *i.e.,* in one of the phases on which the Latin tongue entered after or during the dark ages. For some centuries by far the larger number of these compositions were narrative fictions in prose or verse; and since the *special* "Romance" language of France—the earliest so-called—was the original vehicle of nearly all such fictions, the use of the term for them became more and more accepted in a limited sense. Yet for a long time there was no definite connotation of *fiction* attached to it, but only of narrative story; and the French version of William of Tyre's *History of the Crusades,* a very serious chronicle written towards the close of the 12th century, bears the name of *Roman d'Éracle* simply because the name of the emperor Heraclius occurs in the first line. But if the explanation of the name "Romance" is quite simple, certain and authentic, the same is by no means the case with its definition, or even with the origin of the thing to which that name came mostly to be applied. For some centuries an abstraction has been formed from the concrete examples. "Romance," "romanticism," "the romantic character," "the romantic spirit," have been used to express sometimes a quality regarded in itself, but much more frequently a difference from the supposed ."classical" character and spirit. The following article will deal chiefly with the matter of Romance, excluding or merely referring to accounts of such individual romances as are noticed elsenhere. But it will not be possible to conclude without some reference to the vaguer and more contentious signification.

Romance in antiquity. — Speculations on the origin of the peculiar kind of story which we recognize rather than define under the name of romance have been numerous and sometimes confident; but a wary and well-informed criticism will be slow to accept most of them. It is certain that many of its characteristics are present in the *Odyssey;* and it is a most remarkable fact that these characteristics are singled out for reprehension—or at least for comparative disapproval — by the author of the treatise *On the Sublime.* The absence of central plot. and the prolongation rather than evolution of the story; the intermixture of the supernatural; the presence and indeed prominence of love-affairs: the juxtaposition of tragic and almost farcial incident; the variety of adventure arranged rather in the fashion of a panorama than otherwise: all these things are in the *Odyssey,* and they are all. in varying degrees and measures, characteristic of romance. Nor are they absent from the few specimens of ancient prose fiction which we possess. If the *Satyricon* of Petronius was ever more than a mass of fragments. it was certainly a romance, though one much mixed with satire, criticism and other things; and the various Greek survivals from Longus to Eustathius always and rightly receive the name. But two things were still wanting which were to be all-powerful in the romances proper—chivalry and religion. They could not yet be included. for chivalry did not exist and such religion as did exist lent itself but ill to the purpose except by providing myths for ornament and perhaps pattern.

The "Saint's **Life."**—A possible origin of the new romance into which these elements entered (though it was some time before that of chivalry definitely emerged) has been seen by one of the least hazardous of the speculations above referred to in the hagiology or "Saint's Life," which arose at an early though uncertain period. developed itself pretty rapidly, and spreading over all Christendom (which by degrees meant all Europe and parts of Asia) provided centuries with their chief supply of what may be called interesting literature. If the author of *On the Sublime* was actually Longinus, the minister of Zenobia. there is no doubt that examples both sacred and profane of the kind of "fiction" ("imitation" or "representation") which he deprecated were mustering and multiplying close to, perhaps in. his own time. The Alexander legend of the pseudo-Callisthenes is supposed to have seen the light in Egypt as early as A.D. 200. and the first Greek version of that "Vision of Saint Paul," which is the ancestor of all the large family of legends of the life after death, is pretty

certainly as old as the 4th century and may be as old as the 3rd. The development of the Alexandreid was to some extent checked or confined to narrow channels as long as something like traditional and continuous study of the classics was kept up. But hagiology was entirely free from criticism; its subjects were immensely numerous; and in the very nature of the case it allowed the tendencies and the folklore of three continents and of most of their countries to mingle with it. Especially the comparative sobriety of classical literature became affected with the Eastern appetite for marvel and unhesitating acceptation of it; and the extraordinary beauty of many of the central stories invited and necessitated embroidery, continuation, episode. Later, no doubt, the adult romance directly reacted on the original saint's life, as in the legends of St. Mary Magdalene most of all, of St. Eustace, and of many others. But there can be very little doubt that if the romance itself did not spring from the saint's life it was fostered thereby.

The Gathering of Matter. — Proceeding a little further in the cautious quest — not for the definite origins which are usually delusive, but for the tendencies which avail themselves of opportunities and the opportunities which lend themselves to tendencies — we may notice two things very important to the subject. The one is that as Graeco-Roman civilization began to spread north and east it met, to appearance which approaches certainty, matter which lent itself gladly to "romantic" treatment. That such matter was abundant in the literature and folk-lore of the East we know: that it was even more abundant in the literatures and folk-lore of the North, if we cannot strictly be said to know, we may be reasonably sure. On the other hand. as the various barbarian nations (using the word in the wide Greek sense), at least those of the North, became educated to literature, to "grammar," by classical examples. they found not a few passages in these examples which were either almost romances already or which lent themselves, with readiness that was almost insistence, to romantic treatment. Apollonius Rhodius had made almost a complete romance of the story of Jason and Medea. Virgil had imitated him by making almost a complete romance of the story of Aeneas and Dido: and Ovid, who for that very reason was to become the most popular author of the middle ages early and late, had gone some way towards romancing a great body of mythology. We do not know exactly who first applied to the legendary tale of Troy the methods which the pseudo-Callisthenes and "Julius Valerius" applied to the historical wars of Alexander, but there is every reason to believe that it was done fairly early. In short, during the late classical or semi-classical times and the whole of the dark ages, things were making for romance in almost every direction.

It would and did follow from this that the thing evolved itself in so many different places and in so many different forms that only a person of extraordinary temerity would put his finger on any given work and say, "This is the first romance," even putting aside the extreme chronological uncertainty of most of the documents that could be selected for such a position. Except by the most meteoric flights of "higher" criticism we cannot attain to any opinion as to the age and first developed form of such a story as that of Weland and Beadohild (referred to in the *Complaint of* Deor), which has strong romantic possibilities and must be almost of the oldest. The much more complicated Volsung and Nibelung story, though we may explore to some extent the existence backwards of its Norse and German forms, baffles us beyond certain points in each case; yet this, with the exception of the religious element, is romance almost achieved. And the origin of the great type of the romance that is achieved — that has all elements present and brings them to absolute perfection — the Arthurian legend, despite the immense labours that have been spent upon it and the valuable additions to particular knowledge which have resulted from some of them, is, still more than its own Grail, a quest unachieved, probably a thing unachievable. The longest and the widest inquiries, provided only that they be conducted in any spirit save that which determines to attain certainty and therefore concludes that certainty has been attained, will probably acquiesce most resignedly in the dictum that romance "grew" — that its birthplace is as unknown as the grave of its greatest representative figure.

But when it has "grown" to a certain stage we can find it, and in a way localize it, and more definitely still analyse and comprehend its characteristics from their concrete expressions.

CLASSES OF SOURCE

Approaching these concrete expressions, then, without at first putting forward excessively hard and fast requirements in regard to the validation of the claims, we find existing in Europe about the 11th century (the time is designedly left loose) divers classes of what we should now call imaginative or fictitious literature, nearly all (the exceptions are Scandinavian and Old English) in verse. These are: (i.) The saints' lives; (ii.) the Norse sagas, roughly so-called; (iii.) the French chansons de geste; (iv.) the Old English and Old German stories of various kinds; (v.) perhaps the beginning of the Arthurian cycle; (vi) various stories more or less based on classical legend or history from the tales of Alexander and of Troy down to things like *Apollonius* of Tyre, which have no classical authority of either kind, but strongly resemble the Greek romances, and which were, as in the case named, pretty certainly derived from members of the class; (vii.) certain fragments of Eastern story making their way first, it may be, through Spain by pilgrimages, latterly by the crusades.

Now, without attempting to fence off too rigidly the classical from the romantic, it may be laid down that these various classes possess that romantic character, to which we are, by a process of netting and tracking, slowly making our way, in rather different degrees, and a short examination of the dilference will forward us not a little in the hunt.

With i. (the saints' lives) we have least to do: because by the time that romance in the full sense comes largely and clearly into view, it has for the most part separated itself off — the legend of St. Eustace has become the romance of Sir Isumbras, and so forth. But the influence which it may, as has been said, have originally given must have been continually re-exerted; the romantic-dynamic suggestion of such stories as those of St. Mary of Egypt, of St. Margaret and the Dragon, of St. Dorothea, and of scores of others, is quite unmistakable. Still, in actual result, it works rather more on drama than on narrative romance, and produces the miracle plays.

In ii. (the sagas), while a large part of their matter and even not a little of their form are strongly romantic, differences of handling and still more of temper have made some demur to their inclusion under romance, while their final ousting in their own literatures by versions of the all-conquering French romance itself is an argument on the same side. But the Volsung story, for instance, is full of what may be called "undistilled" romance — the wine is there, but it has to be passed through the still — and even in the most domestic sagas proper this characteristic is largely present.

It is somewhat less so in iii. (the *chansons* de geste), at least in the apparently older ones, though here again the comparative absence of romantic characteristics has been rather exaggerated, in consequence of the habit of paying disproportionate and even exclusive attention to the Chanson de Roland. There is more, that is, of romance in Aiiscans and others of the older class, while *Amis* and Amiles, which must be of this class in time. is almost a complete romance, blending war, love and religion — salus, *venus*, *virtus* — in full degree.

The other four classes, the miscellaneous stories from classical, Eastern and European sources, having less corporate or national character, lend themselves with greater ease to the conditions of romantic development; but even so in different degrees. The classical stories have to drop most of their original character and allow something very different to be superinduced before they become thoroughly romantic. The greatest success of all in this way is the story of *Troilus* and Cressida. For before its development through the successive hands of Benoît de Sainte-More, Boccaccio (for we may drop Guido of the Columns as a mere middleman between Benoît and Boccaccio) and Chaucer, it has next to no classical authority of any kind except the mere names. In the

various Alexandreids the element of the marvellous — the Eastern element, that is to say — similarly overpowers the classical. As for the Eastern stories themselves, they are particularly difficult of certain unravelment. The large moral division — such as *Barlaam* and *Josaphat*, the Seven Wzse *Masters* in its various forms, etc., comes short of the strictly romantic. We do not know how much of East and how much of West there is in such things as Flore et *Blanchefleur* or even in Huon of *Bordeaux* itself. Contrariwise we ought to know, more certainly than apparently is known yet, what is the date and history of such a thing as that story of Zumurrud and Ali Shahr, which may be found partly in Lane and fully in the complete translations of the Arabian Nights, though not in the commoner editions, and which is evidently either copied from, or capable of serving as model to, a Western roman d'aventures itself.

We come, however, much closer to the actual norm itself — closer, in fact, than in any other place save one — in the various stories. English, French, and to a less extent German,' which gradually received in a loose kind of way the technical French term just used, a term not to be translated without danger. Nearly all these stories were drawn, by the astonishing centripetal tendency which made France the home of all romance between the 11th and the 13th centuries, into French forms; and in most cases no older ones survive. But it is hardly possible to doubt that in such a case, for instance, as *Havelok*, an original story of English or Scandinavian origin got itself into existence before, and perhaps long before, the French version was retransferred to English, and so in other cases. If, once more, we take our existing English *Havelok* and its sister King Horn, we see that the latter is a *more* romanced form than the former. Havelok is more like a *chanson* de grste — the love interest in it is very slight; while in *King* Horn it is much stronger, and the increased strength is shown by the heroine being in some forms promoted into the title. If these two be studied side by side the process of transforming the mere story into the full romance is to no small extent seen in actual operation. But neither exhibits in any considerable degree the element of the marvellous, or the religious element, and the love interest itself is, even in Horn, simple and not very dramatically or passionately worked out. In the later ronzan d'aventures, of which the 13th century was so prolific (such as, to give one example out of many, *Amadas* and *Idoine*), these elements appear fully, and so they do in the great Auchinleck collection in English, which. though dating well within the 14th century, evidently represents the meditation and adaptation of French examples for many years earlier.

The last of our divisions, however, exhibits the whole body of romantic elements as nothing else does. It is not our business in this place to deal with the Arthurian legend generally as regards origin, contents, etc., nor, in the present division of this actual article, to look at it except for a special purpose and in connection with and contradistinctive to the other groups just surveyed. Here, however, we at last find all the elements of romance, thoroughly mixed and thoroughly at home, with the result not merely that the actual story becomes immensely popular and widely spread; not only that it receives the greatest actual development of any romantic theme; but that, in a curious fashion, it attracts to itself great numbers of practically independent stories — in not a few cases probably quite independent at first — which seem afraid to present themselves without some tacking on (it may be of the loosest and most accidental description) to the great *poly*-centric cycle, the stages of which gather round Merlin, the Round Table, the Grail and the Guinevere-Lancelot-Mordred catastrophe. All the elements, let it be repeated, are here present: war, love and religion; the characteristic extension of subject in desultory adventure-chronicles; the typical rather than individual character (though the strong individuality of some of the unknown or half-known contributors sometimes surmounts this); the admixture of the marvellous, not merely though mainly as part of the religious element; the presence of the chivalrous ideal. The strong dramatic interest of the central story is rather superadded to than definitely evolved from these elements; but they are still present, just as, though more powerfully than, in the weakest of miscellaneous *romans* d'aventures.

'Italian romance seems to have modelled itself early on French, and it is doubtful, rich as is the late crop of Spanish romances, whether we have any that deserve the name strictly and are really early.

TYPES OF STORY, INCIDENT AND PERSONAGES

A further step in the logical and historical exploration of romance may be taken by regarding the character-and-story classes round which it groups itself, and which from the intense community of mediaeval literature — the habit of mediaeval writers not so much to plagiarize from one another as to take up each after each the materials and the instruments which were not the property of any — is here especially observable. Prominent above everything is the world-old motive of the quest; which, world-old as it is, here acquires a predominance that it has never held before or since. The object takes pretty various, though not quite infinitely various, forms, from the rights of the disinherited heir and the hand or the favour of the heroine, to individual things which may themselves vary from the Holy Grail to so many hairs of a sultan's beard. It may be a friendly knight who is lost in adventure, or a felon knight who has to be punished for his trespasses; a spell of some kind to be laid; a monster to be exterminated; an injured virgin or lady, or an infirm potentate, to be succoured or avenged; an evil custom to be put an end to; or simply some definite adventure or exploit to be achieved. But quest of some sort there must certainly be if (as in Sir Launfal, for instance) it is but the recovery of a love forfeited by misbehaviour or mishap. It is almost a sine qua non — the present writer, thinking over scores, nay hundreds, of romances, cannot at the moment remember one where it is wanting in some form or another.

It will be observed that this at once provides the amplest opportunity for the desultory concatenation or congregation of incident and episode which is of the very essence of romance. Often, nay generally, the conditions, localities and other circumstances of the quest are half known, or all but unknown, to the knight, and he is sometimes intentionally led astray, always liable to be incidentally called off by interim adventures. In many (perhaps most) cases the love interest is directly connected with the quest, though it may be in the way of hindrance as well as of furtherance or reward. The war interest always is so connected; and the religious interest commonly — almost universally in fact — is an inseparable accident. But everything leads up to, involves, eventuates in the fighting. The quest, if not always a directly warlike one, always involves war; and the endless battles have at all times, since they ceased to be the great attraction, continued to be the great obloquy of romance. It is possible no doubt that reports of tournaments and single combats with lance and sword, mace and battle-axe, may be as tedious to some people as reports of football matches certainly are to others. It is certain that the former were as satisfactory in former times to their own admirers as the latter are now. In fact the variety of incident is almost as remarkable as the sameness. And the same may be said, with even greater confidence, of the adventures between the fights in castle and church and monastery, in homestead or hermitage. The actual stories are not much more alike than those who have read large numbers of modern novels critically know to be the case with thern. But the absence, save in rare cases, of the element of character, and the very small presence of that of conversation, show up the sameness that exists in the earlier case.

The same deficiency in individual character-drawing, and in the conversation which is one of its principal instruments, brings out in somewhat unfair relief some other cases of apparent sameness — the "common forms" of story and of character itself. The disinherited heir, the unfaithful or wronged wife, the wicked stepmother, the jealous or wrongly suspected lover, are just as universal in modern fiction as they are in mediaeval — for the simple reason that they are common if not universal in nature. But the skeleton is more obvious because it is less clothed with flesh and garments over the flesh; the texture of the canvas shows more because it is less worked upon. Some of these common forms, however, are more peculiar to mediaeval times; and some, though not many, allow excursions into abnormalities which, until

recently, were tabooed to the modem novelist. Among the former the wickedness of the steward is remarkable, and of course not difficult to account for. The steward or seneschal of romance, with some honourable exceptions, is as wicked as the baronet of a novel, but here the explanation is not metaphysical. He was constantly left in charge in the absence of his lord and so was exposed to temptation. The extreme and almost Ephesian consolableness of the romance widow can be equally rationalized—and in fact is so in the stories themselves—by the danger of the fief being resumed or usurped in the absence of a male tenant who can maintain authority and discharge duties. While such themes as the usually ignorant incest of son with mother or the more deliberate passion of father for daughter come mostly from very popular early examples—the legend of St. Gregory of the Rock or the story of Apollonius of Tyre.

Characters of Romance Proper.—The last point brings us naturally to another of considerable importance—the singular purity of the romances as a whole, if not entirely in atmosphere and situation, yet in language and in external treatment. It suited the purposes of the Protestant controversialists of the Renaissance, such as our own Ascham, to throw discredit upon work so intimately connected with Catholic ceremony and belief as the *Morte d'Arthur;* and it is certain that the knights of romance did not even take the benefit of that liberal doctrine of the Cursor *Mundi* which regards even illicit love as not mortal unless it be "with spouse or sib." But if in the romances such love is portrayed freely, and with a certain sympathy, it is never spoken of lightly and is always punished; nor are the pictures of it ever coarsely drawn. In a very wide reading of romance the present writer does not remember more than two or three passages of romance proper (that is to say before the latter part of the 15th century) which could be called obscene by any fair judge. And the term would have to be somewhat strained in reference even to these.

The contrast with the companion divisions of fabliaux and farces is quite extraordinary; and nearly as sharp as that between Greek tragedy on the one hand and Greek comedy or satiric play on the other. It is brought out for the merely English reader in Chaucer of course, but in him it might have been studied. In the immense corpus of known or unknown French and English writers (the Germans are not quite so particular) it comes out with no possibility of deliberation and with unmistakable force.

The history of the forms in which romance presents itself follows a sufficiently normal and probable course. The oldest are always—save in the single case of part of the Arthurian division, in which we probably possess none of the actually oldest, and in some of the division of Antiquity which had a long line of predecessors in the learned languages—the shortest. They become lengthened in a way continued and exemplified to the present moment by the tendency of writers to add sequels and episodes to their own stories, and made still more natural by the fact that these poems were in all or almost all cases recited. "Go on" is the most natural and not the least common as well as the most complimentary form of "Bravo!" and the reciter never seems to have said "no" to the compliment. In not a few cases—Huon of Bordeaux, Ogier the Dane, Guy of *Warwick,* are conspicuous examples—we possess the same story in various stages; and can see how poems, perhaps originally like King Horn of not more than a couple of thousand lines or even shorter in the 13th century, grew to thirty, forty, fifty thousand in the 14th. The transference of the story itself from verse to prose is also—save in some particular and still controverted instances—regularly traceable and part of a larger and natural literary movement. While, also naturally enough, the pieces become in time fuller of conversation (though not as yet often of conversation that advances the story or heightens its interest), of descriptive detail, etc. And in some groups (notably that of the remarkable *Amadis* division) a very great enlargement of the proportion and degradation of the character of the marvellous element appears—the wonders being no longer mystical, and indeed being magical only in the lower sense.

CHARACTERISTICS OF ROMANCE

And so we come to the particular characteristics of Romance. What are these characteristics?

The answer given to this question universally (with a few dissidents) from the Renaissance to nearly the end of the 18th century and not infrequently since was that romance on the whole, and with some flashes of better things at times, is a jumble of incoherent and mostly ill-told stories. combining sameness with extravagance, outraging probability and the laws of imitative form, childish as a rule in its appeal to adventure and to the supernatural. immoral in its ethics, barbarous in its aesthetics, destitute of any philosophy, representing at its very best a necessary stage in the education of half-civilized peoples, and embodying some interesting legends. much curious folklore and a certain amount of distorted historical evidence. On the other hand, since the end of the 18th century, there have been some who have seen in romance almost the highest and certainly the most charming form of fictitious creation, the link between poetry and religion, the literary embodiment of men's dreams and desires. the appointed nepenthe of more sophisticated ages as it was the appointed pastime of the less sophisticated Between these opposites there is of course room for many middle positions.

Romance enmeshes and retains a vast amount of story material to which there is little corresponding in ancient literature. It lays the foundation of modern prose fiction and involves the whole structure of the novel (*q.v.*). It antiquates the classical assumption that love is an inferior motive, and that women, though they "may be good sometimes" are scarcely fit for the position of principal personages. It helps to institute and ensure a new unity—the unity of interest. It admits of the most extensive variety. It gives a scope to the imagination exceeding that of any known older literary form. At its best it embodies the new or Christian morality, and it establishes a concordat between religion and art in more nays than this. Incapable of exacter definition, it is nevertheless comprehensible and, informal as it is, possesses its own form of beauty—a precious one. These characteristics were taken at their worst by early critics; they were perceived by its champions and perhaps exaggerated. From both attitudes emerged that distinction between the "classic" and the "romantic" which mas referred to at the beginning of this article. The crudest is Goethe's "Classicism is health; Romanticism is disease." Classicism might be said to be method and romanticism energy. But in fact sharp distinctions do much more harm than good. It is true that the one tends to order, lucidity. proportion; the other to freedom, to fancy, to caprice. But the attempt to reimpose these qualities as absolutely distinguishing marks and labels on particular works is almost certain to lead to mistake and disaster, and there is more than mere irony in the definition of romance as "Something which was written between an unknown period of the Dark Ages and the Renaissance, and which has been imitated since the later part of the 18th century." What that something really is, is not to be knoun well except by reading more or less considerable sections of it.

See also articles on the different national literatures, especially French and Icelandic; and the following:

Classical or Pseudo-Classical *Subjects.*—APOLLONIUS OF TYRE; LONGUS; HELIODORUS; APULEIUS; LUCIUS; TROY AND TROAD; THEBES; CAESAR, GAIUS JULIUS; ALEXANDER III (The Great); HERCULES; JASON; OEDIPUS; VIRGIL.

Arthurian *Romance.*—ARTHURIAN LEGEND; CHRETIEN DE TROYES; GOTTFRIED VON STRASSBURG; MALORY, SIR THOMAS; WOLFRAM VON ESCHENBACH; etc.

French *Romance.*—CHANSONS DE GESTE; CHARLEMAGNE; GUILLAUME D'ORANGE; OGIER THE DANE; ROLAND, LEGEND OF; RENAUD DE MONTAUBAN (*Quatre* fils Aymon); HUON OF BORDEAUX; MACAIRE; PARTONOPEUS DE BLOIS; ROBERT (the Devil); AUCASSIN AND NICOLETTE; RAOUL DE CAMBRAI; BENOÎT DE SAINTE MAURE, etc.

Anglo-Norman, Anglo-Danish, English Romance.—HORN; HAVELOK THE DANE; ROBIN HOOD; MAID MARIAN.

German.—NIBELUNGENLIED; ORTNIT; DIETRICH VON BERN; WOLFDIETRICH; HELDENBUCH; WALTHARIUS; RUODLIEB.

Northern.—SIEGFRIED; WAYLAFD THE SMITH; HAMLET; EDDA.

Spanish.—AMADIS DE GAULA.
Various.—REYNARD THE FOX; ROMAN DE LA ROSE; GENEVIEVE OF BRABANT; GESTA ROMANORUM; BARLAAM AND JOSAPHAT; SEVEN WISE MASTERS; MAELDUIN, VOYAGE OF.

BIBLIOGRAPHY.—The first modern composition of importance on romance is the very remarkable dialogue De la Lecture des vieux *romans* written by Chapelain in mid-17th century, a surprising and thoroughgoing defense of its subjects. For long afterward there mas little save unintelligent and mostly quite ignorant depreciation. The sequence of really important serious works almost begins with Hurd's Letters on Chivalry and *Romance* (1762). In succession to this may be consulted on the general subject the dissertations of Percy, Warton and Ritson; Sir Walter Scott, "Essay on Romance" in the supplement to the Encyclopedia *Britannica* (1816–24); Dunlop, History oj Fiction (1816, useiully supplemented and completed by its 4th edition, 1888, with very large additions by H. Wilson); C. L. B. Wolff, *Allgemeine* Geschichte des Romans (1841–50); H. L. D. Ward, Catalogue of Romances in the British *Museum* (vol. i, 1883, vol. ii. 1893) (the most valuable single contribution to the knowledge of the subject); G. Saintsbury, The Flourishing of Romance and the Rire *of* Allegory (1897), and its companion volumes in Periods of European Literature [W. P. Ker, The Dark *Ages* (1904); F. J. Snell, The Fourteenth Century (1899); G. Gregory Smith, The *Transition* Period (1900); D. Hannay, The Later Renaissance (1898)]; W. P. Ker, Epic and Ronzance (1897). (G. Sa.; X.)

ROMANCE LANGUAGES, or Romanic languages (RL), derive their name from *Roman(ic)*—that is. "Latin" because they are modern continuations of Latin. To call them daughter languages of Latin is merely metaphoric. since no descent or new creation is involved. Neo-Latin is a satisfactory term: but the Romance languages are so different from ancient Latin that entirely new names are justified. Enumerating and classifying the many dialects of the RL requires determination of the extent to which idioms called by the same name must be similar or may differ. The "discovery" of a new Romance language such as Franco-Provençal merely expresses the scholar's conviction that a type of speech appears sufficiently distinct from others so as to deserve a name of its own. The problem of classification is simplified if language is defined as a standard literary form of speech as opposed to the numerous unwritten or uncodified dialects. In this sense, the following RL may be enumerated: (1) Italian, (2) Rumanian, (3) French. (4) Provençal, (5) Spanish, (6) Portuguese. (7) Catalan, (8) Rhaeto- (Raeto-) Romance and (9) Sardinian. Italian. with the exception of dialects north of the Apennines, and Rumanian are often classified as Eastern, the rest as Western Romance languages. Rhaeto-Romance and Sardinian have no single standard literary languages, Catalan is endeavouring to retain or revive one, and Provençal no longer has one. Other enumerations of RL are therefore possible, depending on the manner of counting and classifying.

In common usage. terms like French, Italian or Spanish refer to the standard languages as taught in schools. Dialects subsumed under each may well be as different from one another as are the standard languages from one another; hence, speaking of Italian or French dialects often reflects national or geographic rather than linguistic criteria.

Spoken Latin.— One generally says that the RL do not continue Classical Latin (CL) but Vulgar Latin (VL). The latter term is better avoided in this context because it is variously defined and mainly because it almost invariably refers to some kind of late, postclassical or unclassical, "bad" written Latin, whereas the RL are derived from the spoken idioms of the Latin-speaking world (the Romania). CL, like any other classical or standard language, had its roots in-spoken language, but with grammatical codification came some measure of petrifaction. The continuous change in spoken Latin (SL), like all cultural change, was in part a consequence of passing time but it was more significantly conditioned by the cultural history of the speakers.

As Latin spread over former non-Latin-speaking areas (the earliest Latin was spoken only in Rome and its surroundings), the natives transferred some of their linguistic habits to the new language (the influence of the linguistic substratum), and immigration, more or less intense or durable by speakers of foreign languages brought new linguistic traits which speakers of Latin then acquired (the superstratum). The history of Italy and Romania, including such recent events as the Latinization of the Americas, serves therefore as a background and base for their linguistic history.

Since not all regions of the Romania were Romanized at the same time, they were not all exposed to the same kind of Latin; indeed the new world learned Neo-Latin, *i.e.*, French, Spanish and Portuguese. Nor were they Romanized by the same Latin dialect: one district may have learned its Latin primarily from middle-class or lower-class veterans and farmers, another from upper-class administrators. officers and merchants. Some districts were soon provided with schools and learned Latin from, grammarians, others learned it merely by ear in daily intercourse.

Considering all these historic and cultural causes for linguistic variety. one cannot but believe that the entire Romania spoke throughout its history many Latin and Neo-Latin (Romance) dialects, and that the uniformity of Latin is no more than an illusion due to the identification of "Latin" with standard written CL, a view which is conducive to misunderstanding. It is true that apart from good CL there existed also all over the Romania a less classical common speech, something of an international language or *koine*, which became more un-Ciceronian with the passage of time and the political and cultural breakdown that accompanied the decline and fall of the Roman empire. But not all persons spoke this progressively worsening (from a classical viewpoint) common Latin. and it is certainly not the basis of the Romance languages. This *koine* is, however, the predominant idiom of texts coming from all over the empire. Being frequently identified as VL, it has given rise to the view that linguistic uniformity prevailed throughout the Romania until the 8th or 9th century, which suddenly, cataclysmically and catastrophically, disintegrated into the numerous Romance dialects. Linguistic development does not generally occur in this way: there is no reason to assume it did in this instance.

What are the linguist's sources of real spoken Latin, not only for postclassical and Proto-Romance (PR), but also for classical and preclassical times? Latin began to be codified in the mid-2nd century B.C. under Greek influence and with the influx of Greek literature and Greek teachers of grammar. The earlier preclassical texts available, literary and epigraphic (and they are far from abundant), represent fairly well the spoken language, much better than do later texts. With the establishment of a standard language, its use by "good" writers, and grammatical instruction for the youth of the upper classes, went a rejection of all substandard colloquial and popular usage. Henceforth no one wanted to commit the (social) error of using "bad" Latin, and deviations encountered in the extant records are mainly inadvertent. During the classical period and for some time thereafter, when fair public education was accessible to many people, such lapses tended to be few in comparison with their number in subsequent centuries, which experienced a general decline in literary standards and a relaxation of the requirements for grammatical correctness. Dialect literature and "realistic" writing are lacking in the literary records—if they ever existed. Plautus' preclassical comedies, Petronius' 1st-century novel Satyricon and Apuleius' 2nd-century novel The Golden *Ass* are the only examples available. Hence most information comes from the less inhibited inscriptional evidence, especially the *graffiti* (scratchings on walls), from grammarians quoting and chastizing "bad" language, from collections of "errors" such as the Appendix Probi (probably of the 3rd century A.D.), from glosses (interlinear or marginal explanations of difficult words in a manuscript). and, of course, from the RL themselves.

Proto-Romance.— Owing to the poor documentation and the overpowering influence that CL exerted on all writing, it is not surprising that one cannot detect genuine local Latin dialects as forerunners of the Romance dialects, apart from a few, often inconclusive forms. But it n-ould be shortsighted to deny their existence, just because the evidence is lacking, in an area so large and of such pre-Latin linguistic variety as the Romania, particularly since the Roman state attached no importance to the linguistic acculturation of its possessions. The absence anywhere in the Romania of dialectal texts that one could call PR rather than Latin before the 9th century, when they appear with some suddenness and differ in appearance from the Latin texts of the same

localities, is due to the absence of any incentive to use what was obviously bad Latin in writing. But once it was realized that the spoken vernaculars were not really just depraved Latin but languages in their own right, and that it was useless to try to communicate in Latin either in writing or speaking with persons nho knen no Latin, then these bad, rustic. vulgar dialects nere eventually thought worthy of being recorded for certain purposes. All higher literary and scientific endeavour, homever, remained for centuries to come the province of the prestige language. Latin. The history of the Romance dialects is the history of the linguistic emancipation of the Romania.

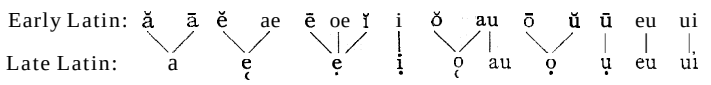
For a time, varying in length in the various regions. all dialects were of equal prestige, and the earlier Romance documents transmit fuller information on dialectal varieties than has since been available. But with the formation of national states of cultural and intellectual centres, often coinciding with the residence of the monarch and the political capital, certain local dialects augmented their prestige and usefulness at the expense of others. The ultimate consequence was the elevation of such dialects. often just one for each nation, to the dignity of a written standard language such as CL had once been, and the relegation of the other dialects to patois of lesser importance. Thus French is essentially the language of Paris. Italian that of Florence and Spanish that of Madrid. (For details, see the articles on the separate languages) The time when and the speed with nhich a new standard language mas formed and acquired currency depend on the accompanying cultural conditions and events

In the future, any one of the standard RL may share the fate of CL by becoming petrified·and estranged from common use to such an extent as to wither away. This evolution, however, is counteracted. first. by the tendency observable during the past several centuries. and likely to continue at a mounting rate, of the acquisition of the standard language by an increasing number of persons thanks to growing literacy. improved communications and the retreat of the nonstandard dialects; and second, by the anareness on the part of modern grammarians that attempts to keep a language "pure" and immutable are merely conducive to its mummification.

This article deals mainly with those historic changes of SL which are more or less common to all Romance dialects and pertain to a stage of development called PR. (For the changes which specifically lead to their current distinctions, see articles on the separate languages.)

It is customary, and. in view of the scanty documentation, virtually inevitable. to compare PR with CL. rather than preceding stages of SL. But such comparison should not imply a linear development·from CL to Romance. The chronological sequence (no matter hon poorly attested in parts) is not Old Latin → Classical Latin → "Vulgar Latin" → Proto-Romance, but rather Old (spoken) Latin → Spoken Latin of the classical period → late spoken Latin → Proto-Romance.

Phonology. — The most important phenomenon in the vowels concerns the change from phonemic quantity to phonemic quality. Where at one time the relative length of the vowels was significant, so that tno forms might be distinguished from one another solely by vocalic quantity. in PR only vocalic quality is distinctive. Since spelling was neither immediately nor consistently affected by this change, it is impossible to say when it began to operate. But it seems certain that its inception precedes the appearance of Romance documents not by decades but by centuries; its earliest traces can in fact be discerned in inscriptions of Rome's republican era. In general, long vowels become close (*uērum* > *ụerum*) and short vowels open (*bĕne* > bpne). (On the pronunciation of Latin spellings, see LATIN LANGUAGE) Where, then. earlier Latin distinguishes tno e-like sounds by their quantity, late SL and PR distinguish them by their quality. It may be assumed that already during the period of phonemic quantity, length was accompanied by closeness and shortness by openness of pronunciation. and that there eventually occurred a shift of distinction from one to the other of the vowel characteristics. Some diphthongs became monophthongized. The following schema illustrates the evolution of the stressed vowels.



Note that the qualitatively similar vowels. ē-ĭ and ō-ŭ. once their quantity ceases to be distinctive, coincide and have henceforth the same development in Romance, with the exception of dialects of southern Italy. Sardinia and some others. Following nasals, palatals or consonant clusters may produce various divergent developments in the different dialects.

The vowels not bearing the main stress develop somewhat differently. It is well to distinguish between final position (*murUm*), secondary stress position (*pótestÂtem*) and unstressed position (initial. *mAritus, Altárem;* pretonic. *potEstátem;* posttonic, *pópUlum*) Among these, the pretonic and posttonic (which occur necessarily in words of more than two syllables — othernise pretonic is impossible and posttonic is final) are weakest and tend to be syncopated early, whereas the secondary stress vonel is strongest and most likely to preserve its vowel in the original quality. The a is, among all vowels in these positions, the most stable. The place of the stress in PR is almost invariably the same as in earlier Latin.

While the history of the vowels is only secondarily determined by their phonetic surroundings and their stress. the consonants change primarily as a result of their surroundings (except h nhich disappears completely). Hence consonants that are different in terms of place of articulation (labial. dental. velar) often undergo changes of the same type in terms of kind of articulation (palatalization, lengthening. fricatization. loss. lenition) according to their position in the word (initial, medial, final) and their surroundings (intervocalic, in clusters, before *r* and 1, before yod). The developments are too varied to be schematized briefly. They will be found in detail in the articles on the separate RL.

Morphology and Syntax. — In the noun, the most important change is from a three-gender and six-case to a two-gender and one-case (*i.e.*, "no case") declension. In some Romance dialects there are remnants of the cases (Rumanian. Old French. Old Provencal) in the noun, and in all dialects of the cases and of the neuter gender in the pronoun. Case and gender reductions are tied up with the phonemic changes which eliminate the final consonants, especially *s* and *m,* which are of crucial importance in the Latin inflection. and with the blurring of distinctions among final vowels, which are essential for recognizing gender and case. In the modern RL the noun gender is formally expressed by the article (formerly a Latin demonstrative pronoun) and the adjective, which must "agree" with the noun they modify. The function of the cases is fulfilled either by a more rigid word-order (le *père aime le* fils: subject-verb-object : *cf.* Latin *pater amat filium, filium amat* pater, *amat* pater *filium,* etc., all meaning the same) or by prepositional phrases (*filio: au* fils; *filii: del figlio*). The Romance constructions are neither more "logical" or "natural." nor less efficient than the corresponding Latin ones. They are merely different.

In the verb. the RL dropped a number of forms (future perfect: except Rumanian. Spanish and Portuguese, but with new meanings: imperfect subjunctive. except in Sardinian; pluperfect. except in Spanish. Portuguese; perfect subjunctive) ; they created a number of new compound tense forms (mainly of the past, indicative and subjunctive) ; they replaced the future by a new composition of infinitive plus *habere,* less frequently *uelle* (Rum.) or *debere* (Sard.)—*cf.* Eng. "I will." "I shall"—which has. however, now lost all appearance of compoundness in most dialects (*amare* habeo > *j'aimerai, amerò,* etc.).

This type of replacement of Latin simple (synthetic) by Romance compounded (analytic) locutions pervades the entire morphology. It shows itself also in the substitution of prepositional phrases for case-forms; in the entire reformation of the passive voice (participle plus form of *esse; amatur: il* est *aimé*), which' causes the disappearance of deponent verbs; the use of plus or *magis* in the comparison of adjectives instead of suffixes (grandis, *grandior:* grand, *plus* grand, mas *grande;* the retained Latin comparatives are few: *melius* > *mieux, meglio; peius* > pis; *minus* > *moins*) ; the formation of the Romance adverb with *mente* (clare:

clara mente > *chiaramente*).

The number of subjunctive forms is reduced, or else they are employed for other purposes. The elaborate consecutio *temporum,* the rule on the sequence of tenses. is abolished. In general, the use of subjunctives is strongly reduced, a development which still continues, especially in colloquial use. Almost all Romance dialects have so-called conditionals. which are employed for expressing conditions contrary to fact and in the main clause of conditional constructions, with the if-clause following various rules (*s'il pouvait,* il le ferait; se potesse, lo farebbe).

Vocabulary.—Most areas of the Romania had been thoroughly Latinized in vocabulary so that relatively few pre-Latin (Celtic. Oscan. Cmbrian, Etruscan, Greek) words were retained. Similarly, linguistic superstrata in the Romania (Germanic, Arabic, Slavonic), while leaving stronger traces than the substrata, account for a small percentage of Romance vocabulary. The number depends on the political and cultural history of each region: it is greater in Rumania where the superstratum is Slavonic, for example, than in Italy where it is Germanic. The later a word is borrowed into the RL, the fewer historic changes it undergoes. This is especially true of "learned" words of Latin and Greek origin which were taken into the languages during the Renaissance and subsequent centuries: down to the present when scientists coin many of their terms from Latin or Greek roots. Any foreign word becomes, after a while, a less foreign loanword, and old enough loanwords may appear so native that they are often recognized as not such only when linguistically analyzed.

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ROMAN DE LA ROSE, a French poem of which the first part was written about 1230 by Guillaume de Lorris, and which was completed about 40 years later by Jean de Meun (*q.v.*). Guillaume de Lorris wrote an allegory, which is an artistic presentment of the love philosophy of the troubadours. In a dream the Lover visits a park to which he is admitted by Idleness. In the park he finds Pleasure, Delight. Cupid and other personages, and at length the Rose. Welcome grants him permission to kiss the Rose. but he is driven away by Danger. Shame. Scandal, and especially by Jealousy. who entrenches the Rose and imprisons Welcome, leaving the Lover disconsolate. The story thus left incomplete, was finished in 19.000 lines by Jean de Meun, who allows the Lover to win the Rose. but only after a long siege and much discourse from Reason. the Friend, Nature and Genius. In the second part. however, the story is entirely subsidiary to picturesque and poetic digressions. and to violent satire in the manner of the fabliaux against the abuse of power, against women, against popular superstition and against the celibacy of the clergy. The length of the work and its heterogeneous character proved no bar to its enormous popularity in the middle ages, attested by the 200 manuscripts of it which have survived.

The *Romaunt of* the Rose was translated into English by Chaucer (see the prologue to the Legende of Good *Women*), but the version which has come down to us (*see* an edition by Max Kaluza, Chaucer society. 1891), is generally admitted to be by another hand. For a list of books on the authorship of the English translation see G. Korting, *Grundriss* der *engl.* **Lit.,** 4th ed.. p. 184 (1905). Three editions of the Ronzan de la Rose were printed between 1473 and 1490; two by Xntoine Verard (1490? and 1496?), by Jean du Pré (1493?), by Nicholas Desprez for Jean Petit and by Michel le Noir (1509 and 1519). In 1503 Jean Molinet produced a prose version. Marot modernized the text (1526), and his corrections were followed in subsequent editions. There is a modern English version by F. S. Ellis in 3 vol. (1900).

ROMAN DE LA VIOLETTE, a romance (1227–29) by Gerbert of Montreuil, dedicated to Marie of Ponthieu, wife of Simon, count of Dammartin. In the romance Gerart of Nevers stakes his domains on the fidelity of his mistress, Euriaut. Lisiart of Forez contrives to see Euriaut bathing and uses his knowledge, thus acquired, of her violet-shaped birthmark to convince Gerart of her faithlessness and claim the wager. Gerart abandons his mistress but later discovers Lisiart's treachery and, after many adventures, kills him and marries Euriaut.

Derived from the Conzte de *Poitiers* (c. 1180) and the *Roman* de la Rose (*Guillaume* de Dole) (c. 1200), this poem, like the latter, is interspersed with lyrics. The same theme, found in the *Decameron* (II, 9), underlies Shakespeare's *Cymbeline;* a 15th-century prose version inspired Wilhelmine de Chézy's libretto for Weber's opera, *Euryanthe* (1823).

See editions *by D.* L. Buffum, *Société des Ancient Textes Français* (1928) and (prose version) L. F. H. Lowe (1928).

ROMAN-DUTCH LAW. The term Roman-Dutch law describes the system of law which existed in the province of Holland from the 1 jth to the 19th centuries. This system, introduced by the Dutch into their colonies. was retained in those of them which passed to the British Crown at the end of the 18th and the beginning of the 19th centuries. These were the maritime districts of Ceylon. the Cape of Good Hope, and the settlements upon the coast of South America now comprised within the colony of British Guiana. In a secondary sense therefore Roman-Dutch law is the original common law of these countries. In Ceylon this system has been extended to the Kandyan Provinces (annexed in 1815), while in South Africa it was carried forward with the expanding range of white settlement into the Republics and Natal. To-day it is in force in the whole of British Africa south of the Zambesi, as well as in the Mandated Territory. known as the Protectorate of South-West Africa.

In British Guiana on the other hand the Roman-Dutch law having been found unsuited to the existing conditions of the colony has by the local Civil Law of ,British Guiana Ordinance 1916, taking effect from Jan. 1, 1917, been to a very great extent replaced by the common law of England. When it is said that Roman-Dutch law forms the common law of British South Africa and Ceylon, this must be understood with a reservation in favour of native law and custom, so far as these are recognized, and with the qualification that the general law of these countries, as will be seen, has in many respects departed from its original type.

Historical Development.— It does not fall within the scope of this article to investigate the historical sources of the old Dutch law. It is enough to say that in the 15th and 16th centuries the Roman law was "received" in *subsidium* in the province of Holland, as it was sooner or later in the Netherlands generally, as well as in Germany. General and local customs, based ultimately upon Germanic tribal law (Frankish, Frisian, Saxon), afforced by privileges and by-laws (keuren), and affected, doubtless, by an earlier "infiltration" of Roman law, held their ground. Hence resulted the mixed system for which Simon van Leeuwen in 1652 invented the term "Roman-Dutch law." This remained in force until superseded in 1809 by the Code Napoléon, which in 1838 gave place to the existing Dutch civil code. The old law was abrogated in the Dutch colonies also, so that to-day the Roman-Dutch law is no longer in force outside the British empire. (*See* ROMAN LAW.)

We have spoken of two elements in the Roman-Dutch system, Roman law and Germanic custom. To these must be added a third, viz., legislative acts of the Burgundian and Spanish periods. Such were the Great Privilege of Mary of Burgundy of 1476; the Placaat of the emperor Charles V. of 1529. requiring immovable property to be transferred before the local court; the Perpetual Edict of the same monarch of 1540, relating to clandestine marriages and other matters; the Maritime Laws of Charles V. of 1551 and of Philip II. of 1563; the Codes of Criminal and Civil Procedure of Philip II. of 1570 and 1580; the Political Ordinance of the States of Holland of 1580; the Placaat on Intestate Succession of 1599. There was much legislation in the 17th and 18th centuries, but it had little effect upon the general character of the legal system. Apart from legislation we derive our knowledge of the Roman-Dutch law from collections of decided cases, from col-

lections of opinions, commonly termed *consultatien* or *advijsen,* and from a rich juristic literature.

Systematization.—The first attempt to reduce the Roman-Dutch civil law to system was made by Hugo de Groot (Grotius) in his *Introduction to the Jurisprudence of Holland (Inleiding tot de Hollandsche Rechts-geleertlzeyd),* written while he was a prisoner in Loevestein in 1619–20, published in 1631. This short treatise, a masterpiece of condensed exposition, remains to this day a legal classic. But after Grotius honor must be assigned to Johannes Voet (1647–1713), professor at Utrecht and Leyden, whose *Commentarius ad Pandectas* (1698–1704) more than any work of the old law is in use to-day. In the 18th century the most famous name is Cornelis van Bijnkershoek, for 20 years president of the Supreme Court (1673–1743). Towards the end of the century Dionysius Godefridus Van der Keessel, professor at Leyden, lectured on the *jus hodiernum,* of which he published a summary in *Theses selectae juris Hollandici et Zelandici* (1800). Copies of the lectures themselves, commonly known as Van der Keessel's *Dictata,* circulate in ms., and these have been cited in judgments of the South African Courts. A younger contemporary of Van der Keessel was Joannes van der Linden, the author of a popular textbook, *Regtsgelecrd, Practicaal en Koopmans Handboek.* These two names conclude the list of the contemporary writers on the old Dutch law.

The Dutch carried to their colonies the law of the home country, just as the English took with them their common law, and subject to the same necessary adaptation to local conditions. In practice the law of the province of Holland was followed. Hence the extension to the colonial empire of the Roman-Dutch system of law. This was supplemented by local ordinances of the governors in council, and in the East Indies by laws made by the governor-general in council established at Batavia. These were collected by Van Diemen in 1642 and by Van der Parra in 1766. The supreme direction of the East India company was exercised by the Council of XVII. and of the West India company by the Council of X. The ultimate legislative authority was vested in the States General.

In the British Empire.—When the Dutch colonies passed to the British Crown, the old law was in principle retained, but during the century and more which has since elapsed it has undergone profound modifications due partly to changed social and economic conditions, partly to the incursion of rules and institutions derived from English law. In commercial matters, in particular, English influences have been predominant. This was so even in the South African republics, and after annexation their law was brought into closer harmony with that of the neighbouring colonies.

The South Africa Act 1909 provided (sec. 135) for the continuance of all laws in force in the several colonies at the establishment of the Union until repealed by the Union parliament, or by the provincial councils within the sphere assigned to them. But since this Act took effect on May 31, 1910, the Union parliament and the appellate division of the Supreme Court of South Africa (which hears appeals not only from the Union, but also from Southern Rhodesia and the Mandated Territory) have been active in consolidating, amending and explaining the law, and will continue to introduce uniformity in place of diversity. Many of the rules of the old law have already been pronounced to be obsolete by disuse.

But, except where the field is occupied by statute or invaded by English law, the law of South Africa (and in a less degree the law of Ceylon) retains the character of a Roman law system. In many departments of the law the texts of the *Corpus Juris* are still cited as authoritative. The approach to them is through the writings of the Dutch jurists, Grotius, van Leeuwen, Voet, van der Keessel, van der Linden and the rest. The influence of English law has been profound, most of all in British Guiana, where its victory has been complete, less in Ceylon, least in South Africa. But at some points the Roman-Dutch law has otiered a stubborn resistance. Thus, it is now settled for both South Africa and Ceylon that "consideration" is not necessary to the validity of a contract. South Africa (but not Ceylon) retains almost unchanged the old law of community of goods with its consequences in the proprietary relations of the spouses.

Upon a general view it must be said that a system of law, which can draw at the same time upon the treasures of the Roman and of the English law has great elements of strength, particularly in a virile and progressive community. But the need to resort to law-books of by-gone centuries is a serious inconvenience.

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ROMANES, GEORGE JOHN (1848–1894), British biologist best known for his popular writings on evolution, was born at Kingston, Ont., on May 20, 1848. Educated at Gonville and Caius college. Cambridge, he at first wished to be a clergyman, but finally specialized in natural science. He began his researches with the study of jellyfish, starfish and sea urchins, but soon enlarged them to include broader problems of biology, and especially the development of intelligence. His *Mental Evolution in Man* (1888) maintained the essential similarity of the reasoning processes in the higher animals and in man. In 1893 he brought out the first part of *Darwin and After Darwin,* the last, unpublished portion of which contained much controversial material on physiological selection. Romanes never lost interest in religious ideas, however; at intervals throughout his life he published essays indicative of his changes of view from Protestant orthodoxy to agnosticism, and through monism back to orthodoxy again. In 1891 he founded at Oxford the Romanes lecture, to be delivered annually on a subject in science, art or literature. He died at Oxford on May 23, 1894.

ROMANESQUE ARCHITECTURE was the style of architecture of western Christendom from the 8th to the 12th century. It was a round-arched style (*i.e.,* Roman architecture with a difference). A preliminary phase marked by very interesting monuments in the northern region, in Italy, in France and in Spain, occurred during the Carolingian period (roughly from 775 to 950). The Romanesque is usually considered to have had its more definitive formative period between 950 and 1050, and it produced its greatest achievements in the High Romanesque period during the century that followed. French Romanesque entered a florid or baroque phase about 1120; then, beginning about 1145, Romanesque receded before the French Gothic style, but buildings in a tardy Romanesque style continued to be constructed even in the 13th century. The style was revived in the early 19th century, and is in occasional, though diminishing, use today.

(For a discussion of the architecture of the periods preceding the Romanesque, *see* ROMAN ARCHITECTURE and BYZANTINE ARCHITECTURE; the periods following the Romanesque are treated in GOTHIC ARCHITECTURE and RENAISSANCE ARCHITECTURE. *See* also ARCHITECTURE.)

CAROLINGIAN (775–950)

The monasteries, particularly those that followed the Rule of St. Benedict (Monte Cassino, 529), were peaceful islands devoted to prayer, the arts and good husbandry in the welter of confusion and local war that followed the collapse of the western Roman empire in 476. Just as Constantine recognized in the church the means of revitalizing the late empire, so Charlemagne recognized the potentialities of the monastic system and reinforced it by legislation. With the economic revival of Europe depending on them, the more important monasteries became imposing corporations with extensive mundane as well as spiritual powers. They controlled and managed considerable areas, and their establishments—intellectual, artistic, industrial, agricultural, judicial and administrative centres—were the training ground for ecclesiastical and governmental officials. The inevitable corollary was that

monastic architecture became the most important type of living architecture. Cathedral architecture was in general less ambitious, and dependent on monastic developments at this time.

Though the ideals of the monastic institute were Roman. Roman architectural uniformity was no longer possible. With communications difficult, localism necessarily flourished, and moreover the Carolingian revival was fecund in ideas and full of fresh energy. Tastes were different. There was no longer a preference for self-consistent. serene and classic design, which it was impossible to exemplify in the chief architectural problem of the age, the highly articulated monastic church.

In the old cities, Roman and early Christian architecture lived on in a somewhat degenerate form. For ordinary work simple Roman procedures survived. except that rubble, faced with stone (or, in other cases, solid brickwork), replaced concrete. Modest works. both urban and rural, employed half timber, timber, mud and thatch, as had been the case under the Romans, but much more picturesquely than in antiquity. Very striking and vigorous silhouettes for all types of buildings in the north resulted from the abundance of wood. the wet climate and the often inferior roofing material. which called for framed roofs of steeper slope and encouraged the addition of picturesque wooden gables, dormers, pinnacles and spires. Gifted northern designers systematized these developments and gave them monumental form in monastic construction.

Charlemagne's cathedral at Aachen (Aix-la-Chapelle, *c.* 790–805) which survives (a vaulted octagon with aisles. galleries, tribune and tower) is a beautiful, but not characteristic, building of its age. Much more typical was the destroyed imperial abbey church of St. Riquier (anc Centula. 790–799), which was the forerunner of the fully evolved medieval church. The scheme was based on the Christian Roman basilica (q *v.*). roofed in wood. The church at Centula had an imposing façade, perhaps the first really monumental church facade, in the shape of a "westwork," consisting of a low vaulted vestibule with a chapel and galleries in the tribune, stair toners and a tall openwork spire. At the east there was a transept with stair towers and a spire at the crossing, and an elaborate arrangement of chapels beyond. The general scheme, with variations. continued in use in the Rhineland during the Romanesque period; its influence affected the Gothic, and is still felt in present-day church architecture.

A Carolingian court architect in a famous plan, dated about 822 and preserved at the Swiss monastery of St. Gall, developed the basic scheme of the Roman rustic villa for the design of a great conventual establishment to house as many as a thousand people, with their multifarious activities and supplies. This type of monastery plan was used. with appropriate changes. throughout the middle ages. and it is still normative today. The residential court of the villa became the cloister (*q.v.*) of the monastery. The typical cloister was square. with arcaded walks and a garden. and the rooms used by the monks were systematically arranged about it. Usually there were. on the east, the chapter house (*q.v.*), where the community met as a corporation, the auditorium (a business room) and the camera (a workroom), with the dormitory on the upper floor above them all. The south side normally had the calefactory (a warmed room), the ceremonial lavatory, the refectory, pantries and kitchens. On the west were ranged. as a rule. the cellars, the almonry and the porter's lodge. The vast bulk of the church was typically on the north side of the cloister. Other courts served: on the east, the infirmary; on the east or south, the novitiate; on the west, the quarters ior lay brethren and wayfarers. North of the church. accommodations were provided for the abbot, for the monastic school and for visitors of mark. Gardens, yards, shops and barns were disposed logically in outer areas. In later times all these elements were enclosed within a fortified girdle wall.

The great contribution of the south during the Carolingian period was a simplified type of Roman vaulting and wall construction in rectangular brick. or more commonly, small stones, with characteristic decorative arcading and corbel tables. This spread from half-Byzantine Ravenna to Lombardy and thence to Germany, eastern France, southern France and Catalonia. The style was propagated by traveling masons called comacine masters (*i.e.*, fellow workers on the scaffold). Formed about 750, this style is called the First Romanesque, and it flourished until about 1050 (example, S. Pietro at Xgliate. in Lombardy, 875). In developed iorm, it became the Lombard High Romanesque style.

FORMATIVE PERIOD (950–1050)

Early independent styles resembling Romanesque are called proto-Romanesque. Such styles, the Mozarabic and the Asturian, based on Roman and Moslem work, flourished in northwestern Spain from about 815 to 950 (example, Sta. Maria de Naranco, vaulted. 848). Contemporaneously. there was a very interesting Irish proto-Romanesque style. The Irish built elegant round towers and small churches of simple form with corbel vaulting (example, Glendalough, about 980). By the 11th century the Scandinavians had developed their remarkable wooden ("stave") churches, often in the form of tall pinnacles built about a system of masts.

Western France suffered terribly in the Carolingian period, until 911, from Norse piratical raids. Kevertheless. considerable numbers of fine churches and monasteries were built, wooden-roofed, with something of Rhenish grandeur. The First Romanesque did not penetrate there, and the use of vaulting was limited, but the designs have a real French ingenuity and elegance, and excellent ashlar masonry. At the cathedral of Clermont, dedicated 946. the ambulatory and radiating chapels about the apse (adumbrated at St. Philibert de Grandlieu, 847, and St. Martin, Tours, 918) took systematic form, and as later developed (at Tours. 997–1014, for example, and in Gothic times) became one of the most inspiring interior features of medieval church architecture. On the exteriors. the towers, pinnacles, and spires gave the churches a finely animated silhouette.

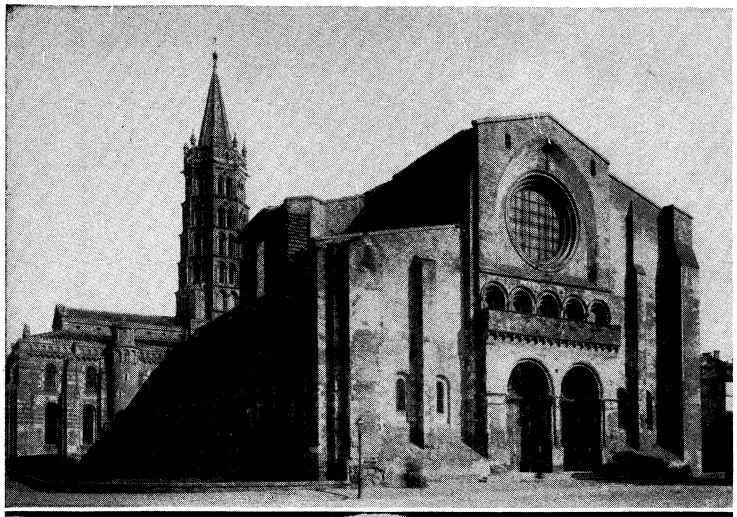
Burgundy, lying in eastern France, mas in contact with the Rhenish, the Lombardo-Catalan and the west French areas. It received architectural influences from all sides, and integrated them successfully. The region became important architecturally about 950 through the development of federative monasticism. The abbey of St. Philibert at Tournus. with widely disseminated priories, built a church between 960 and 1120 in which the various elements of the Burgundian style are still perceptible, though not yet fused in synthesis. as they were to be in Cluniac and Cistercian architecture.

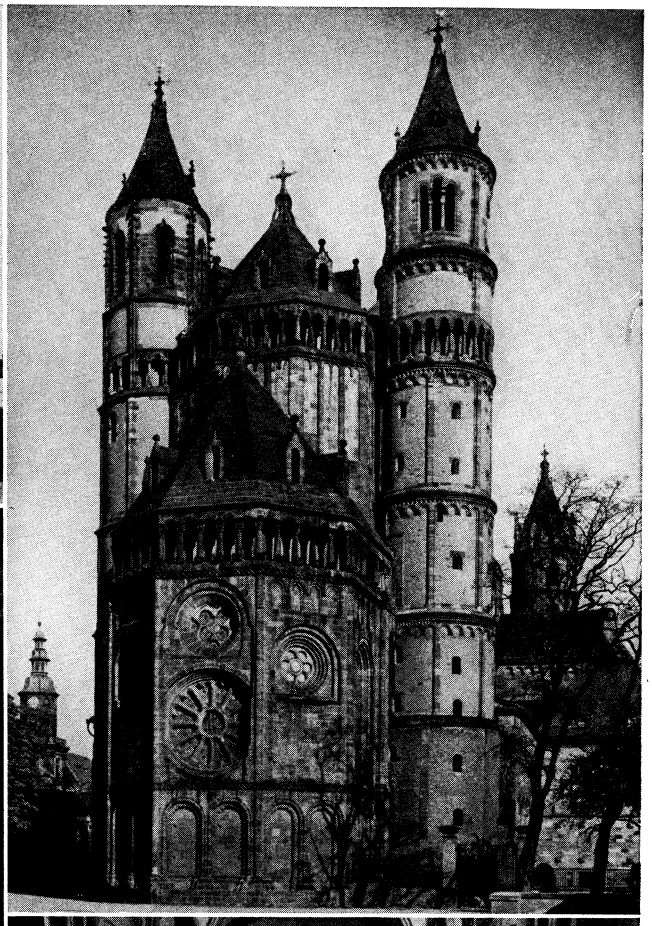
The monastery of Cluny, founded in 909, was the most important of the early monastic congregations. It soon became interregional and international, and ultimately had about 1,450 dependencies. The abbey's own second church (950–981) was a very interesting building, uhich became normative to a certain extent. It was one of the first churches to have the familiar arrangement of two western belfries and a tall crossing tower. There mas a series of seven chapels at the east. The Cluniacs built substantial vaulted churches as a matter of policy beginning about the year 1000, and the building art gained greatly by their interest in good construction. The monastery buildings which were built at Cluny between 990 and 1043 were widely influential all over western Europe.

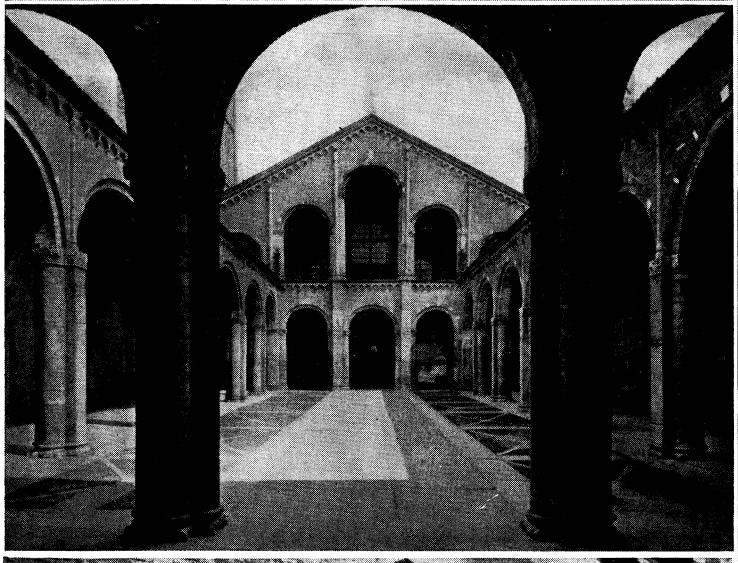
There were interesting developments elsewhere in the formative period, as in the vast earlier cathedrals of Chartres (1020, 1037) and Auxerre (1025). In Catalonia a vast church in the Lombard style was built at Ripoll (1032). Huge abbey and cathedral buildings mere built in Ottonian Germany, as at Speyer in the Rhineland (1030 and later). Saxon England. from about 950 to 1050, built in a provincial version of the German Carolingian Romanesque style.

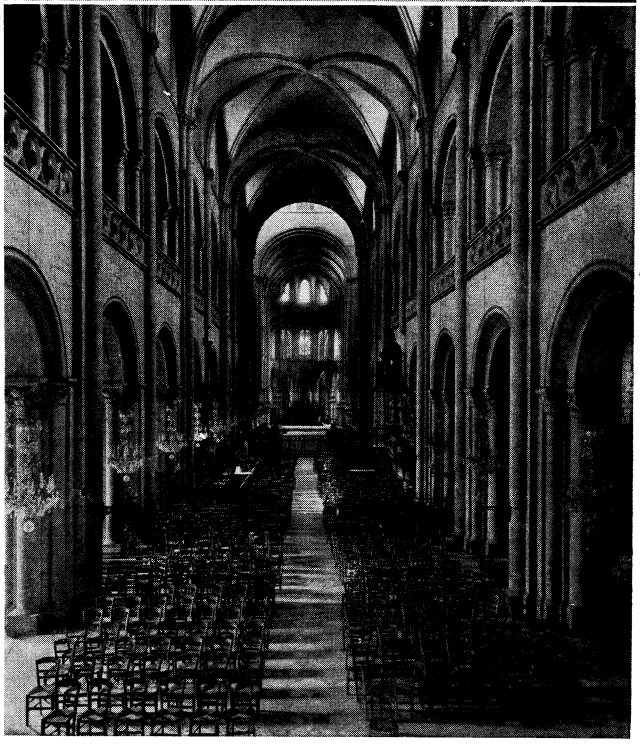
HIGH ROMANESQUE (1050–1150)

The High Romanesque style was made possible by increasing resources and greater skill in construction and decoration (both sculptured and painted). Oriental and Byzantine influences were absorbed. and many attractive regional types were worked out. High Romanesque may be said to have begun with the creation of a handsome spacious and stable type of entirely vaulted French church that was connected with the pilgrimage to Santiago









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11TH AND 12TH CENTURY ROMANESQUE

Top left: The abbey church of St. Sernin, Toulouse, France; High Romanessue; c. 1080–1200

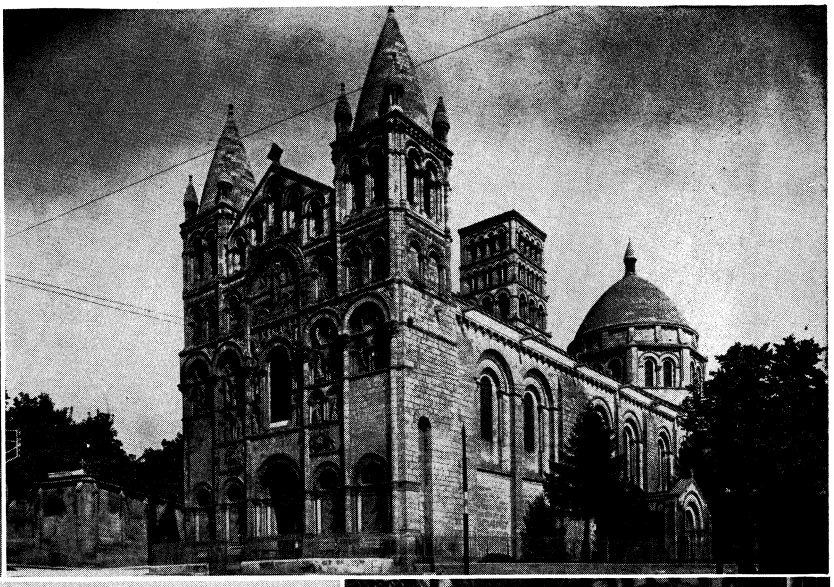
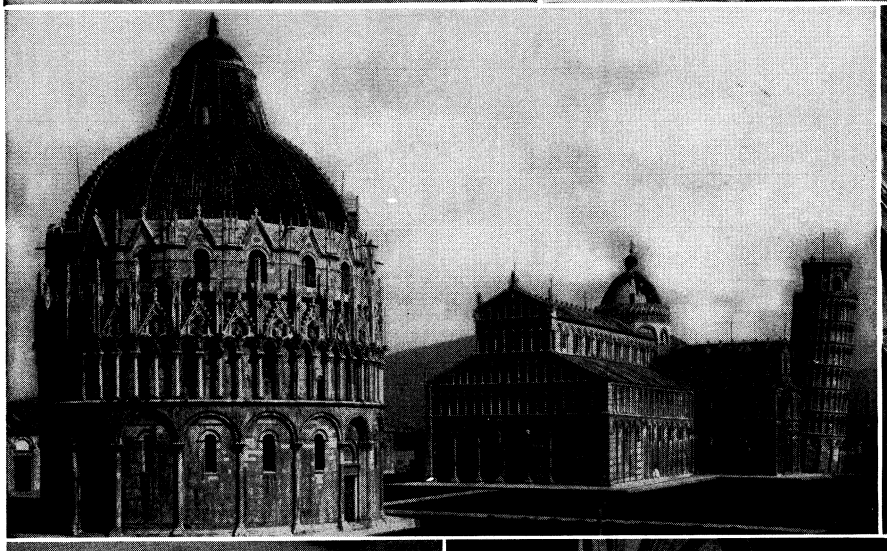
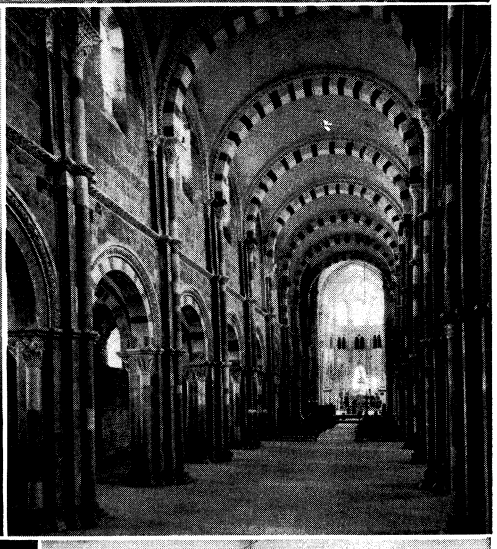
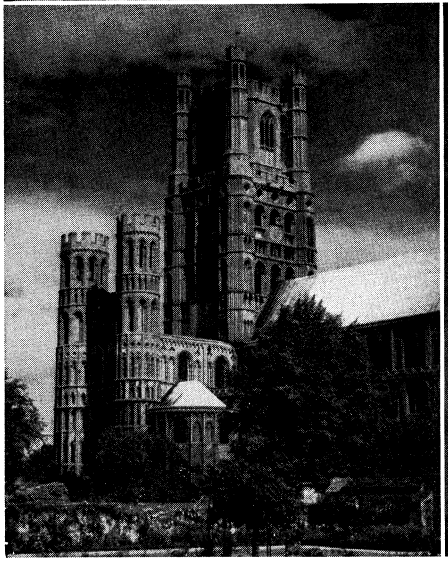
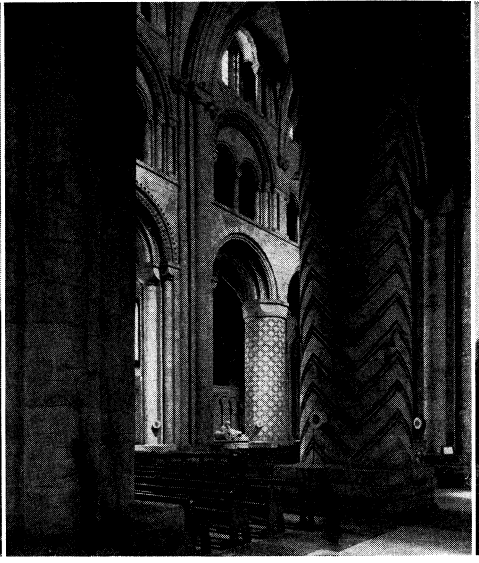
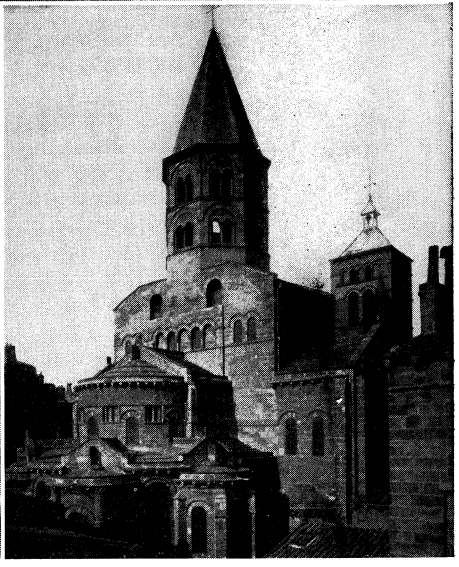
Top right: Cathedral of Worms, Germany: 12th and 13th century

Centre left: Basilica of S. Ambrogio, Milan, Italy; restored 11th–12th century

Bottom left: Main portal of west fapade of Ste. Trophime, Arles, France; 12th century

Bottom right: Abbaye-aux-Hommes, Caen, France; begun in the 11th century

ROMANESQUE ARCHITECTURE

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ROMANESQUE BUILDINGS IN ENGLAND, FRANCE AND ITALY

Top left: Crypt of Basilica of S. Zeno Maggiore, Verona, Italy; 12th century
Top right: St. Pierre cathedral, Angoulême, France; 11th–12th centuries
Centre left: Cathedral group at Pisa, Italy; 11th–12th centuries
Centre right: Nave of church of the Madeleine, Vézelay, France; completed *c.* 1130
Bottom left: Ely cathedral, England; 12th century
Bottom centre: Durham cathedral, England; 1093–1133
Bottom right: Church of Notre Dame at Clermont-Ferrand. France; 1150

de Compostela, and consequently became interregional and international. On the pilgrimage roads there were four great French abbey churches (Tours, Conques, Limoges, St. Sernin at Toulouse), together with many smaller pilgrimage buildings. The chief shrine was at Santiago, built in 1078–1211. All five great churches had magnificent plans with ambulatories and radiating chapels, and impressive towers. There was beautiful and abundant decorative sculpture, especially at the portals and in the cloisters. These churches characteristically had the aisles covered by groin vaults, the galleries by quadrant vaults and the naves by banded barrel vaults. The churches at Conques and Toulouse survive uith very little change; that at Santiago has been rebuilt on the exterior.

On a still grander scale was the masterpiece of Romanesque architecture, the third church of the abbey of Cluny (1088–1130 and later; 615 ft. long, barrel vaults of the nave 32 ft. wide and 96 ft high to the crown, over a clerestory). This building had many features which prepared the way for Gothic: tall proportions, grouped piers, pointed arches, specialized wall and vault construction. It had a very elaborate and sophisticated modular system and characteristic carvings of great beauty in the apse (where one of the first medieval sculptural allegories was placed, 1095) and at the portals of the nave (where the first really grand ensemble of monumental carved and painted west portals was placed, about 1109–15). Further great projects of Cluny in and near Burgundy were Vézelay and La Charité-sur-Loire, where the two-towered Gothic cathedral faqades with rich portals were anticipated, about 1120–25. Vézelay (1104–32) had the first wide nave with groin vaults at a high level, anticipating the ribbed groin vaults which were essential to Gothic architecture.

In Lombardy, where the First Romanesque style developed (by better construction and decoration, rather than by radical change) into Lombard High Romanesque, there were experiments with domed-up rib vaulting in square bays for the naves in the early part of the 12th century at S. Ambrogio, Milan, with two smaller vaults in the corresponding aisles of each bay. The logical "alternate system" of alternately heavy and light supports was developed.

It is generally supposed that through high-ranking ecclesiastics of Lombard origin these ideas were introduced into Kormandy. Here a noble High Romanesque school, generally with unvaulted naves at first, came into being under the influence of western France and the Rhineland (Jumièges, 1040–67; Caen, 1062 and 1068) (See NORMAN STYLE.) It was carried to England; William the Conqueror founded magnificent and powerful Benedictine abbeys after 1066 as instruments of royal policy. All of them built nobly and well; one of them, the cathedral abbey of Durham, built the first splendid great church which was entirely vaulted with heavy ribbed groin vaults (1093–1133).

The innovation was adopted, along with proto-Gothic suggestions from Burgundy, and was improved by the use of lighter, cleverer cut-stone work, in the creation of the first consciously Gothic design (the abbey of St. Denis, near Paris, about 1137–44). This style attracted the attention of the bishops of the entire royal domain near Paris, and quickly superseded the undistinguished local Romanesque of the fle de France. The cities underwent a spectacular growth at this time in commerce, in intellectual and civic life. The new Gothic style flourished in them and became symbolic because of this, and it ultimately superseded the Romanesque.

The last great effort of monastic Romanesque was in buildings of the austere Cistercian order, which was founded in 1098 and expanded all over Europe during the 12th century. For their churches and monastic buildings a simple, practical version of the Burgundian Romanesque style was developed, using rather rudimentary heavy Gothic vaulting, which is often called "half-Gothic." An excellent example is the abbey of Fontenay, 1139 and later. This special type of design, representing the personal preference of St. Bernard, mas made obligatory. Thus, throughout western Christendom, it prepared the way for the expansion of the true Gothic of the Île de France. The Cistercians extended the use of vaulting, especially the use of repetitive square ribbed groin-vaulted bays, to the monastery quarters, though they also built these, in traditional fashion, with wooden roofs.

Because so many of the buildings in which the real history of Romanesque was written have been destroyed, it has become customary to study the style, catalogue fashion. in its various local manifestations. The designers employed local materials, and intermingled various traditions in special ways; a marvelous imaginative richness was the result. In the High Romanesque everywhere, ashlar masonry was used for the walls, often. by exception, in brick-building regions. Embellishments in painting and sculpture were usual.

The following are the various local schools, aside from those already mentioned.

Germany. — The traditional Carolingian heritage gave form to High Romanesque buildings of the 12th century, and Germany still bears their imprint. The vast imperial cathedrals of the Rhineland (Mainz, Worms and Speyer, now vaulted) had much Lombard detail. A special and interesting school developed in Saxony. Germanic Romanesque also spread to Hungary.

Italy.—Lombardy was an area in which the first Romanesque style was transformed into the High Romanesque, particularly because of the development of ribbed groin vaulting. Decorative arcading mas used, in enriched form. Brick was widely employed in later work. Romanesque forms continued in use long after the coming of Cistercian half-Gothic. The Lombard cities built tremendous cathedrals, simple in plan, during the 12th century. A very handsome belfry tower type was developed; also, spacious baptisteries (*e.g.,* Parma cathedral).

Tuscany retained strong early Christian traditions, exemplified in the octagonal baptistery of Florence (restored in 1059) and the common use of basilican church forms. In the High Romanesque, marble was used extensively, often in panels and zebra work (example, the cathedral group at Pisa, 1063–12th century).

Central Italy was still more conservative; the early Christian style survived there with little change except degeneration. The region about Monte Cassino was more inventive; the famous abbey built the typical church of the region, basilican in form (1066–71). It is believed that Moslem pointed arches entered the European church building tradition here (in the porches), from which they spread to Cluny, and from there to the fle de France and Gothic. A school of painters developed, under Byzantine influence, which was drawn on by the Cluniacs in their work.

Norman Italy and Sicily.—Buildings which are basically Lombard, Tuscan, Moslem, Byzantine or early Christian were built as the realm became prosperous. Nuances of design, and a strange mingling of influences, give them strong local feeling. Examples are S. Nicola, Bari (1087), where St. Nicholas is buried; the cathedral of Monreale, 1174, with wonderful mosaics; S. Cataldo at Palermo, 1160, a former synagogue in the Moslem domed style.

France. — Provence — Romanesque architecture is here most Roman in feeling: grand, simple, spacious bulks were built, usually in fine ashlar masonry, as at Avignon cathedral, about 1140–1200, and often with fine sculpture, as at the cathedral of Arles (1150 and later) and St. Gilles du Gard (1116 and later, to about 1170).

Aquitaine.—For spaciousness, domes on pendentives of special form (often four in line as at Angoulême cathedral) were used. The cruciform St. Front, Périgueux, of 1120, was an exceptional building, spoiled by modern restoration.

Poitou.—Here elaborately arcaded faqades formed somewhat illogical frontispieces for spacious "three-naved" churches with windowed aisles almost as tall as the central windowless naves. There are beautiful paintings (*e.g.,* St. Savin-sur-Gartempe). This region has several fine Romanesque castles, in the usual form (as at Loches, about 1100) of a great square tower, the donjon or keep, with guard and residential rooms on several levels, and appropriate outworks.

Languedoc.—The churches here have bold massing and beautiful sculpture, the tradition of which goes back to the formative period (St. Genis des Fontaines, 1020). St. Sernin at Toulouse (about 1080 to 1200) is in the Pilgrimage style, and many churches are related to it.

Auvergne.—A long tradition (Clermont cathedral, 946) developed here, more or less in the manner of the pilgrimage churches. The high "lantern transepts" are characteristic (*e.g.,* Kotre Dame at Clermont-Ferrand, 1150). The cathedral of Le Puy (11th and 12th centuries), with zebra work in the masonry and a file of domes, represents reflex influence from Spain: Moslem motifs were brought in via the pilgrimage road. Such influence is perceptible also in Burgundy, and perhaps in the west of France.

England. — The vast effort of the Norman Benedictines endowed England with magnificent works which still maintain their Romanesque dignity in spite of many later additions. particularly Gothic vaulting, towers and chapels. The grandest examples, like Durham, Ely and Norwich, have aisles and galleries flanking impressively long naves. Caen stone mas imported for much of this work.

Iberia. — Northern Spain *and Portugal* were expanding through the reconquest in Romanesque times. The architecture clearly testifies to the great influx of men and ideas, particularly from Burgundy, Poitou and Languedoc (as at Santiago cathedral). Cistercian half-Gothic became important (example, Poblet, 1180–96). Catalonia long remained faithful to the Lombard style. Everywhere there are Moslem reminiscences, sometimes obvious, sometimes very subtle.

The walls of Ávila (1090 and later) are among the finest of Romanesque military constructions. The Exchange at Lérida (after 1200) still has its medieval façade, with a characteristic upper window arcade. Bragança in Portugal has a'more or less contemporary municipal hall, also with a clerestory arcade.

Palestine. — The Crusaders built extensively in the Latin kingdom of Jerusalem. The buildings are south French or Burgundian Romanesque, or Burgundian half-Gothic in style (*e.g.,* new constructions at the Church of the Holy Sepulchre, 1099–1147; the present mosque of Beirut, late 12th century). Many remarkable castles were built before and after 1200, incorporating Byzantine and Moslem innovations in military architecture; by reflex this work influenced the west.

A representative Romanesque imperial palace is the Pfalz at Goslar, in south Germany (1050, rebuilt after 1132, and later). The Wartburg near Eisenach (about 1200, celebrated in *Tannhäuser*) is the best-preserved Romanesque dwelling. The plan is simple, with the main rooms on the upper floor and lighted by window arcades. Smaller houses (as at Cluny, 1159, and Lincoln) are like excerpts of such a building.

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ROMANESQUE ART is the term applied to the art prevalent in western Europe prior to the Gothic and distinguished from the parallel Byzantine art (*q.v.*) of eastern Europe. As medieval archeology has shed light on the centuries of the so-called Dark Ages from the fall of Rome to the crusades, the scope of the term Romanesque has gradually contracted until it is generally understood to cover the period from A.D. *1000* to *1150.* The style, however, cannot be understood unless the developments of the preceding centuries are taken into account.

Prior to the florescence of the Romanesque, the Early Christian style may be distinguished; it emanated from Rome, included the art of the catacombs and the imperial basilicas built there under Constantine the Great, and concluded with the art of Ravenna through the last days of the Western empire and Theodoric's Ostrogothic kingdom. Constantine abandoned Rome and reestablished his capital at Byzantium around A.D. *328,* thereby establishing the bases for the separate but interrelated styles of eastern and western Europe—the Byzantine and Romanesque.

The Romanesque style followed the spread of Christianity; in this style the western Roman tradition and eastern Byzantine influences merged with the energetic, muscular paganism of the peoples of the north, whose imagination was unhampered by the classical heritage. Various historians, sometimes slanted by nationalistic considerations, have distinguished, among others, proto-Romanesque styles such as a Frankish Merovingian period (486–751) in France, a Carolingian period coincident with the reign of Charlemagne *(771–814).* an Ottonian period (c. 912–*1024)* in Germany, and a pre-Norman period in Britain before the conquest of 1066. Before the Romanesque could achieve full definition and maturity. it had to undergo a long period of consolidation after the disintegration of Roman power, the period of the great migrations, and the successive invasions of Europe by the Saracens from the south, the Hungarians from the east, and the Vikings from the north. The mature Romanesque consequently bears the imprint of all these events and may properly be characterized as an interplay of Roman, Byzantine, Saracenic and northern Barbarian elements.

Surviving examples of the migratory period are found in the designs of buckles, brooches, decorated dagger sheaths and the like. From Irish monasteries of the 6th through the 9th centuries there are monumental stone crosses carved in bold relief, curious tapering round towers, and manuscript illuminations characterized by fantastic animal forms and by interlaced designs of extraordinary complexity. In Britain a few remnants of architecture prior to the Conquest exist. such as the Saxon tower at Earl's Barton, and the small Church of St. Laurance at Bradford-on-Avon, The first significant architectural synthesis of southern Roman and northern Barbarian styles, however, occurred in the two structures erected during the reign of Charlemagne—the Imperial abbey at Centula (later destroyed), and the Chapel Palatine at Aachen (*Aix-la-Chapelle*), which mas an adaptation of San Vitale at Rsvenna. When the horizontal southern Roman basilica was combined with the vertical northern staged tower, the first step toward Romanesque architecture was taken. The floor plan and structural methods were a Roman heritage, but the silhouette of the rising toners against the skyline was distinctly northern.

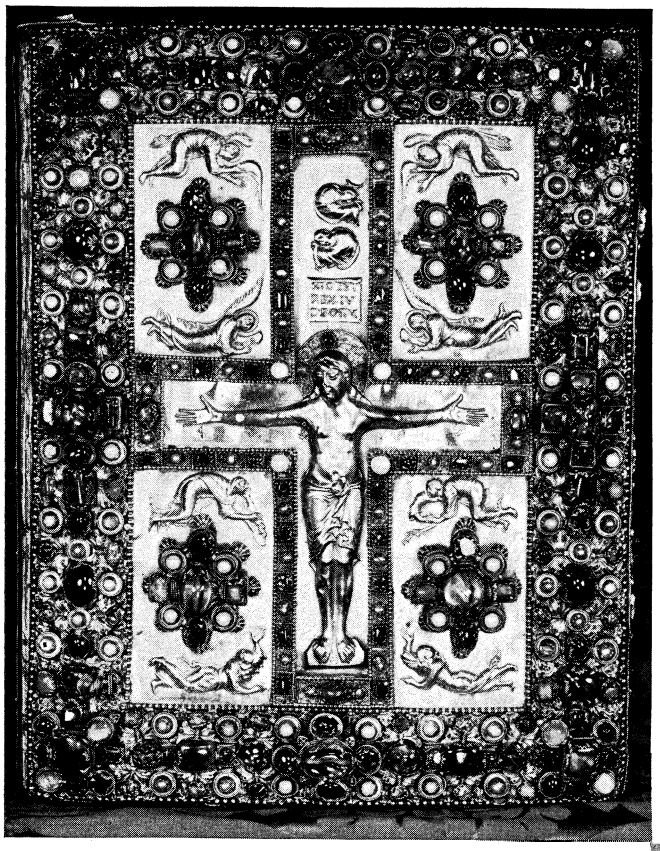
Because of feudalistic rivalries and unsettled conditions generally, Romanesque art developed in the rural strongholds of the monastery and castle rather than in urban centres. Furthermore. since monasteries were less apt to be subjected to fire and sword than castles, the surviving examples are mainly monastic. The relative isolation of abbeys and priories, from Scotland to north Africa, and from Portugal to Jerusalem, accounts for the peculiarly diffused and diverse character of the style. This decentralization also helped make the Romanesque one of the most inventive, original and inspired periods in the history of art.

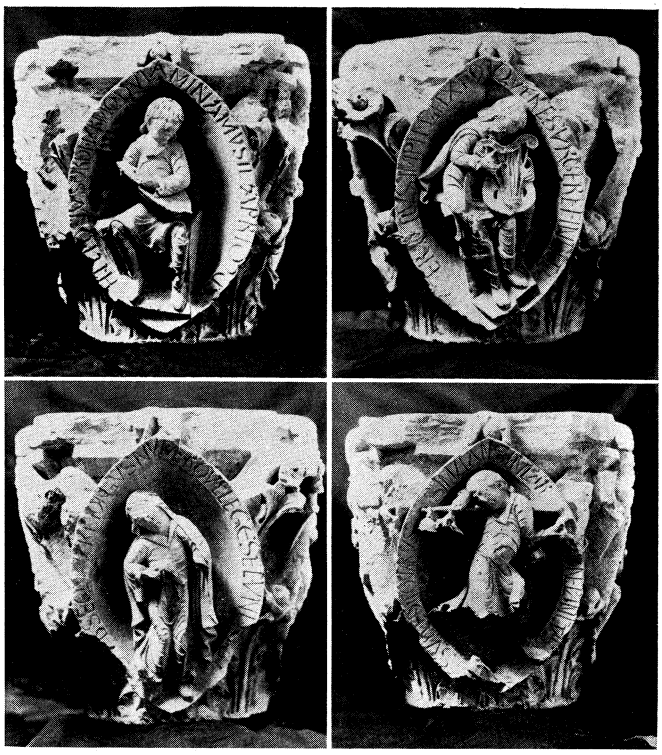
Surviving examples of Romanesque secular art are conspicuous by their rarity. A few castles and keeps, among them the well-known Tower of London, are extant. Town life, for its own protection in a feudal society, had to exist in the shadow of a castle, manor, monastery or cathedral. Enough Romanesque town houses from the 12th century have survived, however, to give a fair idea of the type. The most important secular pictorial work of the period is the Bayeux tapestry (*q.v.*) in which the battle of Hastings is recounted in *72* scenes. Stitched in eight colours of wool on a linen strip about *20* in. wide and 231 ft. long, the designer tells his story with boldly delineated figures and straightforward simplicity. Probably commissioned for the Bayeux cathedral, it nevertheless is modeled after the type of mural paintings and textile wall hangings that adorned the great halls of castles.

Architects of Romanesque abbey churches had to take into account such developments as the growing population in monastic communities, the increasing complexity and magnificence of the liturgies. the demand for additional altar space so that ordained monks could sing daily masses, the pilgrimages that brought large flocks of the faithful at festival seasons, the need for large fireproof structures, and the desire to express the great religious fervour of the time. Such considerations led to the rediscovery of the Roman art of vaulting with stone, and the expansion of space around the high altar especially in the transept and choir areas. Increased attention was given to the aisles and ambulatories, so that pilgrims could have access to side and apsidal chapels without disturbing monastic observances; vaulted narthex entrances were provided for the gathering and marshaling of processions as well as to accommodate pilgrims, and large areas were designed for the richly carved facades and impressive portals. Heavy and clumsy at first. Romanesque architecture, with increasing mastery of methods and materials, gradually achieved both monumentality and elegance. In the process such specifically Romanesque features emerged as the ambulatory with radiating chapels, rose or wheel windows above central portals. stone tracery in window mullions, concealed archaic flying buttresses over side aisles, pointed arches in the nave arcade and peaked barrel vaulting. All these features brought the Romanesque to the threshold of the Gothic.

With Romanesque architecture came the revival of monumental sculpture, a dormant art since late Roman days. In such French abbey churches as Vézelay, Autun and Moissac, large compositions depicting Christ in Majesty and the Last Judgment are found over the portals of the facade and narthex entrances. Such compositions reveal a jumble of large and small figures with no regard to natural proportion or scale. Distortions of the human figure occur partly for expressive purposes and because the sculptor had to fill the allotted surface space. In the interiors of such churches and adjoining cloisters, capitals of columns were carved with the greatest variety of figures and foliated forms. Romanesque painting exists in the extremes of delicate miniature illuminations and monumental murals on vaulted surfaces. The most striking examples of such large-scale frescoes are usually found on the semi-domed apse vaults from which position they dominate the entire interior.

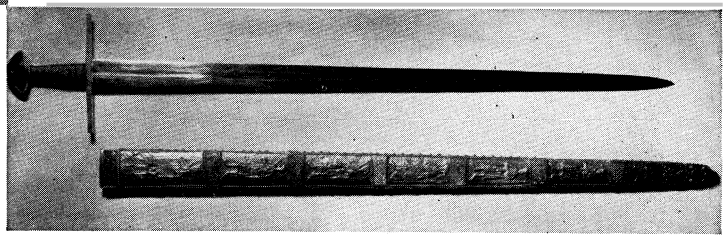
Romanesque art also included the sacred vessels used in the liturgy, ivory and gem-studded book covers, embroidered vest-





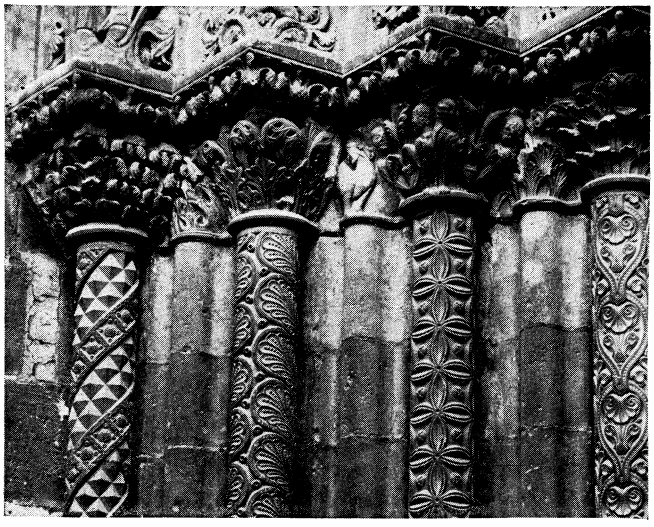
Four sides of a capital from the apse of the Abbey church at Cluny, France. About 1080–1108

Left: Upper cover of the Lindau gospels. A crucifixion design in gold set with precious stones. French (Carolingian), c. 875

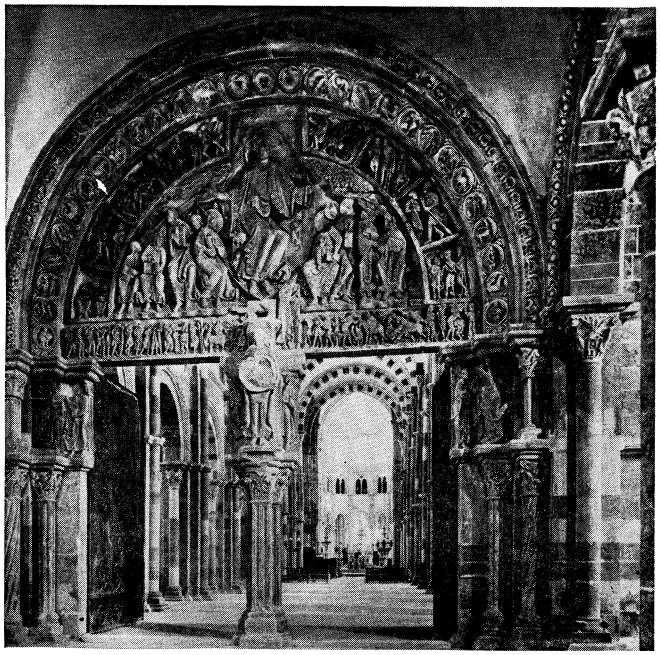


Ceremonial sword and scabbard, 1220, used at the knighthood ceremony, Sicily

Chalice of Ardagh; decorated with gold filigree, enamel, crystal, mica, glass and amber. Irish, probably nor later than the 10th century



Columns of the arches of a doorway in the Abbey of St. Denis, near Paris, begun in 1137



Central door of the narthex (enclosed porch) looking into the nave of the Church of the Madeleine, Vézelay, France, Begun about 1130; restored

ROMANESQUE METAL AND STONE WORK

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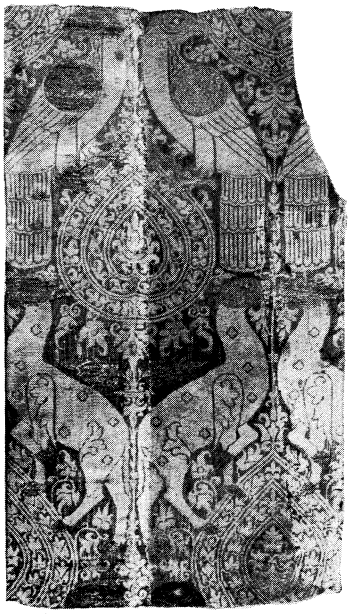
ROMANESQUE ART

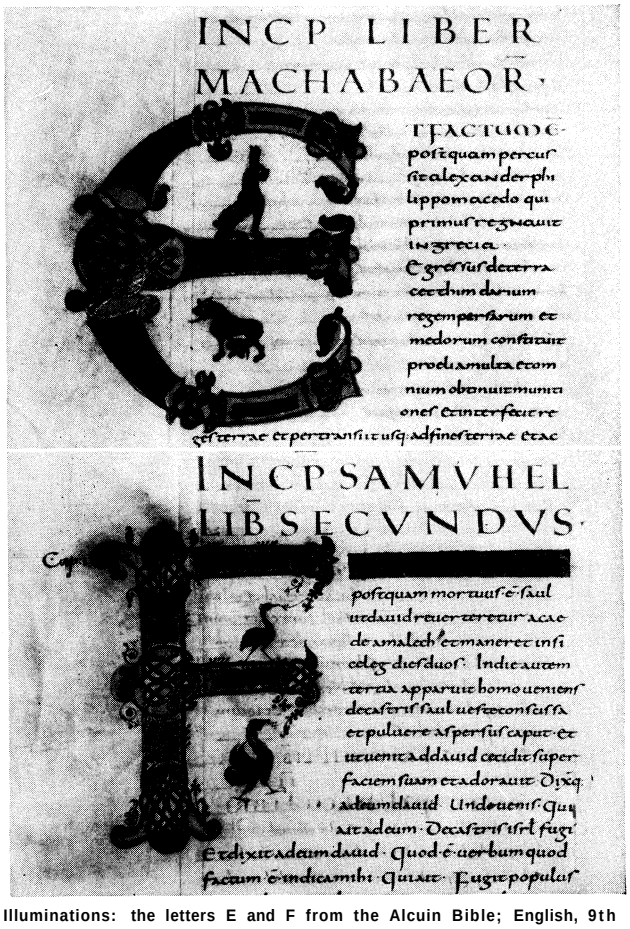
"Christ in Majesty," a monumental fresco mural from Berze la Ville, France (near Cluny); c. 1100

Capitals of columns of the Abbey church, Vézelay. Left, "The Mystic Mill"; right, "The Demons." Early 12th century

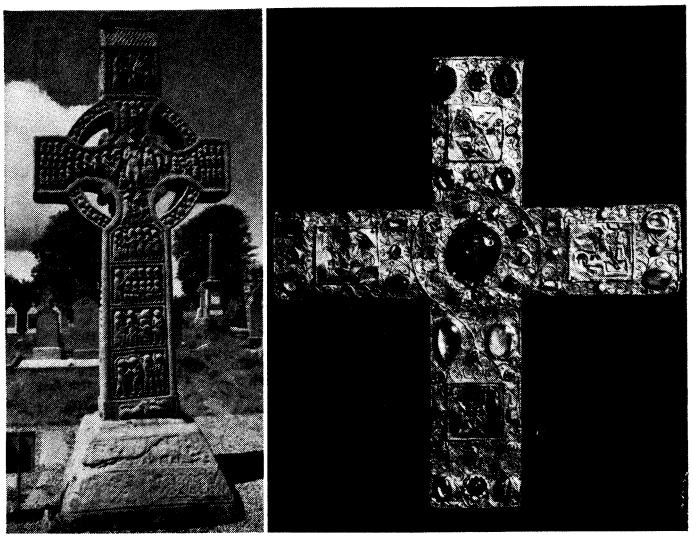
Polychromed wood torso of Christ from a crucifixion; school of Lavandieu, Auvergne, France; 12th century



Fragment of a Sicilian brocade of the 12th or 13th century. Design in buff on green ground; details in silver thread



Illuminations: the letters E and F from the Alcuin Bible; English, 9th century



Crosses: Left, Muiredach's cross, Monasterboice, Ireland. Celtic, 10th century. *Right*, First Gertrudis cross from the Guelph treasure. Gold with cloisonné, niello, filigree and gems. Brunswick (Germany), middle of the 11th century

EXAMPLES OF ROMANESQUE ART, 9TH TO 13TH CENTURIES

ments and altar cloths, candelabra of burnished bronze, carved choir stalls and other embellishments. Since reverence for relics played such an important role in the pilgrimage movement. Romanesque reliquaries are objects of special interest. "Men's eyes' are set under a spell by reliquaries." observed Abbot Suger of St. Denis. "They see the shining image of a saint and in the imagination of the people his saintliness is proportioned to its brilliance."

Such sacred remains were enclosed in statues of gilded wood or polychromed stone. as well as in portable altars and caskets fashioned to resemble miniature churches and other forms. Such work was executed in copper and gilt, chased with low-relief designs and often encrusted with precious gems.

Exhibiting as it does the widest variety and greatest diversity, the Romanesque as a period is unequaled in the history of art for its expression of religious exaltation, bold imaginative qualities, subtle inventiveness and vigorous execution.

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ROMAN LAW. The term "Roman law" is one of somewhat indefinite meaning. It denotes first of all the law of the city of Rome and of the Roman empire. This in itself is an enormously wide subject, for it includes, in the west. the law in force at any period from the foundation of the city (traditional date 753 B.C.) until the fall of the Western empire in the 5th century A.D., and in the east, can be taken to include the law of the Eastern empire, until it too fell with the capture of Constantinople by the Turks in 1453.

But "Roman law" does not mean merely the law of those political societies to which the name Roman may in some sense be applied, for the legal institutions evolved by the Romans have had, not merely influence on those of other peoples, but in many cases actual application, in times long after the disappearance of the Roman empire as a political entity, and even in countries which were never subject to Roman rule. Thus, to take the most striking example, in a large part of Germany until the adoption of a common code for the whole empire in 1900, the Roman law was in force as "subsidiary law," *i.e.*, it was applied unless excluded by contrary local provisions. This law, however, which was in force in parts of Europe long after the fall of the Roman empire, was not the Roman law in its original form. Its basis was indeed always the Corpus iuris *civilis, i.e.,* the codifying legislation of the emperor Justinian (AD. 527–565, see below), but from the 11th century (see GLOSS AND GLOSSARY) this legislation was interpreted, developed and adapted to later conditions by generations of jurists, and necessarily received additions from non-Roman sources. All the forms which it assumed in different countries and at different epochs can claim to be included under "Roman law."[1]

The importance of Roman law is, however, not confined to the actual application of its rules as such either in the Roman empire or elsewhere, for its influence on the development of law in general has been immense. Even if we look at the modern legal systems of peoples aith a aestern civilization. we can say that they fall (with some exceptions, especially the Scandinavian countries) into two groups—an English group, and a group in which the main elements are of Roman origin. To the English group belong England, nearly all the United States of America, and most of the British dominions and colonies; to the Roman group belong the rest. The nations of the continent are, nearly all of them. living under modern codes which, though they contain much that is not Roman, are Roman in their structure, their fundamental categories and their general method of thought. Within the British empire there is Scotland with a system fundamentally Roman. Quebec with its French law. built largely with Roman materials, and South Africa which. like Ceylon. has a system known as "Roman-Dutch," that is to say based on the Roman law as developed by the jurists of the Netherlands. Even English law itself, though owing less to Roman law than any other system, has at different times and in different ways received considerable accessions from Roman sources. (See ENGLISH LAW).

These developments however lie outside the scbpe of the article which is confined to the history of private law within the empire up to the death of Justinian.

Periods in the History of the Law.—Considerations of space make it impossible to discuss separately the different stages through which Roman law passed during the 13 centuries which elapsed between the foundation of the city and the death of Justinian, but some idea of the chief periods and their characteristics is essential and we may perhaps divide as follows:

(a) *The* Period of Conjecture.—This includes the monarchy (753–510 B.C. according to tradition) and the republic up to the passing of the XII tables (451–450). For this period we have really no evidence but unreliable tradition and inference from later institutions.

(b) Mid-Republican Period.—This covers the time from the XII tables until about mid-2nd century B C. Apart from fragments of the tables and from the historians, who are of course chiefly of use for constitutional law, our evidence is not a great deal better than for the previous period when it comes to detail, and the history of law, like the rest of Roman history, suffers still from the destruction of records when Rome was burnt by the Gauls in or about 387 B.C. However we know of some laws passed. of the existence of certain legal institutions and the names of some famous lawyers, though no professedly legal work has survived, and indeed few were written. The period is pre-eminently one of the *ius* civile, as opposed both to the *ius* honorarium or magisterial law and to the *ius* gentium.

(*c*) *The Late* Republican Period.—For the last century and a half of the republic the position as regards evidence is already different. A few quotations from legal writers of the time survive in Justinian's digest; we have Cicero, in all of whose works there are numerous references to legal matters, and we have other non-legal literature from which information on law can be deduced. We have too the text of a few laws in inscriptions. The period is that in which magisterial edict comes to be the chief reforming factor in Roman law and it may thus be described as the period of the earlier *ius* honorarium. It was also the period in which the *ius gentium* began to be of importance, and these two facts are not unconnected, for it was probably through the medium of the Edicts that a large part of the *ius* gentium found its way into the law as administered between citizens.

Ius *gentium* is a difficult phrase to explain, because it has two distinct, though related, meanings, the one practical, the other theoretical. In the practical sense it means that part of the Roman lam which was applied by the Romans both to themselves and to foreigners, while ius civile, as opposed to it, means that part which the Romans applied only to themselves. This dichotomy can only be explained historically. Roman law like other ancient systems. adopted originally the principle of personality, *i.e.,* that the law of the state applied only to its citizens. The foreigner was strictly rightless, and unless protected by some treaty between his state and Rome could be seized, like an ownerless piece of property, by any Roman. But from early times there were treaties with foreign states guaranteeing mutual protection, and even where there was no treaty, the increasing commercial interests of Rome made it necessary for it to protect, by some form of justice, the foreigners who came within its borders. Now a magistrate charged with the administration of such justice could not simply apply Roman law, because that was the privilege of citizens, and even had there not been this difficulty, the foreigners, especially those coming from Greek cities and used to a more developed and freer system, would probably have objected to the cumbrous formalism which characterized the early *ius civile.*

What the magistrate in fact did, was to apply a system composed of the already existing "law merchant" of the Mediterranean peopies and a strong Roman flavouring, the Roman element being, however, purged to a large extent of its formalist elements. This system was also adopted when Rome began to have

[1]The term "civil law" is frequently used in England to denote the Roman system, as opposed to the native "common law."

provinces and her governors administered justice to the provincial *peregrini* (foreigners), a word which came to mean, not so much persons living under another government (of which, with the expansion of Roman power, there came to be fewer and fewer) as Roman subjects who were not citizens. The general principle adopted seems to have been to allow disputes between members of the same (subject) state to be settled by their own courts according to their own law, while the governor's courts applied *ius gentium* to disputes between the provincials of different states or between provincials and Romans. The law thus developed in its turn reacted on the law as administered between Romans, especially by way of making it less formal, with the result that to a considerable extent the two systems were identical, and this is true particularly of the law of contract. When therefore a Roman lawyer says that the contract of sale, for instance, is *iuris gentium,* he means that it is formed in the same way and has the same legal results whether the parties to it are citizens or not. This is the practical sense of *ius gentium,* but the idea is closely interwoven with a theoretical sense, that of a law common to all peoples and dictated by Nature which the Romans took from Greek philosophy.

Aristotle had already divided law into that which is natural (φυσικόν) and that which is man-made (νομικόν) and had asserted that the natural part was in force everywher . This conception fitted well with the Stoic ideal of a life "according to nature," and became a commonplace which was borrowed by the Roman jurists, who, like other educated Romans, were much under the influence of the Stoic system. In their works this theoretical law of nature, "common to all mankind," then becomes identified with the really practical law which the Romans administered to all free men, irrespective of citizenship, simply on the basis of their freedom.

(d) The Early *Empire and* the Classical *Period.*—The change from republic to empire did not make any immediate difference to private law, except in so far as, bringing peace after a century of turmoil, it was favourable to legal progress. Legal literature, too, increased in volume and a number of quotations from authors of the first century survive in the Digest. This age in fact merges insensibly into the classical period. which is generally taken to include the second century A.D. and the early third century, and is thus considerably later than the classical period of Latin literature. It falls roughly into two divisions, an earlier one covered by the reigns of Hadrian (A.D. 117–138) and the Antonine emperors (death of Commodus A.D. 193) and a later one under the Severi (accession of Septimius Severus A.D. 193—death of Severus Alexander A.D. 235). Not that there is any break in the continuity of development, but the work of the earlier period was of a more creative character, while the later represents the working out of existing principles over the whole field of law. In the Digest there are quotations from all the authors of the classical age, but those taken from three writers of the later period (Papinian, Paul, Ulpian) alone comprise over half the work.

(e) The Post-classical Period.—With the era of confusion that followed the murder of Severus Alexander, there came a rather sudden falling off in the value of the legal work done, and the restoration of order by Diocletian (A.D. 284–305) did not revive legal literature. The law, of course, did not stand still. New ideas were introduced, especially from Greek sources, through the establishment of the Eastern empire with its capital at Constantinople, and through the growth of Christianity, while the great social and political changes of the sinking empire necessarily had their repercussions on private law. But it was not until the age just preceding Justinian that there was something of an intellectual revival in legal matters, and this revival Justinian was able to use for his great purpose.

SOURCES OF LAW

The Romans themselves divided their law into *ius scriptum* and *ius* non *scriptum;* by "unwritten law" they meant custom, by "written law," not only that derived from legislation, but, literally, that which was based on any source which was in writing and the list of written sources comprises *leges,* plebiscita, *senatus consulta, edicta magistratuum, responsa prudentium* and *constitutiones principum.* This list is repeated in Justinian's Institutes though ever since the close of the classical period the only source of new law (apart from custom) had been the emperor's constitutions.

A. Ius Non Scriptum or Custom.—Custom (mos *maiorum, consuetudo*) was recognized by the Romans not only as having been the original source of their law, but as a source from which new law could spring. The theory given by the jurists is that the people, by adopting a custom, show tacitly what they wish to be law, just as they might do expressly by voting in the assembly. In the developed law it would seem, however, that custom as an independent source was not very fruitful, and that it exercised its influence rather through the medium of juristic opinion and the practice of the courts.

B. **Ius Scriptum.**—(1) *Leges and Plebiscita.—Lex* is properly an enactment of one of the assemblies of the whole Roman people, the *comitia centuriata, tributa* or *curiata* (*see* COMITIA), but the most ancient of these, the *comitia curiata,* ceased, before the beginning of reliable history, to have any real political functions, though it continued right up to classical times to exist for certain formal purposes. The validity of plebiscite, *i.e.,* resolutions of the purely plebeian assembly, was one of the chief matters of contention between the patricians and plebeians, and the struggle between the orders may be said to come to an end in 287 B.C. when, by the *lex Hortensia,* plebiscita were given the force of *leges.* Thereafter enactments which were strictly plebiscita were often loosely referred to as *leges.*

Roman assemblies, like those of the Greek city states, were primary, *i.e.*, the citizen came and voted himself and did not send a delegate, but their power was restricted by the rule that only a magistrate could put a proposal before them and by the absence of any opportunity for amendment or debate. The only function of the people was to answer "yes" or "no" to the magistrate's "asking" (*rogatio*), and constitutional practice further required that the magistrate should consult the senate before putting a proposal to the assembly, In the later republic, at any rate, rejection of a bill was practically unknown and the real power lay with the senate and the magistrates.

Leges Regiae.—The historians have a good deal to say of *leges* passed in the time of the kings, but legislation at so early a date is unlikely. What they took for laws were probably statements of ancient custom from pontifical sources.

The XII. Tables.--Of greater importance are the' XII. Tables, said to have been passed in 451–450 B.C., some 60 years after the expulsion of the kings. The accounts given by the historians of their compilation (*see* ROME: *Ancient History: The Republic*) are inconsistent and mainly mythical, but tradition is no doubt right in representing it as an incident in the struggle of the plebeians for political equality. The moving cause was a desire to obtain a written and public code which patrician magistrates could not wrest at their will against plebeian litigants. What weight should be given to that part of the story which tells of a preliminary embassy sent to Athens to study the laws of Solon, has been much debated. That the embassy itself is legendary can hardly be doubted, but on the other hand, that there was some Greek influence is clear (See e.g., Tab. VII. 2-D. 10.1.13.) In the main, however, the materials of the code were taken from native customary sources. The authenticity of the whole compilation has been attacked in recent times, but the most authoritative modern opinion holds, in spite of all scepticism as to details, that the XII. Tables really were an enacted code of law, and that tradition is not far wrong in ascribing them to the middle of the fifth century B.C.

The text of the code has not suryived, a remarkable fact, for copies (probably in more or less modernized language) must have been abundant in Cicero's time if, as he says (De Leg. 2, 23, 59) it was still customary in his youth for boys to learn it by heart. All that we have is a number of "fragments" which have had to be collected from allusions and quotations in the works of various authors. *e.g.,* Cicero. (Modern collections are to be found in Bruns' *Fontes iuris Romani antiqui*, 7th ed., 1919, Girard's Textes de *droit Romain,* 5th ed., Paris, 1923, and Riccobono's

Fontes *iuris Romani anteiustiniani.*)

On the establishment of the empire by Augustus, the assemblies did not immediately cease to function, but their assent to any proposal was a mere formal ratification of the emperor's wishes. The last lex known to have been passed was a lex agraria under Nerva (A.D. 96–98).

Senatus Consulta.—The senate acquired legislative power in early imperial times though this was never conferred on it by any imperial enactment. The resolution of the senate preceding the placing of a bill before the people had always been practically decisive, and with the decay of the comitia their assent evidently came to be regarded as a formality which might be omitted. Actually, the senate nearly always, if not always, legislated at the instigation of the emperor, latterly, indeed, simply embodying his oratio or proposal in a resolution, and not long after the classical period, the emperors ceased to use the senate as a vehicle of their legislation

Edicta Magistratuum.—An edict is a proclamation, originally no doubt oral, later in writing, and any superior magistrate might find it necessary to issue such edicts regarding matters which came within his competence. A peculiarity of Roman law, however, is that the magistrates entrusted with jurisdiction made particular use of this power and that their edicts became one of the most important sources of law. Originally the duty of *iurisdictio*, which means supervising the administration of justice, rather than actually deciding cases (see p. 454, "Procedure") had presumably lain with the king, from whom it descended to the consuls. With the growth of business it became impossible for the consuls to discharge this duty in addition to their other functions and in 36; B.C. a new magistrate, the praetor, was appointed for the purpose. About the year 242 B.C. the increase of foreigners at Rome made it necessary to separate the conduct of suits in which they were concerned from those to which citizens alone were parties, and a second praetor, praetor *peregrinus*, was appointed to deal with cases in which a foreigner was involved. In contradistinction to him, the original praetor, now confined to suits between citizens, came to bear the title *urbanus*[1].

Other judicial officers at Rome whose edicts were of importance were the curule aediles, whose duties included the supervision of the market place. In the provinces supreme judicial power lay with the governors, and quaestors carried out functions analogous to those of the aediles at Rome. The law derived from the edicts of all these magistrates was called *ius* honorarium, as opposed to *ius civile* in the sense of law based on legislation or custom, but owing to the pre-eminent position of the praetors, the phrase is often used simply as equivalent to ius *praetorium.* The nature of this magisterial law is peculiar. The praetor was not a legislator, and he could not therefore make law directly as could the sovereign people, but the Roman system of procedure (especially the formulary system, see p. 454) gave him a great power over the provision or refusal of remedies as well as over the form which remedies were to take, and consequently the edict which he issued at the beginning of his term of office setting out what he intended to do was a document of the greatest importance. In it he could say, for instance, "If one man makes such and such an allegation against another, I will give an action," even though the circumstances alleged would not give any right at civil law. The edict called *perpetuum* (continuous) because it wes intended to announce the principles by which the praetor would be governed throughout his year of office, necessarily ceased to have any validity when that term expired, but it became the practice for each succeeding praetor to take over and reissue as his own much of his predecessor's edict, and by the end of the republic, the part which was thus carried on from year to year (tralaticium) must have been considerable, for jurists were just beginning to write commentaries on the edict, a practice which would not have been worth while if the greater part of it had been liable to annual alteration.

[1]This is the usual story, but the historians in an endeavour to reconcile discordant tradition may have read back into early times the institutions of their own day. *See* E. Pais, *Ricerche sulla Storia,* etc. Serie iv. (1921), 265 *seq.*

The change from republic to empire did not immediately make any difference, and the praetors continued to issue their edicts (though we may doubt whether they ever made changes without imperial or senatorial authority), but in the long run their wide powers were evidently felt to be inconsistent with the emperor's supremacy. Hadrian consequently, in or about A.D. 131, instructed the famous jurist Salvius Iulianus to revise and settle the praetorian and aedilician edicts. The changes in substance do not appear to have been of a far-reaching character, but the edict as revised was henceforward made unalterable except by the emperor himself.

The relationship between *ius* honorarium and *ius civile* has often been compared with that existing in England between common law and equity. In both cases we find, as Maine put it (Ancient Law, p. 25) a "body of rules existing by the side of the original civil law, founded on distinct principles, and claiming incidentally to supersede the civil law in virtue of a superior sanctity inherent in these principles," and in both cases the resulting duality enormously complicates the law, but, of course, when we come to detail the comparison no longer holds.

Responsa *Prudentium.*—The force attributed to professional opinions of a certain type was another peculiar feature of the Roman system, and one which contributed in no small measure to its success, for it was the "learned lawyers" (prudentes) to whom the moulding of the law into a coherent system was really due.

Originally, according to an entirely credible tradition, law was considered the special province of the *pontifices* (see PONTIFEX), who seem to have regarded it as a mystery to be exploited in the interests of their order. Their monopoly was however broken down, according to legend, in 304 B.C., by Gn. Flavius, a clerk of Appius Claudius Caecus, who is said to have stolen from his master and made public, a list of *legis* actiones (*i.e.,* forms of words which had to be followed exactly in the conduct of lawsuits), thereafter known as the *ius Flavianum.* The first known legal treatise, called the "cradle of the law" by Pomponius, is the *Tripertita* of Sextus Aelius Paetus Catus (consul 198 B.C.) which contained the text of the XII. Tables, the *interpretatio* put upon it by the jurists and the *legis* actiones. Probably the last part was identical with the *ius* Aelianunz which, according to Pomponius, was a collection of *legis* actiones like the earlier *ius Flavianum.*

It is plain in any case that from about 300 B.C. onwards there came into existence a class of men who made the study of the law their special interest. These iuris *consulti* or *iuris* prudentes were not professional lawyers in the modem sense, but men of rank who sought by giving free legal advice to obtain popularity and advancement in a public career. The responsa (answers) which they delivered to those who consulted them were of greater weight than are our modern "opinions of counsel" because the person who actually decided a case under the Roman system of procedure was not, as with us, a trained lawyer, but a lay iudex, who did not, like our jurymen, have a judge to direct him on points of law. Augustus empowered certain jurists to give *responsa* with the emperor's authority, and this practice led, perhaps by insensible degrees, to the view that rhe iudex was bound to abide by the *responsum* of a jurist who had received this *ius respondendi.* Gaius at any rate mentions a rescript of Hadrian which laid down that *responsa* were binding if they agreed, and that if they disagreed, the *iudex* could decide for himself which to follow. (See Wlassak, *Die klassische Prozessformel,* p. 45.)

The practice of conferring the *ius* respondendi appears to have fallen into disuse about the end of the third century A.D. when the classical period was over, but in the meanwhile, *responsa* had certainly come to be regarded as binding not only for the case for which they were originally given, but also as precedents for future cases, and, further, authority gradually came to be attached to the other writings of those iurists who had the emperor's patent. The "law of citations," an imperial enactment of 426, ultimately laid down that only the works of five jurists, Papinian, Paul, Gaius, Ulpian and Modestinus, might be cited and, subject to some provisos which are obscure, the works of authors quoted

by these five. If the authorities cited disagreed, the majority was to be followed; if numbers were equal, the side on which Papinian stood was to prevail; if he was silent, the *iudex* might please himself.

For the long succession of jurists reference must be made to the individual articles, but mention must be made here of the two "schools," the Sabinians (or Cassians) and the Proculians, into which they were divided in the early empire. Labeo (died between A.D. 10 and A.D. 22), one of the greatest figures in the history of jurisprudence, was the founder of the Proculians (who, however, took their name from a successor, Proculus); Capito, that of the Sabinians (so called from Massurius Sabinus, who was given the *ius respondendi* by Tiberius). What principles, if any, divided these schools, is unknown, though a number of controversies on particular points are preserved, especially in Gaius' Institutes. It is probable, though by no means certain, that there were teaching establishments or societies of some sort in connection with the "schools," for otherwise the list of "heads" given by Pomponius would be difficult to explain. The distinction does not seem to have survived the Antonine age; for Gaius, a Sabinian, is the last jurist of whom we know that he belonged to one or other of the schools.

Constitutiones Principum.—Neither Augustus nor his immediate successors expressly assumed legislative power, and yet Gaius, writing about A.D. 160, can say "there has never been any doubt that what the emperor lays down has the force of law." Ulpian, indeed, refers the validity of constitutions to the so-called *lex regia,* passed at the beginning of each emperor's reign; and there is indeed in the only surviving example of such a lex (the lex de *imperio Vespasiani* line 17 seq., see Bruns Fontes p. 202) a clause conferring such wide powers on the emperor that legislation might be deemed to be included. Nevertheless it is now generally held that this was not the original meaning of the clause and that the emperor's legislative power is a gradual growth. The chief forms of imperial legislation were:—(a) *Edicta, i.e.,* proclamations which the emperor, like other magistrates, might issue; but whereas the other magistrates were confined to their own spheres, the sphere of the emperor was in fact unlimited. (b) *Mandata, i.e.,* instructions to subordinates, especially provincial governors. (c) *Rescripta,* written answers to officials or others who have consulted the emperor, in particular on a point of law. In such cases the rescript lays down the point of law applicable and, since the emperor is supreme, the rule may be a new one. (d) Decreta, *i.e.,* decisions of the emperor sitting as a judge. Here too the emperor may lay down a new rule.

The Earlier Collections of Constitutions and the Legislation of Justhian.— The growth of legal literature and especially of imperial constitutions created a need for works of reference which made itself felt long before Justinian, and a beginning was made, almost certainly in Diocletian's day, by a collection of constitutions known as the codex *Gregorianus,* which was followed by the codex *Hermogenianus,* perhaps also dating in its original form from Diocletian. Both collections were unofficial, but their compilers must have had official countenance, for they clearly had access to the imperial archives. The Gregorianus contained constitutions from Hadrian to Diocletian, the *Hermo*genianus almost exclusively those of Diocletian's time; later constitutions attributed to it were probably only added in subsequent editions. It was clearly intended to supplement the *Gregori*anus. Unlike these two, the codex Theodosianus was an official work compiled by a commission appointed under Theodosius II. and Valentinian III., it was given the force of law as from Jan. 1, 439. Constitutions from the time of Constantine the Great onwards were, with very few exceptions, not to be valid unless contained in it. For the earlier imperial legislation the older codices still had to serve. Nearly the whole of the codex *Theo*dosianus has been preserved, whereas we only have fragments of the others. Theodosius had also planned a collection which would include juristic literature as well as imperial legislation, but this never came to fruition until it was taken up again by Justinian.

Justinian's Legislation.— (See also JUSTINIAN I.) Justinian's main object was, as he himself expresses it, to clear the path of legal authorities of the tangles with which it had become overgrown during the course of centuries, and he set about the task almost immediately on ascending the throne. It must be noted however that he was no mere codifier, but also the author of much new legislation, some of which was of the utmost importance for the later development of law. The emperor was no doubt largely responsible himself for the work undertaken, but it would probably not have been possible to carry it through but for the genius of his chief minister, Tribonian, who was clearly the leading spirit throughout the work. The course of legislation was as follows:—

(1) The Old Codex.—In Feb. 528, a commission of ten members including Tribonian (who, however, was not president) was appointed to compile a new collection of imperial constitutions which was to supersede the older ones entirely and, of course, to include legislation subsequent to the Theodosian. The commissioners were to cut out repetitions and contradictions and had large powers of alteration for this purpose. The work was rapidly done and published in April 529, with the force of law as from the 16th. It has not survived as it was later superseded.

(2) The "Fifty Decisions."—Justinian, probably partly with a view to facilitating the work of compiling the Digest, issued a number of constitutions settling matters on which the writings of the classical jurists disagreed and abolishing finally some institutions and distinctions which had ceased to be of practical importance. Some 90 constitutions of this character are known to us, but a collection of 50 seems to have been made and published separately. Its exact date cannot be determined.

(3) The Digest. (Digesta or *Pandectae*).—Instructions were given on Dec. 15, 530, to Tribonian to form a commission to collect excerpts from the works of the jurists. The collection was to serve practical purposes and consequently everything obsolete or superfluous was to be cut out and, where necessary to bring the matter up to date, alterations were to be made in the text. The excerpts were to be arranged in fifty books and the books into titles according to the subject matter, and the whole was to include all that it was necessary to know of juristic as opposed to imperial law. The compilers were definitely instructed not to adopt the summary methods of the "law of citations" but where the authorities disagreed, to choose what they thought best for themselves. The commission, consisting of 16 members in addition to Tribonian, rapidly completed their task and the Digest was published on Dec. 16, 533, with the force of law as from Dec. 30. Thenceforth no reference might be made to any other text for juristic law. Justinian gives us some idea of the work involved when he says that 2,000 books consisting of 3,000,000 lines were read and that this number was then reduced to 150,000 lines. The Digest is the most important of Justinian's works, for in it are preserved the writings of the classical jurists who were really responsible for the greatness of Roman law, and the "inscription" at the head of each quotation enables us to see from which jurist and from which work it is taken. But of course as evidence for the classical law quotations must be used with care, for the compilers made considerable use of their powers of alteration; much ingenuity, especially within the last 50 years, has gone to the discovery of their "interpolations."

The Institutes.—The revision of the law by Justinian was accompanied by a detailed scheme for the reform of legal education in the universities of Constantinople and Berytus, and one of the requirements of this scheme was a new book to be used for elementary instruction instead of the Institutes of Gaius which had for centuries been the standard work. While the Digest was still unpublished therefore orders were given to Tribonian and two professors to compile a manual for this purpose, and the Institutes were published on Nov. 21, 533, and given the force of law. The work is based on Gaius' Institutes, from which a great part is copied literally, as well as on other elementary works of the classical period; occasional references to imperial legislation are added. It is in fact almost as much a compilation as the Digest, but the references to the authors quoted are omitted and the whole made to read like a lecture delivered by the emperor to his students.

The New Code (Codex *Repetitae Praelectionis*).—The 50 decisions and the many other new constitutions promulgated since 529 necessitated a revision of the old codex and Tribonian, together with four others, was instructed shortly after the publication of the Digest, to prepare a new edition. This was published on Nov. 16, 534, and given the force of law as from Dec. 29.

The Novels.—Although the new code completed Justinian's scheme for providing a collection of authoritative legal texts, he did not cease to introduce new legislation. In all 175 laws published after 534 are known and these are called Novellae *Constitutiones* or Novels. Nearly all are in Greek, which was becoming more and more the official as well as the spoken language of the Byzantine Empire. Justinian never made any official compilation of them, but three private collections have come down to us, and the Novels, together with the Institutes, the Digest and the (new) Code together form what is known as the Corpus *Iuris Civilis*.

THE LAW OF PERSONS

I. Slavery.—"The main distinction in the law of persons," says Gaius, "is that all men are either free or slaves." The slave according to Roman law was in principle a human chattel who could be owned and dealt with like any other piece of property. As a piece of property the slave was not only at the mercy of his owner, but rightless, and (apart from criminal law) dutyless. This is the principle, but if the slave was, in law, a thing, he was, in fact, a man, and this fact produced modifications of the principle. In particular, a slave might be manumitted and would then become in most cases not only free but a citizen.

II. Citizenship.— This was of importance for the purposes of private law, because certain parts of private law applied only to citizens (ius civile). The general rule was that, if the status of the parents differed, the child followed that of the father, if the union was one recognized as marriage by Roman law; otherwise that of its mother, but a lex *Minicia* of republican times enacted that in cases of unrecognized unions between citizens and foreigners the child should always follow the inferior parent. The great extension of the citizenship by Caracalla in A.D. 212 reduced the importance of this part of the law.

III. Family.— (a) *Patria* potestas. The chief characteristic of the Roman family is the famous *patria* potestas which the father exercised over his children and over his more remote descendants in the male line, whatever their age might be, as well as over those brought into the family by adoption—a very common practice at Rome. This meant originally not only that he had control over the persons of his children, amounting even to a right to inflict capital punishment, but that he alone had any rights in private laws. Thus any acquisitions made by a child under power became the property of the father. The father might indeed allow a child (as he might a slave) certain property (peculium) to treat as his own, but in the eye of the law it continued to belong to the father. In classical times there were already modifications of the system; the father's power of life and death had shrunk to that of slight chastisement, and the son could bind his father by contract with a third party within the same strict limits as applied to slaves and their masters. Sons too could keep as their own what they earned as soldiers (peculium castrense) and even make wills of it. In Justinian's day the position as regards property had changed considerably; what the father gave to the son still remained in law the father's property, but the rules of peculium castrense had been extended to many sorts of professional earnings (*pec.* quasi castrense) and in all other sorts of acquisitions (*e.g.*, property inherited from the mother) the father's rights were reduced to a life-icterest (usufruct). At all times *Patria* potestas ceased normally only with the death of the father, but the father might voluntarily free the child by *emancipation*, and a daughter ceased to be under her father's potestas if she was married in such a way as to come under the *manus* of her husband.

(b) Marriage.—There were two types of marriage known to the law, one with *manus* and one without, but the former was rare already in the late republic and had disappeared long before Justinian's day. *Manus* was the autocratic power of the husband over the wife, corresponding to *patria* potestas over the sons, and it might result in any of three ways:—

(1) by confarreatio, a religious ceremony confined to patricians.

(2) by coemptio, a type of mancipation (see below) which was originally no doubt the Roman form of marriage by purchase; it was purely secular.

(3) *usus;* if a woman lived with a man as his wife for a year, he acquired *manus* over her by a kind of prescription. The XII. Tables had already provided that this might be prevented if the woman absented herself for a space of three nights during the year (usurpatio trinoctii). *Usus* was already quite obsolete in classical times.

It may be that at one time marriage with *manus* was the only form of union recognized as marriage at all, but by the time of the XII. Tables this was apparently no longer the case, for it is clear that the usurpatio trinoctii, though it prevented *manus*, left the marriage subsisting, so that it was possible to be married without *manus*.

In any case marriage without *manus* was by far the more common in all periods of which we have any real knowledge. It was formed (provided the parties were above the age of puberty and if under potestas had their fathers' consent) simply by the beginning of conjugal life with the intention of being married, and this was normally evidenced by the bringing of the bride to the bridegroom's house. It was however legally independent of all ceremonies whether pagan or Christian which might accompany it, and of consummation. The wife remained under her father's potestas if he were still alive, if he were dead, she continued (so long as guardianship of women continued) to have the same guardian as before marriage. It was necessary that both spouses should be citizens, or if one was not, that he or she should have conubium, the right given to some non-Romans of contracting a Roman marriage. The chief importance of this was that if a Roman contracted a union with a foreign woman, the children would not be in his potestas unless she had conubium. In marriage without *manus* the property of the spouses remained entirely distinct, and even gifts between husband and wife were invalid. It was usual however for a dowry to be given to the husband on the marriage by the woman or her father; this originally became the indefeasible property of the husband, but in classical times already the wife could recover it if the marriage ended by divorce or by the husband's death, and by Justinian's legislation it had always to be returned to the wife or her heirs.

Divorce was always possible at the instance of the husband in cases of marriage with *manus*, and in marriage without *manus* it was free to either party to put an end to the relationship at will; a letter of *repudium* was usual, but any manifestation of intention to end the relationship made clear to the other party and accompanied by actual parting was all that was legally necessary (see E. Levy, Der *Hergang* bei der romischen Ehescheidung). The Christian emperors imposed penalties on those who divorced without good reason, but the power of the parties to end the marriage by their own act was not taken away. *Concubinatus* was recognized in the empire as a sort of morganatic marriage, differing from marriage only by the different intentions of the parties, and excluding marriage, for a man could not have both a wife and a concubine. Constantine first enacted that the children of such unions might be legitimated by the subsequent marriage of their parents, a rule which the mediaeval civil law extended to all illegitimate children.

(c) Guardianship.—(1) Of children. Persons under the age of puberty (14 for males, 12 for females) needed tutores if they were not under *patria* potestas. Such tutors could be appointed under the will of the pater *familias;* failing such appointment the guardianship went to the nearest agnates (see p. 453 "Succession") until Justinian gave it to the next of kin whether agnatic or cognatic; if there were no qualified relation the magistrates made an appointment.

(2) Of women. Originally all women not under *patria potestas* or *manus* needed tutores, who were appointed in the same way as those for children. In classical times already this *perpetua* tutela *mulierum* was little more than a burdensome technicality and it had long disappeared from Justinian's law.

(3) Of lunatics and spendthrifts. Originally such persons were placed under the *cura* of their agnates; later, magistrates appointed curators.

(4) Of minors. Originally children were considered adult when of the age of puberty, but, by a long development, it became usual for those above puberty and under 25 to have curatores who were always magisterially appointed.

PROPERTY AND POSSESSION

The most striking thing to an English lawyer accustomed to the complexities of English real property law is the absence of any fundamental distinction between the treatment of land and the treatment of movables. Both can, in the law as we know it, be owned absolutely by individuals, though there may have been a time at Rome as elsewhere when land was subject to communal ownership of some sort. This conception of absolute ownership (dominium) is also characteristically Roman, as opposed to the relative idea of ownership as the better right to possession which underlies the Germanic systems, which also, originally, underlay that of Rome. This can be seen by comparing the form of a *vindicatio* (the claim of an owner out of possession) under the *legis* acfio system of procedure with that which it later assumed under the formulary system. In the earlier system the plaintiff first makes his assertion of ownership ("I say that this thing is mine") and then the defendant makes a similar assertion. Finally, the thing goes to the one whose assertion is based on the better right. Under the later system there is no assertion by the defendant at all; the iudex is instructed to condemn the defendant if it appears to him that the thing belongs to the plaintiff, otherwise to absolve the defendant. Hence, unless the plaintiff makes good his title absolutely, the defendant, though he may have no title at all, remains in possession.

A great part of what the jurists have to say on the subject of property comes under the heading "methods of acquiring ownership." These were divided into two classes according as they fell under the *ius* civile or the ius gentium.

I. Methods of the Ius Civile (a) *Mancipatio.*—This was a ceremonial conveyance needing for its accomplishment the presence of the tranferor and transferee, five witnesses (Roman citizens of full age) a pair of scales, a man to hold them (*libripens*) and an ingot of copper. The transferee grasped the thing and said: "I assert that this thing is mine by Quiritarian law; and be it bought to me with this piece of copper and these copper scales." He then struck the scales with the ingot which he handed to the transferor "by way of price." Clearly this was, as Gaius says, a "symbolical sale," and the relic of a real sale. Originally, when money was unknown, the price in uncoined copper had been really weighed out to the vendor. When this became unnecessary there was still a pretence of weighing, but the price was paid separately, and the form could be used as a conveyance where it was not intended that a price should be paid at all, *e.g.,* because the transferor was making a gift to the transferee.

(b) *In* Iure *Cessio.*—This was a conveyance in the form of a lawsuit. The transferee claims before the magistrate that the thing is his, and the transferor who is the defendant, admits the claim. The magistrate then adjudges the thing to the transferee.

(c) *Usucapio.*—According to the XII. Tables, two years' continuous possession gave title in the case of land, one year in the case of movables. In the developed law, possession must have begun in good faith, the thing must not be one which has been stolen (even though the possessor himself is quite innocent of the theft) or occupied by violence (this applies especially to land, which could not be stolen) and the possession must have had a justifiable beginning (*iustus* titulus). *Usucapio,* being an institution of the *ius* civile was possible only to citizens, but Justinian fused it with a similar institution (*praescriptio* longi temporis) which had grown up in the provinces. Under his system, three years were required for movables, 10 or 20 for land.

II. Methods of the Ius Gentium (a) *Occupatio.*—Ownerless things, provided they are capable of private ownership (not, e.g., res sacrae, such as temples) became the property of the first person to take possession of them. This applies *e.g.,* to game, and to articles which have been abandoned or left unattended by their owners.

(b) *Accessio.*—If an accessory thing belonging to A mas joined to a principal one belonging to B, the ownership in the whole went to B, *e.g.,* if A's purple be used to dye B's cloth, the dyed cloth belongs wholly to B. By far the most important application of this rule is expressed by the maxim *superficies* solo cedit, *i.e.,* whatever is built on land becomes part of the land and cannot be separately owned.

(c) *Specificatio.*—If A made a thing out of material belonging to B the Proculians held that ownership went to A, the Sabinians, that it remained in B. Justinian adopted a famous "middle opinion," according to which B retained ownership if reconversion to the original condition was possible (a bronze vase can be melted down), A obtained ownership if it was not (wine cannot be reconverted into grapes).

(d) Thesauri *Inventio.*—The final rule as regards treasure trove was that if it were found by a man on his own land, it went to him; if on that of another, half went to the finder, half to the landowner.

(e) Traditio, *i.e.,* simple delivery of possession with the intention of passing ownership. This was the method of conveyance of the *ius* gentium. It sufficed to pass full Quiritarian ownership of res *nec mancipi,* but not of res *mancipi* (land in Italy, slaves, beasts of draft and burden, and certain rustic servitudes) for which either mancipatio or in *iure cessio* was necessary. If therefore A sold and merely delivered a slave to B, A remained at civil law owner of the slave until usucapion had taken place. The praetor however devised methods of protecting B's possession in such a way that A's title became valueless, and B was said to have the thing in bonis. From this phrase later writers coined the expression "bonitarian" ownership. Already before Justinian's day mancipatio and *in iure* cessio had become obsolete and Justinian took the final step of abolishing the theoretical distinction between Quiritarian and "bonitarian" ownership.

Forms of Property in Land Other Than Ownership.—The ordinary leaseholder according to Roman law had no protection beyond a contractual right against his landlord, and he could not assign his tenancy, but there were two kinds of tenure which, under the praetorian system, obtained protection against third parties as well, and became assignable. These were *superficies* and *emphyteusis;* the former resulting from building leases granted for a long term or in perpetuity, the latter from similar agricultural leases. Both appear to have first originated in grants by the State, or municipalities. Under emphyteusis the grantee did not become owner, though he enjoyed a jus in *re aliena* hardly distinguishable from ownership.

Servitudes.—(a) Praedial servitudes (*i.e.,* easements or profits *à prendre*) were divided into two categories, rustic and urban, according as they served the need of agricultural land or of buildings. Thus rights of way and of water are usually classed as rustic, while rights to light, to view or to support were urban. Praedial servitudes could only be appurtenant, *i.e.,* they could not exist except as additional advantages attached to the ownership of a piece of land (the "dominant tenement").

(b) Personal *Servitudes.*—The law of Justinian's day brought under the heading of servitudes also the rights of *usufructus* and *usus.* Usufruct was the right to use and take the fruits (*e.g.,* crops) of a thing and corresponded to our life-interest. *Usus* was a more restricted right, also not extending beyond the life of the holder, merely to the use of a thing; thus the usuary of a house could live in it himself but could not let it, as that would be equivalent to taking the fruits.

Possession.—Implied in the absolute conception of ownership is a sharp distinction between ownership and possession. The civil law did not protect possession as such, but one of the most important parts of the praetorian system was constituted by the interdicta (special types of remedy) which protected an existing possession irrespective of its rightfulness, *i.e.,* anyone wishing to interfere with it must bring an action and prove his title. If he interfered on his own authority, the praetor would see that the original state of affairs was restored.

OBLIGATIONS

Obligations were classified by the jurists into two main categories, according as they arose from delict (tort) or contract: the remaining obligations the Byzantines placed under the headings of quasi-contract and quasi-delict.

I. **Delict.**—The XII. Tables already show the law in a state of transition from the system of private vengeance to that in which the state insists on the acceptance of compensation instead of vengeance by the person wronged and fixes its amount. Thus in the case of assault (iniuria) if one man broke another's limb, talion was still permitted, *i.e.,* the person wronged could inflict the same injury as he had received, but in other cases there were fixed money penalties, *e.g.,* 25 asses for a blow. Theft involved a penalty of twice the value of the thing stolen, unless the thief was caught in the act (*furtum* manifestum) in which case he was flogged and "adjudged" to the person wronged.

In classical times, praetorian reforms had substituted a fourfold penalty in the case of *furtum* manifestum and penalties for *iniuria* (which now included defamation and insulting behaviour) were assessed in each case by the court. The law of damage to property was regulated by a statute (lex *Aquilia*) dating from the republic, but later than the XII. Tables, much extended by interpretation and by the praetor, and praetorian actions lay for a number of new delicts of varying importance.

II. Contract.—At the time of the XII. Tables a law of contract can hardly be said to have existed, though we know of an institution called *nexum* of which hardly anything can be said with certainty except that it was a kind of loan so oppressive in character that it might result in the debtor's complete subjection to the creditor. It was obsolete long before classical times. The contracts of classical law were divided into four classes, literal, verbal, real and consensual. The literal contract was a type of fictitious loan formed by an entry in the creditor's account book; it was comparatively unimportant, and obsolete in Justinian's day. The verbal contract or stipulatio was of great importance, for it provided a form in which any agreement (provided it was lawful and possible) might be made binding by the simple method of reducing it to question and answer, *e.g.,* "do you promise to pay me ten thousand sesterces?"—"I promise." Originally it was absolutely necessary that the words should be spoken, but it may be said (technicalities apart) that by Justinian's day a written memorandum of such a contract would be binding, even though in fact there had been no speaking at all. If an agreement was not clothed in the form of a stipulation, it must, to be valid, fall, according to its content, under one of the types of real, or consensual contracts. A real contract is one which needs for its conclusion (in addition to the consent of the parties) that some thing should be transferred from one party to the other and that the obligation arising should be for the return of the thing transferred. The real contracts are *mutuum* (loan, *e.g.,* of money), commodatium (loan, e g., of a horse), deposit and pledge. Consensual contracts need no element for their formation except agreement—whether expressed in words or otherwise—between the parties, and though there were only four such known to the law, these were the most important in ordinary life—*emptio* venditio (sale), locatio *conductio* (hire of things or services and also giving out jobs to be done), societas (partnership) and *mandatum* (agency). In Justinian's day it was further a principle that in any case of reciprocal agreement, *e.g.,* an agreement for exchange (which was not sale), if one party had performed, he could bring an action to enforce performance by the other ("innominate contract").

SUCCESSION AT DEATH

I. Testamentary Succession.—That wills existed already at the time of the XII. Tables is certain. and it is highly probable that the form used was still that mentioned by Gaius as the oldest, the will made publicly in the assembly of the curiae (*testamentum comitiis calatis*), with the will made before the people drawn up for battle (testamentum in *procinctuas*) as a variant. It may be however that the mancipatory will (testamentum per aes et *libram*) had already been invented. This began as an expedient for effecting the purposes of a will in an emergency, when the other forms were impossible, and consisted in the use of mancipation to convey the estate of the dying man to a kind of trustee (*familiae* emptor) who then distributed it in accordance with the testator's instructions. By the end of the republic, however, the older forms had disappeared, the mancipation had become a mere formality and the instructions of the testator, which were now contained in a written document, constituted a true will, operative only at death and revocable at any time during the testator's lifetime by the making of a new will. In post-classical times the mancipation had ceased to be necessary and the commonest form of will was the testamentum tripertitum, needing for its completion the seals of seven witnesses and the signatures of the witnesses and of the testator. In classical times the praetor had already given effect in most cases to a document sealed by seven witnesses.

The first requirement of any Roman will of historical times was the appointment of one or more heredes. **A** heres is a universal successor, *i.e.,* he takes over the rights and duties of the deceased (in so far as they are transmissible at all) as a whole. On acceptance, the heir becomes owner where the deceased was owner, creditor where he was creditor and debtor where he was debtor, even though the assets were insufficient to pay the debts. It was thus possible for an inheritance to be *damnosa, i.e.,* to involve the heir in loss. Until Justinian's day this consequence could only be avoided by not accepting the inheritance, but Justinian made one of his most famous reforms by introducing the *beneficium inventarii, i.e.,* the heir who, within a certain time after the acceptance made an inventory of the deceased's assets, need not pay out more than he had received. In addition to appointing an heir, the testator might also leave legacies, *i.e.,* particular gifts which are a burden on the heir. Freedom of testation was, however, not complete, a man being obliged to leave a certain proportion of his property to his children and, in some cases, to ascendants, and brothers and sisters.

II. Intestate Succession.—The history of intestate succession consists broadly in the gradual supersession of a purely agnatic system (*i.e.,* one which takes account of relationship through males exclusively) by a cognatic system (in which relationship is traced indifferently through males or females). The agents in the change were first the praetors and afterwards imperial legislation.

By the XII. Tables those first entitled were the *sui* heredes of the deceased, *i.e.,* those who were in his potestas or *manus* when he died and became free from power at his death. Failing these, the nearest agnatic relation (or relations, if there were several of the same degree) succeeded, and, if there were no agnates, the members of the gens (clan) of the deceased. Praetorian reforms placed emancipated children on an equality with *sui* and gave to the nearest cognates, or failing such, to the surviving spouse (in marriage without *manus*) rights of succession in the absence of agnates; gentile succession became obsolete probably in the first century AD. Even under this system it will be seen that a woman would not succeed to a child of hers if any agnate (*e.g.,* a paternal uncle) were alive, nor a child to its mother if there were any agnate of hers. Both these cases were dealt with before thr end of the classical period, the former by the Sc. Tertullianum junder Hadrian) which gave certain rights of succession to mothers who had the *ius* Eiberorum (*i.e.,* had borne three children) and the latter by the Sc. *Orphitianum* of A.D. 178, which gave to children the first right to succeed to their mothers. Succeeding emperors made many changes but it was not until Justinian's day that the cognatic system completely triumphed. By Novel 118, completed by Novel 127, a new system was introduced, the principal features of which were the following: Descendants had the first claim, and failing these, a composite class consisting of ascendants, brothers and sisters of the full blood, and children of deceased brothers and sisters. Next came brothers and sisters of the half blood and finally the nearest cognate or cognates if there were several in the same degree.

Husband and wife were not mentioned, but their old (praetorian) rights were kept alive in the absence of any of the **above**

categories. Justinian also gave to the poor widow a right to one quarter of her husband's estate unless there were more than three children, in which case she shared equally with them. If, however, the heirs were her own children by the deceased, she only received the usufruct (life interest) in what she took.

PROCEDURE

The earliest form of procedure known to have existed is that of the *legis actiones;* this was superseded by the formulary system, which in its turn. gave way to cognitio extmordinaria. Characteristic of both the earlier systems is the division into two stages, a preliminary one before the jurisdictional magistrate (in *iure)* and the actual trial before the iudex. The object of the first stage is to arrive at an issue, which under the *legis* actio system has to be achieved by the speaking of set forms of words by the parties and sometimes, at least, by the magistrate. Thus in a *vindicatio* (v. supra) each party, when making his assertion of ownership grasps the thing in dispute and lays a wand on it, after which the magistrate intervenes and says "Let go both of you." So formal was the procedure that a plaintiff who made the slightest mistake lost his case. For this state of affairsthe formulary system provided a remedy. It superseded the older system, so Gaius tells us, as a result of the lex Aebutia (date much disputed, perhaps between 149 and 126 B.C.), and two leges Iuliae (of Augustus). Between the lex Aebutia and the leges *Iuliae* the two systems were both in use.

Under the new procedure the issue was formulated in written instructions (formula) to the iudex, couched in the form of an alternative, *e.g.*, "If it appear that the defendant owes the plaintiff ten thousand sesterces the iudex is to condemn the defendant to pay the Plaintiff ten thousand sesterces; if it does not so appear. he is to absolve him." A draft of the formula was probably prepared by the plaintiff before he came into court, but there could be no trial until it was accepted by the defendant; for there was always a contractual element about a lawsuit under both older systems. Pressure could, however, be exercised by the magistrate on a defendant who refused to accept a formula of which the magistrate approved. just as a plaintiff could be forced to alter a formula of which the magistrate disapproved.

The process by which the cognitio extraordinaria took its place was gradual. The new system meant that the magistrate used his administrative powers to settle disputes. As imperially appointed officers who had no iurisdictio in the old sense, superseded republican magistrates, so this administrative process became commoner. The result is that the old contractual element in procedure disappears, as well as the old division into two stages. Justice was now imposed from above by the state.

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ROMANO, GIULIO (GIULIO PIPPI, originally GIULIO DI PIETRO DI FILIPPO DE' GIANUZZI) (?1499–1546), painter, architect, principal heir of Raphael and one of the founders of Mannerism. As his name implies. Giulio was born in Rome, but the exact date is unknown. According to the archives of Mantua, where he died, he was 47 at his death on Nov. 1, 1546, so that he was presumably born in 1498/99. G. Vasari, however, says that he was 54 at his death (which he dates correctly), thus making his birth fall in 1491/92. The earlier birthdate, which is not usually accepted, would make Giulio less precocious. He certainly went to Raphael as a child apprentice and had become so important in the workshop by Raphael's death in 1520 that Vasari names him with G. Penni as Raphael's chief heir; he became his principal artistic executor. Among the works of Raphael which Vasari specifically records as having been worked on by Giulio are the frescoes in the Sala dell'Incendio in the Vatican. completed in 1517, and many of the frescoes, from Raphael's designs, in the logge, certainly finished by June 16, 1519. He also worked on such oil paintings as the "Joanna of Aragon" and the "St. Margaret" for the king of France, both now in the Louvre, Paris. and both of about 1518. His facility was almost proverbial and is testified to by his works, as well as by Vasari.

In the period between Raphael's death on April 6, 1520, and Oct. 1524, when Giulio went to Mantua, it is clear that he and Penni finished a number of works left incomplete at Raphael's death. The most important such commission was the Sala di Costantino, the last and largest of the Vatican rooms, which had hardly been begun by Raphael. After some intrigue, Giulio and Penni secured the contract, completing the frescoes on Sept. 5, 1524. The two certainly finished the "Coronation of the Virgin" (now in the Vatican) for the nuns of Monteluce. Giulio painting the upper part and Penni the lower. They may also have put the finishing touches to the "Transfiguration." Giulio also painted some original works during these years, including the "Madonna and Saints," now in Sta. Maria dell' Anima. Rome; the "Stoning of St. Stephen" (1523; S. Stefano, Genoa); and the Naples "Madonna." He also undertook some of the decorative painting at the Villa Madama, begun under Raphael's general direction in 1516, and at the Villa Farnesina. The Roman palaces of the Cicciaporci and Maccarani families, closely based on the palace of Raphael by Bramante, are also by him.

Giulio left Rome in Oct. 1524 for Mantua, apparently at the request of Federigo Gonzaga, marquis of Mantua. Very soon, there was a great scandal over some obscene engravings which Marcantonio Raimondi (*q.v.*) had made from Giulio's drawings; Raimondi was imprisoned, but Giulio was by then safe in Mantua. Much the most important of all his works is the Palazzo del Te, on the outskirts of Mantua, begun in 1525 or 1526 and built and decorated entirely by him and his pupils. This palace is one of the first and greatest examples of Mannerist architecture, being almost a parody of the serene classicism of Bramante while retaining the forms of Roman antiquity. The building consists of a square block around a central court. with a splendid garden opening off at right angles to the main axis—in itself characteristic of the way in which all the elements are slightly different from what would be expected. There is a series of splendid staterooms, mostly decorated in the rich but elegant Roman manner invented by Raphael on the basis of the recently rediscovered Golden House of Nero. The principal rooms are the Sala di Psiche, with erotic frescoes of the loves of the gods; the Sala dei Cavalli, with life-size portraits of some of the Gonzaga horses; and the fantastic Sala dei Giganti. This is one of the showpieces of Mannerist decoration and consists of a room, roughly square, which is painted from floor to ceiling with a continuous scene of the giants attempting to storm Olympus and being repulsed by the gods. On the ceiling, Jupiter hurls his thunderbolts, and the spectator is made to feel that he, like the giants, is crushed by the mountains which topple on to him, writhing in the burning wreckage. Even the fireplace was incorporated into the decoration, and the flames had a part to play. This room was completed by 1534, with much help from Rinaldo Mantovano, Giulio's principal assistant. The colour is very crude; the subject is all too suited to virtuosity and tends to bring out the streak of cruelty and obscenity which runs just below the surface in much of Giulio's painting.

In Mantua itself he did a great deal of work (including the Sala di Troia) in the huge Reggia dei Gonzaga. He also built for himself a very Mannerist version of the house of Raphael (1544–46) and began the rebuilding of the cathedral (1543 onward). The decorations of the Sala di Troia are particularly noteworthy in that they look forward to the illusionistic ceiling decorations of the baroque; but this was probably inspired by the presence in Mantua of the Camera degli Sposi by Andrea Mantegna. who must have inspired Giulio to further audacities of illusionism, as well as confirming his taste for antique motives. See also RENAISSANCE ARCHITECTURE: Italy: Mannerism.

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ROMANONES, ALVARO DE FIGUEROA Y TORRES-MENDIETA, COUNT DE (1863–1950), Spanish politician, born in Madrid, Aug. 9, 1863. He was president of the Madrid municipality, cabinet minister and home secretary (1905), before

thrice taking office as prime minister—in Nov. 1912; from Dec. 1915 to April 1917, and from Dec. 3, 1918, to April 15. 1919. He was minister of justice. Dec. 1922–Sept. 1923, and foreign minister, Feb.–April 1931. Later he became a leader of the right. He wrote *Las Responsibilidades Políticas del Antiguo Régimen de 1875 a 1922* (1924). He died in Madrid Sept. 11, 1950.

ROMANOS, SAINT (called MELODOS) (fl. 6th century A.D.), Byzantine hymnographer and greatest master of the kontakion (*q.v.*), was born at Emesa (Homs) in Syria. After officiating as deacon at Berytus (Beirut), he went to Constantinople during the reign of the emperor Anastasius I (491–518). Legend relates that when asleep one Christmas eve he was commanded by the Virgin to eat a scroll, and on awaking after doing so he recited his famous Christmas kontakion. Some 80 of his kontakia are extant but none of the music accompanying them survives. This literary form reached its full development in Romanos' kontakia, with their elaborate metrical system and vigorous dialogues, but they often contain too many rhetorical devices for modern taste. Romanos borrows heavily from earlier Greek sermons and other sources, though it is not certain whether he also depends on Ephraem Syrus. His most famous kontakia are perhaps those on Christmas, Easter and the Passion. His feast day is Oct 1.

There is no complete edition of Romanos' kontakia. The Christmas kontakion is edited by P. Maas in *Byz. Zeitschrift*, 24:1–13 (1923–24). Of several selections see *Analecta sacra*, vol. 1, edited by J. B. Pitra (1876); G. Cammelli, with Italian translation (1930); E. Mioni (1937); and N. B. Tomadakes. 3 vol. (1952–57).

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ROMANOV, the name of the dynasty that ruled Russia from 1613 to 1917. The last direct descendant of the earlier dynasty of Rurik. Tsar Theodor, son of Ivan (John) the Terrible, died in 1598. After him the throne was occupied first by his brother-in-law: Boris Godunov, then by an adventurer claiming to be a son of Ivan the Terrible (usually known as the false Demetrius). After his murder, in 1606, Prince Basil Shuiski was proclaimed tsar: but was dethroned four years later. The faction which was in power offered the crown to Vladislas, son of the king of Poland. A Polish army advanced to support his claim. Another faction brought in a Swedish army to fight the Poles. In the meantime two more men sprang up in succession, both pretending to be Demetrius, miraculously saved from death. The country was in confusion and civil war until Minin, a tradesman from Nijni-Novgorod, joined hands with Prince Pojarski, one of the generals who had proved himself an efficient soldier. They formed an army and took Moscow in Oct. 1612; they then sent messengers all over the country urging the people to choose representatives who would assemble in Moscow to elect a new ruler. On Feb. 21, 1613, Michael Romanov was unanimously proclaimed tsar.

The Romanovs were not of Rurik's stock, nor were they even of very ancient lineage. They descended from a German nobleman who had emigrated to Moscow early in the 14th century. His fifth son. nicknamed Koshka ("the Cat"), became head of the family of Koshkins, many of whom were prominent at the court of Moscow in the 14th and 1 jth centuries. Early in the 16th century one of them. whose first name was Roman, called himself Romanov. His daughter, Anastasia, was Ivan the Terrible's first wife; it was her son. Theodor, who was the last tsar of the Rurik dynasty. As Ivan the Terrible had no high opinion of his son's mental powers, he appointed a council of noblemen to transact business for his successor, and Anastasia's brother, Nikita, was chairman of this council. He made himself very popular by his constant defense of common people's rights, and one of his sons, Theodor, u-as celebrated for his learning and refined manners. Boris Godunov, fearing the popularity of the Romanovs, had obliged Theodor and his wife to divorce and to become monk and nun. It was their son. Michael, who was elected tsar in 1613.

Theodor's monastic name was Philaret. After Boris Godunov's death Philaret became metropolitan of Rostov. At the time of his son's election to the throne, he was a prisoner in Poland. Michael was only 16 years old, and was living with his mother in a convent. His personal reputation played a minor part with those who chose him, as in their eyes he was the lawful heir, being nephew to the last tsar descending from Rurik. His name had been often mentioned in those years of civil war as the only one on which all shades of opinion might meet. A popular rumour asserted that when Tsar Theodor was dying, he appointed his cousin Theodor Romanov (now the monk Philaret) as his successor, but Godunov stepped in and prevented the tsar's will being fulfilled. As Philaret had taken monastic vows, he could not ascend the throne; besides the boyars thought Michael, a mere boy. would be a more manageable sovereign. His election was no doubt because of the general striving after legitimacy, which was satisfied by his close relationship to the extinct dynasty. Three years later his father returned to Moscow and was made patriarch; he then reigned jointly with his son and up to his death in 1633 all state documents bore Philaret's signature and Michael's.

The main work of the Romanov dynasty was to extend Russia to its natural geographical limits, and to turn it into a European state from the semi-Asiatic one it had become after being under Tatar rule. Though this policy is usually connected with the name of Peter the Great, it was actually started by his grandfather and unswervingly pursued by his successors down to the 20th century. But though the general trend of Russia's internal and international development progressed along the same lines for three centuries, various undercurrents predominated at certain times and were characteristic of definite epochs. Those epochs, into which the history of the Romanov dynasty may be divided for purposes of study, correspond fairly exactly with the customary division by centuries. The first epoch, when Moscow was the only important centre and when the general intercourse with western Europe was nearly as limited as in previous days, corresponds to the 17th century, as it lasted not only until 1689, when Peter the Great became sole ruler, but more exactly until the end of 1698, when, after his first journey abroad. he began transacting state business himself. The second period, down to the death of Paul I, corresponds to the whole of the 18th century, during which Russia, with St. Petersburg as principal centre, gradually became a European country and reached the shores of all the seas bordering on the Russian plain. The third period, from the accession of Alexander I. in 1801, down to the overthrow of the dynasty in 1917, marks the highest point of Russia's activity as a European power. Whatever territorial enlargements were acquired in this period were in Asia and mostly attributed to the necessity of reaching a natural and easily defensible frontier on the Asiatic continent, whereas most of the government's energies were devoted to the work of internal progress, both economic and educational.

17TH CENTURY

The state of chaos to which the country had been reduced in the first years of the 17th century, set a hard task to the new dynasty. The pervading poverty, insecurity and disorder required protracted and patient labours before the country could overcome its weakness and disorganization. All the first tsars of the Romanov house came to the throne at such an early age that no personal guidance could be expected from any one of them for a long time. Therefore the actual work of government was always in the hands of a council. The first three tsars never took any decision without its having been discussed by this council, but favouritism and intrigue naturally influenced the choice of its members. The government was constantly convening assemblies of deputies from the whole land—sometimes to discuss a special question, sometimes for submitting all pending business to their decisions. In those assemblies, called *zemski sobor*, the permanent boyar council represented the nobles; in addition came deputies from the clergy and from "all the land," both towns and villages. The *sobors* of later days, between 1653 and 1682, however, became mere commissions for elaborating points of law and had no positive authority. The government had become stronger and had built up an efficient staff of agents of its own. On the other hand the *sobor* of 1648–49 had promulgated a code of laws, which was commonly folloned and did not require further commissions to enforce universality.

Wars of the New Dynasty.—A great part of the country's strength was wasted in attempts to counteract the encroachments effected by the neighbouring powers on its territory during the period of anarchy. Russia got back Smolensk and Seversk. which had been seized by the Poles, and annexed Kiev and part of Little Russia, east of the Dnieper, because of a rising against Poland of the Cossack hetman, Bogdan Khmelnitski. But the mars against Sweden, which had annexed a large area in the Baltic region, led to no result in the 17th century, and Russia had to wait for Peter the Great in order to regain what she had lost in the northwest.

Down south, where since the 15th century a separate State, the khanate of Crimea, had arisen under Turkey's protectorate, the first Romanovs waged no regular wars; but the danger of Tatar incursions demanded the building up of defenses which slowly advanced into the steppe, and by the end of the 17th century the fortified line of defense was 400 mi. S. of the capital. But the farther Russia spread down in that direction the clearer it became that no peaceful agreement was possible so long as the Black sea was not reached, and that would have meant war with Turkey, a much too formidable opponent at that stage. A cossack hetman. Doroshenko, went to war with the Turks, applied to Moscow for help and was eventually supported; but this adventure led to a disastrous peace (1681) by which western Ukraine had to be surrendered to Turkey. It took 100 years more, and all the energy of Catherine II and of Potemkin to reverse the situation.

Taxation Reforms.—The finances of the country at the beginning of the new dynasty's rule were perhaps in a still more disastrous condition than any other branch of public service. The main spring of former revenue, taxation of cultivated land, was no more adequate because of so many fields having been abandoned during the years of anarchy. Besides, those peasants who returned to their devastated villages were often successful in defrauding the state of their taxes. The government was obliged gradually to work out a new system, that of taxing no more the land. but the landowner, not the "field," but the "house." Large landowners were made responsible for the taxes due from peasants who were settled on their land, besides being obliged to come forward with a fixed number of soldiers in case of war. In order that they should be able to fulfill their obligations the peasants were gradually attached to the soil; and thus a serfdom arose which lasted up to 1861 and practically transformed the peasants into slaves.

Religious Matters.—The administration of the church was at first entirely in the hands of Philaret, who was elected patriarch in 1616. Until his death, in 1633, he was the actual sovereign, and in ecclesiastical matters his power was absolute. In 1652 the patriarchal see mas again occupied by a strong personality. Nikon. Tsar Alexis called him his "particular friend" and gave him a free hand in the reforms he undertook. He revised and corrected the texts of prayer books, the manuscripts of which had been disfigured by ignorant scribes, and abolished ceremonial practices for which no authority existed. But his activity met with strong opposition, due in most part to Nikon's tactlessness, and led to a schism, Raskol. Nikon's opposition to secular legislation about monastic property, and his efforts to place his own authority above that of the tsar, eventually made Alexis alter his attitude toward him. He then retired to a convent and refused to perform his duties. For nearly ten years the tsar ruled the church in his stead, until a council was convened which deposed Nikon and appointed a new patriarch. The danger of having a man next to himself who might succeed in usurping such a measure of power, made Peter the Great abolish the Russian patriarchate.

A curious feature of the first Romanovs is that notwithstanding their efforts to rule in accordance with the people's wishes, and though each of them in turn manifested a total lack of personal ambition, circumstances so imperiously demanded a strong hand that autocracy was evolved and imposed upon a succession of totally ungrasping autocrats. This leaning of the country toward a firm rule prepared the way for Peter the Great's activities.

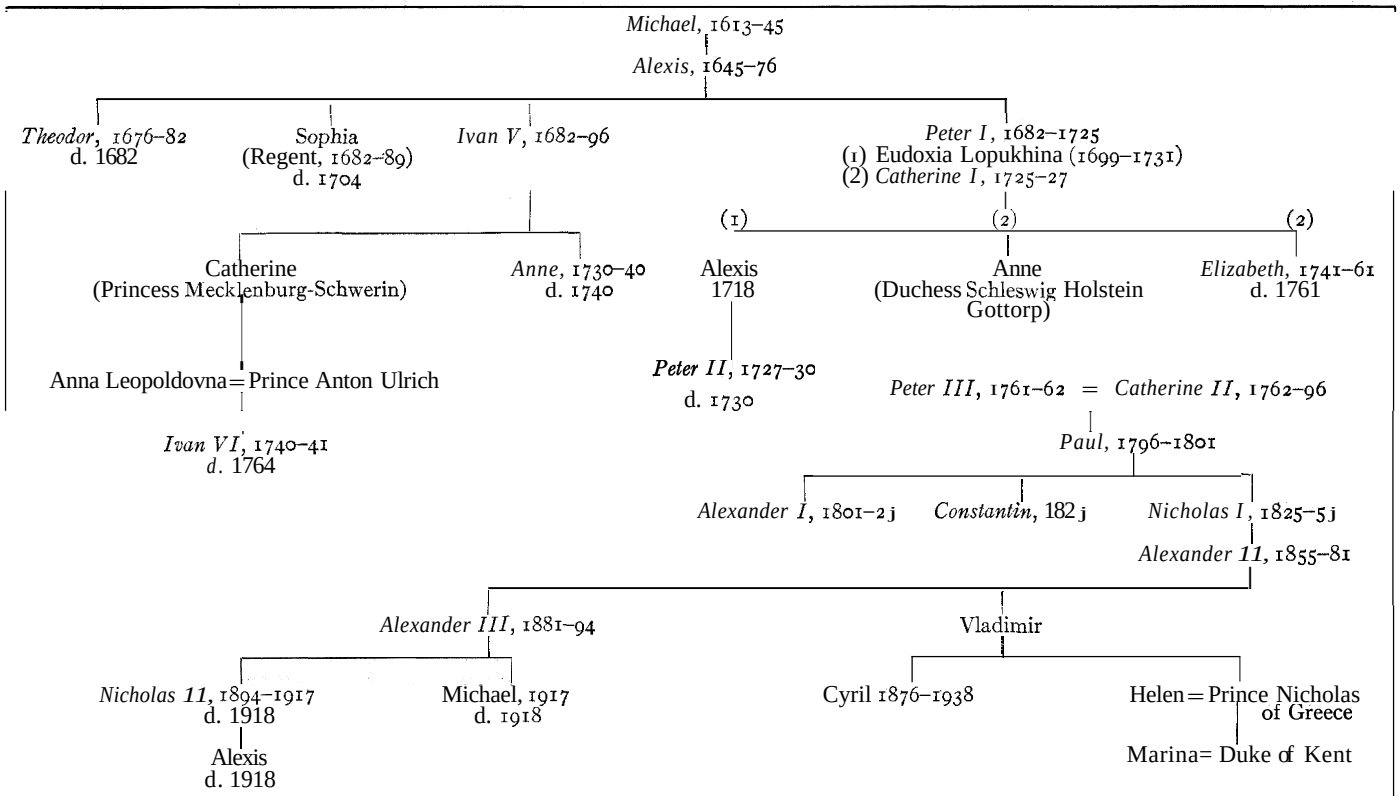
18TH CENTURY

The salient figures among the Romanovs of the 18th century are those of Peter the Great and of Catherine II. With Peter, Russia reached the Baltic sea after 20 years' war against Sweden; with Catherine, the southern frontier, after two wars against Turkey, came down to the Black sea, whereas, on the west, because of the partition of Poland, and the annexation of Courland, it came in contact with the Germanic confederation. Two brilliant episodic wars—that of the empress Elizabeth against Frederick the Great, and that of Paul I against the French in Italy and Switzerland—were brought on by political alliances and led to no tangible results. Sweden's two attempts (1741 and 1788) to regain by a sudden attack some of its lost advantages nearly led to Russia's spreading farther over southeast Finland. The conquest of Finland became necessary for the security of St. Petersburg, which gradually became the seat of government. Two attempts at advance in central Asia remained fruitless; Peter the Great's conquest of the southern border of the Caspian in 1723 was annulled by the empress Ann in 1732 when the annexed provinces were handed back to Persia. Peter the Great's attempt to seize Khiva failed.

Reforms of Peter the Great.——Peter the Great's decision to turn Russia into a western power demanded a complete upheaval of existing conditions. The emperor (he assumed this title in 1721) carried through his reforms against a stubborn resistance of the greater part of the nation. The whole of his tremendous energy mas aimed at making Russia strong, and at opening the country to the influence of western science and art. He started alone in the field, and the motto he chose for his seal is most characteristic: "I am of those who must be taught and am seeking for teachers." The work he performed between 1699 and his death in 1725 is astounding. (For a discussion of his accomplishments, see PETER 1.) Peter not only set a marvellous example of what personal energy can accomplish, but he was also the first to put forward the idea of "citizen" or "servant of his country" as being the highest aim of a man's activity. He did not hesitate to sacrifice even his only son when he saw he would undo his father's work and lead a life of ignorant self-indulgence. Later in the century Catherine II also seized every opportunity of showing that all her life and energies were devoted to the service of the country. Her grandsons, Alexander I and Nicholas I, and her great-grandson, Alexander II, proclaimed the same rule. In this respect Peter the Great was ahead of his times not only in Russia but in Europe, since the first western sovereign who prided himself on being the servant of his people was Frederick II. nearly half a century later. Peter's daughter, Elizabeth (1741–61), was also a pioneer in her way when she abolished capital punishment (1744), which from then on mas not practised in Russia except in retribution for attempts to overthrow the existing order of government. She also opened a fine arts academy. The short reigns of Peter the Great's immediate successors, his widow and his grandson, during which favourites ruled in their stead, prompted a group of political men to offer the throne in 1730 to Ann, a niece of the great reformer's. but on the condition that she sign a promise to take no steps without the approval of a council of eight men (themselves) and this council would recruit its members by free election. Ann signed the paper and then. backed by the guards, destroyed it as soon as she reached Moscow for her coronation. That was the only attempt made in the 18th century to limit autocracy in Russia.

The two 18th-century sovereigns of the Romanov dynasty whose political activity was not regulated by their sense of duty, but merely by their personal whims, Peter III and Paul I, rapidly became so unpopular, that conspiracies at once arose which did away with them, the first after six months'. the second after four years' rule. The one law of Peter III's which it was not possible to abrogate was that which freed the members of the nobility from being obliged to serve the country, an obligation which was the only justification of the privileges they enjoyed.

Liberalism Under Catherine 11.—The 34 years of Catherine II's reign produced a fundamental change in all paths of life. Liberal ideas, those of the French encyclopaedists, became the foundation of her reforms. She convened a commission for preparing a new code of laws and composed instructions to guide



this assembly in its labours. Catherine accomplished a vast number of reforms tending to economic prosperity and encouraging certain manifestations of local self-government. She did a great deal for art, protected artists and formed the nucleus of the great Hermitage collection. which has been a powerful instrument of culture in Russia. (See also CATHERINE II.)

19TH CENTURY

The beginning of the century saw the last of Russia's expansion in Europe. as the annexation of the Swedish province of Finland took place in 1809. The changes which occurred in the redistribution of parts of Poland and of Bessarabia. in the first half of the century, partook more of the character of frontier rectifications than conquest. Russia's territorial acquisitions of the century were mostly in Asia. In 1801 the kingdom of Georgia was annexed to Russia, and that led to a gradual absorption of Transcaucasia. the last part of which was pacified in 1864. Central Asia (or Russian Turkistan with Bokhara and Khiva), that perpetual hotbed of raids and stronghold of the slave trade, was conquered between 1830 and 1876, with the addition of the Turkoman steppe in 1831. But Russia's advance to the Black sea had opened up a new question, that of the Straits (Dardanelles and Bosphorus), for, without a free passage into the Mediterranean. the Black sea mas of small commercial value. Catherine II had obtained from Turkey the right of protection over Turkish subjects of the Orthodox faith. This new principle, akin to the more modern idea of "spheres of influence," originated the efforts of the Romanovs for the liberation of Slav nationalities from Turkish rule; Russia participated in the war for the independence of Greece and bore the greater part of the burden in those which eventually led to the creation of Rumania, Bulgaria, Serbia and Montenegro. The same policy brought on the Crimean War, which was disastrous for Russia and bared its weakness. even in military matters, before the eyes of the norld. The staunch qualities of the Russian soldier had left a durable impression in Europe from the time of the Napoleonic wars, but the Crimean War led to a general revaluation of Russian methods, both inside the country and abroad.

Conservatism of Later **Romanovs.**—However, the main characteristics of the Romanovs' rule in the 19th and early 20th century is undoubtedly the opposition to the principles of revolution which had triumphed in France. When Alexander I was confronted with them, as personified by Napoleon, he was beaten, then pretended to yield until his forces were ready for a second and triumphant struggle. He realized so well the true meaning of his victory that, though the halo of "liberator of Europe" put him in a situation in which he would hardly have met with a refusal on any point. he never turned Napoleon's downfall to any merely material advantage for Russia. All he had gone through; the disasters of Jena and Austerlitz, the humiliations of Tilsit and Erfurt, the fire of Moscow, the entry into Paris, the congress of Vienna, he used all that to enhance Russia's prestige and to create a situation where his own voice would carry most weight against revolutionary propaganda. The Holy Alliance was the only harvest he sought to reap for having led his army from Moscow to Paris.

Growth of Revolutionary Sentiment.— But this moral comfort was of short duration. and the emperor very soon perceived that he and his allies were unable to cope with the tide. Moreover. in his own country a vast conspiracy was formed, of which he was aware in the last weeks of his life, though he took no steps against it. A military revolt was organized the very moment his brother and successor came to the throne (Dec. 182 j), and though it mas suppressed in the course of one day, the danger he had undergone left its imprint on the whole of Nicholas I's mind and behaviour. After 1848, nhen most European governments gave nay to political reform, the emperor of Russia remained almost the sole bulwark of legitimacy. His son, Alexander II. understood that however well the principles of his ancestors might have been adapted to the requirements of his country, they had to be exercised in conformity with the spirit of the times, and he effected a number of important reforms. But the enemies of tsardom used these liberal measures merely as a broader basis for revolutionary propaganda, and this became so strong that it led to the murder of the emperor (1881).

His son. Alexander III, proclaimed his allegiance to reaction; the constitution his father had elaborated and would have granted had he lived a few days longer, was forgotten, and a police regime was instituted which appeared to stifle revolutionary activities but in reality drove them underground Outwardly. the country was quiet and prosperous. The political alliance with

France created an era of peace and permitted the whole force of the nation to be devoted to economic development. The building of railroads was pushed on in gigantic strides, the trans-Siberian railway (because of the emperor's personal initiative) being the most notable achievement.

The last Romanov emperor, Nicholas II, came to the throne at the age of 26, and strove to continue his father's work along the same lines. He succeeded in creating economic prosperity. His desire to obtain a strong footing on the Pacific, and thereby to prompt the development of eastern Siberia, led to a disastrous war with Japan (1904). A revolution broke out, and though it was suppressed the emperor attempted to pacify the land by granting constitutional rights (Oct. 1905). This, however, was done but half-heartedly, and led to incessant misunderstandings between the government and the people's representatives.

Final **Success** *of Revolution.*— Propaganda was already strong, and every liberal concession, instead of quieting public opinion, gave fresh opportunities of carrying it on. The emperor, while well-intentioned, was scarcely strong enough in character to withstand the forces of unrest which from 1905 on became yearly more active. At last, Russia's participation in World War I and the emperor's wish to unite all classes in one effort against the enemy cleared the ground for propaganda in the army; it was especially active in the hospitals, which were largely in the hands of volunteers. The general discontent and uneasiness produced by several years of war were put to use and a spark was sufficient for bringing on a general conflagration in the midst of which the last Romanov emperor descended from the throne. The three centuries of the Romanovs' rule correspond to a period of expansion and brilliancy such as Russia had not hitherto known. See also separate biographies of the Romanov emperors; and RUSSIA. (M. PAL.; X.)

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ROMAN RELIGION. The religion of ancient Rome, from the earliest known times to the final suppression of paganism, may be conveniently divided into four periods: (1) native; (2) Italian (including Etruscan); (3) Greek, passing into Greco-Roman; and (4) oriental. These divisions emphasize the principal influence at each stage, without implying that no other influences existed.

Native.— The earliest Romans were a small community of peasant farmers, probably held together in a loose organization with a king at its head. Under him would be the heads (patres) of families or clans. with their retainers (clientes). Even in its earliest days the community probably engaged in a certain amount of trade in addition to farming and stock raising, since Rome lies advantageously on the principal natural highway of central Italy, which is the Tiber, and on the border between the Etruscan cities northward and the towns of the Latin league farther south. According to tradition the people were of mixed stock, with some Latin and some Sabine highland blood; various linguistic and other facts tend to confirm this. Threatened by powerful neighbours, they were of necessity warlike.

Like many peoples at a comparable or even at a lower stage of culture, the Romans had developed a few "high gods" by the earliest known period of their history. The names of some of their deities can be recovered, chiefly from surviving festival calendars. None of these was composed earlier than the 1st century B.C., and by that late date many of the oldest feast days and religious seasons had lost their former prominence; but the calendars nevertheless record the gods' names in large letters. Chief among them comes Jupiter (in Latin, Iuppiter), whose name is etymologically equivalent to the Greek Zeus and the Sanskrit Dyaus. It must therefore have come down from immemorial antiquity in the Indo-European family, along with the Latin language. The name Jupiter includes also the stock title pater; i.e., head of the house, hence, person in authority. (Neither pater nor its correlative mater had originally any physiological meaning.) Like Zeus and Dyaus, Jupiter was a sky- and weather-god, obviously important to farmers. With him were early associated two other gods. Mars and Quirinus. Mars was a deity of great importance, widely worshiped in Italy, but of doubtful origins—his name is of highly uncertain etymology. His functions were very wide, and included the protection of his worshipers, their cattle and other possessions against all manner of evils, such as disease or the devastation of their property. These evils included the perils of war, and Mars was consequently a warlike god. Quirinus, whose name is plainly adjectival, was much less important. He is said to have been Sabine, despite the fact that the sound represented by qu- did not exist in the Sabine dialect, and it seems that he was the god of the *quirium*, whatever that may have been. The word would seem to be connected with the name *Quirites* by which Roman citizens were collectively known. Jupiter, Mars and Quirinus formed a triad, but their festivals were separate. Jupiter was worshiped especially on the ides (day of full moon) of each lunar month. Mars was worshiped almost exclusively in his own month, the first of the original Roman year, *Martius* (i.e., March), and in October. Quirinus' feast day was the Quirinalia on Feb. 17.

At least one goddess, Juno, was important in the earliest-known times. She seems to have had no original connection with Jupiter or with any other god save perhaps Janus, one of whose titles was Iunonius. Juno's name may most reasonably be associated with words denoting young maturity, such as *iuuenis*, and so may signify a marriageable woman. Certainly her chief function was to supervise the life of women. and since their sexual life has what may be called a lunar rhythm, Juno has certain lunar associations, under the title of Iuno Couella. The month of June (*Iunius*) is hers, though its name is derived from a stem, *iuni-*, seen in the Etruscan corruption of her name, which is Uni. Her festival, marked by curious and obviously ancient ritual, was the Nonae Caprotinae, or Nones of the Wild Fig, on July 7. A sacrifice was made to her, together with Janus, on the first day (knlendae) of every month. On March 1, the dedication day of the temple of Juno Lucina, the birth-goddess, married women held a festival, the Matronalia. This, however, is not one of the oldest holy days. The u-omen swore an oath by this goddess, "Eiuno." There are several examples, too, of a woman speaking of "my Juno," as a man would speak of his "Genius." It has been suggested that there were to begin with many iunones, one for each woman, and that the goddess originated from the coalescence of these into the single great figure. But the evidence for an individual iuno is late, not earlier than the time of Augustus; while examples of a divine name coupled with a possessive pronoun are fairly common. The locution means no more than, for example: "Such-and-such a divinity, whom I worship"; "this deity in his or her dealings with me." Juno was widely worshiped outside Rome, being sometimes the chief deity of a state, and as such on occasion having warlike functions. Thus at Lanuvium, Juno Sospita Mater Regina was represented clad in a goatskin and bearing a spear and shield.

But the most characteristic deities of this period were vague figures of limited and sharply defined functions. Like the greater gods, they were regarded as possessing superhuman power, known as *numen* from at least the 2nd century B.C. This they could be induced to employ for the benefit of their worshipers if rightly approached. Beyond this, Roman curiosity did not go; the gods have no myths, do not form married pairs (though a masculine and a feminine name are often conjoined) and have no offspring. To name them correctly and to worship them with the proper words and gestures were supremely important; hence there grew up in time elaborate lists of liturgical formulas, the indigitamenta (*indigitare* means to address a deity with the appropriate titles, etc.). These are complicated by the intrusion into surviving documents of a host of names of godlings presiding over the most minute details of human life and activity. Some of the names were apparently invented for special occasions, others are due to false etymologies. These numerous godlings appear to be the result of priestly elaboration at a comparatively late period; but it seems true that some such di *minuti* did exist. Thus Janus, who was on his way to develop into a god of beginnings (hence the

name, January, of the first month in the reformed calendar and the sacrifice to Janus on all kalends), is almost certain to have been nothing more originally than the personification of an *ianus* or gateway. to pass through which is an act often of magico-religious significance. Vesta the hearth-goddess is the sacred hearth itself, the recipient of some cult in every household. Terra or Tellus Mater, the earth-goddess, probably was the holder of that *numen* which was necessary to make the Roman territory productive; certainly she was not goddess of the whole earth. The name of Ceres, the corn-goddess, may have been an adjective, "productive," applied to Terra; she owes her whole personality to her early identification with Demeter. A curious deity is the Genius, a sort of divine double of a man. The name means "begetter." and the Genius was supposed to be pleased if the man was well fed, defrauded if he lived poorly. In classical times every man, bond or free, had a Genius, but it may be that he belonged originally to the head of the house only. Various of these deities form groups. Such are the Indigetes and the Novensides, whose functions remain uncertain; the Lares, originally little gods of the farmland and of the houses standing on it, though their office was enlarged later; and the Penates (singular *penas*), who have an adjectival name: "of the inner rooms," and who particularly looked after the storeroom.

The cults of these and numerous other divinities were regulated in historical times by an elaborate priesthood, which was doubtless much simpler in earlier days. At its head, and including its most important members, stood the college of pontiffs (*pontifices,* or bridgebuilders). There were originally three pontiffs proper; they were increased to 16 under Julius Caesar. The college included also the rex *sacrorum* or king of the sacred rites, originally the actual king, but under the republic an official appointed for life to perform the king's sacral duties. In addition there were 15 *flamines* or priests of individual gods, the 3 chief (maiores) being those of Jupiter. Mars and Quirinus (*flamines Dialis, Martialis, Quirinalis*). Lastly came the vestal virgins, who tended the Vesta *publica,* or state hearth, in the forum. There were normally six of these; they were girls of patrician families, successors of the king's daughters or their substitutes. and chosen in childhood to serve for 30 years (originally for five; *i.e.,* until puberty). 411 other priests were men, at first patricians—*i.e.*, full citizens. This requisite remained in force for a few posts even after the attainment of equal political rights by the plebeians. Hence Ceres. though a goddess, was served by a man (the *flamen Cerialis*), a thing abnormal to ancient ideas in general. There was no priestly caste like that of the Indian Brahmins. Most of the priesthoods could be held along with a secular magistracy, although the elaborate taboos which the *flamen Dialis* was obliged to observe made this almost impossible in his case, and the rex *sacrorum* was excluded from other posts. The head of the whole body was the chief pontiff (pontifex *maximus*), who exercised disciplinary functions and formally appointed each new vestal and *flamen Dialis.* Outside their purely sacral duties, the priesthood had advisory (not executive) powers.

Outside the college of pontiffs stood the augurs (augere, "to increase"). The derivation of their name implies that they had once been officiants in fertility rites; they were now specialists in divination, particularly from the behaviour of birds. They did not themselves conduct the auspicia or taking of omens to ascertain whether the gods favoured a proposed action. for that was the business of every magistrate and could be done even by private citizens on occasion; the augurs were there to advise and direct as needed. There were also several minor bodies. The *Salii* (dancers) performed ceremonial dances, in archaic mar equipment, in honour of Mars and Quirinus; the Luperci ran naked, save for a girdle of goatskin. around the boundary of the original Palatine settlement every year on Feb. 15 (the Lupercalia), striking everyone whom they met with thongs of goatskin. They were popularly known as he-goats (*creppi*). Yet other bodies included the Xrval Brothers (*Fratres* Aruales), who were concerned with agricultural ceremonial of a very archaic type.

It is clear that not all these rites were of the same date. For instance, very ancient custom decreed that the *flamen Dialis* might not touch iron, his hair and nails being cut with a bronze implement. There is evidence that the customs of the vestals were less ancient; their goddess had her seat in the forum, outside the oldest settlement, and they regularly used an iron tool in the preparation of the salt needed for their ritual. The antiquity of some of the rites is evidenced by their not being directed to any deity. The performance of the Luperci, in particular, seems to have been purely magical; they drew a kind of magic circle around the Palatine. to keep good influences in and bad ones out. The evidence for the connection of the Lupercalia with a god or goddess is of the feeblest, and is probably the result of ancient speculation. Another piece of magic was the annual ceremonial of the *Argei,* in which 27 puppets were thrown from the oldest bridge (Pons sublicius) into the Tiber. Here may be recognized a primitive function of the "bridgebuilders" (*pontifices*); the river-god, who may feel insulted at the building of a bridge over his stream, is soothed by a pretense that many persons fall from it and are drowned. The reason for the exact number 27 is unknown.

Italian and Etruscan.— The Etruscan dynasty of the Tarquins (latter half of the 6th century B C) brought innovations to Rome, although it does not appear that the spirit of the local religion was much influenced. Cult statues were introduced, the worship having previously been conducted without images. Temples of Etruscan type began to appear; at any rate one such temple. that on the Capitol, was planned and nearly completed toward the end of the dynasty. (In Latin the word *templum* does not mean a temple in the accepted modern sense. but a piece of ground set apart and consecrated. This might or might not contain a "holy house"—aedes sacra—for the god or his emblem to reside in.) Elaborate funeral rites, such as remained in use for prominent people in historical times, appear also to be Etruscan. The Etruscans made known to the Romans a complicated method of divination by taking omens from the entrails, especially the liver, of a sacrificial victim; the practitioners of this rite (*haruspices*) never became Roman priests, however. They remained foreign or foreign-trained experts, consulted on occasion. Etruscan also was a system of divination from lightning. and a reform of the calendar. The primitive Roman calendar had consisted of only ten lunar months, a gap intervening between December ("tenth month") and March. This calendar was now replaced by one of 12 months, obviously meant to begin with January, since that month is named from the festival of Janus occurring in it. presumably at first called Ianuar. The fall of the Tarquins seems to have prevented the full use of the reformed calendar, however, for the year continued to begin with March for several centuries. (Two month-names, *Iunius* and Aprilis, witness to the Etruscan influence behind the reform. Aprilis cannot be derived, as was anciently supposed by some, from *aperire,* so as to mean "month of opening," but comes from the name of the goddess Aphrodite, corrupted into some such form as Apru.) The 12 lunations of the new calendar were about 11½ days short of a solar year. An extra month, called Mercedonius or Intercalaris, was therefore inserted at intervals to make up the difference, but so clumsily that the calendar lost touch more and more with the seasons until Julius Caesar's reform.

During this period (*i.e.,* the end of the regal epoch and the earlier part of the republican), importations of deities from other than purely Etruscan sources took place. The Capitoline cult gave Jupiter as partners Juno and Minerva, the latter not originally a Roman goddess. The grouping is most readily explained by Greek influence coming through Etruria. for the two goddesses were early identified with Hera and Athena, respectively the wife and the daughter of Zeus. Venus, Fortuna and Diana came in during this period from native Italian sources. Very early in the republic, Castor and Pollux were given a temple in the forum, in consequence, according to tradition, of their aid to the Romans at the battle of Lake Regillus (499? B.C.) against the Latin league. (The form Pollux is the Latin corruption of the Greek Polydeuces.) Even among the earliest-known deities are some whose names yield no discoverable Latin etymology, and certain of them are probably Etruscan. Examples are Volcanus, god of destructive fire, at first volcanic fire; Saturnus or Saeturnus, a deity of very

uncertain original functions; and Volturnus, apparently a river-god. probably of the Tiber. Almost certainly a very old importation was Hercules. This form of his name is an Italian corruption of the Greek Herakles. His altar stood in the cattle market (Forum boarium) near the Palatine, whose traditional boundary swung out to enclose the market. A widely recognized deity, such as Hercules had become, was needed to keep the peace in a market where strangers were dealt with.

Greek (Greco-Roman).—As Rome expanded, its relations with the Greek communities of southern Italy and, later, with Greece itself and with the empires of Alexander's successors became more frequent. As a result, Greek cults made their appearance, being sometimes new importations, sometimes modifications of existing worships brought about by identification of Greek with Roman or other Italian deities A new importation was the cult of Apollo, which steadily grew in importance; he had no generally accepted Italian equivalent. The oracles of the Sibyl of Cumae, supposedly inspired by him, were acquired at an early date, according to tradition by the elder or the younger Tarquin. They were thereafter consulted on occasion by a new priestly college, the *duouiri* sacris *faciundis,* whose numbers were gradually increased from the original 2 to 1 j or even more. In the hands of these priests lay the general management of all worship conducted otherwise than in native fashion (*i.e.,* worship by the Graecus ritus), and their importance grew as more foreign cults made their way into the city. Such cults did not as a rule invade the inner circle of Roman worship, for this lay inside the sacral boundary (pomerium) of the city; but they often spread into the inhabited quarters, which rapidly grew beyond the traditional limits. Apollo himself. in his capacity as a divine physician, soon followed the oracles of his inspired prophetess His first Roman temple is said to have been vowed in 433 B.C. "for the public health," which presumably means on the occasion of a plague; he appears. however, to have had some sort of sacred place (*Apollinar*) earlier than this. Evidence of the latter species of cult is the temple (on the Aventine and thus outside the *pomerium*) of Ceres, Liber and Libera, a triad copied from the Eleusinian uorship of Demeter, Kore and Iacchus. Iacchus was commonly identified with Dionysus and hence with Liber, the Italian wine-god and associate of Jupiter. The Aventine temple became the central sanctuary of the Roman plebs. It was dated 493 B.C., having been vowed three years earlier; its style was Etruscan, but its decorations were Greek. With Greek cults came Greek art, at least in the form of statues of deities, and Greek mythology also. This the Romans accepted eagerly and apparently at a fairly early date — for. despite their intense national pride, they were reinarkably ready to learn from foreign sources anything that struck them as important.

The Romans also developed a Greek attitude toward their own early history. It was hardly respectable for any important place not to have a founder with high, preferably divine, connections, and for a barbarian city to be thought something better than barbarous it was well for it to produce some evidence of Greek or, failing that, Trojan origins. As a result of this tendency there grew up various highly artificial legends concerning the foundation of Rome, which finally took their most familiar shape in the tale of Romulus and Remus, sons of Mars and descendants of Aeneas of Troy. The sequel of this particular legend stated that Romulus was transformed into the god Quirinus, this despite the fact that native Roman feeling drew a very sharp line between men and gods. Roman cult had nothing corresponding to Greek hero worship. This embellishment, however, is not known to have been current before the age of Cicero. A landmark in the hellenization of Rome is the *lectisternium,* a sort of banquet at which the gods were guests, which was held in 217 B.C. Such a banquet in itself was nothing new. but the old manner was to have the gods invisibly present, their attendance at the couches (*puluinaria*) prepared for them being denoted merely by bunches of herbs known as "gods' heads" (capita *deorum*). On this occasion, however, moved by their ill success in the early battles against Hannibal, the Romans resorted to a number of measures intended to secure divine favour. At the *lectisternium* of 217 the gods were represented by their statues and paired in a manner wholly Greek — Jupiter with Juno, Neptunus the water-god with Minerva, Mars with Venus, Apollo with Diana, Volcanus with Vesta, Mercurius, the traders' god, with Ceres. These, in fact, were Zeus with his consort Hera; Poseidon with Athena (a union of the two most characteristic Athenian cults), Ares with his love Aphrodite; Apollo and his sister Artemis; the two powers of fire, Hephaestus and Hestia; and the two deities most concerned with trade. for grain was a very important article of commerce. Together, therefore, the figures at the *lectisternium* made up the typical and popular Greek group of the 12 gods.

Greek myths seem to have had a remarkable effect on a people formerly piously incurious about the gods' character and activities except insofar as these concerned their worshipers. This effect was felt at a time when serious belief in the gods was at least greatly weakened among the Greeks themselves, and when they had a tendency to explain the traditional tales away or to use them merely as literary ornaments with the divine characters strongly humanized. The Romans, however, do not seem to have been greatly scandalized either by such plays as Plautus' *Amphitruo,* in which Jupiter and Mercurius appear as comic figures, or by Ennius' introduction of Euhemerus (*q.v.*), according to whom the gods were not gods at all, but deified kings and other notabilities. Such manifestations marked a stage toward the weakening of the traditional reverent attitude, and this by the last century of the republic had led to widespread indifference or skepticism. Yet, through their native conservatism, the Romans kept up all or most of the traditional observances, even when they had ceased to have any meaning or were at best a subject for learned speculation.

The age of Augustus saw a revival of the old cults, fostered and sponsored by his government and reinforced by new splendour of temples. An addition was the development of the worship of the emperor's patron, Apollo. His great temple on the Palatine became the centre of what might not unjustly be called a rival system to that headed by the Capitolian triad. Whatever Augustus' own beliefs may have been, and however much he may have regarded his religious revival as a useful political instrument, it was the beginning of something resembling an age of faith.

Oriental. — Although the Roman and the Greco-Roman modes of worship were as a rule decent and originally expressed genuine religious feeling, neither was exciting. Moreover, they were state or family cults concerned with this world, little attention being paid to aspirations for a future life. A dead Roman was thought to join the company of the Good People (*Manes,* a word that has no singular). As a member of a family or of a clan he would be one of the di *parentes*—again, no singular form of this description is known until at earliest the latter part of the 2nd century B.C.—and as such he would share in the respectful attentions of the surviving kin. But little hope was entertained of any effective survival for him, though it was trusted that the memory of a distinguished person would be long kept alive.

During the later years of the republic. however, and still more under the empire, a strong but mostly inarticulate demand for some kind of personal religion was growing. There grew up, chiefly in the east, sundry cults that promised their votaries the personal favour of deities, or even divine rank, if certain conditions were fulfilled. These usually included some form of initiation. The orient first obtained a foothold in Rome in 204 B.C., when by advice of the Sibylline oracles the Great Mother of the Gods (*q.v.; Mater* deum magna Idaea) was imported from Pessinus in Asia Minor and in 191 B.C. given a temple on the Palatine, in the heart of Rome itself Her rites, carried out by eunuch-priests, shocked Roman sentiment, and citizens were long forbidden to take part in them; but the goddess was treated uith respect, especially as she was associated with Troy and mith the legendary ancestry of the Roman people. In 186 B.C. came the affair of the Bacchanalia (*q.v.*). A cult of Dionysus was introduced into Italy, comprising rites of initiation and nightly ceremonies that had something of the wildness of the god's original Thracian or Thraco-Phrygian worship. They were alleged to be attended by all manner of sexual and other crimes. Scenting a conspiracy against law and order, the senate took severe and effective measures to suppress the movement, but it was the precursor of numerous Diony-

siac mysteries, apparently harmless enough, and varying from serious religious associations to dining and drinking clubs nominally under the patronage of the god. These last characterized the early empire especially. The older mysteries, especially the Eleusinian, retained their prestige and drew many Roman initiates, who seem to have read into them whatever philosophical doctrines they found attractive; but the most marked tendencies of the age were definitely toward the east, to Asia or to Egypt.

Astrology gained ground rapidly from about the age of Augustus, and its rigid determinism dismayed many, who sought refuge in anything that would enlist the power of the gods in their favour. (The gods were supposed to live beyond the stars, and so to be free from their centripetal influence.) Some people used elaborate magical practices of a kind supposed to bring the practitioner into contact with deities, and particularly those of theurgy (*theourgia*), a term literally meaning "god-working." But the most characteristic feature of this age (the last century B.C. to the end of paganism) was the multiplying of mystery cults. These generally had for their central feature the adventures, often including death, of a god with whom the initiates were brought into contact, being even perhaps identified with him, so that they passed through some simulacrum of his sufferings and shared his triumph. There were three principal mysteries. First came those of Isis, which although ultimately of genuine Egyptian origin, had been considerably hellenized in passing to the west. Their language was Greek, and they contained several elements not really Egyptian. Then there were the mysteries of Attis, which were an offshoot of the cult of the Great Mother. Attis. the goddess' young favourite, who had died and been at least partly revived, was their central figure. Lastly came the mysteries of Mithra (*see* MITHRAISM). They were in some ways the most important of all, and were originally Persian. The worship was for men only, and was popular especially in the army. It centred on the mythical career of Mithra, was divided into grades vaguely reminiscent of those of freemasonry, and carried with it a high and stern morality. It was for a while a formidable rival to Christianity.

Solar worship was very characteristic of the later imperial epoch. Certain Syrian cults, either originally solar or later held to be so, were partly responsible for this. Perhaps more important, however, was the conception that to the emperor corresponded the greatest of the visible heavenly bodies. The emperor was lord on earth, with power now grown absolute and having many features of that of an oriental despot, while the sun was lord in the sky. There was even a kind of solar monotheism, for a strong tendency existed to explain all other gods as equivalent to the sun. On occasion, the sun cult provided a sort of bridge to or compromise with Christianity, through the identification of the sun-god with the Sun of Righteousness (Mal. iv, 2).

Such was the religious world within which Christianity grew up, and over which it finally triumphed. Constantine the Great recognized Christianity (313) and Theodosius I in 391 and 393 forbade all pagan cult. public or private.

See also under names of individual deities, festivals, etc.

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(H. J. R.)

ROMANS, EPISTLE TO THE. The occasion of this New Testament epistle is revealed in i.8f, xv 14f. St. Paul had finished his mission in Greece and was on his way to Jerusalem with the proceeds of the collection made by his churches for the poor Christians in Judaea. Casting about for a new sphere, he turns to the extreme West of the Mediterranean, to Spain, where evidently no one had preached the gospel. On his way to Spain, after settling the business at Jerusalem, he proposes to visit the Christians at Rome. This corresponds to the situation outlined in Acts xx. 2f; it is probable, though not certain, that the apostle wrote the epistle from Corinth or on his way from Corinth eastward, i e, after the Corinthian epistles. What is certain is that he takes this opportunity of stating his gospel in its width and range of appeal In the light of his experience and in view of the fresh propaganda which he contemplated in the Western Empire, his aim is to reiterate the principles of the Christian religion as he preached it. There was an appropriate note in such an epistle being sent to Christians at the capital of the Empire. Besides, the apostle was not confronted here as, *e.g.*, in Galatia, with any attacks upon himself by the Jewish Christian party in the Church Hence the breadth of view and the comparative absence of controversial references, He sets himself to put forward what he regards as vital Christianity rather than to counteract any policy of his opponents at Rome, and this vital Christianity is stated in its relations to the older Jewish religion, with the object of persuading the Roman Christians, most of whom seem to have been Gentile converts, that the hopes and promises of God as revealed in the Christian gospel rest upon His previous revelation to Israel, although they go far beyond that. The two main errors before his mind seem to have been a tendency to throw over the earlier revelation and a tendency on the part of Jews to depreciate Christianity as morally inferior to Judaism. The epistle therefore is more of a treatise than any other; it does not ignore the Roman Christians, but it is not written with them constantly in view, since their local situation offered no particular problems But, while it is a tract, it does not contain any compendium of Christianity; topics like the sacraments, eschatology, and the resurrection, for example, are not discussed as they are in the First Epistle to the Corinthians. The predominating motive of the epistle is the desire to propound the faith as a faith for all men, which has its roots in the earlier revelation of God to the Jews and yet goes far beyond that. He pours out his very soul in expounding the glory of the gospel as the final and all-embracing revelation of God for mankind; every now and then the argument glows with passion, and the exposition thrills with the writer's joy in expressing convictions which had become for him living powers and hopes.

The outline of the epistle is as follows. After apologizing for his inability to visit the Roman Christians before now, he promises to visit them, bringing "some spiritual gift" to this world-famous church of the capital. Meantime he explains the gospel of which he is so proud, endeavouring to stir up his readers to a sense of its wonder and strength. Such is the theme of the first five chapters, God's "righteousness" or salvation for faith offered in Jesus Christ to all men, apart from national restrictions. To be right with God, to enjoy His fellowship and favour, is a position which is His gift. Both pagans and Jews have hitherto missed it, but in Jesus Christ (iii. 21f) it is now brought within reach of all men, as' they believe. Not that faith and revelation had been absent from the earlier history of God's people; the apostle shows that this was implicit in the religious experience of Abraham (iv.). Only, it required the divine revelation in Christ to overcome the sin of man, which had weakened the race hitherto (v. 1f). From a philosophy of history he is now passing to the deeper experience of religion, and the magnificent sweep of the next passage (vi.–viii.) shows how this faith embodies the power of receiving and realising the gift of God, since it invests man with the divine Spirit, which is the sole guarantee of a sound life in the present and of a secure life in the future.

Reverting to history, he now (ix.–xi) faces the problem of the Jewish nation's antipathy to the gospel, seeking to reconcile this with the justice and promises of God in the Old Testament. God is not to blame for such unbelief, he argues. And, with patriotic pathos, he hopes it will not be final; the rejection of Christ by the Jews, he contends, is merely partial and temporary. But part of his interest is to prevent Gentile Christians from depreciating their relation to God's earlier revelation in Israel

and from disparaging the historical link between themselves and the saving purpose of God in the world. All men are equally under the sweep of God's marvellous mercy, he concludes, in an impassioned outburst (xi. 25–36).

Such an experience of the divine mercy brings obligations in its train, however, and these are now outlined (xii.–xiii.) as they bear upon the conduct of Christians as members of the Church, of society, and of the State; love is the supreme law, and as the Day of the Lord is near, there is no time for indulgence in vice. "It is high time to wake up." But, instead of dwelling on this motive, he proceeds to apply the law of Christian love to one special problem of contemporary ethic, viz., the strain set up between the narrower and the more liberal parties over total abstinence and vegetarianism (xiv.–xv. 13), pleading for consideration on the part of the liberal majority, and finally calling on all alike to glorify God for His mercy to them in Jesus Christ.

Such is the outline of the epistle as a whole. It is not unfair to suggest that faith dominates the first part (i.–v.), hope the second (vi.–viii., ix.–xi.), and love the third (xii –xv.), though none of the three is ever isolated entirely from the others The epilogue (xv. 14–33) reverts to the situation noted in the opening paragraph; the apostle tells them of his plans and asks for their prayers.

The sixteenth chapter seems to contain a note intended for a different audience. It is possible that the apostle may have known a number of Christians who had found their way to Rome, but the probability is that the first part of this chapter (1–16, 1–20, or 1–23), represents a letter of commendation for Phoebe, addressed to the church at Ephesus The number of personal references and the unusual wealth of detail point to some community with which St. Paul was more familiar than he could be with the Roman church Ephesus answers this requirement better than almost any other sphere; besides, the sharp warning against errorists in verses 17–20 applies to Ephesus at this period (1 Cor, xvi. 8–9, Acts xx 29f) better than to what we know of the Roman church, for it is improbable that the apostle meant the words to be a vague warning against something that might happen in the future. For these reasons many editors and critics detach xvi. from the original Roman epistle.

The tone and style of xvi. 25–27 suggest also that it is an editorial addition, later than St. Paul. Indeed in some early copies of the epistle during the second century it is found after xiv. 23, perhaps in editions drawn up for reading in worship. This is merely one of a number of textual phenomena, which are discussed fully in Lake's *The Earlier Epistles of St. Paul* (pp. 335f), in Lightfoot's *Biblical Essays,* in Zahn's *Einleitung in das Neue Testament* (section 22), in Westcott and Hort's *Greek New Testament* (appendix), and in the present writer's *Introduction to the Literature of the New Testament* (pp. 134f), as well as by the critical editors. Some early editions of Romans seem to have omitted the words "in Rome" at i. 7 and 15. Unless this was due to a desire to make the epistle a catholic document, or to Marcion's revision, it may point to the fact that there were more than one edition of the epistle. Lake, for example, argues on textual grounds that Paul himself wrote an edition, without "in Rome," consisting of i. i.–xiv. 23, xvi. 25–27, as a companion letter to Galatians, and that later he edited the epistle as we have it for the special purpose of instructing the Roman church. Others, like Renan *(St. Paul,* pp. 461f), think of two editions, the first (i.–xiv., xvi. 1–20) intended for Asia or Ephesus, the second for Rome — a hypothesis which assumes a variety of forms. But it is not easy to suppose that the apostle ever left xiv. 23 with xvi. 25–27 as a self-contained letter, even if the doxology be accepted as Pauline. It is fairly clear that the canonical epistle represents an edited form of the original, and one natural hypothesis is that the original ended with xv., whilst xvi. 1f contains an addition. As Deissmann points out, the papyri supply numerous analogies for a "letter of commendation plunging at once *in medias res* and beginning with 'I commend' " *(Light from the Ancient East,* p. 235); and if Tertius wrote both, the smaller letter might be put in the wake of the larger, as the canonical editors drew upon the copybook in which both were preserved. The mechanical conditions for such a practice are discussed in Gregory's *Canon and Text of the New Testament* (pp. 319f).

It is no longer necessary to discuss theories that the whole epistle is a later forgery: Schmiedel's examination of this aberration (in *Hibbert Journal* i. 532f) sufficiently indicates the impossibility of taking such views seriously. Nor is it needful to criticize the theories which attribute xv.–xvi. in whole or part to some later hand, much less the idea, voiced recently by H. Delafosse (*L'epître aux Romains, traduction nouvelle, avec introduction, notes et commentaire,* Paris, 1926), that the canonical Romans represents an originally Pauline letter which was first edited by Marcion and then catholicized. The epistle as it stands was known early to writers of the second century like Justin and Polycarp, possibly even to Ignatius; indeed traces of it are to be found in the epistle of Clemens Romanus, which lies within the last decade of the first century, at the very latest *(see* for an even earlier date, G. Edmundson's *The Church* of *Rome in the first Century,* 1913, pp. 14f, etc).

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ROMANUS (d. 897), pope, succeeded Stephen VI (VII) about Aug. 897 and died a few months later, perhaps in November. Very little is known about his life or his brief pontificate. He was born at Gallese, near Cività Castellana and was cardinal-priest of S. Pietro in Vincoli when he became pope. He seems to have been a virtuous man in an era of ecclesiastical degeneracy at Rome. He may have been deposed by one of the quarreling factions in the city. (D. AR.)

ROMANUS, the name of four East Roman emperors.

ROMANUS I (Lecapenus), who shared the imperial throne with Constantine VII (*q.v.*) and exercised all the real power from 919 to 944. was admiral of the Byzantine fleet on the Danube when, hearing of the defeat of the army at Achelous (917), he resolved to sail for Constantinople. Soon after the marriage of his daughter Helena to Constantine he was crowned colleague of his son-in-law. In 944 his own sons, Stephen and Constantine, compelled him to become a monk. He died in 948.

ROMANUS II succeeded his father Constantine VII in 959 at the age of 21, and died — poisoned, it was believed, by his wife, Theophano — in 963. The great event of his reign was the conquest of Crete by Nicephorus Phocas.

ROMANUS III (Argyrus), emperor 1028–1034, was an undistinguished Byzantine patrician, who was compelled by the dying emperor. Constantine VIII, to marry his daughter Zoe and to become his successor. He was mostly unfortunate in his enterprises, and in his endeavour to relieve the pressure of taxation disorganized the finances of the state. In 1030 he resolved to retaliate upon the incursions of the Moslems on the eastern frontier, but was defeated at Azaz near Antioch. His early death was supposedly due to poison administered by his wife.

ROMANUS IV (Diogenes), emperor 1068–1071, had risen to distinction in the army, when he was convicted of treason against the sons of Constantine X. He was pardoned, however, by the empress Eudocia, whom he subsequently married. After his coronation he carried on three successful campaigns against the Saracens and Seljuk Turks; in a fourth he was defeated by Alp Arslan on the banks of the Araxes and taken prisoner. After releasing himself by the promise of a large ransom and the conclusion of a peace, he turned his arms against the pretender Michael VII, but was compelled after a defeat to resign the empire and retire to the island of Prote, where he soon died in great misery. During this reign the Byzantine empire lost its last hold upon Italy.

ROMANY LANGUAGE, the language of the gypsies, is one of the Indo-Aryan languages (*q.v.*), a fact which constitutes the strongest proof that the gypsies originally came from India. Romany is not only derived from the same original source as the other Aryan languages of India, but must for many centuries after the Vedic age have shared their development nithin or near the borders of India, for in general it shows the phonetic and grammatical changes which the Indian languages as a whole reached not long before the beginning of the Christian era.

Dialectal Position. — The dialect group in which Romany had its origin is a question that has been widely discussed. One school holds that it belongs to the northwestern and especially to the Dardic, which comprises certain dialects of the Hindu Kush and also includes the more important Kashmiri. These languages, in some respects more conservative than those of areas farther in India, have kept certain features of the old Sanskrit sound system unchanged; *e.g.,* the preservation of two or more sibilants (S, *ṣ*, s) or of an r preceded by a consonant. The Romany dialects also show some of these peculiarities, but the preservation by descendants of characteristics that existed in the parent language is not proof that they have any specially close relationship other than common origin. The existence of the same early innovations in both is proffered by those who hold that Romany originally belonged to a more central group of dialects of which a typical modern representative in India is Hindi. It is with these that it shares its earliest sound changes. Romany does not however share other later innovations of the central group which had set in or were setting in at the time of Aśoka (c. 250 B.C.). They must, therefore, have severed their relations with this group before that date. The word rom, "gypsy man," southeast European rom, Armenian Ry. *lom,* Palestinian Ry. *dōm,* is the same word as the Skt. *ḍomba,* "a low caste of dancers and singers," from whom the *Ḍōms* of India derive their name. It is probable that wandering tribes, perhaps of the same character as some criminal tribes of modern India and speaking a central dialect, made their way to the northwest (probably western Panjab or Peshawar district) before the middle of the 3rd century B.C. There, among speakers of the northwestern dialect group, they stayed until some time before the 9th century A.D. they left India in a migration which spread them all over western Asia, Europe and even America.

Dialects. — It is not known whether the gypsies left India in one or several separate migrations or whether there were even marked dialectal variations in the language they spoke. But presently there are at least three distinct groups of dialects, Asiatic, Armenian and European. One of the most noticeable differences lies in the treatment of the original voiced aspirates of Sanskrit. The Asiatic dialects have either preserved these or, losing the aspiration, have reduced them to simple voiced sounds; the European and Armenian dialects on the other hand have changed them to surd aspirates: Skt. bh, dh, gh became Asiatic *b,d,g,* but Armenian and European *ph,th,kh* (*p',t',k'*). Thus Skt. *bhrâtā* "brother," *dhūmáḥ* "smoke," *ghṛtám* "melted butter" are in Eur. Ry. *p'ral,-t'uv,k'il* and in Pal. Ry. bar, dif, gir.

There is considerable dialectal variation even within a single group such as the European Romany group, dating probably from the time of separation within Europe itself. These dialects differ according to locality and the degree to which they have been influenced by surrounding languages. In this respect they may vary from the comparatively pure Indian idiom of, for example, some of the Balkan gypsies or even the gypsies of Wales, to mere jargons consisting of a framework of the local language; *e.g.,* English, in which a certain portion of the vocabulary is replaced by Romany words.

Phonology. — The vowel system rests on Sanskrit. As in all Middle Indian dialects, Skt. *ai* and au have become *ē* and *ō; e.g.,* Arm. Ry. tel "oil" from *tailám;* mol "price" from *maulyam.* In the European dialect, Skt. a in an open syllable appears as e but in an originally closed syllable as a, which is also the representative of Skt. *ā: merel* "dies," rak'el "keeps," *manuš* "man." from mdrate, *rákṣati, mānuṣáḥ.*

In the consonant system, the chief innovation is the change of the voiced aspirates already mentioned. Of the surd aspirates, *ph* appears to remain (*p'al* "board" from Skt. *phálaḥ*); ch loses its aspiration in west European Romany (W. Eur. *čin-* "to cut," S.E. Eur. *č'in-* from Skt. *chinná-*); kh perhaps becomes a spirant *χ* (*χanro* "sword" from Skt. khandakah). Intervocalic consonants, as in all other descendants of Sanskrit, are weakened. The gutturals and palatals disappear altogether; the cerebrals remain as r (S.E. Eur. *r̥*), the labials partly as v, the dentals as *l* in the European and Armenian dialects and as r in the Asiatic.

Sanskrit	*Romany*	*Sanskrit*	*Romany*
yūkā "louse"	*ǰuv* id.	*ā̆gataḥ* "came"	*alo* id.
sūcī "needle"	*suv* id.	*vijānāti* "bears young"	*benel* id.
kīṭáḥ "insect"	*kiri* "ant"	*bidālaḥ* "cat"	*blári (Syr.)* id.
sthāpáyati "places"	*t'ovel* id.	*píbati* "drinks"	*piel* id.
yuvatíḥ "young woman"	*ǰuvel* id.	*hṛdayam* "heart"	*yilo* id.
	ǰŭăr (Syr.)		*ẖri (Syr.)*

Assimilation of consonant groups has occurred generally, with the exception of r preceded by a stop and of sibilants followed by dental or cerebral stops, except in the Armenian dialect.

Sanskrit	*Romany*
dugdhám "milk"	*t'ud (from duddham), Arm.* ***lut'***
bhrâtā "brother"	*p'ral* id., *Arm. p'al, Syr. bar.*
hdstah "hand"	*vast, Syr. ẖăst, Arm. at'.*

Grammar. — In grammar too the main structure of the better preserved dialects rests upon its Sanskrit original. The declension of the noun is based on two cases, a direct (descended from the Sanskrit nominative and accusative) and an oblique (descended from the Sanskrit genitive) to which various postpositions can be added.

	Sanskrit	*Prakrit*	Romany
Sing. nom.	*cōráḥ (-ó)*	*cōrō*	} *čor*
	cōrám	*cōraṁ*	
gen.	*cōrásya*	*cōrassa (-asa)*	*čores*
Pl. nom.	*cōrā́ḥ*	*cōrā*	*čoy*
gen.	*cōrā́ṇām*	*cōrāṇaṁ*	*čoren*

The verb is built up of the old present stem, of which the indicative, the imperative and the participle still survive, and of the past participle, which alone or combined with auxiliaries forms past tenses.

		Sanskrit	*Romany*
Present indicative:	*Sing.*	*ráksāmi*	*rak'av*
		ráksasi	*rak'es*
		ráksati	*rak'el*
	Pl.	*ráksāmas*	*rak'as*
		ráksatha	*rak'en*
		ráksanti	*rak'en*

The opposition between present stem and past participle, though in most cases the latter has been remodeled on the former, still survives in a few verbs:

Skt. márate "dies"	:	*mṛtáḥ* "dead" =	*Ry. merel*	: *mulo.*
" *yâti* "goes"	:	*gatáḥ* "gone" =	" *ǰal*	: *gelo.*

Romany has preserved the Sanskrit numerals 1 to 6, 10, 20 and 100 but 7, 8, 9 and higher numbers are borrowed — by Asiatic generally from Persian, by European from Greek — or are formed by various methods of addition or multiplication from existing numerals.

Vocabulary. — The borrowing of vocabulary has been extensive. The first examples can be dated back to the time when, leaving the central group of dialects in India, the gypsies sojourned among the speakers of the northwestern group. Indeed, the borrowed words of a Romany dialect disclose the itinerary of its migrations. When in the dialect of the gypsies of Wales there are borrowed words from Persian. Armenian, Greek, Rumanian, Bulgarian, Serbian, Czech, German, French and English, it may be assumed that at some time or other the ancestors of this particular group passed through the countries where these languages were spoken. The form in which the words appear may give some clue as to the date when they mere borrowed. The most numerous source for the European dialects is Greek, a fact which accords with the long stay the gypsies appear to have made in the Eastern empire.

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ROMBLON, the name of a province, the provincial capital and an island in the Republic of the Philippines. The province, located in the Sibuyan sea south of Luzon, north of Panay and east of Mindoro is made up of three main islands, Tablas. Sibuyan and Romblon, in order of decreasing size, plus six small populated islands and dozens of islets and reefs. Area 512 sq.mi. Pop. (1959 est.) 133,310, an increase of 33,943 over 1939. The area was attacked by Moro pirates several times during the Spanish regime. The islands are hilly to mountainous with cultivatable land at a minimum. The highest point is Mt. Guitinguitin on Sibuyan Island which reaches a height of 6,752 ft. The most extensive level land is along the western and southern shores of Tablas and the richest soil, of volcanic and coraline origin, is found on Romblon. About 65% of the cultivated land produces coconuts and almost 30% is planted in rice; crops of cassava, sweet potatoes, bananas, corn and tobacco are small but widespread. Larger settlements on the main islands are connected by hard-surfaced roads. Large and small interisland vessels call at Romblon; all the inhabited islands have at least weekly service. The capital is Romblon, a municipality with 27 *barrios* (villages) in addition to the *poblacion* (administrative centre), which has a deep, well-sheltered port. Pop. (1958 est.) 15,778. The main trading and commercial centre of the province, it is a collecting, processing and shipping point for copra and a sales centre for the province's buri mats. a product of home industries. (R. E. HE.)

ROME, a province of modern Italy, forming a part of the district of Latium (Lazio) (*q.v.*).

ROME, the capital of the Republic of Italy, lies on the Tiber river, 17 mi. northeast from its mouth on the Mediterranean. It was the capital of the ancient Roman republic and of the Roman empire and became very early the headquarters of the Christian Church. With a longer record of continuous political and religious importance than any other city it is unique for its antiquarian interest. In the following account the general subject of Rome is treated broadly under two aspects, themselves subdivided. These are: (1) the topography and growth of the city of Rome, the evolution of which is traced from the earliest times to the present, and (2) Roman history, *i.e.,* the political and social history of the Roman republic, empire, the mediaeval commune, and briefly the modern Rome.

THE ANCIENT CITY

The primitive city of Rome stood not in the Tiber valley, but on the ridges—so-called hills—of the Latin plain that jut unevenly into the valley. During the empire the city encroached more and more on the lower level till it covered the whole of the Campus Martius that lay in the wide bend of the river opposite the Vatican hill. These ridges, like the whole Latin plain, consisted of volcanic ash, partly cemented into hard tuff, which had, during a long series of eruptions in the Alban hills, filled an inland lake and built up an uneven plateau. In drilling wells outside of Rome's gates the following strata, enumerated from top to bottom, are usually pierced: several layers of brownish ash or tuff, a stratum of cappellaccio or friable grey tufa mixed with alluvial sediment, sand and gravel of the former lake bottom, and finally pliocene clay. Where erosion has not been very active the volcanic deposit near Rome rises to about 100 feet. Nearer the Alban hills it is far deeper.

The First Settlements.—On the part of Latium covered by the ash deposits we have as yet no convincing proofs of human settlements prior to the early iron age (about 1000 B.C.), whereas on the calcareous areas of Latium—on the Sabine and Volscian hills—which this ash did not reach, numerous remains even of Neolithic settlements have been found. It would seem that the site of Rome (and its neighbourhood on the south and east) was not an attractive place for settlement until about 1,000 years before our era, and the cause may well have been the activity of the Alban volcanoes. The first settlers coming from north of the Tiber seem to have taken possession first of the Alban hills and then of the Roman "hills." They were apparently shepherd and agricultural peoples of the "Italic" branch of the Indo-European race, related to the Villanovans (*q.v.*) who were settling in southern Etruria at the end of the second millennium B.C. The highest and safest points (the Palatine hill, probably the Capitoline and the outjutting spurs of the Esquiline) seem to have been chosen for the first communities. About the 8th century a related people came in from the older settlements of the Sabine hills and built their straw huts on the Esquiline and Quirinal ridges. In the 6th century Etruscan princes seem to have conquered the whole of Latium. They soon organized these communities into a city, and, bringing it into connection with the rapidly growing Etruscan cities north of the river. laid the foundations of a flourishing principality. Before they were driven out. about 500 B.C., a large temple had been built to Jupiter, Juno and Minerva on the Capitoline, a stone wall had been raised enclosing all the hill communities. and the forum valley had been drained.

In early Rome ordinary dwellings were straw huts or straw-thatched adobe huts, while temples and public buildings were erected in the Etruscan manner to suit the materials of the vicinity. The Capitoline temple, for instance, had walls of volcanic tuff well coated with stucco to hide the ugliness of the material. The ceiling beams which supported a tile roof were probably held up by a cantilever brace. The roof of the portico rested on four tuscan columns of wood or stuccoed tufa. The wooden architraves' were covered with figured terra-cotta slabs that provided some adornment and protection for the beams. The pediment figures were also of terra-cotta. Because of the absence of good building stone the Etruscans early developed for architectural adornment a dignified plastic art in terra-cotta. and its artistic qualities can now be appreciated in the splendid Apollo-figure recently discovered in Veii, a few miles north of Rome. This Etruscan method of building sufficed for the city till Greek artists were brought to Rome in the second century B.C. The building of stone bridges and aqueducts during the 2nd century popularized the use of the stone arch.

Materials.—Since public buildings were frequently rebuilt and enlarged it is difficult to assign the present remains to their proper epoch, and the accounts of early Roman architecture do not by any means agree as to dates. It is only by careful observation of the materials[1] used that we can assign the remains of the republican period to their approximate periods. Before the Gallic fire in 387 B.C. practically the only stone used was the soft grey volcanic tufa called cappellaccio. This is a very poor weathering stone so that it was regularly protected by a coat of stucco when used above ground. After the Gallic fire, the yellowish grey tufa of the Veientian quarries of Grotta Oscura came into popular use. This stone was as easily worked as the native one, and being more uniform in texture was cut into larger blocks of 2×2 feet. The massive fortification walls of Rome were largely rebuilt of this material during the 4th century, as were many of the public structures that had been destroyed by the Gauls. For rough work some very ugly volcanic stone, full of inclusions of black scoria, was also used for a while. This was also found in southern Etruria, and the blocks that mere used at Rome and Ostia may have come from the abandoned walls of Fidenae, north of Rome. The gray tufa of Grotta Oscura was the favourite building stone of the city for over 200 years, while the scoria-filled stone was soon abandoned.

These materials also weathered poorly and proved too weak for

[1]Middleton, *The Remains* of *Ancient Rome* (1892); Lanciani, *Ruins and Excavations* (1897); Delbriick, *Hellenistische Bauten (1907);* Van Deman, *The Date of Concrete Monuments (1912);* Frank, *Roman Buildings of the Republic (1924).*

heavy loads. Hence in the 3rd century architects went to the Alban hills for the stronger dark grey tufa (Lapis *Albanus, peperino*) when in search for architrave beams and heavy column drums. The Tullianum, Rome's first prison, which required a very hard stone, seems to be the first structure built of this material. It probably was constructed about 250 B.C., certainly not in the regal period as has been supposed. All the large temples built during the 2nd century B.C. used peperino for points of great stress and weight. At the Gabine lake, an old volcanic crater which was hearer Rome, a tufa somewhat rougher than peperino, but equally strong, was then brought into use. This Gabine stone (Lapis *Gabinus, sperone*) was freely employed in massive walls for a century or more, but its use was limited by the fact that it would not yield to ornamental cutting. Both of these stones were costly because of the heavy transportation charges. Hence during the 2nd century experiments were made with the brown tufas nearer Rome. As can still be seen, the hills of Rome had an abundant supply of this brown tufa lying above the cappellaccio, but these hills were now so well covered with buildings that quarrying inside the city was impracticable. South of the Jsniculum, on Mt. Verde, a quarry was opened and used for several buildings of the second century and of the early decades of the first. The Mt. Verde stone is hard, close-grained, but too brittle for heavy burdens, and was seldom used after Sulla's day. The brown tufa from the Anio river just above Rome proved to be very strong and uniform, in fact an excellent material except for its ugly appearance. After the fine arches of the Aqua Marcia were built of it in 144 B.C., it remained because of its durability and cheapness the favourite stone for ordinary ashlar masonry for two centuries. This Anio tufa is now to be found in the ruins of more than half of the buildings of the forum. During the 2nd century B.C. two very important discoveries of materials were made. The travertine deposits at Bagni on the road to Tivoli were found. This is a limestone of recent formation caused by the deposit of the carbonate of lime from the hot springs that arise at that point. Since the ground was level and covered with vegetation the splendid deposit had for centuries lain unobserved. The stone being rather soft when at first exposed is easily sawed and worked. It soon hardens under exposure. The Romans used it at first with some hesitation, but by Caesar's day they had learned to appreciate its good qualities. During the early empire it was freely used, as may be seen in the massive walls of the Colosseum. Recently this stone has been exported in large quantities to America.

Unfortunately for the aesthetic qualities of Roman architecture the process of making a cheap and durable, though ugly, concrete was discovered at about the same time. Since good sand is difficult to find near Rome, volcanic ash (*pozzolana*), which lies in abundance everywhere in Latium, was substituted. This ash is of course a crushed dehydrated slag, and it was eventually found that if the ash was taken from deep pits where rain-water had not destroyed its qualities it would mix with lime into a very firm hydraulic cement. By adding a filler of tufa fragments a very cheap and durable concrete could thus be made. Concrete was first used freely in the foundations and podia of the temple of Concord in 120 B.C. and the temple of Castor in 117 B.C., but it is found even earlier in a part of the platform that was constructed in front of Castor several years before. This platform probably belongs to the Gracchan period. Concrete however came into free use in superstructures only in the age of Caesar, when marble was imported in such abundance that it could be used as a veneer for ugly concrete walls. The great importance of concrete for Roman architecture lay in the fact that during the empire, when Rome required very extensive structures, domes and vaults of immense span could be built of this material. During the empire most of the heavy walls were constructed of concrete because of its cheapness and durability. They were usually faced with brick or with marble slabs. The bricks when used were generally triangular with one angle stuck into the concrete; the marble slab veneering was usually held in place by iron clamps.

Though the art of making good terra-cotta ware was known in primitive Rome, and roof-tiles of terra-cotta of excellent quality had freely been used for six centuries before Augustus' day, bricks were not burned at Rome for use in wall-construction during the republic. Immense heaps of fragments of broken roof-tiles had however accumulated, and the Augustan architects began to use these fragments in facing concrete walls. When this supply gave out, triangular bricks were made for the same purpose—during the reign of Claudius—and when, after the great fire of Nero's day, a vast programme of rebuilding followed, brick yards turned out an immense quantity of material for the facing of concrete walls. This material continued to be used freely through imperial times.

Marble was very expensive and relatively few buildings were made of solid marble; but for veneering, for columns, entablatures and decorative members large quantities of marble were imported. A few wealthy nobles had imported marble columns for their porticoes before Caesar's day. While Caesar was governor of Cisalpine Gaul his architects and engineers began to import to Rome Carrara marble, found in that province. The architects of Augustus developed the Numidian quarries of Simitthu, which yielded a variety of yellow and cream coloured marbles of great beauty (giallo antico). The transpottation costs were very heavy since it had to be brought 100m. over land before it was loaded on ships. Its use was largely confined to decorative purposes. The pavonazzetto of Synnada, 200m. inland from Smyrna in Asia Minor, also came into use, as well as the greenish cipollino of Euboea, the marbles of Pentelicon, Hymettus and Paros, and the red granites of Aswan in Egypt. During the empire architects vied with each other in attaining new colour effects with contrasting veneers, and the Christian basilicas and churches of Rome which are decorated with the marbles stripped from Roman buildings are rich with stones that the emperors had imported from all parts of the world. Besides those mentioned we may name the products of quarries of Chios (called Africano), Thasos (porta santa), Laconia (rosso antico and nero antico), Thessaly (verde antico), and the alabasters and porphyries of Egypt.

Early Town Walls.—Tradition speaks of very early fortifications around the Palatine and Capitoline hills. These may have been earthen mounds bearing a fence of stakes. There is no doubt that a stone wall was constructed of cappellaccio blocks around the whole city at the time of the Etruscan kings. This wall was almost wholly rebuilt after the Gallic fire (387 B.C.) with the stronger Grotta Oscura stone, and later strengthened and improved from time to time with better materials. This so-called Servian wall (at first not including the Aventine) was nearly 6km. long. It began at the Tiber near the present Ponte Rotto, had two gates between the Tiber and the Capitoline hill, skirted the Capitoline on its west side (where a few blocks of the 4th-century wall are visible), then proceeded across the valley to the edge of the Quirinal hill. A small gate (perhaps an embrasure for artillery) is still visible inside the Palazzo Antonielli, but this consists of Anio tufa and must date from about the time of the first civil war. The fragment of wall seen in the via Nazionale just above is of Grotta Oscura stone belonging to the 4th century. From this point the wall followed the edge of the Quirinal hill north-eastwards for over a mile to the porta Collina. At the via Finanze may be seen a well preserved portion in cappellaccio. Because of the material this part has usually been assigned to the 6th century, but the fine workmanship and battering would rather indicate a 4th century reconstruction. From the Porta Collina the wall turned southwards across the level plateau to the porta Esquilina, a distance of about a mile. Here the city was especially exposed to attack and the wall was not only made with special care in the 4th century but was later frequently strengthened and repaired. In constructing this portion a moat 30ft. deep and 100ft. wide was dug and the earth of this excavation was used for an agger about 40ft. thick. The stone wall itself that stood behind the moat and supported the mound was about 10ft. thick and more than 30ft. high and was made of Grotta Oscura stone. The inner side of the agger was supported by a lower cappellaccio wall. The numerous quarry marks found in the section near the railway station are probably those of the Etruscan workmen of the 4th century, while those found at Piazza Fanti seem to belong to the repairs of the second Punic War. The Gabine and Monte Verde stones of the reconstructed

Viminal gate may belong to the time of the Social War, while the concrete work and Anio stone at Piazza Macao seem to be a part of the repairs made during the Catilinarian Rebellion or the civil war.

The original wall skirted the Palatine hill on the south side and ran directly to the river. Here several portions of the 4th-century wall, built in Grotta Oscura tufa and the scoriated Fidenae stone, have been found, but at the south-west corner of the hill a fragment of the original 6th-century wall in cappellaccio blocks may still be seen. During the 4th century the Aventine was also included in the fortifications. The large wall on the Via di porta S. Paulo, however, was repaired with Anio stone and a concrete backing during the Sullan period, and near the gateway arched openings for the placement of defensive artillery were neatly constructed.

Streets. — It is doubtful whether Rome had paved streets before the 2nd century B.C. The earliest pavement that has been found is that of the street which ascends the Capitoline hill from the forum. It was laid in 174 B.C. The few remains of it still visible at the side of the temple of Saturn are hard rough lava blocks full of leucitic crystals. This lava was brought from beyond Civita Castellana and was preferred to the native lava of the Appian Way because the crystals furnish a rough surface which is essential on a steep roadway. During the 1st century B.C. most of the streets were paved with large polygonal lava blocks neatly fitted and (at times) set in a concrete bedding and curbed with travertine. Outside of the city some of these pavements are still in use after 2,000 years of wear.

Bridges and Drains. — The first bridges of Rome were laid on wooden piles. In 179, stone piers were built for the Aemilian bridge (the ponte *rotto*). In the period between Gracchus and Sulla, architects had learned to make strong arches and then the Aemilian and the Mulvian bridges were constructed of splendid stone arches. The Fabrician bridge, contracted for apparently during Cicero's consulship, with two vast arches, is still in use. The first large sewer which drained the forum and cattle market seems to have been an open channel lined with cappellaccio masonry. It was covered over early in the republic. The magnificent Cloaca Maxima which opens out near the Palatine bridge and was in use until the beginning of the 20th century was, to judge from its free use of Gabine stone, not constructed till the latter part of the 2nd century B.C. During the empire the whole city was as thoroughly drained with well-built sewers as any modern city.

Aqueducts. — Before 312 B.C. the city depended upon wells and springs for its water supply. In that year Appius Claudius, the censor, constructed an underground aqueduct 7m. in length to supply water to the poor of the crowded sections of the city. Forty years later the Anio Vetus was added. In 144 the Aqua Marcia was laid bringing an abundant supply of excellent water from high in the Sabine hills 44m. away. Where it crossed the lower plain outside of Rome the conduit was raised on splendid arches so as to bring the water to the top of the Capitoline hill. Some of these arches are still standing near Porta Furba; and the city of Rome is still using the springs that supplied the Aqua Marcia. Augustus, Claudius and later emperors enlarged the water supply, laid an extensive system of leaden pipes in the streets and built numerous fountains, till in Trajan's day the city was generously supplied with pure water.

THE FORUM[1]

In the early days the valley between the Palatine hill and the Capitoline was marshy ground with an open pool, the Lacus Curtius, near the centre, another near the west end, the Lacus Servilius, which caught the spring waters of the Capitoline hill, and another, the Lacus Juturnae at the base of the Palatine. On the lower slope of the Capitoline hill, on a protruding ledge of rock, were altars to Saturn and to Vulcan, and between them a speaker's platform. On the corresponding lower slope of the Palatine was the shrine of Vesta with the house of the vestals near by and the office of the pontifex maximus. Below the Esquiline was an extensive burial ground. When the marsh was drained and the three springs walled in the central part became an open market place — forum — which was soon lined with two rows of shops (tabernae), while the north-west corner was laid off for open-air town-meetings (the comitium), and a speaker's platform was early constructed between the comitium and the forum. Without regard for chronology we shall briefly mention the more important buildings of the forum of which there are remains, beginning at the Tullianum on the north-west corner.

The *Tullianum*[2] ("Mamertine prison") took the place, as death-chamber, of the older quarry caverns that here ran deep into the Capitoline hill. It was apparently built in the 3rd century B.C. Alban stone — the hardest material available — was used. The chamber was a truncated cone, about 12ft. high. It originally had a ceiling of oak beams, and could be entered only from a trap-door above. In the 2nd century an arc of the circle was cut away to make room for the road in front, and a straight wall of Grotta Oscura stone was built in its place. About 100 B.C. an upper vaulted chamber of Mt. Verde and Anio stone was constructed above the Tullianum, and later the lower chamber was given a horizontal stone vault. Finally, in the reign of Tiberius, a massive façade of travertine was built on the forum front. This is the chamber where noted prisoners like Jugurtha, the Catilinarian conspirators and Vercingetorix were kept before execution. It could never have been a well-house, as has been supposed, since the floor is actually above the republican level of the comitium. The present floor is about 6ft. above the original, if Sallust's measure of its depth is correct.

On the south of the Tullianum are the remains of the Temple of *Concordia*.[3] The original temple was erected to the deified abstraction of Concord in 366 to mark the temporary peace in the class conflict between the patricians and plebeians. The temple was rebuilt, partly with the earlier materials, and enlarged by the aristocratic consul Opimius in 120 B.C., to mark the end of the Gracchan class contests. The rededication to Concord was however considered an insult by the defeated Gracchans. Here Cicero delivered two of his Catilinarian speeches, using the temple for his addresses not only because he wished to remind the people of his programme of concordia *ordinum* but also because of the suggestive proximity of the place to the death-chamber. Tiberius rebuilt the temple in marble to commemorate the Concord of the Augustan régime. This new temple had a large portico and entrance on the forum side and the concrete base of this comes forward nearly to the Vulcanal. Portions of the elaborately carved cornice and of some of the capitals and bases are still to be seen in the corridor of the Tabularium. The temple was one of the most richly decorated at Rome and became a veritable museum of precious works of art. The corner of the podium nearest the prison originally belonged to the senaculum — a gathering place of senators — but was incorporated in the enlarged portico of this later temple.

Below the steps of the temple of Concord may be seen the remains of a very old Altar of *Vulcan* cut in the native cappellaccio, and near by several cuttings in the rock which give evidence of an early cemetery here. Passing the Arch of *Septimius Severus*, a work of pleasing proportions though covered with confused reliefs of a decadent and boastful art, we reach the remains of the old Rostra, the scene of Rome's legislative struggles from the time of the Twelve Tables till Caesar. It is the birthplace of modern democracy. In the centre of the mass may be seen a few of the old steps that may belong to the platform of the decemviral times. The name rostra derived from the iron rams taken as trophies from the warships of Antium (338 B.C.) and fastened on the back of the platform (on the forum side). The outer steps of Mt. Verde stone on the side of the Comitium and the circular rear wall of concrete lined with reticulate blocks belong to a rebuilding of the Sullan period.

Between the rostra and the Arch lies a black stone pavement that marks a sacred area uncovered in the excavations of 1899.

[1] Jordan, *Topographie*, i.; Lanciani, Ruins and Excavations; Huelsen (Carter, tr.), The *Roman* Forum, with references to the reports of the excavators: Carlo Fea, Rosa, Fiorelli, Lanciani, Boni, et al.; Thédenat, *Le* Forum *Romain;* Lugli, *La Zona Archeologica di Roma.*

[2] Frank, Roman Buildings of the *Republic*, 39 ff.

[3] Rebert and Marceau, in Memoirs of *Amer.* Acad. in Rome, v. 53.

The layer of gravel which covered this area as well as the pre-Sullan rostra shows that the sacred area was abandoned and covered up when the Sullan rostra were built. The objects found beneath the black stone are a 6th-century inscription of very great importance, though so much damaged that no line is complete, a truncated cone which probably supported a statue, a double base which, according to Varro, supported two figures of lions, presumably such as Etruscans placed in front of important tombs, and a great many votive objects of different periods—now to be seen in the forum museum. Some of these objects were found in their original setting, others had been removed here and buried as being too sacred to destroy at the time when the rostra were rebuilt.

The inscription is cut on stone imported from Etruscan territory, and since the lettering is too archaic for the 4th century, when Rome captured the region from which it came, we must assume that it was brought here during the Etruscan period, *i.e.,* before 509 B.C. The "black stone" was supposed by the Romans to mark the tomb of Romulus, of Faustulus or of Hostilius. The riddle has not yet been solved.

The *Curia* or senate chamber, which stands in the comitium, is the. debased structure of Diocletian's day, much altered and converted into a church. The first senate house (attributed to the king Hostilius) stood farther back, leaving room for a large comitium between the Curia and the rostra. The original bronze doors of Diocletian's Curia may now be seen at the end of the nave of the Lateran basilica.

Crossing the narrow street, the *Argiletum,* which led into the Forum from the north, we come to the extensive remains of the *Basilica Aemilia.* This was a covered hall in which court could be held when the weather was too inclement for sessions in the open forum. When building it in 179 B.C. Aemilius Lepidus and Fulvius Nobilior also rebuilt the row of public shops (*tabernae novae)* and included these under the same roof with a covered arcade in front. There was a hasty reconstruction by Aemilius Lepidus in 79. About the year 54 when Caesar planned his basilica along the opposite side of the forum at a higher level he lent large sums to Aemilius Paullus to reconstruct the Aemilian basilica at a corresponding level and in an appropriate style. This rebuilding, frequently interrupted, was not completed for 20 years. The foundations now visible are chiefly of this period, though the shop walls reveal materials of all three periods. Augustus later provided money for lavish repairs and decorations after the structure had been damaged by fire. Most of the splendid marble decorations now to be seen date from the Augustan period, deriving partly from the Doric façade, partly from the interior porticoes decorated with Ionic and Corinthian columns.

East of this basilica stands the temple which Antoninus Pius built in honor of his deified wife *Faustina.* After the emperor's death his name was added to the inscription. The columns are of the expensive and garish Carystian stone *(cipollino)* from Euboea, the walls are of peperino, a good fire-proof material, and were of course faced with marble slabs. The frieze has a charming design of griffins grouped in pairs around a candelabrum.

In front of this temple are the remains of the *Regia,* one of the oldest buildings of Rome. It may have been the office of the early kings, and certainly was of the pontifex maximus throughout the republic. The cappellaccio podium of the main quadrangle may well date from the fifth century. Professor Huelsen, who excavated the site, has drawings of a decorated terracotta slab from its frieze which belonged to the 5th-century structure. The rear wall, however, contains materials of a reconstruction, probably made in 148 B.C., when the place was damaged by fire. In this building were kept the important pontifical records and lists of magistrates which provided the skeleton of facts that historians eventually used in writing the story of the early republic. And because of this historical association, Domitius Calvinus, when rebuilding the house in 36 B.C. in marble, had a complete list of magistrates and of triumphs inscribed on its walls. Some remains of these inscriptions, called Capitoline Fasti, are now preserved in the Capitoline museum. The few architectural remains that lie near by reveal the fact that even as late as 36 B.C. marble cutting was still very crude.[1] The pontifex himself had his home in the *domus publica,* the foundations of which, as it was when Caesar lived there, may still be seen a few yards to the south-east of the regia.

The extensive *House of the Vestals,*[2] as it appeared in the late empire, has many of its walls intact. They date from several rebuildings and additions made at various times during the empire. A few of the Vestal statues and honorary inscriptions remain, but not on their original locations, since all were found in a confused heap ready for the limekiln. Of the small republican structure there are few remains except the simple mosaic floor visible at a low level near the entrance. The foundation of the round shrine of Vesta is visible between this Atrium and the Regia, and near by are remains of the marble entablature cut in the decadent workmanship of Septimius' day.

Between the Regia and the open space of the forum stands the podium of the *Temple of Divus Iulius* which Augustus erected to the deified Caesar (dedicated 29 B.C.). This site was chosen because Caesar's body was burned upon a speaker's platform at this place (probably the *tribunal Aurelianum*). The spot had first been marked by an altar, the foundations of which may still be seen.

Augustus in building the temple respected the altar, indenting the portico so that the steps of the temple rose at the sides of the altar. Hence the strange ground-plan. This temple was the first striking proof at Rome of the acceptance of the theory of "Divine rights" of Rome's princes. Foundation walls of heavy masonry built outside of the concrete mass now visible supported the walls of the temple. The temple itself was an Ionic hexastyle building of marble, the columns being about ten and a half metres high. The interior was very richly decorated with imported works of art, but the architectural decoration of the entablature, fragments of which are still to be seen on the south side, was rather crude, as was all such work at Rome during the period. A few feet south of this temple there still exist the foundations of the *Arch of Augustus* erected only ten years later. Fragments of the marble decoration of this arch may be seen lying at the nearby corner of the Regia. Though somewhat too graceful and delicate for the purpose of a triumphal arch those carvings are done with a care which shows a remarkable advance in such work during the ten years after the construction of the temple of Divus Iulius.

The famous *temple of Castor and Pollux,*[3] which still has three Pentelic columns erect with a part of the entablature, is the most prominent ruin of the Forum. The first temple on the site was built in the Tuscan style early in the republic (484 B.C.) to the divinities of the Greek cavalry who aided the Romans at the battle of Lake Regillus. Since these gods were adopted as the patron-deities of the Roman knights, the temple became the official meeting place of the knights and wealthy business men of Rome, and these took some interest in maintaining it. They used its coffers for safety deposits, and its basement offices for the protection of standard weights and measures and for an assay-laboratory for the testing of coins and metals. It thus came to be Rome's "Bureau of Standards." The cappellaccio blocks which may be seen in the podium remain from the first structure, while those found in a small room under the front stairway belonged to an early speaker's platform not directly connected with the first temple. Much of the inner core of concrete belongs to a reconstruction made by Caecilius Metellus in 117 B.C., while the rest of the concrete, as well as the heavy masonry, are a part of the reccnstructed temple built by Tiberius in AD. 6. The splendid Pentelic columns seem, however, to belong to a reconstruction of Hadrian's day. though of this we are not yet certain. This last temple was Corinthian, octostyle and peripteral, with 11 columns on each side, the whole measuring about 30x50 metres. No temple at Rome reveals finer decorative workmanship.

Along the west side of this temple runs the vicus Tuscus which leads to a very large brick structure behind Castor. This has long been called the *temple of Augustus,* though the brick-work belongs chiefly to the Flavian period and no traces of an earlier temple

[1] Töbelmann-Fiechter, *Romische Gebalke;* p. *8 (1923).*
[2] Van Deman, *Atrium Vestae* (1909).
[3] *Memoirs Amer. Acad. in Rome,* v. **p.** *79.*

have been found. The suggestion has also been made that it was intended as an audience chamber by Domitian.[1] There are serious objections to both hypotheses. East of this massive structure one enters the remains of the mediaeval church, *S. Maria Antica,* directly from the area of the Lacus Iuturnae. It contains frescoes—interesting to students of early Christian art, from the 7th, 8th and 9th centuries.[2] What the building was before Christian times is still a matter of dispute: older authorities assumed that it was a library, though it has not the usual form of a Roman library. A more recent suggestion is that it was the *Atrium Minervae* where the records of honourable dismissal of legionaries were kept. The impluvium, part of which is visible, belonged to the palace which Caligula had built here as an extension of his Palatine residence.

West of the vicus Tuscus, in the forum, are the confused remains of the *Basilica Iulia.* Caesar first built this on the site of the small basilica Sempronia, dedicating it in 46 B.C. To gain the necessary space he removed the shops which lined the Via Sacra of the Forum, and built in their place a row of shops all along the rear colonnade of his basilica. The whole was a vast structure designed to serve as a set for the four lower civil courts as well as for a market place. After a fire Augustus rebuilt it with lavish adornments of Oriental marbles, but later rebuildings after fires in the 3rd and 4th centuries left little of these structures to be seen. The modern excavators attempted to outline the ground plan by erecting bases of brick and marble fragments, but succeeded only in confusing the evidence of the structure found. An accurate reconstruction is no longer possible. The old *praetor's tribunal,* which stood in the forum in front of the Basilica Iulia, has now quite disappeared, but the remains of an inscription in honour of Naevius Surdinus, praetor, cut into the pavement blocks of the forum reveals the location. It was merely a low platform large enough to seat judges and jury, and was unprotected except for a canopy over the praetor's seat. The place was seldom used after the larger basilicas were built to house the courts, but it was here that the principles of Roman law were first formulated.

West of the Basilica Iulia, beyond the narrow street that was called the *vicus Iugarius,* stands a large part of the old *temple of Saturn.* The ugly granite columns with a portion of the entablature belong in part to a hasty reconstruction of the 4th century A.D.[3] (a part of one column is even inverted). The inscription recording the final restoration avoids mention of the pagan god, and the building was then in secular use. Some fragments of the cornice are remains of the republican temple of 42 B.C.—from the period of crude stone-carving—while others are later work done on the same design On the interior facing of the frieze may be seen some good decorative slabs that were actually filched from Trajan's forum for this hasty patchwork. The podium has not a little of the splendid travertine masonry of Plancus' temple of 42 B.C. The only remains of the original temple of the early republic (497 B.C.) are the few cappellaccio blocks visible in the podium (at the very base of the east side), and in the crude wall in front of the temple—remains apparently of the original altar. The low drain-vault that appears near the latter—also early work—carries a shelf on which was found a shallow trough, apparently the runnel constructed to carry away the blood of the victims sacrificed on the altar. Saturn was an early agrarian divinity, but since his temple stood not far from the senate house, the senators—who knew that temples alone might escape looting in times of war—began to store State moneys in this temple. It thus became the official Aerarium or State treasury at Rome.

West of the temple of Saturn stands the colonnade of the *Dei Consentes,* the 12 chief gods whose images were represented at public festivals, according to an imported Greek rite. The older parts of the structure belong to the 3rd century B.C., when the rite was introduced at Rome. The cult never received much attention. Between this and the temple of Concord is seen the podium of the *Vespasian Temple,* on which three fine Corinthian columns still stand. Titus began to build this temple to his deified father and after his death it was completed by Domitian. The well carved frieze and cornice are good examples of Flavian workmanship.

Finally at the very head of the market place are the remains of the *Rostra* built by Caesar and Augustus. What we see is a semicircular approach in travertine steps from the area of Concord to the platform, and, on the forum side, the front foundation in tufa blocks (partly restored). The timber platform extending from the one to the other was at first supported by travertine posts standing upright, a few of which are still visible. When these proved too weak brick piers were added. The fragment of a fine wall of tile seen on the inside seems to be Augustan, and is one of the earliest instances of brick (broken-tile) masonry of Rome. It was removed in large part during the empire and the foundation which it lined was cut back into a semicircle to make room for a small chamber. The tufa wall on the forum side was originally faced with marble and to this wall were attached the beaks of ships (rostra) brought from the old platform of the comitium. The platform held numerous statues, and in the older concrete mass of Caesar's period we may discern separate concrete bases which probably supported such statues. The interesting marble balustrades that now stand near the centre of the forum, decorated with excellent representations of political and sacrificial scenes, were probably made for this platform in Trajan's day.

East of the forum along the *Via Sacra* in its course over the *Velia* the excavations have left many problems unsolved. Between the street and the Palatine there are remains of many residences of the republican period. The foundations of old shops along the street—it was the jeweller's street—are probably of the Gracchan era. After Nero's fire the emperor covered the whole area with one vast commercial hall with an imposing portico of travertine arches along the street.[4] Owing to faulty construction this building had to be strengthened later with brick-lined concrete piers which are now seen everywhere throughout the building. North of the Via Sacra, beyond Faustina's temple, stands the church of Cosmas and Damianus, which seems to have been the *temple of the Penates.*[5] In front of this, later used as entrance to it, is an ugly round temple not yet identified with certainty.

Beyond the narrow street is the massive *Basilica of Constantine* (almost completed by Maxentius) which Michelangelo and Bramante studied for their plans of Saint Peter's, and which has influenced the architects of more than one structure in England and America. This basilica first had its entrance at the east end with its apse at the west. Constantine's architect built a portico at the centre of the south wall on the street, and made a tribunal against the north wall opposite this new entrance. Of the immense marble monolith columns (brought from the sea of Marmora) one is still standing in the piazza in front of S. Maria Maggiore. The plan is that which had been developed for the central halls of Roman baths rather than for the earlier basilicas. The four enormous piers, for instance, bear the weight on the interior, whereas in the Basilica Iulia, which is only a third as large, 74 pillars are used. The material of this immense basilica was sumptuous to a degree, but the decorative carving reveals the tasteless exaggerations and lack of practised artistry of Constantine's day.

At the top of the Velia stands the tasteful *arch of Titus,* as restored by Valadier more than a century ago. It commemorates the capture of Jerusalem, A.D. 70, and is decorated with two of the best reliefs that Roman art produced; the triumphal quadriga with the Dea Roma entering the city, and the floats that bore the chief objects of booty.

PALATINE HILL

The Palatine hill,[6] according to tradition, was the site of the earliest settlement at Rome. Since the "hut of Romulus" stood

[1]Delbrück, *Jahrbuch des Instituts* (1921).
[2]Rushforth, *Papers of the British School at Rome,* i. (1902); Wilpert, *Mosaiken und Malerien; M.* Avery, *in Art Bulletin* (1925).
[3]Töbelmann-Fiechter, *Röm. Gebälke,* p. 65 (1923)
[4]Van Deman, in *Memoirs Am. Acad.* vol. v.
[5]Whitehead, "The Church of S.S. Cosma a Damiano," *Am. Jow. Arch., 1927.*
[6]Haugwitz, *Der Palatin* (1901); Jordan-Huelsen, *Topographie* (1907); Lugli, *La Zona Archeologica di Roma* (1924); Platner, *Topography and Monuments of Ancient Rome* (1911); Huelsen, *The Forum and the Palatine* (with bibliography and illustrations, 1928).

on the southern brow of the hill above the Scalae *Caci*, farthest removed from the forum, that side was presumably the aristocratic quarter in the early day. Fragments of good terra-cotta revetments of temples and palaces of the 5th and 6th centuries B.C. have been found in this area, two large cisterns of early workmanship, and cappellaccio blocks of an early town wall. After the second Punic War many of the nobles are incidentally mentioned as living on the Palatine, especially on the northern brow of the hill, which overlooks the forum. In Cicero's day the Clivus Victoriae, the street which ran near the crest of the hill above the house of the vestals, was lined with palaces of important men, *e.g.*, Cicero, Catullus, Crassus, Metellus Celer, Scaurus and several members of the Claudian family. During the empire a large part of the hill was gradually covered by the expanding imperial palace. Augustus' first palace arose south of the centre on property confiscated from republican nobles. The Claudian emperors, especially Tiberius and Caligula, built extensively on the old properties of the family at the north-west corner. Nero enlarged the Augustan palace, connecting it with the Tiberian structure. Vespasian abandoned the Palatine palace for more modest quarters, but Domitian moved into the Augustan structure, enlarging it with magnificent State apartments and public halls. Septimius Severus finally threw out on massive substructures a vast complex of wings toward the south-east corner of the bills with a lofty facade on the Appian Way. As early as Augustus' day the word *palatium* began to be used to designate the imperial palace.

We begin the topographical survey at the very south-west corner of the hill, where there may be seen a portion of the regal fortifications in grey tufa, as well as a large section of the 4th century town wall built in Grotta Oscura and Fidenae stone. Turning eastwards we pass apartments of the Antonine period, perhaps those of the imperial guard. Ascending the hill by the old Scalae Caci we reach the confusion of walls that mark one of Rome's most venerated sites. From the area of Cybele's temple a few steps, made of brown tufa (2nd century B.c.), lead down to the stone platform on which the rethatched hut of *Romulus* apparently stood in Cicero's day. The stone water-trough around the platform indicates that the building above was incapable of bearing its own water-gutter. South of this, and at a lower level, the native rock of the nill has borings that seem to mark the position of poles that supported an early straw hut. Then are found a few stones of the 4th-century fortification, and immediately beyond an early inhumation grave. This is probably a grave of the very early period, since its position proves that it was there before the wall was built. The 4th-century urn found in it may have been placed there for expiation when the grave was disturbed by the builders of the wall. Here then we have actual remnants of the primitive settlement though much confused by later builders. The two cisterns near by probably belong to the same community. The one near the house of Livia has an interesting corbelled vault.

The concrete foundation overgrown with ilexes near by is a part of the temple of Cybele or Magna *Mater*, first built soon after the second Punic War. Here the first oriental cult gained entrance to Rome, and the orgiastic rites practised here probably inspired Catullus' remarkable poem, the Attis. The concrete podium and the peperino fragments from its stuccoed entablature date from a rebuilding in 111 B.C. Augustus' architects who reconstructed it in A.D. 3 seem to have used much of the old material, which they restuccoed in a new design. This temple became very important in the empire, being considered the "mother church" of a widely extended cult.

East of this temple area is the house of Livia, the wife of Augustus. Its very low level is due to the desire of later emperors to preserve this house intact when the other palaces about it were being raised on lofty substructures. It was built about 50 B.C., and contains excellent wall paintings (now badly faded) which correspond to the "second style" of decoration at Pompeii. The house is the best preserved of Roman houses of its period. South of this house is a level platform laid over the ruins of republican houses not yet excavated. On this platform, according to a plausible conjecture,[1] may have stood Augustus' first palace. The house at any rate was connected with Livia's.

The temple foundation that projects into this platform at the southern corner has recently been identified with plausible arguments as that of the great temple of Apollo erected by Augustus in 28 B.C.[2] (*cf.* Horace Odes 1. 28 and Propertius' description in Bk. II. 31). The final proofs have not yet appeared. The temple, octostyle and peripteral, was of Luna marble, with Numidian columns. The acroterion represented the sun-god in his chariot, the pediment group Apollo with Artemis and Leto; the doors were covered with ivory reliefs of the defeat of the Gauls at Delphi and the death of the Niobids—two themes reminding of Apollo's power. This too became a museum of splendid works of art. Adjoining the temple area—in the space on the south-east of the temple, if the identification is correct, was the extensive portico of the Danaids into which Augustus built the first great public library of Rome.

The centre of the Palatine is occupied by the ruins of *Domitian's* palace (usually called the *domus* Augustiana) which faces northwards. At the front are the audience and public chambers: (1) a "basilica" with an apse in the rear for the emperor's tribunal, used when he acted as judge in political cases; (2) on the east of this room, the aula or large audience room where foreign legations were heard and meetings of the senate were held; (3) farther to the right a smaller room which is incorrectly called the lararium. The centre of the palace was occupied by an extensive peristyle containing a garden with an elaborate fountain. In the rear was the large dining room flanked on both sides with curious fountain-chambers. The emperor's table apparently stood on a dais at the end. All of these rooms were decorated with coloured marbles and floor mosaics, and the architectural carving reveals the exquisite designing of the Flavian architects. The large central audience chamber was roofed with concrete vaulting, the earliest example of such a vault employed on a large scale.

Under this vast palace there are buried many houses of earlier periods which have recently been excavated in part but not yet described.[3] Under the basilica one enters the segments of a large room that has not only wall paintings of the second style but also stuccoed reliefs of bold design. The masonry is not unlike that of the house of Livia. If this is not a part of Octavian's first palace it must have belonged to one of his powerful friends. The room was later abandoned for the construction of a large reservoir and finally cut through by a solid curved wall which must be a part of the foundations of Nero's palace. Deep under the lararium are five rooms of an even earlier period; the oldest frescoes and mosaics of this house point to a period of about 75 B.C. Some important family of Cicero's time lived here. Under the dining room there are remains of two previous periods of the palace, the lower rooms pertaining apparently to the reign of Claudius. The delicate decorations of a fountain-house and tbe very charming wall-decorations in coloured stucco plaques that resemble those of the "golden house" of Nero are as successful as anything in their kind at Rome.

Of the *Domus Tiberiana* which occupied a large part of the north-west corner of the Palatine and which is now covered with pleasing gardens very little remains but the substructures with their dark rooms. Many of these rooms have not even been excavated, and since they must have been used for servant quarters it is not likely that things of importance would be found here. Tiberius' palace did not extend to the Clivus Victoriae on the brow of the hill because this street still retained several of its republican mansions when the palace was built. Caligula seems to have connected this corner of the palace with a new wing on the forum level behind the temple of Castor. The magnificent ramp that zigzags down to the forum seems to belong to the Flavian period. The splendid arches thrown over the Clivus Victoriae to carry the palace grounds forward to the very edge of the hill above the forum are attributed to the architects of Trajan and Hadrian. These lend much to the picturesqueness of the Palatine as seen from the forum and to the long vistas over Rome when viewed

[1] Richmond, *Jour. Roman Studies* (1914).

[2] Pinza, *Bull. Com.* (1910 and 1913); Richmond, *Jour. Rom. Stud.* (1914).

[3] Lugli, *La Zona Archeologica di Roma*, pp. 202 ff.

from the platform laid over these piers.

The north-east quarter of the Palatine is still occupied by S. Sebastian and S. Bonaventura. What buildings stood there in antiquity we do not know. The south-east quarter is occupied chiefly by the so-called "hippodrome" and the substructures of Septimius' additions to the palace. The "hippodrome" (the word was sometimes used for gardens of the long oval type) seems to have been a large garden which was surrounded by high retaining walls to keep the higher portions of ground from caving in. It certainly contained fountains, trees and walks, with a portico circling the whole within the wall. Perhaps the portico roof had hanging gardens. The masonry is of the Flavian period with additions and changes of a century later. The substructures of Septimius' palace spread in several directions. The central portion contained very luxurious baths. The lofty ruins that extend along the brow of the hill were apparently substructures that supported apartments from which the emperor could view the games of the circus below, while farther south-east stood the Septizonium with its lavishly decorated façade which was to remind the African friends of Septimius on approaching Rome that one of their countrymen occupied the imperial palace. A large part of the Septizonium stood till the 16th century, when it fell a prey to the greed of Sixtus V. (1588).

THE CAPITOLINE HILL

The Capitoline hill,[1] which in ancient times could be approached only from the forum, had in the regal period a fort (*arx*) on the northern height, an area sacred to Jupiter on the southern height and a wooded asylum on the depression that lay between these two. In the area sacred to Jupiter the last of the kings built a magnificent Etruscan temple with three cellas to the triad Jupiter, Juno and Minerva, and this, officially called the temple of Jupiter Optimus Maximus, was ready for dedication the first year of the republic, 509 B.C. The foundations of this temple have long been known, and when in 1919 the German embassy, which stood upon it, was torn down to make place for an enlargement of the Capitoline museum the old walls were excavated and measured. (*Notizie degli Scavi*, 1919.) These foundations, built of the native cappellaccio, are now visible at two corners, and prove that though masonry was still fairly crude in technique, the original temple was built on the magnificent scale that it had in imperial restorations, about 60x50 metres. Since it was the largest temple in existence in Italy in that day we may conclude that the tradition was not far from correct which held that Rome was a large and wealthy city under the Etruscan princes. The first temple was probably, like the foundations, built of native tufa and covered with a white stucco. The porch was probably supported in four wooden columns set wide apart, and the wooden architraves were in Tuscan fashion covered with painted terra-cotta slabs. A few fragments which may possibly belong to the early temple have been found and placed in the museum near by. On the roof was placed a quadriga of Jupiter in terra-cotta made by the artists of Veii, probably by the same school of artists which created the splendid Apollo now to be seen in the Villa Giulia museum. This old temple, with its decorations renewed from time to time, stood until it was burned in 83 B.C. After various rebuildings it was reconstructed in marble with Pentelic columns by Domitian, and the surviving marble fragments of the entablatures that are in the museum give some idea of the magnificence of this Flavian temple. This marble structure was hexastyle with three rows of columns across the front and a row on each side.

Of the Arx and the temple of Juno Moneta later built thereon all traces have been hidden by the church of Ara Coeli and the recent monument to Victor Emmanuel II. The *Tabularium*, the gaunt walls of which command the view of the forum, has so frequently been altered in rebuilding the rooms of the modern council chamber of Rome that little but the rear remains intact. It was erected after the Sullan fire, which destroyed the Capitoline temple, to serve as a fireproof hall of records for the State. Gabine stone was employed for the exterior walls because it was known not to suffer from fire. The ceilings of the rooms were domed with concrete and an arcade of round and flat arches was developed far beyond the usual architectural customs of the day to avoid the use of inflammable material. It is probably the first attempt at a hall of records that was to be absolutely impervious to the accidents of the elements, and the attempt was successful as the present condition of the store-chambers proves.

[1]Rodocanachi, Le *Capitole romain*, 1904; Platner, Ancient *Rome*, p. 291.

THE IMPERIAL FORA[a]

The **Julian** Forum.—Julius Caesar set aside a large part of the moneys which he derived from Gallic booty for the relief of the overcrowded forum. Thus he moved the comitium to the new *saepta* farther north, and built in the forum the large basilica mentioned above. His most extensive building, however, was a new forum enclosure with high walls and numerous shops lining the walls north of the old forum. In the via delle Marmorelle there are remains of the portico and walls ingeniously constructed of the three varieties of stone best adapted to the requirements. This wall was veneered with marble. Beneath, not now visible, are the remains of several of the shops built of tufa and vaulted with concrete. In the centre of the forum Caesar erected a marble temple to Venus Genetrix, the "ancestress" of the Gens Iulia. This temple he vowed at the battle of Pharsalus, doubtless intending that it should be a visible reminder of his own exalted claims. The forum itself was planned in 54 B.C. but not yet fully completed at Caesar's death in 44.

Forum Augusti.—Augustus completed the forum of his predecessor and built a larger one on adjacent ground chiefly for the purpose of enclosing a *temple to Mars Ultor* which he vowed at Philippi, 42 B.C. To protect the temple from fire he raised a massive wall of Gabine and Alban stone about the area. This wall, one of the most imposing now at Rome, rises 100ft. high. On the outside the great blocks were left rustic, while on the inside, where it was faced with marble, two rows of niches were cut to hold statues and honorary tablets to the noted heroes of Roman history. The statues have disappeared but many fragments of the tablets have been found. The area in front of the temple and on its north side was excavated in 1925–27 and revealed fragments enough of the entablature to ensure complete drawings of the whole structure. The marble decoration was of the best that the Augustan age could produce. The temple proves to be octostyle with a row of columns on each side while the rear of the cella stands solidly against the massive enclosure wall.

Forum Vespasiani.—The next imperial forum to be built was that of Vespasian, through the area of which the Via Cavour now runs. In its centre he constructed a magnificent temple to Peace, which is frequently mentioned for its library and its large collection of works of art—among them statues of Phidias and Lysippus. No part of this structure is now visible. Between the forum of Augustus and that of Vespasian lay the long and narrow area of the lower Argiletum about forty metres wide in which Domitian began to build a forum to contain a small *temple of Minerva*. Since Nerva completed and dedicated it, the structure bore his name, but the decorative work is all of the luxurious style of the Flarian period. Two of the columns of the handsome colonnade still remain with a part of the entablature. Its frieze is in bold relief representing the story of Arachne and other themes suitable for the adornment of a precinct sacred to the goddess of arts and crafts. No portion of the temple of Minerva is now visible but the whole area will probably soon be excavated.

Forum Traiani.—The *forum of Trajan*, north-west of the Augustan group, was a large complex of open areas and buildings, including the spacious forum proper enclosed with a portico, the basilica Ulpia, the two library buildings, the column of Trajan, and, an addition of Hadrian, the massive temple of Trajan. Since the valley was too narrow for all these structures the opposing slopes of the Capitoline and Quirinal hills were cut back, and when necessary heavy retaining walls of concrete and brick erected, a part of which still remain. The forum proper had its stately entrance in the form of a triumphal arch near the forum

[2]Platner, *Ancient* Rome, p. 274 (1911), with earlier bibliography.

of Augustus. Its area is rectangular, 116 metres wide and 95 metres long. The large hemicycle against the Quirinal which is now being excavated served as a retaining wall of the Forum. The corresponding one on the opposite side has disappeared The forum was of course open to the sky. but was surrounded by a very beautiful marble portico backed by a masonry wall. Many fragments of this portico may be seen lying about in the area. Next to the forum proper stood the basilica, which far surpassed the earlier ones in magnificence. A double row of 96 Corinthian columns supported the upper arcade that bore the roof. The nave was 25 metres wide; the apses at the end have been destroyed. North of this judgment hall were the two wings of the library, a rendezvous of literary men and students. In the area between these was built the column of Trajan[1] which is still standing. This column is 100ft. high and is covered with reliefs arranged in a spiral band representing the events of Trajan's two campaigns in Dacia. This is apparently the first column which was decorated in this manner, and the reliefs are made with such fidelity to fact as to be our best document for the history of the wars. Since the porticoes of the library rose on both sides, the reliefs could then be seen from near at hand. Nothing now remains of the great temple of Trajan which Hadrian erected north of the column.

FORUM BOARIUM AND CAMPUS MARTIUS

Between the Capitoline and the well known church of S. Maria in Cosmedin is an area which in early Rome was used as a cattle market, though during the empire it was as thickly populated as it is now. In this area, near the river, are found two republican temples for which the original names have not yet been discovered. The rectangular temple, usually called the *Temple of Fortuna,* was freed from mediaeval additions in 1923 and conservatively restored. It is exceedingly interesting as showing the type of building used at Rome in the late republic before Caesar and Augustus began to reconstruct Rome's tetnples in marble. It is an Ionic tetrastyle pseudo-peripteral temple of pleasing proportions, though small, measuring only 20x12 metres. The walls are of Anio tufa as are also the imbedded columns except those at the corners. These latter, as well as the free columns of the portico, all the capitals, the entablature of the porch and the facing of the podium are of travertine. The whole was covered with white stucco and the stucco of the frieze was neatly moulded into low reliefs of ox-skulls and garlands. The careful distribution of these materials points to the period of about 70–50 B.C. The round temple near by stands on a foundation of the 3rd or 4th century B.C., but the marble temple itself seems to belong to the Augustan period. It would be a graceful temple if the entablature and roof could be restored as well as several of the capitals which have apparently been replaced by alien material. It is of course not a temple of Vesta, but its true name is not known. Huelsen has suggested "Portunus."

The double-arched *Ianus quadrifrons* which stands over the Cloaca Maxima, is of late date and of ugly proportions. The extensive remains that are found in and under S. Maria in Cosmedin apparently belong to the public granary as it was in Cicero's day. Under the church of S. *Nicola in Carcere* near the Piazza Montanara are seen the foundations of three temples that stood beside the vegetable market outside the ancient Porta Carmentalis. These seem to be—from north to south—the temples of Janus, Juno Sospita, and Spes, originally built respectively in 260, 194 and 258 B.C. Most of the materials now visible belong to the rebuildings of *c.* 90 B.C. (Janus), 90 B C. (Juno Sospita) and 31 B.C. (Spes). For the architectural history of the republic they are very important. Farther north on the site of S. Maria in Campitelli stood the famous old *temple of Apollo* where the sibylline books were kept and near which, on the slope of the Capitoline, Rome's early plays were given at the games of Apollo. The temple was first built in the early republic (431 B.C) but the extensive remains now to be seen under the church seem to belong to the reconstruction of 179 B.C.[2] Because of the association of this district with early dramatic performances Augustus constructed a very large theatre near by (first used, when still incomplete, in 17 B.C.) which he named in honour of his nephew Marcellus. A large part of the semicircular façade is still standing and when it has been cleared of its ugly shops and superstructure --excavations are in progress—it will be one of the most imposing ruins of ancient Rome. The exterior consisted of three series of open arcades, the lower one being decorated with engaged columns of the Doric order, the middle with Ionic ones, the third with Corinthian pilasters. The theatre seated about 10,000 spectators and had a stage of the enormous proportion of 80x20 metres.

North of this theatre may be seen the portal of the extensive Porticus of Octavia (originally the Porticus of Metellus) which enclosed large temples of Juno and Jupiter. The whole was originally built in the and century B C., but all the remains now visible belong to the debased art of the Septimian period. Within may be seen, rising above shabby walls, a column and capital of one of the great temples. North-east of this lay the extensive *Circus Flaminius* built before the second Punic war as a place to hold the plebeian games. Fragments of the supporting walls may be seen in the basements of several houses on the Via d. Bottege Oscure, but these all belong to a rebuilding of about 50–30 B.C. A few hundred feet to the north-west of this circus, Pompey built his massive theatre in 55 B.C.. the first permanent theatre of Rome. This was about the same size as the Marcellus theatre and its stage was even longer. Considerable remains of it are to be found under the shops east of the Campo dei Fiori.

Farther north, in the old Campus Martius is the Pantheon,[3] a structure which Hadrian built to replace the earlier temple of Agrippa and Domitian. This round temple was one of the boldest of old Roman structures, having a brick and concrete dome with a diameter of 433 metres without support except on the walls of the temple. The dome itself was built of narro ing circles of brick on which were laid several layers of concrete which hardened into one firm mass so that there is no lateral thrust on the walls. The walls of the rotunda are also of brick-faced concrete with solid brick arches running through the mass to aid in carrying the weight over the niches while the mass was solidifying. The portico is a rectangular structure, most of whose columns belong to Hadrian's time. Some of the repairs of its entablature seem to be of a later period. The large inscription on its front generously credits the building to Agrippa while the smaller one mentions the repairs of Septimius. Nothing is said of the actual builder, but the brick stamps and the style of work prove that Hadrian should have the chief credit. The exterior was of course faced with marble slabs, and the sumptuous decoration of the interior—originally even more elaborate—will give some idea of how lavish the whole building must have been. The temple was dedicated by Agrippa to the divinities of the Julian house, and the name was intended to convey the idea of "all-holy." Of other notable buildings in this region we may mention the *temple of Hadrian,* the walls of which have been incorporated in the Borsa, or stock exchange; the *Mausoleum of Augustus* which has till recently served as a concert hall, called the Augusteo, and the *tomb of Hadrian,* on the right bank of the Tiber, rebuilt during the middle ages into a fort called the Castel Sant' Angelo.[4]

The *Colosseum,*[5] or more correctly, the *Amphitheatrum Flavium,* was begun by Vespasian on the low ground that Nero had used for a lake in the centre of his imperial villa. It was used for hunts, sham battles, gladiatorial shows and races, and the arena could be flooded for sham naval battles. The façade consists of three series of 80 arches decorated in the three orders as were the theatres of Pompey and Marcellus, and rises 48½ metres. Stone masonry in travertine lined with tufa supports the heavier outer portion, while the vaulting of the arcades and the inner bowl consist of concrete. The seats were of marble and could hold about 50,000 spectators. The building which is elliptical measures

[1] Cichorius, ***Die Trajans-Säule*** (1896); Lehmann-Hartleben, ***Die Trajans-Saule*** *(1926).*

[2] **Frank, *Roman Buildings* of *the Republic,* p. 133.**

[3] Ashby's revision of Anderson and Spiers, ***Architecture of Rome*** p. 78.

[4] Pierce in Journal Rom. ***Studies*** (1925).

[5] **Ashby, *The Architecture of Ancient Rome,* p. 93.**

620 ft. in length and 513 ft. in width, and the arena measures 287x180 ft. It was apparently the largest amphitheatre in the Roman world.

Near by stands the well proportioned *Arch* of *Constantine* which however is largely constructed of materials taken from previous arches. The only sculpture upon it that belongs to Constantine's day is the very narrow frieze rudely carved in a band about its centre. The other reliefs were taken from structures of the second century and in the use of these the imperial portraits were rechiselled to represent Constantine. North-east of the Colosseum one may enter several rooms of the *golden house* of Nero,[1] or rather the private apartments of that emperor. The rooms have been to some extent preserved because the walls were later used as substructions for a part of Trajan's baths built at a higher level. Many of the rooms of the palace have recently been excavated and reveal much damaged frescoes and stucco reliefs which represent the best work of its kind at Rome for the period of Nero. It was here, as graffiti on the walls indicate, that several of the Renaissance painters borrowed themes and designs for the arabesque and "grotesque" decoration so popular when the loggia of the Vatican was decorated.

Several of the massive *Thermae* (Baths) of ancient Rome are still among the most conspicuous ruins of the city. The first large structure of this type was the one built by Agrippa in 20 B C. south of the Pantheon. Little now remains of this. More may be seen of the ruins of those constructed by Titus and Trajan (on the grounds of Nero's *Domus Aurea),* by Caracalla on the edge of the Aventine and by Diocletian (part of which is now used for the national museum). Since these buildings contained, besides the baths, playgrounds, gymnasia, clubrooms and auditoria for immense crowds, the architects who constructed them had to employ all the arts and sciences at their disposal. The central building of Caracalla's baths covers an area of 270,000sq.ft.; and the central hall has a clear space of 183x79ft. It is roofed with a solid concrete intersecting barrel vault that rests chiefly on four massive piers and rises 108ft. from the pavement. It was while solving the problems of such construction that the Roman architects made those contributions to their art which have been most frequently studied by recent architects. The baths of Diocletian have suffered more from time, but the church of S. Maria degli Angeli has preserved two of its great halls. Here may be seen in their most advanced use at Rome good examples of flying and rectangular buttresses, a careful system of thrusts and counter thrusts and of ribbed quadripartite vaulting. A large number of the smaller rooms are used by the Museo delle Terme.

Finally the *Subterranean Basilica*[2] discovered near Porta Maggiore in 1917 has proved to be not only one of the best preserved of ancient buildings but one of the most important for the interpretation of Roman life. Though it seems to have been built before the middle of the 1st century A.D. it has the regular basilican form with nave, apse and two aisles. It was built wholly underground apparently for the purposes of a secret religious sect. The ceilings of the nave, the apse and the aisles are richly adorned with excellent stucco reliefs, the interpretation of which has proved as difficult as would be the explanation of the biblical illustrations of a mediaeval cathedral if we had no copies of the Bible. The most generally accepted view is the one proposed by Cumont. that this basilica was the temple of a Neo-Pythagorean congregation which practised mystic rites of initiation that were not approved of by the imperial authorities, and that the reliefs in question pertain to myths and rites which had been given a symbolic interpretation in the Neo-Pythagorean ritual. But quite apart from their meaning, they now give us the best conception possible of the beauty of Roman interior decoration for the 1st century of the empire. *(See* Rivoira, *Roman Architecture,* p. 204.)

(T. F.)

THE MODERN CITY

The city proper is composed of 22 districts and covers an area of 9.07 sq.mi. The commune of Rome extends over 58.2 sq.mi. Pop. of the city: (1871) 244,484; (1901) 462,783; (1931) 1,008,083; (1951) 1,555,773; (1958 est.) 1,935,041.

Rome lies on the undulating plain of the Tiber river, the Roman Campagna, which is bordered by hills. or rather small mountains: to the northwest rise the Sabatini hills; on the other side of the Tiber, to the east of Rome, are the Sabini and the Prenestini hills; in the southeast are the Alban (Colli Laziali) hills with Mt. Cavo (3,113 ft.). Rome itself is built on seven hills and it varies in height above sea level between 44 ft. at the Pantheon, and 462 ft. at Monte Mario. Situated in the central part of the Italian peninsula in the sheltered valley of the Tiber, 16 mi. from the Tyrrhenian sea, Rome has summers that are dry and hot (up to 77° F. in July) and winters that are wet and mild (about 44° F.). Rainfall is heaviest in the spring and autumn.

Rome is built on both sides of the Tiber, but developed mostly on the left bank in the valley and on the low hills to the east. On the right (or western) bank is the Vatican City state (*q.v.*). The river makes two distinct bends within the city; below the Cavour bridge it flows westward under the Umberto I and S. Angelo bridges, where it passes on the right bank the Castel S. Xngelo, originally built for Hadrian's mausoleum. From there the Via di Conciliazione leads westward away from the river to the Piazza S. Pietro and Vatican City. The Tiber then flows southeast and, making an easterly bend past the island of Tiberina, passes beneath the Capitoline hill on the left bank. Further inland on the same bank are the Roman Forum and the Colosseum and other ruins of ancient Roman buildings on the Palatine hill. The Tiber then turns back again to the southwest past the Aventine hill on which, according to legend. Remus is buried.

On the right bank between these two bends there are extensive parks around the hill of Gianicolo and there are gardens around the Vatican palace behind St. Peter's. On the left bank, in the north of the city. is the Villa Borghese or Villa Umberto I, one of 'the most beautifully laid out parks in Italy. Although much was contrived in the way of statuary and fountains the park has great natural beauty.

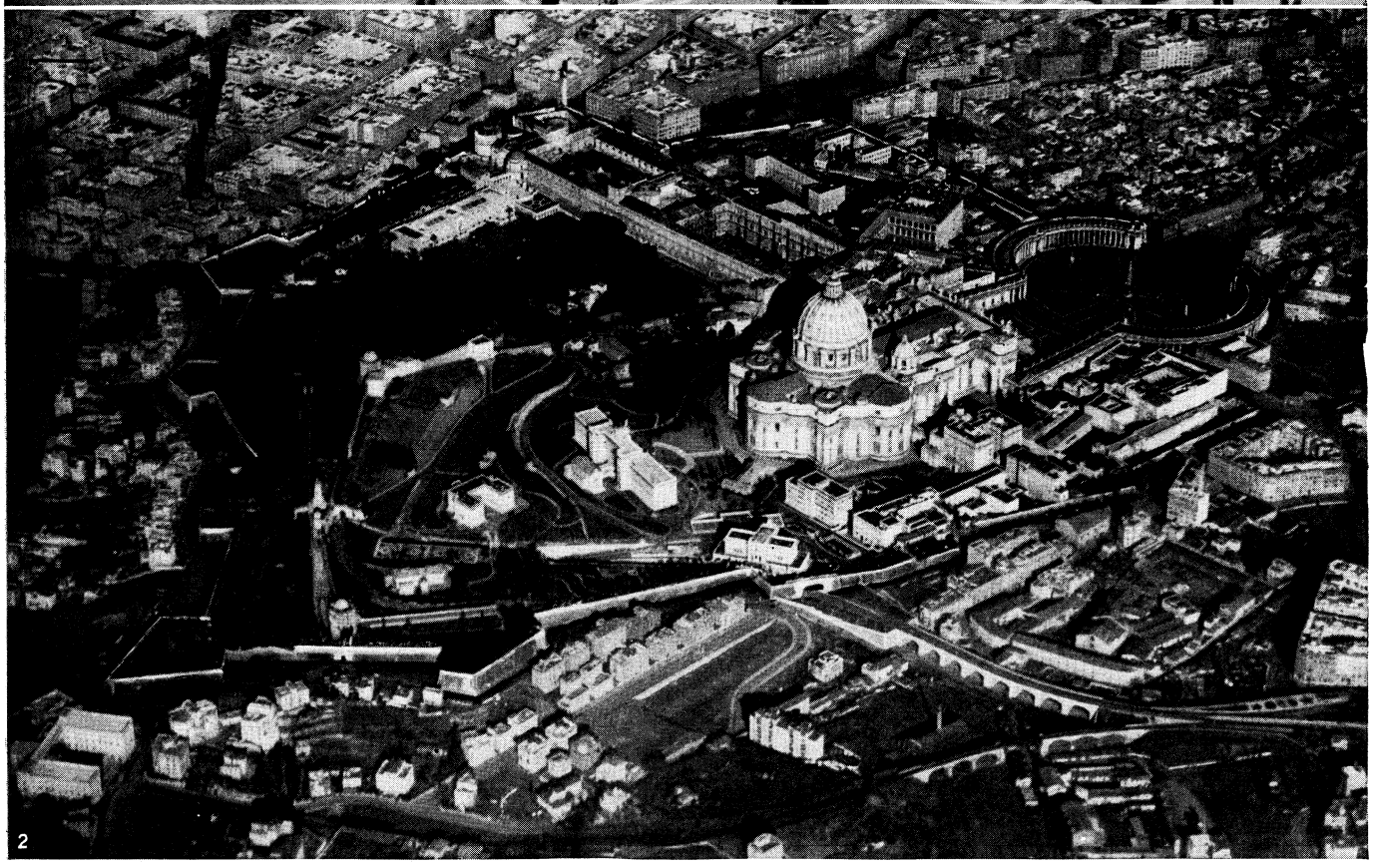
During the 20th century new roads were cut and many old ones widened. The principal but rather narrow street in Rome is the Via del Corso with its elegant shops. It is the central of the three roads radiating southward from the Piazza del Popolo, a beautiful and spacious square in the north of the city, situated between the river and the gardens of the Pincio hill. The Via del Corso runs almost due south to the Piazza di Venezia and thus traverses the central part of the city. From the northeast three wide straight thoroughfares, the Via Venti Settembre, the Via Nazionale and the Via Cavour approach the centre of the city near the Piazza di Venezia. Of these, the Via Nazionale falls gradually from the Piazza della Repubblica (formerly dell' Esedra), near the main railway station, down to the Piazza di Venezia, from there. as the Via del Plebiscito and the Corso Vittorio Emanuele, it runs through the heart of the old city northeastward to the Vittorio Emanuele bridge, which was opened in 1911.

The early settlements of Rome were on seven hills rising above the marshy lowlands of the Campagna. The seven hills (all on the left bank of the Tiber) are: the Quirinal. Viminal, Esquiline, Caelian and Aventine hills—these five form a sort of semicircle facing west—roughly in the centre is the Palatine hill, above the Colosseum and the Forum; and, to the northwest, the Capitoline hill.

Rome is unique in its possession of so many fine buildings spanning so many centuries. In addition to the ancient Roman remains, there are buildings of the early Christian period and a wealth of beautiful Renaissance architecture. Rome is a city of palaces and churches, of parks and squares and statuary and fountains.

Apart from the ancient Roman remains some of the earliest extant building dates from the 4th century, when, under Constantine I. the city entered upon a new life with the recognition of Christianity by the edict of Milan (A.D. 313). Whereas worship had taken place in private houses. churches were built. and an entirely new art form was introduced. The basilica of St. Peter's is one of the churches dating from this period. Among

[1] Weege, *Das Goldene Haus, Jahrb. des Arch. Inst.* p. 127 (1913).
[2] Carcopino, *La Basilique Pythagoricienne* (1927); for illustrations see *Memoirs Amer. Acad.* IV (1924).

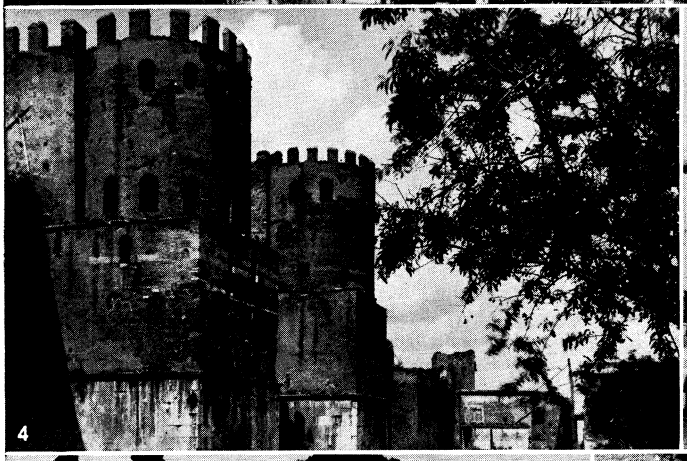


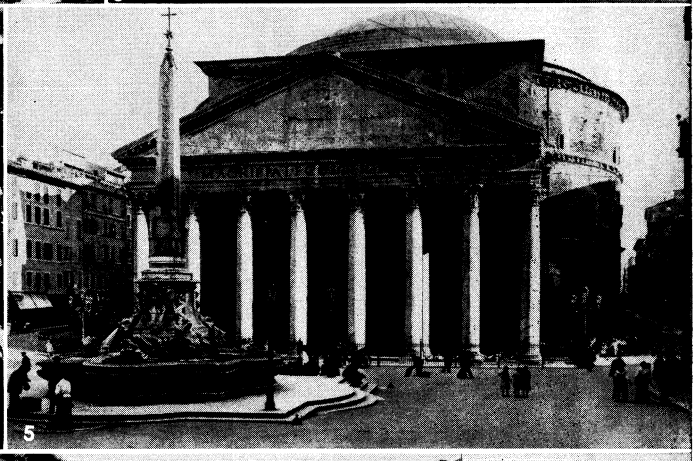
PHOTOGRAPHS, (1) FRITZ HENLE FROM BLACK STAR, (2) PIX-WOLFGANG WEBER

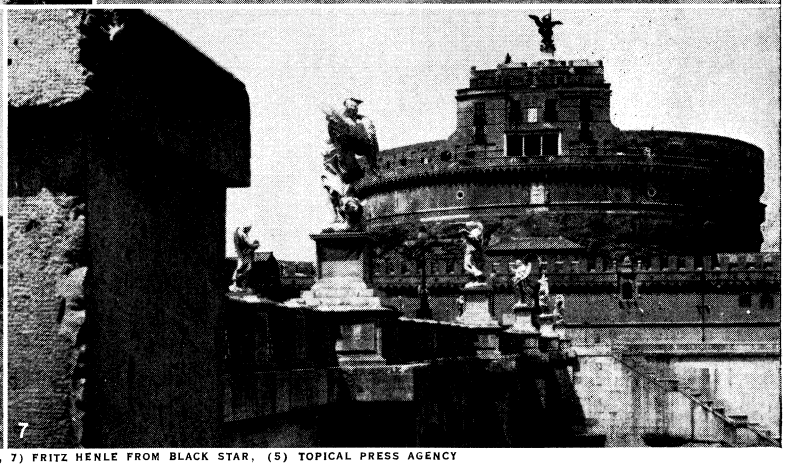
ST. PETER'S AND THE VATICAN

1. Front view of St. Peter's and the Piazza San Pietro, enclosed by a quadruple colonnade designed by Bernini and constructed in 1656-67. The obelisk in the centre was brouaht from Heliopolis by Caligula in the 1st century A.D. and was move3 to the Piazza San Pietro in 1586
2. Airview of the Vatican City state. The tiny area, less than ½ sq.mi. in extent, is surrounded by a wall. The rectangular structures to the left of St. Peter's are the Vatican palace and the Vatican gardens

ROME







PHOTOGRAPHS, (1) FRITZ HENLE FROM EUROPEAN, (2, 3, 6) FRITZ HENLE, (4, 7) FRITZ HENLE FROM BLACK STAR, (5) TOPICAL PRESS AGENCY

MONUMENTS AND BUILDINGS OF ANCIENT AND MODERN ROME

1. The Colosseum, begun by Vespasian and completed in A.D. SO
2. The monument of Victor Emmanuel II, designed by Giuseppe Sacconi, begun in 1835 and dedicated in 1911
3. Stairway of the Piazza di Spagna
4. The ancient walls of Rome
5. The Pantheon, built by Hadrian and consecrated as a Christian church in 609
6. The Appian Way
7. Bridge and Castle of S. Angelo, begun by Hadrian as a mausoleum for himself and his successors. It later became the mediaeval citadel of Rome

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others are: St. John Lateran (S. Giovanni in Laterano), the cathedral of Rome, said to have been given to Pope Silvester I by Constantine: S. Maria Maggiore in the piazza of the same name east of the Via Cavour; and S. Pudenziana, built on the site of a house where St. Peter was said to have been given hospitality. Near the beginning of the Appia Nuova is S. Croce in Gerusalemme, built by Constantine or his mother St. Helena, to house the relics of the True Cross; while south of the Colosseum is the 4th-century SS. Giovanni e Paolo. Across the Tiber, on the right bank. is S. Maria in Trastévere, which was the first church in Rome to be dedicated to the Virgin Mary.

Far from the centre of Rome, on the ancient consular roads, several other basilicas were built during the reign of Constantine: S Paolo fuori le Mura in the extreme south between the Via Ostiense and the river; S. Lorenzo fuori le Mura to the east in the Campo Verano, the Roman cemetery; S. Agnese fuori le Mura to the north of the Via Nomentana, the northeastward continuation of the Via Venti Settembre. Built in the 4th century this church was erected over the catacombs where St. Agnes uas laid. Adjoining it is the church of S. Costanza, the mausoleum of Constantina. the daughter of Constantine.

The invasions of the barbarians during the latter part of the 5th century wrought great damage to the city. The ancient aqueducts were destroyed, buildings were pillaged and the Romans were forced to abandon large residential areas and to withdraw to the banks of the Tiber. There were outbreaks of malaria, buildings were allowed to decay and earthquakes did further damage. Those buildings which lay in ruins were used as sources of stone for new building.

In the 6th century the papal power increased and from that century onward many hitherto secular buildings were used as churches. An example of this type of conversion is SS. Cosma e Damiano, adjoining the Roman Forum, which mas originally the Bibliotheca Pacis S. Maria in Cosmedin, a fine example of medieval Romanesque ecclesiastical architecture. was built from the remains of the Statio Annonae. In the midst of the piazza are two of the best-preserved temples in Rome. the so-called temples of Fortuna Yirilis and of Vesta, the latter possibly dating from the 1st century AD. The church of S. Adriano, also near the Forum, was converted in the 7th century from the Curia (senate house), built originally by Tullus Hostilius: the church of S. Teodoro was built in the Horrea Agrippiana; S. Maria Antiqua was transformed into a church possibly from the library of the temple of Augustus. Perhaps the most remarkable conversion of this period was the consecrating of the Pantheon, built by Agrippa in 27 B C., which in 609 became the church of S. Maria ad Martyres or S. Maria Rotunda.

Between the 8th and 9th centuries the Lateran palace, adjoining St. John Lateran. was enlarged and enriched by Popes Zacharias (741–752), Adrian I (772–795) and Leo III (795–816). It was the earliest papal residence and used as such until the exile of the popes to Avignon. Under Leo IV (847–855) walls were built around the Vatican after damage done by Saracen raids, and the fortified suburb on the right bank was known as the Leonine city. Later (1277) the Vatican was connected by a covered passageway, the Passetto Vaticano, with the Castel S. Angelo. At this period monasteries such as SS Quattro Coronati to the south of the Via di San Giovanni in Laterano assumed the aspect of small forts. Many churches were rebuilt, among them SS. Nèreo ed Achilleo, a church near the baths of Caracalla to the south of the city; S. Maria in Domnica was rebuilt by Paschal I in 817. S. Prassede, south of S. Maria Maggiore. the foundations of which date from the 5th century, was rebuilt in the 9th century; S. Maria in Trastévere was one of the most important churches to be rebuilt between the 9th and 12th centuries.

The beginning of Rome's feudal period as well as the rise of papal poner may be said to date from the 9th century; turreted fortresses superseded the ancient buildings which had outlived their usefulness. After 1143, when the republic was proclaimed, the commune of Rome was fully constituted, and the Palazzo Senatorio was built on the Piazza del Campidoglio to the north of the Capitoline hill.

During the 12th and 13th centuries a remarkable number of churches. which had been damaged and pillaged by the Normans under Robert Guiscard in 1084, mere restored. One of the best examples is S. Clemente east of the Colosseum mhich Paschal II rebuilt 1099–1118 on the ruins of an earlier church During this period too. the cloisters of St. John Lateran were constructed between 121 5 and 1232, one of the famous achievements of I. and P. Vassalletti The small forts of the Torre delle Milizie close to Trajan's market and of the tower of the Conti (Torre dei Conti) off the Via Cavour date from the 12th–13th centuries. With the removal of the popes to Avignon in 1305 there followed a period of stagnation in the city.

When Pope Martin V came to Rome in 1420, it was to a city half-deserted. He began the work of renovation which was to be continued by his successors. Nicholas V (1447–55) was responsible for the restoration of 40 churches, and bridges and aqueducts; he also began the reconstruction of the Vatican palace, in which the popes had lived after the return from Avignon in 1377. The basic plan of the Vatican and the approach to St. Peter's was on the designs of Leon Battista Alberti.

The Palazzo di Venezia. which houses a museum containing medieval and Renaissance works of art, was begun north of the Capitoline hill about 145 j by Cardinal Pietro Barbo. later Pope Paul II (1464–71). He was also responsible for the reconstruction of the adjacent basilica of S. Marco.

During the latter part of the 15th century many sumptuous buildings were erected by Sixtus IV (1471–84), who rebuilt the ruined Valentinian bridge (Ponte Sisto) between 1473 and 1475 and the church of S. Maria del Popolo (1472–77); he built S. Maria della Pace in 1480. S. Agostino, north of the Piazza Navona, was built by G. da Pietrasanta (1479–83). Its interior decorations include paintings by Raphael and Caravaggio and the high altar by Bernini. Of the 1 jth century, too, are S. Pietro in Montorio where legend has it that St. Peter was crucified, the hospital of S. Spirito (1474–82) and the Sistine chapel (in the Vatican palace), which was built for Sixtus IV by G. de' Dolci betneen 1473 and 1480. **(See** VATICAN, THE.)

Cardinal Riario's palace was also built at this time, begun probably by A. Bregno and completed by D. Bramante. Later called the Palazzo della Cancelleria it stands on the Corso Yittorio Emanuele and is one of the finest examples of early Renaissance architecture in Rome.

At the beginning of the 16th century, under Pope Julius II (1503–13), a new plan for St. Peter's basilica was evolved by Bramante to whom the work of rebuilding was entrusted The ground plan was to be in the form of a Greek cross. Michelangelo was the most famous of the architects who directed the building after Bramante's death (1514), and with others was responsible for the construction of the magnificent dome.

Also under Julius II the Via Giulia was opened and a beginning was made in the building of the three streets radiating from the Piazza del Popolo; this layout is evident in the 20th century in the Via del Babuino (leading to the Piazza di Spagna), Via del Corso and Via di Ripetta.

Other major alterations in the layout of the city were effected during the 16th century, notably the development of the Piazza del Campidoglio according to Michelangelo's plan; the Campidoglio mas not completed. however. until the 17th century. The construction of the Strada Pia (after 1870 called the Via Venti Settembre) encouraged a growing tendency for the city to expand eastward beyond the Quirinal hill.

Plans for the development of the city co-ordinated by Sixtus V (1585–90) included a series of streets radiating from S. Maria Maggiore toward the basilicas of St. John Lateran, S. Croce and S. Lorenzo. By 1586 the Via Sistina was already in progress up to the Trinità dei Monti, the church which stands at the top of the monumental flight of steps leading from the Piazza di Spagna. Sixtus V favoured the shift of the old centre toward the Piazza di Spagna and encouraged expansion in its vicinity. During his pontificate, the front squares of the major basilicas were embellished with obelisks, the Lateran palace was reconstructed by D. Fontana (1586) and a Sistine chapel was added

to S. Maria Alaggiore.

Not only did Rome take on the shape of a planned city in the 16th century, but many existing buildings were restored and more remarkably beautiful ones erected. These included the Palazzo Massimo alle Colonne by B. Peruzzi (1532–36); the Palazzo Farnese, a masterpiece of Renaissance building begun by A. da Sangallo and completed by Michelangelo; the Palazzo Caetani of Ammanati; and the Palazzo Colonna in the Via del Corso.

This great activity in planning and building was continued into the 17th century. During the pontificate of Paul V (1605–21), work on the Palazzo del Quirinale was continued, the buildings and gardens of the Villa Borghese mere laid out and the Palazzo Borghese finished. The churches of S. Susanna (C. Maderno, 1605), S. Andrea delle Fratte and S. Carlino in the Quattro Fontane, a baroque masterpiece by F. Borromini. are of the early 17th century The city was further embellished by fountains, notably the fountains of the Piazza S. Pietro (earlier one by Maderno. 1614); of the Ponte Sisto (G. Fontana. 1613); and the Fontana Paola near the Piazzali del Gianicolo, nhich was designed by Fontana and F. Ponzio (1612) to commemorate the restoration of the ancient aqueduct of the Aqua Trajana (Acqua Paolo).

Under Urban VIII (1623–44) baroque art reached a peak in the work of Bernini. Borromini and Pietro da Cortona. They directed the building of the Palazzo Barberini (begun by Maderno) on the Quirinal hill and the Collegio di Propaganda Fide overlooking the Piazza di Spagna. Bernini designed the Triton fountain in the centre of the Piazza Barberini. Further developments, under Innocent X (1644–55), included Borromini's interior reconstruction of St. John Lateran, the construction of the Palazzo Pamphili by G. Rainaldi in the Piazza Navona. This piazza mas given the Fontana dei Fiumi by Bernini in 1651. Alexander VII (1655–67), helped mainly by Bernini, started the Palazzo Odescalchi in the Piazza dei SS. Apostoli; enlarged the Piazza Colonna; built the church of S. Maria in Campitelli: finished the restoration of the Palazzo della Sapienza; completed the Piazza del Popolo with its two churches. S. Maria di Monte Santo (1675) and S. Maria dei Miracoli (1678). Bernini's finest achievement was the colonnade with nhich he surrounded the piazza in front of St. Peter's basilica.

Early in the following century the port of Ripetta on the Tiber was established. Architectural achievements of the 18th century included new façades to St. John Lateran, S. Maria Maggiore and S. Croce in Gerusalemme; the building of the Palazzo della Consulto, the Palazzo Braschi and the sacristy of St Peter's built by C. Marchionni (1776–84). The most imposing of Rome's fountains. the Fontana di Trevi (N. Salvi. 1732–62) and the Scalinata della Trinità dei Monti, a flight of 137 steps (1721–2j), are among the finest adornments to the city. Other developments in the north of the city, the embellishment of the Piazza del Popolo, the laying out of a public garden on the slopes of the Pincio took place at the beginning of the 19th century. Under Pius IX (1846–78) the \.-ia Nazionale was designed to give access to the new railway station — Stazione Termini.

As the capital of the kingdom of Italy after 1870, many plans were drawn up for the improvement of Rome. One of the greatest achievements was the building of high walls along the Tiber to prevent extensive flooding; in addition to the seven bridges across the river ahich existed in 1870, another 12 were built. During the last two decades of the 19th century the face of Rome greatly changed. Buildings around the Palazzo di Venezia were demolished, giving greater prominence to the historic buildings in the vicinity, including the ancient Roman remains; the Piazza di Venezia was enlarged and the Corso Vittorio Emanuele constructed (1876), opening a route from the heart of the old city to the Tiber and thus giving access to St. Peter's and the Vatican. The immense monument to Vittorio Emanuele II on the northern slopes of the Capitoline hill was begun by G Sacconi in 1885. The city spread across the Tiber and beyond the city walls. Such buildings as the Palazzo di Giustizia (palace of justice) on the right bank of the river and to the northeast the Policlinico one of the finest hospitals in Europe, were erected. With this expansion outward. the area around the baths of Caracalla. the Roman Forum and the Palatine was entirely preserved and made a protected area because of its archaeological importance.

At the beginning of the 20th century a tunnel was cut under the Quirinal hill. By the ambitious city plan of 1931, the Via dei Fori Imperiali from the Piazza di Venezia to the Colosseum was opened. extensive excavations in the vicinity were carried out, and, with the demolition of houses which had cluttered its slopes, the Capitoline hill was made more impressive by its isolation. In 1935 the new University of Rome (Citta Universitaria) was completed.

Industry and Communications. — Rome developed remarkably as a centre of industry and commerce after the 1920s. There are many medium and light industries covering almost every type of hand- and machine-made product. Of particular importance are the film and printing industries, and the production of foodstuffs and pharmaceutical goods. Certain of Rome's light industries depend on the existence in the hinterland of an agricultural region capable of producing such raw materials as wool, leather, milk and wheat, and all can rely on the consumers' market of the largest town in Italy.

More than a quarter of the working population is employed in local administration and transport. The city is primarily a cultural and religious centre, and the tourist trade is an important feature in its economy.

Its central position in the Italian peninsula makes Rome a focus of road, rail and air communications. Although a terminal station, the capital is an important junction of the railway lines connecting northern and southern Italy. The airport for Italian and international airlines is at Ciampino, a village to the southeast nearly 7 mi. from the centre of the city.

(C. PI.; L. PA.; A. BI.)

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ANCIENT HISTORY

I. THE BEGINNINGS OF ROME

The limestone ridges that border Latium contain numerous remains of stone age settlements, and one has even been found on Monte Mario within 3m. of the Vatican in the old volcanic stratum that borders the right bank of the Tiber. On the left bank, however, nithin the area that was in prehistoric times subject to rains of volcanic ash from the Alban craters there are very few traces of human habitation before the iron age.[1] Perhaps the activity of the volcanoes kept migrants from settling there during the bronze age. The oldest settlements so far discovered within this peculiar region seem to be those of the Alban hills. between Grotta Ferrata and Albano. Here several groups of cremating people belonging apparently to the so-called Villanova[2] (*q.v.*) branch of the Indo-Europeans came down from Tuscany and settled. about the end of the 2nd millennium B.C. In the early part of the 1st millennium they spread here and there over the Latin plain as far at least as Antium on the sea and the Palatine hill on the Tiber. In the primitive cemetery of the Forum 40 graves have so far been excavated. The deepest and earliest mere cremation burials containing the same kind of pottery and personal ornaments as those of the Alban hills. Later, possibly in the 8th century, the rite of inhumation began to take the place of cremation here as on the Alban hills, at Antium, at Veii and at Falerii north of the Tiber. It is generally assumed that Sabine people from the central mountains were at this time pressing into Latium in large enough groups to become in several towns the dominating element. Whether further excavations will prove that this rite replaced cremation in all the primitive burial places at Rome is doubtful. The fact that cremation again became the orthodox rite during the Roman republic would indicate that cremation survived in some cemeteries that have not yet been discovered.

Early Institutions. — By the 7th century we may assume that

[1]Von Duhn, *Italische Gräberkunde,* 392 (1924); Antonielli, in *Hull Palet. Ital.,* 161 (1924)

[2]Randall MacIver, *Villanovans and Early Etruscans* (1925); *Iron Age in Italy* (1927)

the Palatine, the Capitoline, the Esquiline and the Quirinal hills had compact settlements of "Villanovan" and Sabine farmers and shepherds. These two groups were closely related in culture, language and religion. Philology proves that the bearers of the Latin language (probably the cremating group) and those who spoke the Sabellic dialects had not been separated very many centuries, and that they had been one people before entering Italy over the Alps. Several of their deities—Jupiter, Mars, Juno, Minerva and others—were also a common inheritance, and were worshipped by both peoples with rites that knew nothing of anthropomorphism. That it was a religion peculiarly adapted to an agricultural people we learn from the oldest calendar of festivals, which was drawn up before the Etruscans came to Rome. (W. Warde-Fowler, *The Religious Experience of the Roman People* [1911], 92.) Their political and social organizations were also of the same kind. The property-owning males constituted the "town-meeting" and the army. They elected the annual leaders (usually two "praetors" or "consuls") who summoned and conducted the meetings, held the elections and directed the army. The consuls must consult a smaller group of elders (senators), heads of important families, in all matters of public interest. Without the approval of the elders no proposal was put before the commons. For purposes of transacting business the commons of a town were usually divided into ten wards called *curiae*. That Rome had 30 instead of ten seems therefore to indicate that Rome was a union of three settlements already organized into regular polities before the city government was formed. In taking possession of the country, these people had settled in village groups, usually upon some hill which could be defended, and which gave access to a good spring of water or a stream. Most of the land near each village was apparently divided into private holdings, though it also seems probable that some land was left undivided for community grazing. Sacred land, used for the support of the cult, was also set apart at a very early period. These villages were independent and autonomous within the tribe. A tribal organization, however, existed, which supported a tribal cult on the Alban mount. This tribal organization was kept alive by an annual religious festival, and it had a presiding officer whose duty it was in time of danger to summon the forces of the different communities to common action. Since both the Villanovan and the Sabine communities shared in these democratic customs they coalesced readily in such a large tribal organization.

Finally both peoples long retained the institutions of a very strong patriarchal organization. Women, children and slaves were subject to the *potestas* of the family patriarch. He gave the members of his household in marriage, assigned the properties—there are but shadowy traces of clan-ownership, and testamentary rights are highly developed—and he, with his family council, meted out punishment for crimes committed within the family, and in the earlier day at least, directed the vendetta of the family against those who had committed a wrong against him or his. While the villages were still small, there were few opportunities for community action, whether judicial or legislative, so long as the patriarchal customs were respected.

City States.—At an early day these numerous communities belonging to a wide-spread tribe began to aggregate to a few favoured centres where cities grew up. Such cities soon overshadowed the villages and endangered the existence of the Latin tribal organizations. It is likely that raids from across the Tiber and from the Sabine and Volscian hills emptied the more exposed villages that could not well be fortified, drove the populace to more defensible villages, and in the case of places like Praeneste, strongly situated near the natural road between Etruria and Campania, trade of a lucrative kind also attracted settlers. It was in this way that some six city-states gradually grew up in Latium to take the place in each case of several villages. The growth of such cities in these circumstances naturally required stronger and more efficient governments, a better army organization, the building of walls or at least defensible earthen mounds with protecting pickets.

Kings.—At Rome the coalescing of three villages with their 30 curiae may date from the 8th century B.C. And here since the threats of Etruscan raiders from Veii and Caere added much to the difficulty of governing communities that are not wholly homogeneous, elective princes holding office for life seem for a while to have displaced the customary annual magistrates. Tradition held that of these early princes Romulus (*q.v.*), Hostilius and Ancus Marcius were Latins, but that Titus Tatius (the prince of a Sabine group) and Numa Pompilius (*q.v.*) were Sabine in origin, while Tarquinius Priscus was said to be the son of a Corinthian adventurer who had first settled in Tarquinium and married an Etruscan woman, and Servius Tullius was an Etruscan chief by the name of Mastarna.

There is nothing unreasonable in this tradition, and since the art of writing was already known, the names may well have survived from early times on inscriptions of public buildings, treaties and tombs. The tradition regarding Servius Tullius was at least derived from Etruscan documents of an early date (*See* the speech of the Emperor Claudius, Dessau, *Ins. Lat. Sel.*, 212.) History, however, need not take seriously the numerous legends preserved by Livy regarding the wars and deeds of these kings. Villages near Rome which naturally dwindled to insignificance under the attractive power of a neighbouring city left traces of themselves in abandoned walls; and picturesque legends grew up to account for their annihilation, but most of them had decayed several centuries before history was written.

Etruscan Kings.—The Etruscan house of the Tarquins seems to be more tangible. Tradition places their rule in the latter half of the 6th century B.C., at a time in fact when we know that Etruscan princes were making conquests southward as far as Capua, when Etruscan art and Greek objects of art carried by Etruscans (*q.v.*) came into Rome as they did into Praeneste. Velitrae, Ardea, Satricum[1] and other Latin towns, when Rome received a stone ring-wall enclosing a remarkably large area and ceased to use the Forum cemetery for burial—since that now was included within the ring—and when Rome's rulers began to reach out to gain the control of the larger part of Latium.

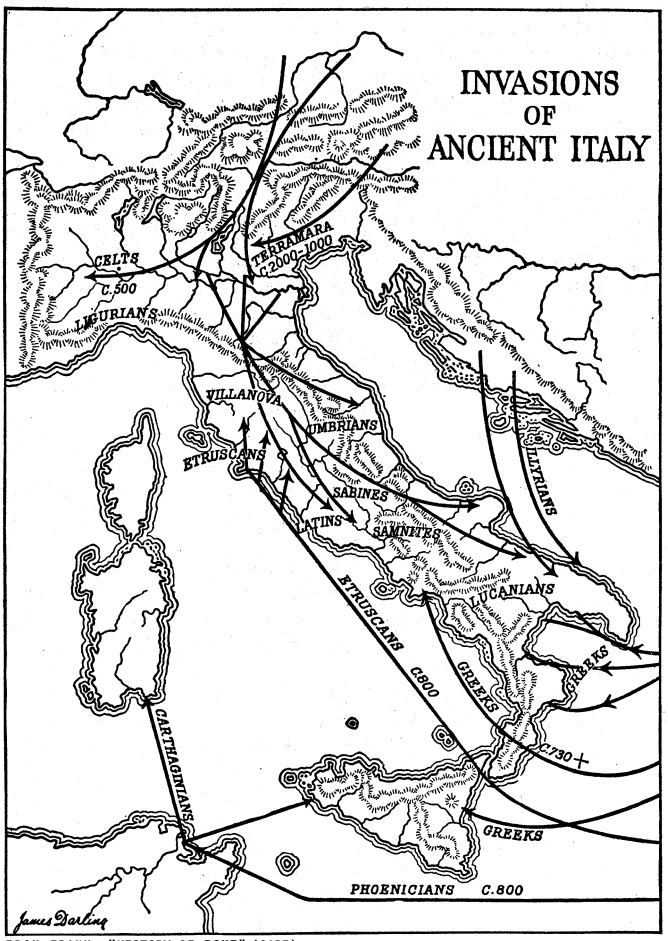
The Etruscan adventurers, employing methods like those of the Normans who ruled the Sicilian cities in the 12th century, had come by sea to govern and exploit the unorganized communities of the Villanovans some two centuries before. Different families had secured control of most of the districts of Tuscany, had fortified their various cities, trained their subjects into effective armies as well as into obedient tenants and serfs, had developed farming by improved methods of planting, draining and irrigation, had exploited the copper and iron mines of Etruria and organized a flourishing industry in metal work with which they attracted Phoenician and Greek traders and had even entered actively into maritime commerce[2]

Whether the Tarquins actually seized Rome by force or migrated to Rome and secured control by political devices we do not know. Under them Rome and Latium underwent very remarkable changes. An extensive wall[3] of almost 6m. was built to enclose an area that would readily house 200,000 inhabitants living in low small houses. There could hardly have been so many inhabitants when the enclosure was made; and indeed the walls, in order to make use of natural escarpments and to include outlying shrines, probably took in many undeveloped tracts. We cannot be sure that the regal wall extended as far out as the so-called Servian wall, despite the existence of very old remains in the gardens of the "Villa Spithoever." Tombs of the 4th century within the area seem to prove at least that the sacred *pomerium* did not extend so far, even if the fortifications did. Nevertheless the regal city was remarkably large when compared with other Italian cities, and its size points to a builder who was intent upon extensive projects of development. The Tarquins certainly opened the city to the currents of Mediterranean commerce now being attracted westward by Etruscan prosperity. Tradition plausibly holds that a port was used at the mouth of the Tiber as early as the 6th century; Greek and Etruscan articles came

[1] Della Seta, *Museo di Villa Giulia*, i., 235 (1918).
[2] D. Randall-MacIver, *The Etruscans* (1927).
[3] *Papers of the American Academy in Rome*, iii., 112 (1924).

to the city, Greek and Etruscan artisans were at work on the public buildings, and it is not unlikely that some of the industries that prospered in Etruria were enticed to Rome.

A strong army was also organized. Tradition attributes the regal army of nearly 20,000 men to Servius, who came from Etruria and doubtless employed the same methods as other Etruscan princes. Of these, 9,800 belonged to the "first class" of property holders, the rest to the other four classes; that is to say, all of the "first class" men were liable to army service, but



FROM FRANK, "HISTORY OF ROME" (CAPE)

MAP SHOWING INVASIONS OF ANCIENT ITALY. WITH APPROXIMATE DATES

only a diminishing proportion of the lower classes. In any modern industrial city where 10,000 males of military age constitute the highest 20% of taxpayers one would have to assume a population of at least 500,000 souls, or 100,000 male citizens; and that would be a very large population for a city with a rural territory of only about 500sq.m. (320,000ac.). It must, however, be remembered that in early Latium the proportion of property owners was large, that the Latin communities had consisted chiefly of farmers practising hoe-culture to whom 5–10ac. would not only suffice for a family but would require all its energies for cultivation. In the rural area, at least, property was more evenly divided than would be the case in an industrial community to-day, so that the 9,800 soldiers of the first class need not imply as large a population as it might to-day. Considering the extent of the city walls and the intensive cultivation of the Latin soil, we may accept for the last years of the regal period the tradition of the army of 193 centuries (19,300 men), and conjecture an urban population of about 200,000 and a rural population of about the same size. That the Latin country was at that time intensively cultivated we may well believe, when we recall the long underground drainage channels which were driven through the tufa on the Alban slopes to carry off torrential rain waters in order to save the surface soil from erosion. Such expensive work of salvage would not have Seen undertaken unless land had been very much in demand and the population much more dense than in historical times.

The Etruscan princes were also vigorous conquerors, bent on extending their power throughout Latium. Tradition, reported by Livy and Dionysius, dwells long on their wars of conquest with Veii, Latin towns like Gabii, Aricia, Ardea and the Volscians as far as Tarracina. That this tradition happens to be fairly correct we may conclude from the facts that the region below Velitrae was particularly submitted to agricultural development (Frank, Economic History of Rome, 8 and 35, 2nd ed. 1927), that the colony of Cora existed at the founding of the first Latin league, and that the terms of the first treaty between Carthage and Rome, signed in 509, prove that the principality developed by Tarquin extended as far as Tarracina. This famous treaty recorded by Polybius (III. 22–3) is our oldest genuine document of Roman history. It was signed with the new republic of Rome immediately after the Etruscans had been banished and doubtless to a large extent reiterated the provisions of the previous treaty which the Tarquins had signed when in control of Rome. In the first sections it assumes that the free Romans would continue commerce on the seas to the extent that the Tarquins had, and it therefore makes an effort to safeguard the Punic trade monopoly at Punic ports. That proved to be a needless precaution, for the Romans abandoned the seas soon after they fell out of touch with Etruscan enterprise. A paragraph of the second part of the treaty reveals how far the ambitions of Etruscan Rome had advanced. It reads, "The Carthaginians shall do no injury to the people of Ardea, Antium, Laurentum, Circeii, Tarracina, nor any other people of the Latins that are subject to Rome. From those townships of Latium which are not subject to Rome they shall hold their hands; and if they shall take one they shall deliver it unharmed to the Romans." If, as seems to be the case, these clauses remain standing from Tarquin's last treaty with Carthage, they indicate that Tarquin had conquered at least the towns named, and that such towns as Pometia and Satricum, which are not mentioned, are considered within the sphere of Rome's natural interests, so that even if Carthage in some dispute should attack them she must deliver them to Rome. Needless to say the Roman republic which signed this treaty could not long entertain such ambitions, inherited for the time from Tarquin. Rome discovered within a few years that she had to release the Latins from subjection in order to win their support in her struggle with the returning Etruscans.

The terms of this treaty reveal how powerful Rome had become under the Tarquins and explain to us the resources that could pay for the building of a wall of 6m. and the power that could muster and employ an army of 20,000 men. They also help us to picture the resources that were expended in a very aggressive building programme. The temple to Jupiter which Tarquin nearly completed on the Capitoline hill stood on a lofty stylobate more than 20ft. high and measured about 200ft. x 185ft. None of the flourishing Etruscan cities with all their commercial prosperity had any temple comparable to this. Tarquin also moved the Diana cult from Aricia to Rome so as to make Rome the religious centre of the Latin communities of the Alban hills, and to Diana he built a famous temple on the Aventine. To the Etruscan period are also attributed several Fortuna temples—since soothsaying was particularly in favour with the Etruscans. Then in the first years of the republic there were built several temples begun by the Tarquins or vowed in the vigorous spirit of enterprise that the Tarquins had instilled; the large temple of Saturn below the Capitoline, the temple of Mercury—the god of commerce—behind the Palatine, the temple of Ceres nearby, and the splendid temple of Castor in the Forum. Not till two centuries later did the republic spend so much energy and money in public buildings, for with the expulsion of the Etruscans Rome became again a rural market place.

The effects of the Etruscan régime were widespread, though it apparently did not last more than about a century—if we are right in dating the last of the Forum burials about 600 B.C. In the Etruscan Government the senate had been retained, though virtually stripped of power, and the assembly was probably never

summoned by the last Tarquin. A large industrial class must have come into existence in the city in the regal period, for even though the walls were raised by forced citizen-labour as tradition held, the increase in trade at the Roman market, the manufacture of the elaborate decorations for the new buildings, the service of a luxurious court, the provisioning and equipping of a large army would require much skilled labour. In some of the regions of Latium taken by force it is probable that the natives were reduced to serfdom as had been the custom in various parts of Etruria. The long and expensive drainage canals that are found between the Alban hills and the sea are not explicable in a system of small free farmers. In that region at least there must have been one or more strong lords who commanded much labour and capital. Whether the prince retained the land as a royal domain or assigned it as fiefs to favourites we have no means of knowing, and we must also admit that no conclusive evidence survived in Roman custom of the servile system which is frequently posited for this period.

This foreign régime also accounts for certain changes in rites, customs and institutions that were more or less lasting. The Etruscans had usually accepted the Italic deities from their subjects, but having come from the East and imbued with anthropomorphic conceptions they made representations of these deities in bronze or terra-cotta and built temples for them. Since such representations were usually derived from figures of Greek gods this process not only localized and gave human form to the Italic deities, but syncretized them with definite Greek gods regarding whom there existed a mythology. In this respect therefore the intervention of the Etruscans completely revolutionized the ideas of the younger generation of Romans. The Etruscans also lent their influence to the growing custom of inhuming the dead, and, for a while at least, to the interment of costly adornments with the body. Since the Etruscan burial rites—brought from Asia—were definitely connected with beliefs of the survival of the *genius* in a state of happiness or suffering, the Italic ideas of future existence were thus permanently altered, even though the Republican Government when restored tried to abolish funeral adornments and encourage a return to the Italic burial customs. That the Latin language was not displaced at Rome even in official regal inscriptions is proved by the survival of the famous "stele" of the forum, which is written in Latin though on an Etruscan stone and containing a reference to the king.

Expulsion of the King.—Near the end of the 6th century the Etruscan usurpers were ejected and a republican government formed with a restoration of annual elective magistrates, an advisory senate of nobles and a timocratic popular assembly. The traditional date is 509 B.C., but since the chronology adopted by later writers is a reconstruction from consular lists and from the marks made every year on the doorposts of the Capitoline temple, and since a discrepancy of a few years existed between these two records, we must not insist upon exact dates. Livy attributes the revolt against the Tarquins to a general objection to forced labour on public buildings and in the last instance to the wrong done to Lucretia by a son of the king. That tradition should have kept an accurate and adequate explanation of causes for several hundred years is not plausible, but in view of the evidence of archaeology and of institutional survivals we cannot doubt that Etruscan princes held Rome for a while and that they were ejected with a restoration of native rule.

II. THE REPUBLIC

Period A: 509–265 B.C.—(*a*) The Struggle Between the Orders.—The Tarquins apparently did not at once acquiesce in the results of the revolution. Securing the aid of friends in Etruscan cities and also in some Latin towns like Tusculum, still held by friendly princes, they attacked Rome again and again. An Etruscan tradition mentions a temporary victory by Lars Porsenna of Clusium by which he was able to disarm Rome for a while; and as late as 499 there was a famous battle at Lake Regillus in which the Romans won a decisive victory over Etruscan and some Latin forces, and the general on that occasion vowed the temple to Castor in recognition of aid received from Greek cavalry. Rome also had trouble with the Latin cities, for the new Government attempted to take over the hegemony of the Latin towns that had been subjected by the Tarquins, while these Latin towns also wished a restoration of independence. Rome's wars with the Etruscans made it impossible to enforce her claims over the Latins, and consequently she had to come to terms with them. The independent league of Latin towns' consisting of Tibur, Tusculum, Aricia, Lanuvium, Ardea, Pometia and Cora, formed in order to resist Rome's pretensions, soon (c. 493) entered into a defensive alliance with her (the *foedus Cassianum*), and this new league made enough progress at once so that Signia and Norba were settled as common Latin colonies. But the Volscian towns of Antium, Satricum, Velitrae and Tarracina fell away from Latin connections.

The Government.—The new Government of Rome was more nearly an aristocracy than the old native Italic Governments. During the regal period with its great prosperity, its immigration of labourers, its partial imposition of serfdom, and grants of fiefs and privileges, class distinctions had come into existence. The favoured elders, selected by position, influence and favour for seats in the senate, were now considered a caste apart from the rest and they and their descendants were called patricians (*q.v.*). Since this group seems to have led the revolution and formed the new Government it is not strange that they imposed the requirements that patricians alone could hold the magistracies and priesthoods and interpret the laws, and that no resolution of the popular assembly should be binding unless ratified by the patrician senators. And when the more influential of the plebeians were enrolled as senators these *conscripti* apparently were not allowed to participate in the ratification of laws. Economic changes added to the disagreement between the classes. With the departure of the king and his court Rome fell out of the current of sea-going commerce, if we may judge from the evidence of excavations. For a while also trade relations with Etruria were cut off. Building construction which had flourished also soon came to an end. Furthermore when Rome had to surrender her hegemony not only over the Volscians of southern Latium but also over all the towns of central Latium, the profits that had flowed into the city from those regions ceased. There must have been much poverty and a large number of unemployed. And since the laws still permitted imprisonment and under certain conditions enslavement for debts, there arose among the poorer plebeians a demand for political rights with which to win some relief from economic distress. There were still in the vicinity several primitive Latin villages with their old town meetings which reminded the Romans of the old democratic government that had existed before the Etruscan invasion.

In the domain of external politics the 5th century was largely devoted to a reconquest by the league of the parts of Latium which were lost to the Volsci and Aequi during the distressing years of warfare with the Etruscans. In internal politics the plebeians made some progress during the century in their battle for recognition. What the plebeians first asked for was the right to elect advocates (tribunes of the people) who should have the right to prevent arbitrary arrest, and to speak for them in court when arrested. This seems to have been an attempt to find a remedy against harsh debtor-laws, and a substitute for the king who had listened to such appeals. The historians say that the plebeians were not granted this request until they had seceded to Mons Sacer when called upon for service against the Volsci. The fact that the privilege was granted by a sacred agreement which also invoked a curse upon any who impeded a tribune in the performance of his duty gives evidence that the measure rested upon a solemnly sworn compact between the orders. The story of the political strike is therefore plausible. There may at first have been four tribunes, one for each city tribe; but before the time of the decemvirs there were ten, and this remained henceforth the standing number.

It would be difficult to find a parallel to the tribunate anywhere. The tribune never became, strictly speaking, a magistrate of the Roman people. His one prerogative in the early day was

[1]Rosenberg, in Hermes, 159 (1919).

to protect individual plebeians against summary arrest by patrician officials and he must exercise this function in person and within the city. That he was sacrosanct and absolutely protected in the performance of his duty clearly points to the intention that in this one function he was to be as efficient a protector of the oppressed individual as the absolute monarch had been. Such powers could hardly be kept from abuse, and in time the tribunes became powerful individuals who could intervene in almost any department of state.

Since the tribunes were elected annually by the plebeians it was only natural that the plebeian assembly — which met by local groups or tribes — might remain to discuss policies and instruct the tribunes by resolution. In 471, if Livy is correct, a law was passed (the lex Publilia) which recognized the plebeian tribal assemblies as lawful, and authorized the tribunes to propose and carry resolutions in such assemblies. These resolutions (plebiscites) had of course only such force as plebeian influence gave them, but the time was to come when the plebeians were the most powerful element of the state, and when the law-making body dared not long resist the demands of plebiscites.

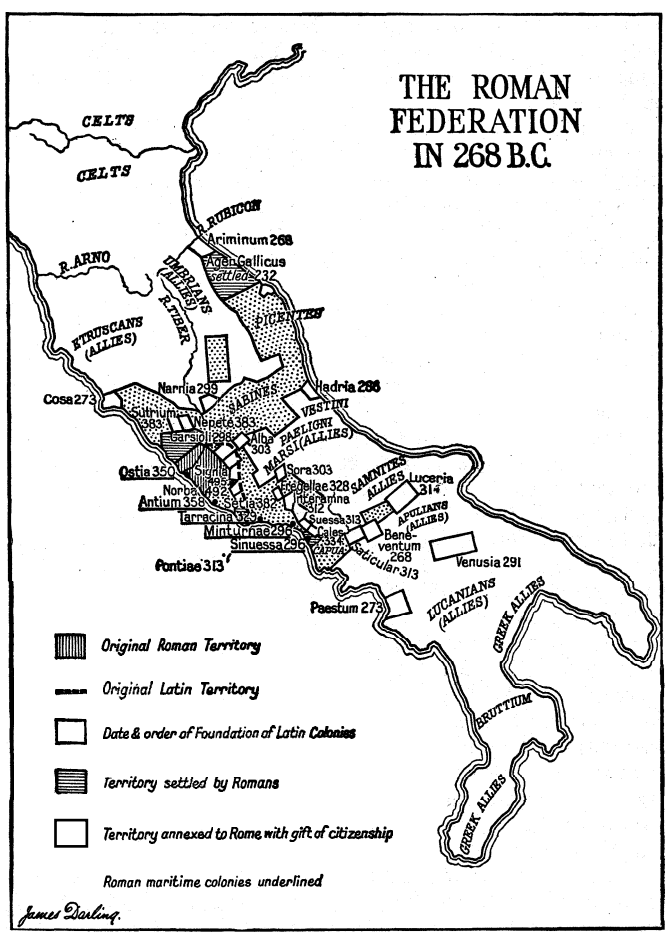
The Twelve Tables. — The plebeians now had advocates in court, but the tribunes were hampered by the fact that court judgments were rendered according to unwritten custom preserved from father to son within a narrow group of learned patricians. It therefore became apparent that the customary law must be codified and posted. After many years of discussion a law was passed substituting for the while a board of ten patricians in place of the two consuls and authorizing this board of ten to frame and publish a code of laws to be binding upon all. The *decemviri* worked on this code in 451 and 450, when it was inscribed and posted in the Forum. These "XII. tables" were in no sense a reform or a liberalizing of old custom. They recognized the prerogatives of the patrician caste and of the patriarchal family, the validity of enslavement for unpaid debt and the interference of religious custom in civil cases. That they reveal a remarkable liberality for their time in respect to testamentary rights and to contracts is probably not due to any alteration brought in by the *decemviri,* but rather to the progress that had been made in commercial customs in the Roman Forum in the days of prosperity and vigorous trade. The gist of this code has survived in quotations and is now the historian's safest index of the state of Rome's culture in the 5th century. (T. F.)

Constitutional Changes.—The *decemviri,* who had incurred much opposition because of their autocratic administration of Rome, were deposed at the demand of the plebeians who seceded to the Janiculan Hill and made a formal demand that the former Government be restored. The assemblies accordingly met and elected consuls and tribunes again. But the plebeian assembly went farther and demanded certain reforms in the constitution. These demands were embodied in the very important Valerio-Horatian laws passed by the popular (centuriate) assembly in 449. These laws granted or reaffirmed the inviolability of the tribunes, the right of every citizen to carry his appeal to the assembly in cases of death sentences, and finally enacted that plebiscites passed by the plebeian assembly should be placed before the senate and if ratified by the *patres* should be recognized as law. Only a few years after the Valerio-Horatian legislation came the *lex Canuleia,* itself a *plebiscitum* (445 B.C.), by which mixed marriages between patricians and plebeians were declared lawful, and the social exclusiveness of the patriciate broken down. In the same year with this measure, and like it in the interests primarily of the wealthier plebeians, a vigorous attack commenced on the patrician monopoly of the consulate, and round this stronghold of patrician ascendancy the conflict raged until the passing of the Licinian laws in 367. The original proposal of the tribune Gaius Canuleius, in 445, that the people should be allowed to elect a plebeian consul was evaded by a compromise. The senate resolved that for the next year, in the stead of consuls, six military tribunes with consular powers should be elected, and that the new office should be open to patricians and plebeians alike. The consulship was thus for the time saved from pollution, as the patricians phrased it, but the growing strength of the plebs is shown by the fact that in 50 years out of the 78 between 444 and 366 they succeeded in obtaining the election of consular tribunes rather than of consuls. Despite, however, these discouragements, the patricians fought on. Each year they strove to secure the creation of consuls rather than consular tribunes, and failing this strained every nerve to secure for their own order at least a majority among the latter. Even the institution of the censorship (435), though rendered desirable by the increasing importance and complexity of the census, was, it is probable, due in part to their desire to discount beforehand the threatened loss of the consulship by diminishing its powers. Other causes, too, helped to protract the struggle. Between the wealthier plebeians, who were ambitious of high office and the poorer, whose minds were set rather on allotments of land recently taken from Veii, there was a division of interest of which the patricians were not slow to take advantage, and to this must be added the pressure of war. The death struggle with Veii and the sack of Rome by the Gauls absorbed for the time all the energies of the community. In 377, however, two of the tribunes, G. Licinius Stolo and L. Sextius, came forward with proposals which united all sections of the plebs in their support. Their proposals were as follows: (1) that consuls and not consular tribunes be elected; (2) that one consul at least should be a plebeian; (3) that the priestly college, which had the charge of the Sibylline books, should consist of ten members instead of two, and that of these half should be plebeians; (4) that no single citizen should hold in occupation more than 500 ac. of the common lands, or pasture upon them more than 100 head of cattle and 500 sheep; (5) that interest already paid on debts should be deducted from the principal, and the remainder paid off in three years. The last two proposals were obviously intended to meet the demands of the poorer plebeians, and to secure their support for the first half of the scheme. Ten years of bitter conflict followed, but at last, in 367 B.C., the Licinian rogations became law, and one of their authors, L. Sextius, was created the first plebeian consul. For the moment it was some consolation to the patricians that they not only succeeded in detaching from the consulship the administration of civil law, which was entrusted to a separate officer, praetor *urbanus,* to be elected by the comitia of the centuries, with an understanding apparently that he should be a patrician, but also obtained the institution of two additional aediles (aediles *curules*), who were in like manner to be members of their own order. With the opening of the consulship, however, the issue of the long contest was virtually decided, and the next 80 years witnessed a rapid succession of plebeian victories. Now that a plebeian consul might preside at the elections, the main difficulty in the way of the nomination and election of plebeian candidates was removed. The proposed patrician monopoly of the new curule aedileship was almost instantly abandoned. In 356 the first plebeian was made dictator; in 350 the censorship, and in 337 the praetorship was filled for the first time by plebeians; and lastly, in 300, by the *lex Ogulnia,* even the sacred colleges of the pontiffs and augurs, the old strongholds of Patrician supremacy, were thrown open to the *plebs*. The patricians lost also the control they had exercised so long over the action of the people in assembly. The *patrum auctoritas,* the sanction given or refused by the patrician senators to laws and to elections, had hitherto been a powerful weapon in their hands. But in 339 a law of Q. Publilius Philo, a plebeian dictator, enacted that this sanction should be given beforehand to laws enacted in the *comitia centuriata,* and a *lex Maenia* of uncertain date extended the rule to elections in the same assembly, Henceforward the *patrum auctoritas* sank into a meaningless form, though as such it still survived in the time of Livy. From 287 onwards it is certain that measures passed by the plebs, voting by their tribes, had the full force of lams without any further conditions whatsoever. The legislative independence of the plebeian assembly was secured, and with this crowning victory ended the long struggle between the orders.

(b) Conquest of Italy.—Twelve years after the passing of the *lex Hortensia,* King Pyrrhus, beaten at Beneventum, withdrew from Italy, and Rome was left mistress of the peninsula.

The steps by which this supremacy had been won have now to be traced.

The expulsion of the Tarquins from Rome, followed as it seems to have been by the emancipation from Etruscan supremacy of all the country between the Tiber and the Liris, entirely altered the aspect of affairs'. North of the Tiber the powerful Etruscan city of Veii, after a vain attempt to restore the Tarquins, relapsed into an attitude of sullen hostility towards Rome, which, down to the outbreak of the final struggle in 407, found vent in constant and harassing border forays. The Sabines recommenced their raids across the Anio; from their hills to the south-east the Aequi pressed forward as far as the eastern spurs of the Alban range, and ravaged the low country between that range and the Sabine mountains; the Volsci overran the coast-lands as far as Antium, established themselves at Velitrae and even wasted the fields within a few miles of Rome. But the good fortune of Rome did not leave her to face these foes single-handed, and it is a significant fact that the history of the Roman advance begins, not with a brilliant victory, but with a timely alliance. According to Livy, it was in 493, only a few years after the defeat of the prince of Tusculum at Lake Regillus, that a treaty was concluded between Rome and the Latin communities of the Campagna. The alliance was in every respect natural. The Latins were the near neighbours



FROM FRANK, "HISTORY OF ROME" (CAPE)

MAP SHOWING GROWTH OF THE ROMAN FEDERATION UP TO 268 B.C.

and kinsmen of the Romans, and both Romans and Latins were just freed from Etruscan rule to find themselves as lowlanders and dwellers in towns face to face with a common foe in the ruder hill tribes on their borders. The exact terms of the treaty cannot, any more than the precise circumstances under which it was concluded, be stated with certainty (see LATIUM), but two points seem clear. There was at first a genuine equality in the relations between the allies; Romans and Latins, though combining for defence and offence, did so without sacrificing their separate freedom of action, even in the matter of waging wars independently of each other. But, secondly, Rome enjoyed from the first one inestimable advantage. The Latins lay between her and the most active of her foes, the Aequi and Volsci, and served to protect her territories at the expense of their own. Behind this barrier Rome grew strong, and the close of the Aequian and Volscian wars left the Latins her dependents rather than her allies. Beyond the limits of the Campagna Rome found a second ally, hardly less useful than the Latins, in the tribe of the Hernici, in the valley of the Trerus, who had equal reason with the Romans and Latins to dread the Volsci and Aequi, while their position midway between the two latter peoples made them valuable auxiliaries to the lowlanders of the Campagna.

Capture of Veii.—During the period 449–390 there is an unmistakable development of Roman power on all sides. In southern Etruria the capture of Veii (396) virtually gave Rome the mastery as far as the Ciminian forest. Sutrium and Nepete, "the gates of Etruria," became her allies and guarded her interests against any attack from the Etruscan communities to the north, while along the Tiber valley her suzerainty was acknowledged as far as Capena and Falerii. On the Anio frontier we hear of no disturbances from 449 until some ten years after the sack of Rome by the Gauls. In 446 the Aequi appear for the last time before the gates of Rome. After 418 they disappear from Mt. Algidus, and in the same year the communications of Rome and Latium with the Hernici in the Trerus valley were secured by the capture and colonization of Labicum. Successive invasions, too, broke the strength of the Volsci, and in 393 a Latin colony was founded as far south as Circeii. In part, no doubt, these Roman successes were due to the improved condition of affairs in Rome itself, consequent upon the great reforms carried between 450 and 442; but it is equally certain that now, as often afterwards, fortune befriended Rome by weakening, or by diverting the attention of, her opponents. In particular, her rapid advance in southern Etruria was facilitated by the heavy blows inflicted upon the Etruscans during the 5th century B.C. by Celts, Greeks and Samnites. By the close of this century the Celts had expelled them from the rich plains of what was afterwards known as Cisalpine Gaul, and were even threatening to advance across the Apennines into Etruria proper. The Sicilian Greeks, headed by the tyrants of Syracuse, wrested from them their mastery of the seas, and finally, on the capture of Capua by the Samnites in 423, they lost their possessions in the fertile Campanian plain. These conquests of the Samnites were part of a great southward movement of the highland Sabellian peoples.

Sack of Rome by the Gauls.—But in 390, or more probably 389, the Roman advance was for a moment checked by a disaster which threatened to alter the course of history in Italy, and which left a lasting impress on the Roman mind. In 391 a Celtic horde left their newly won lands on the Adriatic, and, crossing the Apennines into Etruria, laid siege to the Etruscan city or Clusium (Chiusi). Thence, provoked, it is said, by the conduct of the Roman ambassadors, who, forgetting their sacred character, had fought in the ranks of Clusium and slain a Celtic chief, the barbarians marched upon Rome. On July 18, 390 B.C., only a few miles from Rome, was fought the disastrous battle of the Allia. The defeat of the Romans was complete, and Rome lay at the mercy of her foe. But in characteristic fashion the Celts halted three days to enjoy the fruits of victory, and time was thus given to put the Capitol at least in a state of defence. The arrival of the barbarians was followed by the sack of the city, but the Capitol remained impregnable. For seven months they besieged it, and then in as sudden a fashion as they had come they disappeared. The Roman chroniclers explain their retreat in their own way, by the fortunate appearance of M. Furius Camillus with the troops which he had collected, at the very moment when famine bad forced the garrison on the Capitol to accept terms. More probably the news that their lands across the Apennines were threatened by the Veneti, coupled with the unaccustomed tedium of a long siege and the difficulty of obtaining supplies, inclined the Celts to accept readily a heavy ransom as the price of their withdrawal. But, whatever the reason, it is certain that they retreated, and, though during the next 50 years marauding

bands appeared at intervals in the neighbourhood of Rome, and even once penetrated as far south as Campania (361–360), the Celts never obtained any footing in Italy outside the plains in the north which they had made their own.

Annexation of Southern Etruria.—Nor, in spite of the defeat on the Allia and the sack of the city, was Rome weakened except for the moment by the Celtic attack. The storm passed away as rapidly as it had come on. The city was hastily rebuilt, and Rome dismayed the enemies who hastened to take advantage of her misfortunes by her undiminished vigour. Her conquests in southern Etruria were successfully defended against repeated attacks from the Etruscans to the north. The creation in 387 of four new tribes (Stellatina, Sabatina, Tromentina and Arnensis) marked the final annexation of the territory of Veii and of the lands lying along the Tiber valley. The addition of these tribes, containing Roman settlers as well as Veientines, increased the number and influence of the plebeian group. A few years later Latin colonies were established at Sutrium and Nepete for the more effectual defence of the frontier, and finally, in 353, Caere (*q.v.*) signed a treaty of peace for 100 years[1].

Next to the settlement of southern Etruria, the most important of the successes gained by Rome between 390 B.C. and 343 B.C. were those won against her old foes the Aequi and Volsci, and her old allies the Latins and Hernicans. The Aequi indeed, already weakened by their long feud with Rome, and hard pressed by the Sabellian tribes in their rear, were easily dealt with, and after the campaign of 389 we have no further mention of an Aequian war until the last Aequian rising in 304. The Volsci, who in 389 had advanced to Lanuvium, were met and utterly defeated by Camillus, the conqueror of Veii, and this victory was followed up by the gradual subjugation to Rome of all the lowland country lying between the hills and the sea as far south as Tarracina. Latin colonies were established at Satricum (38j), at Setia (382), and at Antium and Tarracina some time before 348. In 358 two fresh Roman tribes (Pomptina and Publilia) were formed in the same district.

Reorganization of the Latin League.—Rome had now nothing more to fear from the foes who a century ago had threatened her very existence. The lowland country, of which she was the natural centre, from the Ciminian forest to Tarracina, was quiet, and within its limits Rome was by far the strongest power. But she had now to reckon with the old and faithful allies to whose loyal aid her present position was largely due. The Latini and Hernici had suffered severely in the Aequian and Volscian wars; it is probable that not a few of the smaller communities included in the league had either been destroyed or been absorbed by larger states, and the independence of all alike was threatened by the growing power of Rome. The sack of Rome by the Celts gave them an opportunity of reasserting their independence, and we are consequently told that this disaster was immediately followed by the temporary dissolution of the confederacy, and this again a few years later by a series of actual conflicts between Rome and her former allies. Between 383 and 358 we hear of wars with Tibur, Praeneste, Tusculum, Lanuvium, Circeii and the Hernici. But in all Rome was successful. In 382 Tusculum was fully incorporated with the Roman state by the bestowal of the full franchise; in 358, according to Livy and Polybius, the old alliance was formally renewed with the Latini and the Hernici. We cannot, however, be wrong in assuming that the position of the allies under the new league was far inferior to that accorded them by the treaty of Spurius Cassius. Henceforth they were the subjects rather than the equals of Rome, a position which it is evident that they accepted much against their will, and from which they were yet to make one last effort to escape.

First Samnite War.—Rome had won her supremacy from the Ciminian forest to the Liris as the champion of the comparatively civilized communities of the lowlands against the rude highland tribes which threatened to overrun them, and so, when her legions first crossed the Liris, it was in answer to an appeal from a lowland city against invaders from the hills. While she was engaged in clearing Latium of Volsci and Aequi, the Sabellian tribes of the central Apennines had rapidly spread over the southern half of the peninsula. Foremost among these tribes were the Samnites, a portion of whom had captured the Etruscan city of Capua in 423, the Greek Cumae in 420, and had since then ruled as masters over the fertile Campanian territory. But in their new homes the conquerors soon lost all sense of relationship and sympathy with their highland brethren. They dwelt in cities, amassed wealth, and inherited the civilization of the Greeks and Etruscans whom they had dispossessed; above all, they had before long to defend themselves in their turn against the attacks of their ruder kinsmen from the hills, and it was for aid against these that the Samnites of Campania appealed to the rising state which had already made herself known as the bulwark of the lowlands north of the Liris, and which with her Latin and Hernican allies had scarcely less interest than the Campanian cities themselves in checking the raids of the highland Samnite tribes.

The Campanian appeal was listened to. Rome with her confederates entered into alliance with Capua and the neighbouring Campanian towns, and war was formally declared (343) against the Samnites. While to the Latins and Hernicans was entrusted apparently the defence of Latium and the Hernican valley against the northerly members of the Samnite confederacy; the Romans themselves undertook the task of driving the invaders out of Campania. After two campaigns the war was ended in 341 by a treaty, and the Samnites withdrew from the lowlands, leaving Rome the recognized suzerain of the Campanian cities which had sought her aid.

The Latin War.—There is no doubt that the check thus given by Rome to the advance of the hitherto invincible Sabellian highlanders not only made her the natural head and champion of the low countries, south as well as north of the Liris, but also considerably added to her prestige. Carthage sent her congratulations, and the Etruscan city of Falerii voluntarily enrolled herself among the allies of Rome. Of even greater service, however, was the fact that for 15 years the Samnites remained quiet, for this inactivity, whatever its cause, enabled Rome triumphantly to surmount a danger which theatened for the moment to wreck her whole position. This danger was nothing less than a desperate effort on the part of nearly all her allies and dependents south of the Tiber to throw off the yoke of her supremacy. The way was led by her ancient confederates the Latini, whose smouldering discontent broke into open flame directly the fear of a Samnite attack was removed. From the Latin Campagna and the Sabine hills the revolt spread westwards and southwards to Antium and Tarracina, and even to the towns of the Campanian plain, where the mass of the inhabitants at once repudiated the alliance formed with Rome by the ruling class. The struggle was sharp but short. In two pitched battles the strength of the insurrection was broken, and two more campaigns sufficed for the complete reduction of such of the insurgent communities as still held out. The revolt crushed, Rome set herself deliberately to the task of re-establishing on a new and firmer basis her supremacy over the lowlands, and in doing so laid the foundations of that marvellous organization which was destined to spread rapidly over Italy, and to withstand the attacks even of Hannibal. The old historic Latin league ceased to exist, though its memory was still preserved by the yearly Latin festival on the Alban Mount. Most if not all of the common land of the league became Roman territory; five at least of the old Latin cities were compelled to accept the Roman franchise (Livy viii. 14; Lanuvium, Aricia, Nomentum, Pedum and Tusculum) and enter the pale of the Roman State. The rest, with the Latin colonies, were ranked as Latin allies of Rome, but on terms which secured their complete dependence upon the sovereign city. The policy of isolation, which became so cardinal a principle of Roman rule, was now first systematically applied. No rights of *conubium* or *commercium* were any longer to exist between these communities. Their federal councils were prohibited, and all federal action independent of Rome forbidden.

In Campania and the coast-lands connecting Campania with Rome, a policy of annexation was considered safer than that of alliance. Of the two frontier posts of the Volsci, Antium and

[1] For the status of Caere, see *Klio* xi., 377.

Velitrae, the former was constituted a Roman colony, its long galleys burnt and their prows set up in the Forum at Rome, while the walls of Velitrae were razed to the ground, its leading men banished beyond the Tiber, and their lands given to Roman settlers. Farther south on the route to Campania, Fundi and Formiae were, after the precedent set in the case of Caere, declared Roman and granted the civil rights of Roman citizenship, while lastly in Campania itself the same status was given to Capua, Cumae and the smaller communities dependent upon them[1]. During the ten years from 338 to 328 the work of settlement was steadily continued. Tarracina, like Antium, was made a Roman colony. Privernum, the last Volscian town to offer resistance to Rome, was subdued in 330, part of its territory allotted to Roman citizens, and the state itself forced to accept the Roman franchise. Lastly, to strengthen the lines of defence against the Sabellian tribes, two colonies with the rights of Latin allies were established at Cales (334) and at Fregellae (328). The settlement of the lowlands was accomplished. As a single powerful and compact state with an outer circle of closely dependent allies, Rome now stood in sharp contrast with the disunited and degenerate cities of northern Etruria, the loosely organized tribes of the Apennines, and the decaying and disorderly Greek towns of the south.

Second Samnite War.—The strength of this system was now to be tried by a struggle with the one Italian people who were still ready and able to contest with Rome the supremacy of the peninsula. The passive attitude of the Samnites between 342 and 327 was no doubt largely due to the dangers which had suddenly threatened them in South Italy. But the death of Alexander of Epirus, in 332, removed their only formidable opponent there, and left them free to turn their attention to the necessity of checking the steady advance of Rome. In 327, the year after the ominous foundation of a Roman colony at Fregellae, a pretext for renewing the struggle was offered them. The Cumaean colony of Palaepolis had incurred the wrath of Rome by its raids into her territory in Campania. The Samnites sent a force to defend it, and Rome replied by a declaration of war. The two opponents were not at first sight unequally matched, and had the Sabellian tribes held firmly together the issue of the struggle might have been different. As it was, however, the Lucanians to the south actually joined Rome from the first, while the northern clans, Marsi, Vestini, Paeligni and Frentani, after a feeble and lukewarm resistance, subsided into a neutrality which was exchanged in 304 for a formal alliance with Rome. An even greater advantage to Rome from the outset was the enmity existing between the Samnites and the Apulians, the latter of whom from the first joined Rome and thus gave her a position in the rear of her enemy and in a country eminently well fitted for maintaining a large military force. These weaknesses on the Samnite side were amply illustrated by the events of the war.

After several years of partial success, the Romans were thoroughly defeated at Caudine Forks (321) and, in order to save their captured army, were compelled to sign a dishonourable treaty of peace. Rome, however, continued to strengthen her connections with the Lucanians and Apulians, settling a Latin colony at Luceria (314), and to draw the net of alliances more closely by winning over the Vestini and Frentani, north and east of Samnium. The Samnites accordingly, finding that peace was more dangerous than war, renewed hostilities in 316, by making a series of desperate efforts to break through the lines of defence which protected Latium and Campania. Sora and Fregellae on the upper Liris were captured by a sudden attack; the Ausones in the low country near the mouth of the same river were encouraged to revolt by the appearance of the Samnite army; and in Campania another army, attracted by rumours of disturbance, all but defeated the Roman consuls under the very walls of Capua. But these efforts were unavailing. Sora and Fregellae were recovered as quickly as they had been lost, and the frontier there was strengthened by the establishment of a colony at Interamna. The Ausones were punished by the confiscation of their territory, and Roman supremacy further secured by the two colonies of Suessa and Pontiae (313). The construction of the famous Via Appia, the work of the censor Appius Claudius Caecus, opened a safe and direct route to Campania, while the capture of Nola deprived the Samnites of their last important stronghold in the Campanian lowlands. The failure of these attempts broke the courage even of the Samnites. Their hopes were indeed raised for a moment by the news that Etruria had risen against Rome (310), but their daring scheme of effecting a union with the Etruscans was frustrated by the energy of the Roman generals. Five years later (305) the Romans revenged a Samnite raid into Campania by an invasion of Samnium itself. Arpinum on the frontier was taken, and at last, after a 22 years' struggle, the second Samnite War was closed by a renewal of the ancient treaty with Rome (304).

The six years of peace which followed (304–298) were employed by Rome in still further strengthening her position. Already, two years before the peace, a rash revolt of the Hernici had given Rome a pretext for finally annexing the territory of her ancient allies. The tribal confederacy was broken up, and all the Hernican communities, with the exception of three which had not joined the revolt, were incorporated with the Roman State as municipia, with the civil rights of the Roman franchise. Between the Hernican valley and the frontiers of the nearest Sabellian tribes lay what remained of the once formidable people of the Aequi. In their case, too, a revolt (304) was followed by the annexation of their territory, which was marked in this case by the formation there (301) of two Roman tribes (Aniensis and Teretina). Not content with thus carrying the borders of their own territory up to the very frontiers of the Sabellian country, Rome succeeded (304) in finally detaching from the Sabellian confederacy all the tribes lying between the north-east frontier of Latium and the Adriatic sea. Henceforward the Marsi, Paeligni, Vestini, Marrucini and Frentani were enrolled among the allies of Rome, and not only swelled her forces in the field but interposed a useful barrier between her enemies to the north in Etruria and Umbria and those to the south in Samnium, while they connected her directly with the friendly Apulians. Lastly, as a security for the fidelity at least of the nearest of these allies, colonies were planted in the Marsian territories at Alba Fucentia (303) and at Carsioli (298). A significant indication of the widening range of Rome's influence in Italy, and of the new responsibilities rapidly pressing upon her, is the fact that when in 302 the Spartan Cleonymus landed in the territory of the Sallentini, far away in the south-east, he was met and repulsed by an Italic and Roman force.

Third Samnite War.—Six years after the conclusion of the treaty which ended the second Samnite War, news arrived that the Samnites were harassing the Lucanians. Rome at once interfered to protect her allies. Samnium was invaded in force, the country ravaged and one stronghold after another captured. Unable any longer to hold their own in a position where they were hedged round by enemies, the Samnite leaders, turned as a last hope to the communities of northern Etruria, to the free tribes of Umbria and to the once dreaded Celts. With a splendid daring they formed the scheme of uniting all these people with themselves in a last desperate effort to break the power of Rome.

For some 40 years after the final annexation of southern Etruria (351 B.C.) matters had remained unchanged in that quarter. Sutrium and Nepete still guarded the Roman frontier; the natural boundary of the Ciminian forest was still intact; and up the valley of the Tiber, Rome had not advanced beyond Falerii, a few miles short of the most southerly Umbrian town Ocriculum. But in 311, on the expiry, apparently, of the long truce with Rome, concluded in 351, the northern Etruscans, alarmed no doubt by the rapid advances which Rome was making farther south, rose in arms and attacked Sutrium. The attack, however, recoiled disastrously upon the heads of the assailants. A Roman force promptly relieved Sutrium, and its leader, Q. Fabius Rullianus, without awaiting orders from home. boldly plunged

[1] For the controversy as to the precise status of Capua and the "equites Campani" (Livy viii. 14), *see* Beloch, *Ital. Bund*, 122 seq.; *idem, Cnmpanien,* 317; Mommsen, ***Staatsr.*** iii. 574; **Frank, *Roman Imperialism.*** 41.

into the wilds of the Ciminian forest, and crossing them safely swept with fire and sword over the rich lands to the north. Then turning southwards he met and utterly defeated the forces which the Etruscans had hastily raised in the hopes of intercepting him at the Vadimonian lake. This decisive victory ended the war. The Etruscan cities, disunited among themselves, and enervated by long years of peace, abandoned the struggle for the time, paid a heavy indemnity and concluded a truce with Rome (309–08). In the same year the promptitude of Fabius easily averted a threatened attack by the Umbrians, but Rome proceeded nevertheless to fortify herself in her invariable fashion against future dangers on this side, by an alliance with Ocriculum, which was followed ten years later (299) by a colony at Narnia, and an alliance with the Picenes, whose position in the rear of Umbria rendered them as valuable to Rome as the Apulians had proved farther south.

Fourteen years had passed since the battle on the Vadimonian lake, when the Samnites appeared on the borders of Etruria and called on the peoples of northern Italy to rise against the common enemy. Their appeal, backed by the presence of their troops, was successful. The Etruscans found courage to face the Roman legions once more; a few of the Umbrians joined them; but the most valuable allies to the Samnites were the Celts, who had for some time threatened a raid across the Apennines, and who now marched eagerly into Umbria and joined the coalition. The news that the Celts were in motion produced a startling effect at Rome, and every nerve was strained to meet this new danger. While two armies were left in southern Etruria as reserves, the two consuls, Q. Fabius Maximus Rullianus and P. Decius Mus the younger, both tried soldiers, marched northwards up the valley of the Tiber and into Umbria at the head of four Roman legions and a still larger force of Italian allies. At Sentinum, on the farther side of the Apennines, they encountered the united forces of the Celts and Samnites, the Etruscans and Umbrians having, it is said, been withdrawn for the defence of their own homes. The battle that followed was desperate, and the Romans lost one of their consuls, Decius, and more than 8,000 men. But the Roman victory was decisive. The Celts were annihilated, and the fear of a second Celtic attack on Rome removed. All danger from the coalition was over. The Etruscan communities gladly purchased peace by the payment of indemnities. The rising in Umbria, never formidable, died away, and the Samnites were left single-handed to bear the whole weight of the wrath of Rome. During four years more, however, they desperately defended their highland homes, and twice at least, in 293 and 292, they managed to place in the field a force sufficient to meet the Roman legions on equal terms. At last, in 290, the consul M. Curius Dentatus finally exhausted their power of resistance. Peace was concluded, and it is significant of the respect inspired at Rome by their indomitable courage that they were allowed to become the allies of Rome, on equal terms and without any sacrifice of independence.

Between the close of the third Samnite War and the landing of Pyrrhus in 281 B.C. we find Rome engaged, as was her wont, in quietly extending and consolidating her power. In southern Italy she strengthened her hold on Apulia by planting on the borders of Apulia and Lucania the strong colony of Venusia. In central Italy the annexation of the Sabine country (290) carried her frontiers eastwards to the borders of her Picentine allies on the Adriatic. Farther east, in the territory of the Picentes themselves, she established colonies on the Adriatic coast at Hadria and Castrum (286–283). North of the Picentes lay the territories of the Celtic Senones stretching inland to the north-east borders of Etruria, and these too now fell into her hands. Ten years after their defeat at Sentinum (285–284) a Celtic force descended into Etruria, besieged Arretium and defeated the relieving force despatched by Rome. In 283 the consul L. Cornelius Dolabella was sent to avenge the insult. He completely routed the Senones. Their lands were annexed by Rome, and a colony established at Sena on the coast. This success, followed as it was by the decisive defeat of the neighbouring tribe of the Boii, who had invaded Etruria and penetrated as far south as the Vadimonian lake, awed the Celts into quiet, and for more than 40 years there was comparative tranquillity in northern Italy.

Pyrrhus.—In the south, however, the claims of Rome to supremacy were now to be disputed by a new and formidable foe. At the close of the third Samnite War the Greek cities on the southern coast of Italy found themselves once more harassed by the Sabellian tribes on their borders, whose energies, no longer absorbed by the long struggles in central Italy, now found an attractive opening southwards.

The city of Thurii appealed to Rome for protection, and the plebeian assembly at Rome—recently given full legislative powers by the Hortensian law—voted to send the consul Fabricius to aid the Greeks. The consul easily routed the barbarians and established a garrison in the city. Thurii thus accepted Rome's suzerainty. The Tarentines, who claimed to be the protectors of the Greeks in Italy, were offended at the course taken by Thurii, and rightly feared that Rome's advance to the sea would soon compel all the cities of Magna Graecia to acknowledge the dominance of Rome's influence. While the Tarentines were debating whether to protest, several Roman ships (presumably of the *socii navales*), bound for the Adriatic colonies of Rome, appeared off the harbour of Tarentum. Since the Romans had long before signed a treaty that no Roman ships of war should sail east of the Lacinian cape, the Tarentines regarded the appearance of this squadron as a hostile act, attacked it. killed the admiral and sank most of the ships. Rome, desiring peace, asked for reparations without making a hostile demonstration, but the democratic party in Tarentum, bent upon asserting the independence and power of their city, engaged King Pyrrhus of Epirus to come to their aid and, in reliance upon his forces, declared war upon Rome (281).

King Pyrrhus (see PYRRHUS), whose timely appearance seemed for the moment to have saved the independence of Tarentum, was the most brilliant of the military adventurers whom the disturbed times following the death of Alexander the Great had brought into prominence. High-spirited, generous and ambitious, he had formed the scheme of rivalling Alexander's achievements in the East, by winning for himself an empire in the West. He aspired not only to unite under his rule the Greek communities of Italy and Sicily, but to overthrow the great Phoenician state of Carthage—the natural enemy of Greeks in the West, as Persia had been in the East. Of Rome it is clear that he knew little or nothing; the task of ridding the Greek seaports of their barbarian foes he no doubt regarded as an easy one; and the splendid force he brought with him was intended rather for the conquest of the West than for the preliminary work of chastising a few Italian tribes, or securing the submission of the unwarlike Italian Greeks. He defeated the Roman consul, M. Valerius Laevinus, on the banks of the Siris (280), and gained the support of the Greek cities as well as that of numerous bands of Samnites, Lucanians and Bruttians. But, to the disappointment of his new allies, Pyrrhus showed no anxiety to follow up his advantage. His heart was set on Sicily and Africa, and his immediate object was to come to terms with Rome. But though he advanced as near Rome as Anagnia (279), nothing could shake the resolution of the senate, and in the next year (278) he again routed the legions at Asculum (Ascoli), but only to find that the indomitable resolution of the enemy was strengthened by defeat. He now crossed into Sicily, where, though at first successful, he was unable to achieve any lasting result., Soured and disappointed, Pyrrhus returned to Italy (276) to find the Roman legions steadily moving southwards, and his Italian allies disgusted by his desertion of their cause. In 275 the decisive battle of the war was fought at Beneventum. The consul M. Curius Dentatus, the conqueror of Samnium, gained a complete victory and Pyrrhus, unable any longer to face his opponents in the field, and disappointed of all assistance from his allies, retreated in disgust to Tarentum and thence crossed into Greece.

A few years later (272) Tarentum was surrendered to Rome by its Epirot garrison; it was granted a treaty of alliance, but its walls were razed and its fleet handed over to Rome. In 270 Rhegium also entered the ranks of Roman allies, and finally in 269 a single campaign crushed the last efforts at resistance in Sam-

nium. Rome was now at leisure to consolidate the position she had won. Between 273 and 263 three new colonies were founded In Samnium and Lucania — Paestum in 273, Beneventum in 268, Aesernia in 263. In central Italy the area of Roman territory was increased by the full enfranchisement (268) of the Sabines, and of their neighbours to the east, the people of Picenum. To guard the Adriatic coast, colonies were established at Ariminum (268), at Firmum and at Castrum Novum (264), while to the already numerous maritime colonies was added that of Cosa in Etruria.

Rome the Mistress of Italy. — Rome was now the undisputed mistress of Italy. The limits of her supremacy to the north were represented roughly by a line drawn across the peninsula from the mouth of the Arnus on the west to that of the Aesis on the east. Beyond this line lay the Ligurians and the Celts; all south of it was now united as "Italy" under the rule of Rome.

But the rule of Rome over Italy, like her wider rule over the Mediterranean coasts, was not an absolute dominion over conquered subjects. It was in form at least a confederacy under Roman protection and guidance; and the Italians, like the provincials, were not the subjects, but the "allies and friends" of the Roman people. In the treatment of these allies Rome consistently followed the maxim, *divide et impera*. In every possible way she strove to isolate them from each other, while binding them closely to herself. The old federal groups were in most cases broken up, and each of the members united with Rome by a special treaty of alliance. In Etruria, Latium, Campania and Magna Graecia the city was taken as the unit; in central Italy where urban life was non-existent, the unit was the tribe. The northern Sabellian peoples, for instance — the Marsi, Paeligni, Vestini, Marrucini and Frentani — were now constituted as separate communities in alliance with Rome. In many cases, too, no freedom of trade or intermarriage was allowed between the allies themselves. Nor were all these numerous allied communities placed on the same footing as regarded their relations with Rome herself. To begin with, a sharp distinction was drawn between the "Latini" and the general mass of Italian allies. The "Latins" of this period had little more than the name in common with the old 30 Latin peoples of the days of Spurius Cassius. With a few exceptions, such as Tibur and Praeneste, the latter had either disappeared or had been incorporated with the Roman State, and the Latins of 268 B.C. were almost exclusively the "Latin colonies," that is to say, communities founded by Rome, composed partly of allies but chiefly of men of Roman blood, and whose only claim to the title "Latin" lay in the fact that Rome granted to them some portion of the rights and privileges formerly enjoyed by the old Latin cities under the Cassian treaty. Though nominally allies, they were in fact offshoots of Rome herself, bound to her by community of race, language and interest, and planted as Roman garrisons among alien and conquered peoples. The Roman citizen who joined a Latin colony lost his citizenship — to have allowed him to retain it would no doubt have been regarded as enlarging too rapidly the limits of the citizen body; but he received in exchange the status of a favoured ally. The member of a Latin colony had the right of *commercium* and down to 268 of *conubium* also with Roman citizens. Provided they left sons and property to represent them at home, they were free to migrate to Rome and acquire the Roman franchise. In war-time they not only shared in the booty, but claimed a portion of any land confiscated by Rome and declared "public." These privileges, coupled with their close natural affinities with Rome, successfully secured the fidelity of the Latin colonies, which became not only the most efficient props of Roman supremacy, but powerful agents in the work of Romanizing Italy. Below the privileged Latins stood the Italian allies; and here again we know generally that there were considerable differences of status, determined in each case by the terms of their respective treaties with Rome. We are told that the Greek cities of Neapolis and Heraclea were among the most favoured; the Bruttii, on the other hand, seem, even before the Hannibalic War, to have been less generously treated. But beyond this we have no detailed information.

Rome, however, did not rely only on this policy. Her allies were attached as closely to herself as they were clearly separated from each other, and from the first she took every security for the maintenance of her own paramount authority. Within its own borders, each ally was left to manage its own affairs as an independent State. The badges which marked subjection to Rome in the provinces — the resident magistrate and the tribute — were unknown in Italy. But in all points affecting the relations of one ally with another, in all questions of the general interests of Italy and of foreign policy, the decision rested solely with Rome. The place of a federal constitution, of a federal council, of federal officers, was filled by the Roman senate, assembly and magistrates. The maintenance of peace and order in Italy, the defence of the coasts and frontiers, the making of war or peace with foreign Powers, were matters the settlement of which Rome kept entirely in her own hands. Each allied State, in time of war, was called upon for a certain contingent of men, but, though, its contingent usually formed a distinct corps under officers of its own, its numerical strength was fixed by Rome, it was brigaded with the Roman legions, and was under the orders of the Roman consul.

The Roman State. — This paramount authority of Rome throughout the peninsula was confirmed and justified by the fact that Rome herself was now infinitely more powerful than any one of her numerous allies. Her territory, as distinct from that of the allied States, covered something like one-third of the peninsula south of the Aesis. Along the west coast it stretched from Caere to the southern borders of Campania. Inland, it included the former territories of the Aequi and Hernici, the Sabine country, and even extended eastwards into Picenum, while beyond these limits were outlying districts, such as the lands of the Senonian Celts, with the Roman colony of Sena, and others elsewhere in Italy, which had been confiscated by Rome and given over to Roman settlers. Since the first important annexation of territory after the capture of Veii (396), 12 new tribes had been formed, and the number of male citizens registered at the census had risen from 152,000 to 290,000. Within this enlarged Roman State were now included numerous communities with local institutions and government. At their head stood the Roman colonies (*coloniae civium Romanorum*), founded to guard especially the coasts of Latium and Campania. Next to these eldest children of Rome came those communities which had been invested with the full Roman franchise, such, for instance, as the old Latin towns of Aricia, Lanuvium, Tusculum, Nomentum and Pedum. Lowest in the scale were those which had not been considered ripe for the full franchise, but had, like Caere, received instead the *civitas sine suffragio*, the civil without the political rights. Their members, though Roman citizens, were not enrolled in the tribes, and in time of war served not in the ranks of the Roman legions but in separate contingents. In addition to these organized town communities, there were also the groups of Roman settlers on the public lands, and the dwellers in the village communities of the enfranchised highland districts in central Italy.

The administrative needs of this enlarged Rome were obviously such as could not be adequately satisfied by the system which had done well enough for a small city State with a few square miles of territory. The old centralization of all government in Rome itself had become an impossibility, and the Roman statesmen did their best to meet the altered requirements of the time. The urban communities within the Roman pale, colonies and *municipia*, were allowed a large measure of local self-government. In all we find local assemblies, senates and magistrates, to whose hands the ordinary routine of local administration was confided, and, in spite of differences in detail, e.g., in the titles and numbers of the magistrates, the same type of constitution prevailed throughout. But these local authorities were carefully subordinated to the higher powers in Rome. The local constitution could be modified or revoked by the Roman senate and assembly, and the local magistrates, no less than the ordinary members of the community, were subject to the paramount authority of the Roman consuls, praetors and censors. In particular, care was taken to keep the administration of justice well under central control. The Roman citizen in a colony or *municipium* enjoyed, of course, the right of appeal of the Roman people in a capital

case. We may also assume that from the first some limit was placed to the jurisdiction of the local magistrate, and that cases falling outside it came before the central authorities. But an additional safeguard for the equitable and uniform administration of Roman law, in communities to many of which the Roman code was new and unfamiliar, was provided by the institution of prefects (*praefecti iuri* dicundo), who were sent out annually, as representatives of the Roman praetor, to administer justice in the colonies and *municipia*. To prefects, moreover, were assigned the charge of those districts within the Roman pale where no urban communities, and consequently no organized local government, existed. In these two institutions, that of municipal government and that of prefectures, we have already two of the cardinal points of the later imperial system of government.

Lastly, the changes which the altered position and increased responsibilities of Rome had effected in her military system tended to weaken the intimate connection between the Roman army in the field and the Roman people at home, and thus prepared the way for that complete breach between the two which in the end proved fatal to the republic. It is true that service in the legion was still the first duty and the highest privilege of the fully qualified citizen. But this service was gradually altering in character. Though new legions were still raised each year for the summer campaigns, this was by no means always accompanied, as formerly, by the disbandment of those already on foot, and this increase in the length of time during which the citizen was kept with the standards had, as early as the siege of Veii, necessitated a further deviation from the old theory of military service—the introduction of pay. Moreover, while in the early days of the republic the same divisions served for the soldier in the legion and the citizen in the assembly, in the new manipular system, with its three lines, no regard was paid to civic distinctions, but only to length of service and military efficiency, while at the same time the more open order of fighting which it involved demanded of each soldier greater skill, and therefore a more thorough training in arms than the old phalanx. One other change resulted from the new military necessities of the time, which was as fruitful of results as the incipient separation between the citizen and the soldier. Under the early republic, the chief command of the legions rested with the consuls of the year. But, as Rome's military operations increased in area and in distance from Rome, a larger staff became necessary, and the inconvenience of summoning home a consul in the field from an unfinished campaign became intolerable. The remedy found, that of prolonging for a further period the imperium of the consul, was first applied in 327 B.C. in the case of Q. Publilius Philo, and between 327 and 264 instances of this *prorogatio imperii* became increasingly common. This proconsular authority, originally an occasional and subordinate one, was destined to become first of all the strongest force in the Republic, and ultimately the chief prop of the power of the Caesars.

Period B: Rome and the Mediterranean States, 265–146 **B.C.**—(*a*) Conquest of the West.—Though marked out by her geographical position as the natural centre of the Mediterranean, Italy had hitherto played no active part in the Mediterranean politics, but, now that she was for the first time united, it was felt throughout the Mediterranean world that a new Power had arisen, and Rome, as the head and representative of Italy, found herself irresistibly drawn into the vortex of Mediterranean affairs. Egypt sought her alliance, and Greek scholars began to interest themselves keenly in the history, constitution and character of the Latin republic which had so suddenly become famous. But Rome looked naturally westwards rather than eastwards. The western coasts of the peninsula were the most fertile and populous and wealthy; and it was in this direction that the natural openings for Italian commerce were to be found. It was, however, precisely on this side that Rome had serious ground for anxiety. Carthage was now at the height of her power. Her outposts were threateningly near to Italy in Sardinia and in Sicily, while her fleets swept the seas and jealously guarded for the benefit of Carthage alone the hidden treasures of the West. In the east of Sicily, Syracuse still upheld the cause of Greek independence against the hereditary foe of the Greek race; but Syracuse stood alone, and her resources were comparatively small. What Rome had to fear was the establishment, and that at no distant date, of an absolute Carthaginian domination over the western seas—a domination which would not only be fatal to Italian commerce, but would be a standing menace to the safety of the Italian coasts.

First Punic War, 265–241.—It was above all things essential for Rome that the Carthaginians should advance no farther eastwards. But in 265 Rome was threatened with the establishment of Carthaginian rule at Messana, within sight of the Italian coast. The intervention of both powers in a quarrel between the Mamertines, a body of Campanian mercenaries who had occupied Messana, and Hieron II. of Syracuse, led to the outbreak of war between Rome and Carthage in 264 B.C. The military history of the struggle which followed is treated in the article PUNIC WARS; it will suffice to note here that the war lasted until 241 B.C., when the Carthaginians were compelled to cede Sicily and the Lipari islands to Rome, and to pay an indemnity of 3,200 talents (about £800,000).

The struggle was one in which both Rome and Carthage were serving an apprenticeship in a warfare the conditions of which were unfamiliar to both. The Roman legions were foes very unlike any against which the Carthaginian leaders had ever led their motley array of mercenaries, while Rome was called upon for the first time to fight a war across the sea, and to fight with ships against the greatest naval power of the age. The chief dangers for Carthage lay obviously in the jealousy exhibited at home of her officers abroad, in the difficulty of controlling her mercenary troops, and in the ever-present possibility of disaffection among her subjects in Libya—dangers which even the genius of Hannibal failed finally to surmount. Rome, on the other hand, was strong in the public spirit of her citizens, the fidelity of her allies, the valour and discipline of her legions. What she needed was a system which would make a better use of her splendid materials than one under which her plans were shaped from day to day by a divided senate, and executed by officers who were changed every year, and by soldiers most of whom returned home at the close of each summer's campaign.

The interval between the first and second Punic Wars was employed by both Rome and Carthage in strengthening their respective positions. The eastern end of Sicily was still left under the rule of Hieron as the ally of Rome, but the larger western portion of the island became directly subject to Rome, and a temporary arrangement seems to have been made for its government, either by one of the two praetors, or possibly by a quaestor. Sardinia and Corsica had not been surrendered to Rome by the treaty of 241, but three years later (239), on the invitation of the Carthaginian mercenaries stationed in the islands, a Roman force occupied them; Carthage protested, but, on the Romans threatening war, she gave way, and Sardinia and Corsica were formally ceded to Rome, though it was some seven or eight years before all resistance on the part of the natives themselves was crushed. In 227, however, the senate considered matters ripe for the establishment of a separate administration in her oversea possessions. In that year two additional praetors were elected; to one was assigned the charge of western Sicily, to the other that of Sardinia and Corsica, and thus the first stones of the Roman provincial system were laid. Of at least equal importance for the security of the peninsula was the subjugation of the Celtic tribes in the valley of the Po. These, headed by the Boii and Insubres and assisted by levies from the Celts to the westward, had in 225 alarmed the whole of Italy by invading Etruria and penetrating to Clusium, only three days' journey from Rome. Here, however, their courage seems to have failed them. They retreated northwards along the Etruscan coast, until at Telamon their way was barred by the Roman legions returning from Sardinia to the defence of Rome, while a second consular army hung upon their rear. Thus hemmed in, the Celts fought desperately, but were completely defeated and the flower of their tribesmen slain. The Romans followed up their success by invading the Celtic territory. The Boii were easily reduced to submission. The Insubres, north of the Po, resisted more obstinately, but by 222 the war was over,

and all the tribes in the rich Po valley acknowledged the supremacy of Rome. The conquered Celts were not enrolled among the Italian allies of Rome, but were treated as subjects beyond the frontier. Two colonies were founded to hold them in check—Placentia (218) and Cremona in the territory of the Insubres—and the great northern road (Via Flaminia) was completed as far as the Celtic border at Ariminum.

On the Adriatic coast the immediate interests of Rome were limited to rendering the sea safe for Italian trade. It was with this object that, in 229, the first Roman expedition crossed the Adriatic, and inflicted severe chastisement on the Illyrian pirates of the opposite coast. This expedition was the means of establishing for the first time direct political relations between Rome and the states of Greece proper, to many of which the suppression of piracy in the Adriatic was of as much importance as to Italy. Alliances were concluded with Corcyra, Epidamnus and Apollonia; and embassies explaining the reasons which had brought Roman troops into Greece were sent to the Aetolians, the Achaeans and even to Athens and Corinth. Everywhere they were well received, and the admission of the Romans to the Isthmian games (228) formally acknowledged them as the natural allies of the free Greek states against both barbarian tribes and foreign despots. Meanwhile Carthage had acquired a possession which promised to compensate her for the loss of Sicily, Sardinia and Corsica. The genius of her greatest citizen and soldier, Hamilcar Barca, had appreciated the enormous value of the Spanish peninsula, and conceived the scheme of founding there a Carthaginian dominion which should not only add to the wealth of Carthage, but supply her with a base of operations for a war of revenge with Rome. The conquest of southern and eastern Spain, begun by Hamilcar (236–228) and carried on by his kinsman Hasdrubal (228–221), was completed by his son Hannibal, who, with all his father's genius, inherited also his father's hatred of Rome, and by 219 the authority of Carthaqe had been extended as far as the Ebro (see SPAIN, History). Rome's ancient ally Massilia (mod. Marseilles) was especially disturbed by these advances, for she had trading posts on the coast of Spain which would become unprofitable if Carthage conquered the whole of the interior and drew the commerce of the peninsula southwards to the Punic ports. Furthermore, since Carthage forbade Massiliot traders to make use of the straits of Gibraltar, Massiliot trade in British tin would be endangered if Carthage succeeded in reaching southern Gaul. From the fact that Marseilles lent her whole navy to Rome when the war broke out we may assume that her envoys were active in reporting the advance of Carthage in Spain and in interpreting that advance as aimed at Rome. Rome finally was induced to act. A defensive alliance was signed with Saguntum, a seaport of Spain which was still independent, and Hasdrubal was asked to promise that Carthage should not carry her arms beyond the Ebro river (226).

Second Punic War, 218–211.—But these precautions were of no avail against the resolute determination of Hannibal, with whom the conquest of Spain was only preliminary to an attack upon Italy, and who could not afford to leave behind him in Spain a state. allied to Rome. In 219, therefore, disregarding the protests of a Roman embassy, he attacked and took Saguntum, an act which, as he had foreseen, rendered a rupture with Rome inevitable, while it set his own hands free for a further advance.

For the details of the war which followed, see the articles PUNIC WARS; HANNIBAL; and SCIPIO, PUBLIUS CORNELIUS. From the outbreak of hostilities until the crowning victory of Cannae in 216 Hannibal's career of success was unchecked; and the annihilation of the Roman army in that battle was followed by the defection of almost the whole of southern Italy, with the exception of the Latin colonies and the Greek coast towns. In 21 j, moreover, Philip V. of Macedon formed an alliance with Hannibal and threatened to invade Italy; in 214 Syracuse revolted, and in 212 the Greek cities in northern Italy went over to Hannibal. But the indomitable spirit of the Romans asserted itself in the face of these crushing misfortunes. In 212 Syracuse was recovered; in 211 Capua fell after a long siege which Hannibal failed to raise, even by his famous march up to the gates of Rome, and in the same year a coalition was formed in Greece against Philip V. of Macedon, which effectually paralysed his offensive action. Hannibal was now confined to Lucania and Bruttium; and his brother Hasdrubal, marching from Spain to join him, was defeated and slain on the river Metaurus (207). The war in Italy was now virtually ended, for, though during four years more Hannibal stood at bay in a corner of Bruttium, he was powerless to prevent the restoration of Roman authority throughout the peninsula. Sicily was once more secure; and finally in 206, the year after the victory on the Metaurus, the successes of the young P. Scipio in Spain (211–206) were crowned by the complete expulsion of the Carthaginians from the peninsula. On his return from Spain Scipio eagerly urged an immediate invasion of Africa. The senate hesitated; but Scipio gained the day. He was elected consul for 205, and given the province of Sicily, with permission to cross into Africa if he thought fit. Voluntary contributions of men, money and supplies poured in to the support of the popular hero; and by the end of 205 Scipio had collected in Sicily a sufficient force for his purpose. In 204 he crossed to Africa, where he was welcomed by the Numidian prince Massinissa, whose friendship he had made in Spain. In 203 he twice defeated the Carthaginian forces, and a large party at Carthage were anxious to accept his offer of negotiations. But the advocates of resistance triumphed.

Hannibal was recalled from Italy, and returned to fight his last battle against Rome at Zama, where Scipio, who had been continued in command as proconsul for 202 by a special vote of the people, won a complete victory. The war was over. The Roman assembly voted that the Carthaginian request for peace should be granted, and entrusted the settlement of the terms to Scipio and a commission of ten senators. Carthage was allowed to retain her territory in Africa; but she undertook to wage no wars outside Africa, and none inside without the consent of Rome. She surrendered all her ships but ten triremes, her elephants, and all prisoners of war, and agreed to pay an indemnity of 10,000 talents in 50 years. The Numidian Massinissa (*q.v.*) was rewarded by an increase of territory, and was enrolled among the "allies and friends" of the Roman people.

The West Under Roman Rule.—Thebattle of Zama decided the fate of the West. The power of Carthage was broken and her supremacy passed to Rome. Henceforth Rome had no rival to fear westward of Italy, and it rested with herself to settle within what limits her supremacy should be confined and what form it should take. In Sicily the former dominions of Hieron were at once united with the western half of the island as a single province, and in Spain, after nine years of a provisional Government (206–197), two provinces were in 197 definitely established, and each, like Sicily, assigned to one of the praetors for the year, two additional praetors being elected for the purpose. But here the resemblance between the two cases ends. From 201 down to the outbreak of the Slave War in 136 there was unbroken peace in Sicily, and its part in the history is limited to its important functions in supplying Rome with corn and in provisioning and clothing the Roman legions. The governors of the two Spains had very different work to do from that which fell to the lot of the Sicilian praetors. The condition of Spain required that year after year the praetors should be armed with the consular authority, and backed by a standing force of four legions, while more than once the presence of the consuls themselves was found necessary. Still, in spite of all difficulties, the work of pacification proceeded. To M. Porcius Cato (consul, 195) and to Tiberius Sempronius Gracchus (praetor and pro-praetor, 180–179), father of the two tribunes, is mainly due the credit of quieting the Celtiberian tribes of central Spain, and the government of Gracchus was followed by 30 years of comparative tranquillity. The insurrection headed by Viriathus in 149 was largely caused by exactions of the Roman magistrates themselves, while its obstinate continuance down to the capture of Numantia, in 133, was almost as much the result of the incapacity of the Roman commanders. But the re-settlement of the country by Scipio Africanus the younger in that year left all Spain, with the exception of the highland Astures and Cantabri in the north-west, finally and tranquilly subject to

Rome.

Third Punic War, 153–146.—In Africa there was no question at first of the introduction of Roman government by the formation of a province *(see* AFRICA, ROMAN). Carthage, bound hand and foot by the treaty of 201, was placed under the jealous watch of the loyal prince of Numidia, who himself willingly acknowledged the suzerainty of Rome. But it was impossible for this arrangement to be permanent. Every symptom of reviving prosperity at Carthage was regarded at Rome with feverish anxiety, and neither the expulsion of Hannibal in 195 nor his death in 183 did much to check the growing conviction that Rome would never be secure while her rival existed. It was therefore with grim satisfaction that many in the Roman senate watched the increasing irritation of the Carthaginians under the harassing raids and encroachments of their favoured neighbor Massinissa, and waited for the moment when Carthage should, by some breach of the conditions imposed upon her, supply Rome with a pretext for interference. At last in 151 came the news that Carthage, in defiance of treaty obligations, was actually at war with Massinissa. The anti-Carthaginian party in the senate, headed by M. Porcius Cato, eagerly seized the opportunity, and war was declared, and nothing short of the destruction of their city itself was demanded from the despairing Carthaginians. The demand was refused and in 149 the siege of Carthage begun. During the next two years little progress was made, but in 147 P. Cornelius Scipio Aemilianus, grandson by adoption of the conqueror of Hannibal, was, at the age of 37, and though only a candidate for the aedileship, elected consul and given the command in Africa. In the next year (146) Carthage was taken and razed to the ground. Its territory became the Roman province of Africa, while Numidia, now ruled by the three sons of Massinissa, remained as an allied state under Roman suzerainty, and served to protect the new province against the raids of the desert tribes (see CARTHAGE).

In Italy itself the Hannibalic War had been followed by important changes. In the north the Celtic tribes paid for their sympathy with Hannibal by the final loss of all separate political existence. Cispadane Gaul, studded with colonies and flooded with Roman settlers, was rapidly Romanized. Beyond the Padus (Po) in Polybius's time Roman civilization was already widely spread. In the extreme north-east the Latin colony of Aquileia, the last of its kind, was founded in 181, to control the Alpine tribes, while in the north-west the Ligurians were held in check by the colony of Luna (180), and by the extensive settlements of Roman citizens and Latins made on Ligurian territory in 173. In southern Italy the depression of the Greek cities on the coast, begun by the raids of the Sabellian tribes, was completed by the repeated blows inflicted upnn them during the Hannibalic struggle. Some of them lost territory[1]; all suffered from a decline of population and loss of trade; and their place was taken by such new Roman settlements as Brundisium (Brindisi) and Puteoli (Pozzuoli) In the interior the southern Sabellian tribes suffered scarcely less severely. The Bruttii were struck off the list of Roman allies, and nearly all their territory was confiscated. To the Apulians and Lucanians no such hard measure was meted out; but their strength had been broken by the war, and their numbers dwindled; large tracts of land in their territories were seized by Rome, and allotted to Roman settlers, or occupied by Roman speculators. That Etruria also suffered from declining energy, a dwindling population, and the spread of large estates is clear from the state of things existing there in 133. It was indeed in central Italy, the home of the Latins and their nearest kinsmen, and in the new Latin and Roman settlements throughout the peninsula, that progress and activity were henceforth concentrated.

(*b*) **Rome in the East, 200–133.**—Ever since the repulse of Pyrrhus from Italy, Rome had been slowly drifting into closer contact with the eastern states. With one of the three great powers which had divided between them the empire of Alexander, with Egypt, she had friendly relations since 273, and the friendship had been cemented by the growth of commercial intercourse between the two countries. In 228 her chastisement of the Illyrian pirates had led naturally enough to the establishment of friendly relations with some of the states of Greece proper. In 214 the alliance between Philip V. and Hannibal, and the former's threatened attack on Italy, forced her into war with Macedon, at the head of a coalition of the Greek states against him, which effectually frustrated his designs against herself; at the first opportunity, however (205), she ended the war by a peace which left the position unchanged. The results of the war were not only to draw closer the ties which bound Rome to the Greek states, but to inspire the senate with a genuine dread of Philip's restless ambition, and with a bitter resentment against him for his union with Hannibal. The events of the next four years served to deepen both these feelings. In 205 Philip entered into a compact with Antiochus III. of Syria for the partition between them of the dominions of Egypt, now left by the death of Ptolemy Philopator to the rule of a boy-king. Antiochus was to take Coele-Syria and Phoenicia, while Philip claimed for his share the districts subject to Egypt on the coasts of the Aegean and the Greek islands. Philip no doubt hoped to be able to secure these unlawful acquisitions before the close of the second Punic War should set Rome free to interfere with his plans. But the obstinate resistance offered by Attalus of Pergamum and the Rhodians upset his calculations. In 201 Rome made peace with Carthage, and the senate had leisure to listen to the urgent appeal for assistance which reached her from her Eastern allies. With Antiochus indeed the senate was not yet prepared to quarrel; but with Philip the senate was ready to have a serious discussion despite the depletion of all resources. Philip had compelled Rome to give way to him in Illyricum, and he had proved by his attack on Egypt that he would prove to be a dangerous neighbour in time of peril. Furthermore philhellenism had grown very strong at Rome since Livius, Naevius and Ennius had translated scores of Greek plays for production at the Roman festivals. To the nobles who were now eagerly reading Homer, Plato and Euripides, the appeal of the old Greek cities for protection of independence, democracy and culture in Greece came to open ears. The people, to be sure, remembering all too well what they had suffered in the last war, at first rejected the senate's proposal to aid the Greeks, but the nobles, insisting that postponement would only result in a Macedonian invasion of Italy, finally secured a declaration of war (200).

Second Macedonian War, 200–197.—The war began in the summer of 200 B.C., and, though the landing of the Roman legions in Epirus was not followed, as had been hoped, by any general rising against Philip, yet the latter made no progress south of Boeotia. The fleets of Pergamum and Rhodes, now the zealous allies of Rome, protected Attica and watched the eastern coasts. The Achaeans and Nabis of Sparta were obstinately neutral, while nearer home in the north the Epirots and Aetolians threatened Thessaly and Macedonia. His own resources both in men and in money had been severely strained by his constant wars, and the only ally who could have given him effective assistance, Antiochus, was fully occupied with the conquest of Coele-Syria. It is no wonder then that, in spite of his dashing generalship and high courage, he made but a brief stand. T. Quinctius Flamininus (consul, 198), in his first year of command, defeated him on the Aous, drove him back to the pass of Tempe, and in the next year utterly routed him at Cynoscephalae. Almost at the same moment the Achaeans, who had now joined Rome, took Corinth, and the Rhodians defeated his troops in Caria. Further resistance was impossible; Philip submitted, and early the next year a Roman commission reached Greece with instructions to arrange terms of peace. These were such as effectually secured Rome's main object in the war, the removal of all danger to herself and her allies from Macedonian aggression. Philip was left in possession of his kingdom, but was degraded to the rank of a second-rate Power, deprived of all possessions in Greece, Thrace and Asia Minor, and forbidden, as Carthage had been in 201, to wage war without the consent of Rome, whose ally and friend he now became.

The second point in the settlement now eifected by Rome was the liberation of the Greeks. The "freedom of Greece" was

[1] *E.g.,* Tarenturn, Livy, xliv. 16. A Roman colony was established at Croton in 194, and a Latin colony (Copia) at Thurii in 193 (Livy, xxxiv. 45, 53).

proclaimed at the Isthmian games amid a scene of wild enthusiasm, which reached its height when two years later (194) Flamininus withdrew his troops even from the "three fetters of Greece"—Chalcis, Demetrias and Corinth. There is no reason to doubt that, in acting thus, not only Flamininus himself, but the senate and people at home were influenced, partly at any rate, by feelings of genuine sympathy with the Greeks and reverence for their past. It is equally clear that no other course was open to them. For Rome to have annexed Greece, as she had annexed Sicily and Spain, would have been a flagrant violation of the pledges she had repeatedly given both before and during the war; the attempt would have excited the fiercest opposition, and would probably have thrown the Asiatic as well as the European Greeks into the arms of Antiochus. But a friendly and independent Greece would be at once a check on Macedon and a barrier against aggression from the East. Nor while liberating the Greeks did Rome abstain from such arrangements as seemed necessary to secure the predominance of her own influence. In the Peloponnese, for instance, the Achaeans were rewarded by considerable accessions of territory; and it is possible that the Greek states, as allies of Rome, were expected to refrain from war upon each other without her consent.

War with Antiochus, **192–189.**—Antiochus III. of Syria, Philip's accomplice in the proposed partition of the dominions of their common rival, Egypt, returned from the conquest of Coele-Syria (198) to learn first of all that Philip was hard pressed by the Romans, and shortly afterwards that he had been decisively beaten at Cynoscephalae. It was already too late to assist his former ally, but Antiochus resolved at any rate to lose no time in securing for himself the possessions of the Ptolemies in Asia Minor and in eastern Thrace, which Philip had claimed, and which Rome now pronounced free and independent. In 197–196 he overran Asia Minor and crossed into Thrace. But Antiochus was pleasure-loving, irresolute, and no general, and it was not until 192 that the urgent entreaties of the Aetolians, and the withdrawal of the Roman troops from Greece, nerved him to the decisive step of crossing the Aegean; even then the force he took with him was so small as to show that he completely failed to appreciate the nature of the task before him. At Rome the prospect of a conflict with Antiochus excited great anxiety, and it was not until every resource of diplomacy had been exhausted that war was declared, and the real weakness which lay behind the once magnificent pretensions of the "king of kings" was revealed.

Had Antiochus acted with energy when in 192 he landed in Greece, he might have won the day before the Roman legions appeared. As it was, in spite of the warnings of Hannibal, who was now in his camp, and of the Aetolians, he frittered away valuable time between his pleasures at Chalcis and useless attacks on petty Thessalian towns. In 191 Acilius Glabrio landed at the head of an imposing force; and a single battle at Thermopylae broke the courage of Antiochus, who hastily recrossed the sea to Ephesus, leaving his Aetolian allies to their fate. But Rome could not pause here. The safety of her faithful allies, the Pergamenes and Rhodians, and of the Greek cities in Asia Minor, as well as the necessity of chastising Antiochus, demanded an invasion of Asia. A Roman fleet had already (191) crossed the Aegean, and in concert with the fleets of Pergamum and Rhodes worsted the navy of Antiochus. In 190 the new consul L. Scipio, accompanied by his famous brother, the conqueror of Africa, led the Roman legion for the first time into Asia. At Magnesia ad Sipylum, in Lydia, he met and defeated the motley and ill-disciplined hosts of the great king. For the first time the West, under Roman leadership, successfully encountered the forces of the East, and the struggle began which lasted far on into the days of the emperors. The terms of the peace which followed the victory at Magnesia tell their own story clearly enough. There is no question, any more than in Greece, of annexation; the main object in view is that of securing the predominance of Roman interests and influence throughout the peninsula of Asia Minor, and removing to a safe distance the only eastern Power which could be considered dangerous. The line of the Halys and the Taurus range, the natural boundary of the peninsula eastwards, was established as the boundary between Antiochus and the kingdoms, cities and peoples now enrolled as the allies and friends of Rome. This line Antiochus was forbidden to cross; nor was he to send ships of war farther west than Cape Sarpedon in Cilicia. Immediately to the west of this frontier lay Bithynia, Paphlagonia and the immigrant Celtic Galatae, and these frontier states, now the allies of Rome, served as a second line of defence against attacks from the east. The area lying between these "buffer states" and the Aegean was organized by Rome in such a way as should at once reward the fidelity of her allies and secure both her own paramount authority and safety from foreign attack. Pergamum and Rhodes were so strengthened—the former by the gift of the Chersonese, Lycaonia, Phrpgia, Mysia and Lydia, the latter by that of Lycia and Caria—as not only amply to reward their loyalty, but to constitute them effective props of Roman interests and effective barriers alike against Thracian and Celtic raids in the north and Syrian aggression in the south. Lastly, the Greek cities on the coast, except those already tributary to Pergamum, were declared free, and established as independent allies of Rome.

In a space of little over 11 years (200–189) Rome had broken the power of Alexander's successors and established throughout the eastern Mediterranean a Roman protectorate.

Third Macedonian War, 171–168.—It was in the western half of this protectorate that the first steps in the direction of annexation were taken. The enthusiasm provoked by the liberation of the Greeks had died away, and its place had been taken by feelings of dissatisfied ambition or sullen resentment. Internecine feuds and economic distress had brought many parts of Greece to the verge of anarchy, and, above all, the very foundations of the settlement effected in 197 were threatened by the reviving power and aspirations of Macedon. Loyally as Philip had aided Rome in the war with Antiochus, the peace of Magnesia brought him nothing but fresh humiliation. He was forced to abandon all hopes of recovering Thessaly, and he had the mortification to see the hated king of Pergamum installed almost on his borders as master of the Thracian Chersonese. Resistance at the time was unavailing, but from 189 until his death (179) he laboured patiently and quietly to increase the internal resources of his own kingdom, and to foment, by dexterous intrigue, feelings of hostility to Rome among his Greek and barbarian neighbours. His successor, Perseus, his son by a left-handed alliance. continued his father's work. He made friends among the Illyrian and Thracian princes, connected himself by marriage with Antiochus IV. of Syria and with Prusias of Bithynia, and, among the Greek peoples, strove, not without success, to revive the memories of the past glories of Greece under the Macedonian leadership of the Great Alexander. The senate could no longer hesitate. They were well aware of the restlessness and discontent in Greece; and after hearing from Eumenes of Pergamum and from their own officers, all details of Perseus's intrigues and preparations, they declared war. The struggle, in spite of Perseus's courage and the incapacity at the outset of the Roman commanders, was short and decisive. The sympathy of the Greeks with Perseus, which had been encouraged by the hitherto passive attitude assumed by Rome, instantly evaporated on the news that the Roman legions were on their way to Greece. No assistance came from Prusias or Antiochus, and Perseus's only allies were the Thracian king Cotys and the Illyrian Genthius. The victory gained by L. Aemilius Paulus at Pydna (168) ended the war. Perseus became the prisoner of Rome, and as such died in Italy a few years later. Rome had begun the war with the fixed resolution no longer of crippling but of destroying the Macedonian State. Perseus's repeated proposals for peace during the war had been rejected; and his defeat was followed by the final extinction of the kingdom of Philip and Alexander. Macedonia, though it ceased to exist as a single State, was not, however, definitely constituted a Roman province. On the contrary, the mistake was made of introducing some of the main principles of the provincial system—taxation, disarmament and the isolation of the separate communities—without the addition of the element most essential for the maintenance of order—that of a resident Roman governor. The four petty republics now created mere each

autonomous, and each separated from the rest by the prohibition of *commercium* and *conubium*, but no central controlling authority was substituted for that of the Macedonian king. The inevitable result was confusion and disorder, resulting finally (149–48) in the attempt of a pretender, Andriscus, who claimed to be a son of Perseus, to resuscitate the ancient monarchy. On his defeat in 148 the senate declared Macedonia a Roman province, and placed a Roman magistrate at its head.

From 189 to the defeat of Perseus in 168 no formal change of importance in the status of the Greek states had been made by Rome. The senate, though forced year after year to listen to the mutual recriminations and complaints of rival communities and factions, contented itself as a rule with intervening just enough to remind the Greeks that their freedom was limited by its own paramount authority, and to prevent any single state or confederacy from raising itself too far above the level of general weakness which it was the interest of Rome to maintain. After the victory at Pydna, however, the sympathy shown for Perseus, exaggerated as it seems to have been by the interested representations of the romanizing factions in the various states, was made the pretext for a more emphatic assertion of Roman ascendancy. All those suspected of Macedonian leanings were removed to Italy, as hostages for the loyalty of their several communities, and the real motive for the step was made clear by the exceptionally severe treatment of the Achaeans, whose loyalty was not really doubtful, but whose growing power in the Peloponnese and independence of language had awakeped alarm at Rome. A thousand of their leading men, among them the historian Polybius, were carried off to Italy (see POLYBIUS). In Aetolia the Romans connived at the massacre by their so-called friends of 500 of the opposite party. Acarnania was weakened by the loss of Leucas, while Athens was rewarded for her unambitious loyalty by the gift of Delos and Samos.

But this somewhat violent experiment only answered for a time. In 148 the Achaeans rashly persisted, in spite of warnings, in attempting to compel Sparta by force of arms to submit to the league. When threatened by Rome with the loss of all that they had gained since Cynoscephalae, they madly rushed into war. They were easily defeated, and a "commission of ten," under the presidency of L. Mummius, was appointed by the senate thoroughly to resettle the affairs of Greece. Corinth, by orders of the senate, was burnt to the ground and its territory confiscated. Thebes and Chalcis were destroyed, and the walls of all towns which had shared in the last desperate outbreak were razed to the ground. All the existing confederacies were dissolved; no *commercium* was allowed between one community and another. Everywhere an aristocratic type of constitution was established, and the payment of a tribute was apparently imposed. Into Greece, as into Macedonia in 167, the now familiar features of the provincial system were introduced-disarmament, isolation and taxation. The Greeks were still nominally free, and no separate province with a governor of its own was established, but the needed central control was provided by assigning to the neighbouring governor of Macedonia a general supervision over the affairs of Greece. From the Adriatic to the Aegean, and as far north as the river Drilo and Mt. Scardus, the whole peninsula was now under direct Roman rule.

The Roman Protectorate in Asia.—Beyond the Aegean the Roman protectorate worked no better than in Macedonia and Greece, and the quarrels and disorders which flourished under its shadow were aggravated by its longer duration and by the still more selfish view taken by Rome of her responsibilities. At one period indeed, after the battle of Pydna, it seemed as if the more vigorous, if harsh, system then initiated in Macedon and Greece was to be adopted farther east also. The levelling policy pursued towards Macedon and the Achaeans was applied with less justice to Rome's two faithful and favoured allies, Rhodes and Pergamum. The former had rendered themselves obnoxious to Rome by their independent tone. On a charge of complicity with Perseus they were threatened with war, and though this danger was averted they were forced to exchange their equal alliance with Rome for one which placed them in close dependence upon her, and to resign the lucrative possessions in Lycia and Caria given them in 189. Finally, their commercial prosperity was ruined by the establishment of a free port at Delos. With Eumenes of Pergamum no other fault could be found than that he was strong and successful; but this was enough. His brother Attalus was invited, but in vain, to become his rival. His turbulent neighbours, the Galatae, were allowed to harass him by raids. Pamphylia was declared independent, and favours were heaped upon Prusias of Bithynia. These and other annoyances and humiliations had the desired effect. Eumenes and his two successors—his brother and son, Attalus II. and Attalus III.—contrived indeed by studious humility and dexterous flattery to retain their thrones, but Pergamum (*q.v.*) ceased to be a powerful State, and its weakness, added to that of Rhodes, increased the prevalent disorder in Asia Minor. During the same period we have other indications of a temporary activity on the part of Rome. The frontier of the protectorate was pushed forward to the confines of Armenia by alliances with the kings of Pontus and Cappadocia beyond the Halys. In Syria, on the death of Antiochus Epiphanes (164), Rome intervened to place a minor, Antiochus Eupator, on the throne, under Roman guardianship. In 168 Egypt formally acknowledged the suzerainty of Rome, and in 163 the senate, in the exercise of this new authority, restored Ptolemy Philometor to his throne, but at the same time weakened his position by handing over Cyrene and Cyprus to his brother Euergetes.

But this display of energy was short-lived. From the death of Eumenes in 159 down to 133 Rome, secure in the absence of any formidable power in the East, and busy with affairs in Macedonia, Africa and Spain, relapsed into an inactivity the disastrous results of which revealed themselves in the next period, in the rise of Mithridates of Pontus, the spread of Cretan and Cilician piracy, and the advance of Parthia.

'Both the western and eastern Mediterranean now acknowledged the suzerainty of Rome, but her relations with the two were from the first different. The West fell to her as the prize of victory over Carthage, and, the Carthaginian power broken, there was no hindrance to the immediate establishment in Sicily, Sardinia, Spain, and finally in Africa, of direct Roman rule. To the majority, moreover, of her western subjects she brought a civilization as well as a government of a higher type than any before known to them. And so in the West she not only formed provinces but created a new and wider Roman world. To the East, on the contrary, she came as the liberator of the Greeks; and it was only slowly that in this part of the empire her provincial system made way. In the East, moreover, the older civilization she found there obstinately held its ground. Her proconsuls governed and her legions protected the Greek communities, but to the last the East remained in language, manners and thought Greek and not Roman.

(*c*) The Period of the Revolution (146–49 B.C.).—In the course of little more than a century, Rome had become the supreme power in the civilized world. Although in its outward form her old constitution had undergone little change during the age of war and conquest from 265 to 146, the causes, both internal and external, which brought about its fall had been silently at work throughout. Its form was in strictness that of a moderate democracy. The patriciate had ceased to exist as a privileged caste, and there was no longer any order of nobility recognized by the constitution. The senate and the offices of state were in law open to all, and the will of the people in assembly had been in the most explicit and unqualified manner declared to be supreme alike in the election of magistrates, in the passing of laws, and in all matters touching the *caput* of a Roman citizen. But in practice the constitution had become an oligarchy. The senate, not the assembly, ruled Rome, and both the senate and the magistracies were in the hands of a class which, in defiance of the law, arrogated to itself the title and the privileges of a nobility. The ascendancy of the senate is too obvious and familiar a fact to need much illustration here. It was but rarely that the assembly was called upon to decide questions of policy, and then the proposal was usually made by the magistrate in obedience to the

express directions of the senate. In the enormous majority of cases the matter was settled by a *senatus consultum,* without any reference to the people at all. The assembly decides for war or peace, but the conduct of the war and the conditions of peace are matters left to the senate (*q.v.*). Now and then the assembly confers a command upon the man of its choice, or prolongs the *imperium* of a magistrate, but, as a rule, these and all questions connected with foreign affairs are settled within the walls of the senate-house. It is the senate which year after year assigns the commands and fixes the number and disposition of the military forces, directs the organization of a new province, conducts negotiations and forms alliances. Within Italy, though its control of affairs was less exclusive, we find that, besides supervising the ordinary current business of administration, the senate decides questions connected with the Italian allies, sends out colonies, allots lands, and directs the suppression of disorders. Lastly, both in Italy and abroad it managed the finances. Inseparably connected with this monopoly of affairs to the exclusion of the assembly was the control which in practice, if not in theory, the senate exercised over the magistrates. The latter had become what Cicero wrongly declares they were always meant to be, merely the subordinate ministers of the supreme council, which assigned them their departments, provided them with the necessary equipment, claimed to direct their conduct, prolonged their commands, and rewarded them with triumphs. It was now at once the duty and the interest of a magistrate to be in *auctoritate senatus,* "subject to the authority of the senate," and even the once formidable *tribuni plebis* are found during this period actively and loyally supporting the senate, and acting as its spokesmen in the assembly.

The Senatorial Government. — Behind both senate and magistrates, lay the whole power and influence of the new nobility. These *nobiles* were essentially distinct from the older and more legitimate patrician aristocracy. Every patrician was of course noble, but the majority of the "noble families" in 146 were not patrician but plebeian. The title had been gradually appropriated, since the opening of the magistracies, by those families whose members had held the consulship. It was thus in theory within the reach of any citizen who could win this office, and, moreover, it carried with it no legal privileges whatsoever. Gradually, however, the ennobled plebeian families drew together, and combined with the older patrician *gentes* to form a distinct order. Office brought wealth and prestige, and both wealth and prestige were liberally employed in securing for this select circle a monopoly of political power, and excluding new men. Already by the close of the period it was rare for anyone but a noble to find his way into high office or into the senate. The senate and magistrates were the mouthpieces of this order, and identified with it in policy and interest Lastly, it must be allowed that both the senate and the nobility had to some extent justified their power by the use they made of it. It was their tenacity of purpose and devoted patriotism which had carried Rome through the dark days of the Hannibalic War. The heroes of the struggle with Carthage belonged to the leading families; the disasters at the Trasimene lake and at Cannae were associated with the blunders of popular favourites.

From the first, however, there was an inherent weakness in this senatorial government. It had no sound constitutional basis, and with the removal of its accidental supports it fell to the ground. Legally the senate had no positive authority. It could merely advise the magistrate when asked to do so, and its decrees were strictly only suggestions to the magistrate, which he was at liberty to accept or reject as he chose. It had, it is true, become customary for the magistrate not only to ask the senate's advice on all important points, but to follow it when given. But it was obvious that if this custom were weakened, and the magistrates chose to act independently, the senate was powerless. It might indeed anathematize the refractory official, or hamper him if it could by setting in motion against him a colleague or the tribunes, but it could do no more, and these measures failed just where the senate's control was most needed and most difficult to maintain — in its relations with the generals and governors of provinces abroad. The virtual independence of the proconsul was before 146 already exciting the jealousy of the senate and endangering its supremacy. Nor again had the senate any legal hold over the assembly. Except in certain specified cases, it rested with the magistrate to decide whether any question should be settled by a decree of the senate or a vote of the assembly. If he decided to make a proposal to the assembly, he was not bound except by custom to obtain the previous approval of the senate, and the constitution set no limits to the power of the assembly to decide any question whatsoever that was laid before it.

From 150, at least, onwards, there were increasing indications that both the acquiescence of the people in senatorial government and the loyalty of the magistrates to the senate were failing. The rich landowners were not only taking possession of the public lands but were buying out the small farmers. And since the Government took little interest in commerce and industry, the poor were drifting idly to the cities or migrating to the Po valley. Slaves were being brought in to do the work of citizens, and the levies for the wars, which never ceased, fell more and more upon a decreasing citizenry. Between 165 and 135 the number of citizens, which should have increased by at least 100,000, actually dropped 20,000. The populace began to object to the constant levies and to criticize the régime which seemed only to be interested in foreign policies.

It is possible that these constitutional and administrative difficulties would not have proved so rapidly fatal to the republic had not its very foundations been sapped by the changes which followed more or less directly on the conquests of the 3rd and 2nd centuries B.C. For the opening of the world to Rome, and of Rome to the world, produced a radical change in the structure of Roman society. The subjugation of the Mediterranean countries, by placing at the disposal of Rome the vast natural resources of the West and the accumulated treasures of the East, caused a rapid rise in the standard of wealth and a marked change in its distribution. The Roman State was enabled to dispense with the direct taxation of its citizens, since it derived all the revenue which it needed from the subject countries. But this wealth enticed the Romans away from a beneficial development of their own resources into a dangerous parasitism. In time generals and soldiers learned to depend upon the profits of wars, governors to provide for their estates out of illegitimate perquisites of office far away from the vigilant eyes of magistrates at home. Speculators learned to place mortgages in the provinces where interest rates were high, to profit by the protection of Rome's armies, and secure the high return of their investments from lenient governors. Roman nobles, engaged all their lives in the expensive civil and military service, unable to devote any attention to developing their own properties for a livelihood, excused their own and their fellows' exploitation of the subjects. Compelled to find leisure from financial concerns, they disregarded the needs of industry and commerce that might have employed citizens and developed the resources of Italy. Instead they acquiesced in the slave-driven culture of large estates which yielded meagre returns and begot out of war captives a body of citizens bred in servility, ignorance and hatred. Surely the great successes of the 2nd century had come too speedily.

The New Learning. — It was not only the structure and composition of Roman society that underwent a transformation. The victory of Rome in her struggle for supremacy in the Mediterranean basin had been largely due to the powerful conservative forces by which her institutions were preserved from decay. Respect for the *mos maiorum,* or ancestral custom, imposed an effective check on the desire for innovation. Though personal religion, in the deeper sense, was foreign to the Roman temperament, there was a genuine belief in the gods whose favour had made Rome great in the past and would uphold her in the future so long as she trod in the old paths of loyalty and devotion. Above all, the healthy moral traditions of early Rome were maintained by the discipline of the family, resting on the supreme authority of the father — the *patria potestas*—and the powerful influence of the mother, to whom the early training of the child was entrusted. Finally, the institution of the censorship, backed as it was by the mighty force of public opinion, provided a deterrent

which prevented any flagrant deviation from the accepted standard of morals. All this was changed by the influence of Greek civilization with which Rome was first brought face to face in the 3rd century B.C. owing to her relations with Magna Graecia. At first the results of contact with the older and more brilliant culture of Hellas were on the whole good. In the and century B.C., when constant intercourse was established with the communities of Greece proper and of Asia Minor, "philhellenism" became a passion, which was strongest in the best minds of the day and resulted in a quickened intellectual activity, wider sympathies and a more humane life. But at the same time the "new learning" was a disturbing and unsettling force. The Roman citizen was confronted with new doctrines in politics and religion, and initiated into the speculations of critical philosophy. Under the influence of this powerful solvent the fabric of tradition embodied in the *mos maiorum* fell to pieces; a revolt set in against Roman discipline and Roman traditions of self-effacement, and the craving for individual distinction asserted itself with irresistible vehemence. As it had been in the days of the "sophistic" movement at Athens, so it was now with Rome; a higher education, which, owing to its expense, was necessarily confined to the wealthier classes, interposed between the upper and lower ranks of society a barrier even more effectual than that set up by differences of material condition, and by releasing the individual from the trammels of traditional morality, gave his ambition free course. The effect on private morals may be gauged by the vehemence with which the reactionary opposition, headed by M. Porcius Cato (consul, 195 B.C.; censor, 184 B.C.), inveighed against the new fashions. and by the list of measures passed to check the growth of luxury and licence, and to exclude the foreign teachers of the new learning. It was all in vain. The art of rhetoric, which was studied through the medium of Greek treatises and Greek models, furnished the Roman noble with weapons of attack and defence of which he was not slow to avail himself in the forum and the senate-house. In the science of money-making which had been elaborated under the Hellenistic monarchies, the Roman capitalists proved apt pupils of their Greek teachers. Among the lower classes, contact with foreign slaves and freedmen, with foreign worships and foreign vices, produced a love of novelty which no legislation could check. Even amongst women there were symptoms of revolt against the old order, which showed itself in a growing freedom of manners and impatience of control, the marriage tie was relaxed, and the respect for mother and wife which had been so powerful a factor in the maintenance of the Roman standard of morals, was grievously diminished. Thus Rome was at length brought face to face with a moral and economic crisis which a modern historian has described in the words: "Italy was living through the fever of moral disintegration and incoherence which assails all civilized societies that are rich in the manifold resources of culture and enjoyment, but tolerate few or no restraints on the feverish struggle of contending appetites." In this struggle the Roman republic perished. and personal government took its place. The world had outgrown the city-state and its political machinery, and as representative government, tried in Thessaly and Macedonia, was out of the question in a heterogeneous empire, no solution of the problem was possible save that of absolutism. But a far stronger resistance would have been opposed to political revolution by the republican system had not public morals been sapped by the influences above described. Political corruption was reduced to a science for the benefit of individuals who were often faced with the alternatives of ruin or revolution; there was no longer any body of sound public opinion to which, in the last resort, appeal could be made; and, long before the final catastrophe took place, Roman society itself had become, in structure and temper, thoroughly unrepublican.

The Gracchi, 133–121.—The first systematic attack upon the senatorial government is connected with the names of Tiberius and Gaius Gracchus (*qq.v.*) and its immediate occasion was an attempt to deal with no less a danger than the threatened disappearance of the class to which of all others Rome owed most in the past. The small landholders throughout the greater part of Italy were sinking deeper into ruin under the pressure of accumulated difficulties. The Hannibalic war had laid waste their fields and thinned their numbers, nor when peace returned to Italy did it bring with it any revival of prosperity. The heavy burden of military service still pressed ruinously upon them, and in addition they were called upon to compete with the foreign corn imported from beyond the sea, and with the foreign slave-labour purchased by the capital of wealthier men. Farming became unprofitable, and the hard laborious life with its scanty returns was thrown into still darker relief when compared with the stirring life of the camps with its opportunities of booty, or with the cheap provisions, frequent largesses and gay spectacles to be had in the large towns. The small-holders went off to follow the eagles to try fortune in some province, or swell the proletariat of the cities, and their holdings were left to run waste or merged in the vineyards, olive-yards and above all in the great cattle farms of the rich, and their own place was taken by slaves. The evil was worst in Etruria and in southern Italy; but everywhere it was serious enough to demand the earnest attention of Roman statesmen. Of its existence the Government had received plenty of warning in the declining numbers of able-bodied males returned at the census, in the increasing difficulties of recruiting for the legions, in servile outbreaks in Etruria and Apulia, and between zoo and 160 a good deal was attempted by way of remedy. In addition to the foundation of 20 colonies, there were frequent allotments of land to veteran soldiers, especially in Apulia and Samnium. In 180, 40,-ooo Ligurians were removed from their homes and settled on vacant lands once the property of a Samnite tribe, and in 160 the Pomptine marshes were drained for the purpose of cultivation. But these efforts were only partially successful. The colonies planted in Cisalpine Gaul and in Picenum flourished, but of the others the majority slowly dwindled away, and two required recolonizing only eight years after their foundation. The veterans who received land were unfitted to make good farmers; and large numbers, on the first opportunity, gladly returned as volunteers to a soldier's life. Moreover, after 160 evtn these efforts ceased, and with the single exception of the colony of Auximum in Picenum (157) nothing was done to check the spread of the evil, until in 133 Tiberius Gracchus, on his election to the tribunate, set his hand to the work.

The remedy proposed by Gracchus amounted in effect to the resumption by the State of as much of the "common land" as was not held in occupation by authorized persons and conformably to the provisions of the Licinian law, and the distribution in allotments of the land thus rescued for the community from the monopoly of a few. It was a scheme which could quote in its favour ancient precedent as well as urgent necessity Of the causes which led to its ultimate failure something will be said later on; for the present we must turn to the constitutional conflict which it provoked. The senate from the first identified itself with the interests of the wealthy occupiers, and Tiberius found himself forced into a struggle with that body, which had been no part of his original plan. He fell back on the legislative sovereignty of the assembly; he resuscitated the half-forgotten powers of interference vested in the tribunate in order to paralyse the action of the senatorial magistrates, and finally lost his life in an attempt to make good one of the weak points in the tribune's position by securing his own re-election for a second year. But the conflict did not end with his death. It was renewed on a wider scale and with a more deliberate aim by his brother Gaius, who on his election to the tribunate (123) at once came forward with a vast programme of legislation. He shrewdly began by weakening the influence of the senate. Since his followers had every reason to dread the *senatus consultum ultimum,* the senate's chief weapon of attack against opponents, his first plebiscite reasserted the "right of appeal." He then destroyed the senate's prerogative to assign the provinces to its partisans, took away the jury panels from the senators, and also claimed for the assembly the right to assign public contracts and to control the budget so far as it desired. Thus the senate lost control of the gifts by which it cajoled and the lashes by which it compelled obedience. Very early also he gave doles of grain to the poor This later led to great evils, but it must have been instituted as a temporary

measure since he intended soon to distribute the needy in colonies. The evils of the dole must be accredited to the senate which stopped the colonization and did not have the courage to stop the dole. The jury panels he now made up of knights instead of senators. Gracchus wished, it seems, to give official recognition through civil service to men of business, in whom he had great faith. He would thus widen the group interested in public concerns and build up an influential order as a balance to the old nobility. Later it proved a disadvantage that publicans could sit in judgment over provincial governors who had to hold the publicans in check, but this difficulty could hardly have been foreseen since publicans did not yet have provincial contracts. In order to secure larger returns from the Asiatic province recently inherited by Rome, Gracchus permitted the knights to form corporations of limited liability (such corporations were otherwise prohibited) with the privilege of taking contracts to gather and dispose of the Asiatic tithe. The advantages would be that the State would receive in advance the sums bid, would not have to build up a large taxing bureau in order to get all that was due, and the taxpayers could pay the tithe in kind according to the yield of each year. Since this system had not been tried before by Rome, its inherent evils were probably not yet known. In time it led not only to harsh exactions because of collusion between governors and publicans, but also to costly exploitation, because the publicans lent money to delinquents at high rates and engaged generally in unseemly speculation. Gracchus used the money in such public works as the assembly at his bidding authorized. The colonies which Gracchus founded — it was only the beginning of a large project — were well selected. Two were planted in southern Italy where many allotments had recently been made to small farmers — at Tarentum and Scylacium. For these, men specially selected for their capacity were chosen. Then 6,000 hardy farmers were sent to the province of Africa which had been lying desolate for a generation, and which had had to depend upon the Punic city of Utica for its harbour and its praetorian residence. Not even then did the senate comprehend its duty to its provincials, but cancelled the colonial charter, though it dared not cancel the allotments. And now though Gracchus lost his re-election to the tribunate he attempted his last great reform of giving the franchise to the Latins in order that the democracy might rest on a wider and sounder basis. Since Caesar, who took many suggestions from Gracchus, later proposed to extend balloting through Italy by local polls, it is not unlikely that Gracchus had that in view. That would finally have removed democratic legislation from the control of the urban crowd. Be that as it may, the attempt to broaden the franchise failed, not this time because of senatorial opposition but because of the selfishness of the voters who did not wish to diminish their own prerogatives. Gracchus lost his influence, and soon after when a riot arose the senate declared martial law and summoned Gracchus to the bar of the senate. He refused to recognize a procedure which the assembly had outlawed the year before. The senate insisting on the legality of its course ordered his arrest and in the riot which ensued he was slain.

The agrarian reforms of the two Gracchi had little permanent effect. Even in the lifetime of Gaius the clause in his brother's law rendering the new holdings inalienable was repealed, and the process of absorption recommenced. In 118 a stop was put to further allotment of occupied lands, and finally, in 111, the whole position of the agrarian question was altered by a law which converted all land still held in occupation into private land. The old controversy as to the proper use of the lands of the community was closed by this act of alienation. The controversy in future turns, not on the right of the poor citizens to the State lands, but on the expediency of purchasing other lands for distribution at the cost of the treasury.

But, though the agrarian reform failed, the political conflict it had provoked continued, and the lines on which it was waged were in the main those laid down by Gaius Gracchus. The sovereignty of the assembly continued to be the watchword of the popular party, and a free use of the tribunician powers of interference and of legislation remained the most effective means of accomplishing their aims.

Marius, 118–100. — Ten years after the death of Gaius the *populares* once more summoned up courage to challenge the supremacy of the senate; but it was on a question of foreign administration that the conflict was renewed. The course of affairs in the client state of Numidia since Micipsa's death in 118 had been such as to discredit a stronger government than that of the senate. In defiance of Roman authority, and relying on the influence of his own well-spent gold, Jugurtha had murdered both his legitimate rivals, Hiempsal and Adherbal, and made himself master of Numidia. The declaration of war wrung from the senate (112) by popular indignation had been followed by the corruption of a consul (111) and the crushing defeat of the proconsul Albinus. On the news of this crowning disgrace the storm burst, and on the proposal of the tribunes a commission of enquiry into the conduct of the war was appointed. But the popular leaders did not stop here. Q. Caecilius Metellus, who as consul (109) had succeeded to the command in Numidia, was an able soldier but a rigid aristocrat; and they now resolved to improve their success by entrusting the command instead to a genuine son of the people. Their choice fell on Gaius Marius (see MARIUS), an experienced officer and administrator, but a man of humble birth, wholly illiterate, and one who, though no politician, was by temperament and training a hater of the polished and effeminate nobles who filled the senate. He was triumphantly elected, and, in spite of a decree of the senate continuing Metellus as proconsul, he was entrusted by a vote of the assembly with the charge of the war against Jugurtha (*q.v.*).

Jugurtha was vanquished; and Marius, who had been a second time elected consul in his absence, arrived at Rome in Jan. 104, bringing the captive prince with him in chains. But further triumphs awaited the popular hero. The Cimbri and Teutones were at the gates of Italy; they had four times defeated the senatorial generals, and Marius was called upon to save Rome from a second invasion of the barbarians. After two years of suspense the victory at Aquae Sextiae (102), followed by that on the Raudine plain (101), put an end to the danger by the annihilation of the invading hordes; and Marius, now consul for the fifth time, returned to Rome in triumph. There the popular party welcomed him as a leader with all the prestige of a successful general. Once more, however, they were destined to a brief success followed by disastrous defeat. Marius became for the sixth time consul; of the two popular leaders Glaucia became praetor and Saturninus tribune. But Marius and his allies were not statesmen of the stamp of the Gracchi; and the laws proposed by Saturninus had evidently no serious aim in view other than that of harassing the senate. His corn law merely reduced the price fixed in 123 for the monthly dole of corn, and the main point of his agrarian law lay in the clause appended to it requiring all senators to swear to observe its provisions[1]. The laws were carried, but the triumph of the popular leaders was short-lived. Their period of office was drawing to a close. At the elections fresh rioting took place, and Marius as consul was called upon by the senate to protect the State against his own partisans. Saturninus and Glaucia surrendered, but while the senate was discussing their fate they were surrounded and murdered by their opponents.

The popular party had been worsted once more in their struggle with the senate, but none the less their alliance with Marius, and the position in which their votes placed him, marked an epoch in the history of the revolution. The transference of the political leadership to a consul who was nothing if not a soldier was at once a confession of the insufficiency of the purely civil authority of the tribunate and a dangerous encouragement of military interference in political controversies. The consequences were already foreshadowed by the special provisions made by Saturninus for Marius's veterans, and in the active part taken by them in the passing of his laws. Indirectly, too, Marius, though no politician, played an important part in this new departure. His military reforms at once democratized the army and attached it more closely to its leader for the time being. He swept away

[1] For the *leges Appuleiae*, *see* SATURNINUS, LUCIUS APPULEIUS, and authorities there quoted.

the last traces of civil distinctions of rank or wealth within the legion, admitted to its ranks all classes, and substituted voluntary enlistment under a popular general for the old-fashioned compulsory levy. The efficiency of the legion was increased at the cost of a complete severance of the ties which bound it to the civil community and to the civil authorities.

The Social War.—The next important crisis was due partly to the rivalry which had been growing more bitter each year between the senate and the commercial class, and partly to the long-impending question of the enfranchisement of the Italian allies. The *publicani*, negotiatores and others, who constituted what was now becoming known as the equestrian order (see EQUITES), had made unscrupulous use of their control of the courts and especially of the *quaestio* de repetundis against their natural rivals, the official class in the provinces. The threat of prosecution before a hostile jury was held over the head of every governor, legate and quaestor who ventured to interfere with their operations in the provinces. The average official preferred to connive at their exactions; the bolder ones paid with fines and even exile for their courage. In 92 the necessity for a reform was proved beyond a doubt by the scandalous condemnation of P. Rutilius Rufus, ostensibly on a charge of extortion, in reality as the reward of his efforts to check the extortions of the Roman equites in Asia. The difficulties of the Italian question were more serious. That the Italian allies were discontented was notorious. After nearly two centuries of close alliance, of common dangers and victories, they now eagerly coveted as a boon that complete amalgamation with Rome which they had at first resented as a dishonour. But, unfortunately, Rome had grown more exclusive in proportion as the value set upon Roman citizenship increased. During the last 40 years feelings of hope and disappointment had rapidly succeeded each other; Marcus Fulvius Flaccus, Gaius Gracchus, Saturninus, had all held out promises of relief—and nothing had yet been done. On each occasion they had crowded to Rome, full of eager expectation, only to be harshly ejected from the city by the consul's orders. The justice of their claims could hardly be denied, the danger of continuing to ignore them was obvious—yet the difficulties in the way of granting them were formidable in the extreme, and from a higher than a merely selfish point of view there was much to be said against the revolution involved in so sudden and enormous an enlargement of the citizen body.

Marcus Livius Drusus (*q.v.*), who as tribune gallantly took up the task of reform, is claimed by Cicero as a member of that party of the centre to which he belonged himself. Noble, wealthy and popular, he seems to have hoped to be able by the weight of his position and character to rescue the burning questions of the day from the grasp of extreme partisans and to settle them peacefully and equitably. But he, like Cicero after him, had to find to his cost that there was no room in the fierce strife of Roman politics for moderate counsels. His proposal to reform the law courts excited the equestrian order and their friends in the senate to fury. The agrarian and corn laws which he coupled with it alienated many more in the senate, and roused the old anti-popular party feeling; finally, his known negotiations with the Italians were eagerly misrepresented to the jealous and excited people as evidence of complicity with a widespread conspiracy against Rome. His laws were carried, but the senate pronounced them null and void. Drusus was denounced in the senate house as a traitor, and on his way home was struck down by the hand of an unknown assassin. His assassination was the signal for an outbreak which had been secretly prepared for some time before. Throughout the highlands of central and southern Italy the flower of the Italian peoples rose as one man. Etruria and Umbria held aloof; the isolated Latin colonies stood firm; but the Sabellian clans, north and south, the Latinized Marsi and Paeligni, as well as the Oscan-speaking Samnites and Lucanians, rushed to arms No time was lost in proclaiming their plans for the future. A new Italian State was to be formed. The Paelignian town of Corfinium was selected as its capital and re-christened with the proud name of Italica. All Italians were to be citizens of this new metropolis, and here were to be the place of assembly and the senate house. A senate of 500 members and a magistracy resembling that of Rome completed a constitution which adhered closely to the very political traditions which its authors had most reason to abjure.

Now, as always in the face of serious danger, the action of Rome was prompt and resolute. Both consuls took the field; with each were five legates, among them the veteran Marius and his destined rival L. Cornelius Sulla, and even freedmen were pressed into service with the legions. But the first year's campaign opened disastrously. In central Italy the northern Sabellians, and in the south the Samnites, defeated the forces opposed to them. And though before the end of the year Marius and Sulla in the north, and the consul Caesar himself in Campania, succeeded in inflicting severe blows on the enemy, and on the Marsi especially, it is not surprising that, with an empty treasury, with the insurgents' strength still unbroken, and with rumours of disaffection in the loyal districts, opinion in Rome should have turned in the direction of the more liberal policy which had been so often scornfully rejected and in favour of some compromise which should check the spread of the revolt, and possibly sow discord among their enemies. Towards the close of the year go the consul L. Julius Caesar (killed by Fimbria in 87) carried the *lex Iulia*, by which the Roman franchise was offered to all communities which had not as yet revolted; early in the next year (89) the Julian law was supplemented by the *lex* Plautia *Papiria*, introduced by two of the tribunes, M. Plautius Silvanus and C. Papirius Carbo Arvina, which enacted that any citizen of an allied community then domiciled in Italy might obtain the franchise by giving in his name to a praetor in Rome within 60 days. A third law (lex *Calpurnia*), apparently passed at the same time, empowered Roman magistrates in the field to bestow the franchise there and then upon all who were willing to receive it. This sudden opening of the closed gates of Roman citizenship was completely successful, and its effects were at once visible in the diminished vigour of the insurgents. By the end of 89 the Samnites and Lucanians were left alone in their obstinate hostility to Rome, and neither, thanks to Sulla's brilliant campaign in Samnium, had for the moment any strength left for active aggression.

The termination of the Social War brought with it no peace in Rome. The old quarrels were renewed with increased bitterness, and the newly enfranchised Italians themselves complained as bitterly of the restriction which robbed them of their due share of political influence by allowing them to vote only in a specified number of tribes. The senate itself was distracted by violent personal rivalries—and all these feuds, animosities and grievances were aggravated by the widespread economic distress and ruin which affected all classes. Lastly, war with Mithridates VI. had been declared; it was notorious that the privilege of commanding the force to be sent against him would be keenly contested, and that the contest would lie between the veteran Marius and L. Cornelius Sulla.

Sulla.—It was in an atmosphere charged with the elements of disturbance that P. Sulpicius Rufus as tribune brought forward his laws. (See SULPICIUS RUFUS, PUBLIUS.) He proposed: (1) that the command of the Mithridatic War should be given to Marius, though it had legally been assigned to the consul Sulla; (2) that the new citizens should be distributed through all the tribes; (3) that the freedmen should no longer be confined to the four city tribes; (4) that any senator owing more than 2,000 denarii should lose his seat; (5) that those exiled on suspicion of complicity with the Italian revolt should be recalled. These proposals provoked a storm, and both sides were ready for violent measures. The consuls, in order to prevent legislation, proclaimed a public holiday. Sulpicius armed his followers and drove the consuls from the forum. The proclamation was withdrawn and the laws carried, but Sulpicius's triumph was short-lived. From Nola in Campania, where lay the legions commanded by him in the Social War, Sulla advanced on Rome. and for the first time a Roman consul entered the city at the head of the legions of the republic. Resistance was hopeless. Marius and Sulpicius fled, and Sulla, summoning the assembly of the centuries, proposed the measures he considered necessary for the

public security, the most important being a provision that the sanction of the senate should be necessary before any proposal was introduced to the assembly. Then, after waiting in Rome long enough to hold the consular elections, he left for Asia early in 87.

Sulla had conquered, but his victory cost the republic dear. He had first taught political partisans to look for final success, not to a majority of votes in the forum or campus, but to the swords of the soldiery. The lesson was well learnt. Shortly after his departure L. Cornelius Cinna as consul revived the proposals of Sulpicius; his colleague, Gnaeus Octavius, at the head of an armed force, fell upon the new citizens who had collected in crowds to vote, and the forum was heaped high with the bodies of the slain. Cinna fled, but fled, like Sulla, to the legions. When the senate declared him deposed from his consulship, he replied by invoking the aid of the soldiers in Campania in behalf of the violated rights of the people and the injured dignity of the consulship, and, like Sulla, found them ready to follow where he led. The neighbouring Italian communities, who had lost many citizens in the recent massacre, sent their new champion men and money; while from Africa, whither he had escaped after Sulla's entry into Rome, came Marius with 1,000 Numidian horsemen. The senate had prepared for a desperate defence, but fortune was adverse, and after a brief resistance they gave way. Cinna was acknowledged as consul, the sentence of outlawry passed on Marius was revoked and Cinna and Marius entered Rome with their troops. Marius's thirst for revenge was gratified by a frightful massacre, and he lived long enough to be nominated consul for the seventh time. But he held his consulship only a few weeks. Early in 86 he died, and for the next three years Cinna ruled Rome. Constitutional government was virtually suspended. For 85 and 84 Cinna nominated himself and a trusted colleague as consuls. The state was, as Cicero says, without lawful authority. A partial registration of the newly enfranchised Italians was made, but beyond this little was done. The attention of Cinna and his friends was in truth engrossed by the ever-present dread of Sulla's return from Asia. The consul of 86, L. Valerius Flaccus (who had been consul with Marius in 100 B.C.), sent out to supersede him, was murdered by his own soldiers at Nicomedia. In 85 Sulla, though disowned by his Government, concluded a peace with Mithridates. In 84, after settling affairs in Asia and crushing Flaccus's successor: C. Flavius Fimbria, he crossed into Greece, and in the spring of 83 landed at Brundusium with 40,000 soldiers and a large following of *émigré* nobles. Cinna was dead, murdered like Flaccus by his mutinous soldiers; his most trusted colleague, Cn. Papirius Carbo, was commanding as proconsul in Cisalpine Gaul; and the resistance offered to Sulla's advance was slight. At Capua, Sulla routed the forces of one consul, Gaius Norbanus; at Teanum the troops of the other went over in a body to the side of the outlawed proconsul. After a winter spent in Campania he pressed forward to Rome, defeated the younger Marius (consul, 82) near Praeneste, and entered the city without further opposition. In north Italy the success of his lieutenants, Q. Caecilius Metellus Pius (son of Metellus Numidicus), Cn. Pompeius and Marcus Crassus, had been fully as decisive. Cisalpine Gaul, Umbria and Etruria had all been won for Sulla, and the two principal leaders on the other side, Carbo and Norbanus, had each fled, one to Rhodes, the other to Africa. Only one foe remained to be conquered. The Samnites and Lucanians whom Cinna had conciliated, and who saw in Sulla their bitterest foe, were for the last time in arms, and had already joined forces with the remains of the Marian army close to Rome. The decisive battle was fought under the walls of the city, and ended in the complete defeat of the Marians and Italians (battle of the Colline gate).

For a period of nearly ten years Rome and Italy had been distracted by civil war. Sulla (*q.v.*) was now called upon to heal the divisions which rent the State asunder, to set in working again the machinery of civil government, and above all so to modify it as to meet the altered conditions, and to fortify it against the dangers which visibly threatened it in the future. The real charge against Sulla is not that he failed to accomplish **all** this, for to do so was beyond the powers even of a man so able, resolute and self-confident as Sulla, armed though he was with absolute authority and backed by overwhelming military strength and the prestige of unbroken success. He stands convicted rather of deliberately aggravating some and culpably ignoring others of the evils he should have tried to cure, and of contenting himself with a party triumph when he should have aimed at the regeneration and confirmation of the whole State. His victory was instantly followed, not by any measures of conciliation, but by a series of massacres, proscriptions and confiscations, of which almost the least serious consequence was the immediate loss of life which they entailed. From this time forward the fear of proscription and confiscation recurred as a possible consequence of every political crisis, and it was with difficulty that Caesar himself dissipated the belief that his victory would be followed by a Sullan reign of terror. The legacy of hatred and discontent which Sulla left behind him was a constant source of disquiet and danger. In the children of the proscribed, whom he excluded from holding office, and the dispossessed owners of the confiscated lands, every agitator found ready and willing allies. The moneyed men of the equestrian order were more than ever hostile to the senatorial government, which they now identified with the man who cherished towards them a peculiar hatred, and whose creatures had hunted them down like dogs. The attachment which the new Italian citizens might in time have learnt to feel for the old republican constitution was nipped in the bud by the massacres at Praeneste and Norba, by the harsh treatment of the ancient towns of Etruria, and by the ruthless desolation of Samnium and Lucania. Quite as fatal were the results to the economic prosperity of the peninsula. Sulla's confiscations, following on the civil and social wars, opened the doors wide for a long train of evils. The veterans whom he planted on the lands he had seized did nothing for agriculture, and swelled the growing numbers of the turbulent and discontented. The "Sullan men" became as great an object of fear and dislike as the "Sullan reign." The *latifundia* increased with startling rapidity—whole territories passing into the hands of greedy partisans. Wide tracts of land, confiscated but never allotted, ran to waste. In many districts of Italy the free population finally and completely disappeared from the open country; and life and property were rendered insecure by the brigandage which now developed unchecked, and in which the herdsmen slaves played a prominent part. The outbreaks of Spartacus in 73, and of Catiline ten years later, were significant commentaries on this part of Sulla's work. His constitutional legislation, while it included many useful administrative reforms, is marked by as violent a spirit of partisanship, and as apparently wilful a blindness to the future. The re-establishment on a legal basis of the ascendancy which custom had so long accorded the senate was his main object. With this purpose he had already, when consul in 88, made the *senatus* auctoritas legally necessary for proposals to the assembly. He now as dictator followed this up by crippling the power of the magistracy, which had been the most effective weapon in the hands of the senate's opponents. The legislative freedom of the tribunes was already hampered by the necessity of obtaining the senate's sanction; in addition, Sulla restricted their wide powers of interference (intercessio) to their original purpose of protecting individual plebeians, and discredited the office by prohibiting a tribune from holding any subsequent office in the State. The control of the courts (quaestiones *perpetuae*) was taken from the equestrian order and restored to the senate. To prevent the people from suddenly installing and keeping in high office a second Marius, he re-enacted the old law against re-election, and made legally binding the custom which required a man to mount up gradually to the consulship through the lower offices. His increase of the number of praetors from six to eight, and of quaestors to 20, though required by administrative necessities, tended, by enlarging the numbers and further dividing the authority of the magistrates, to render them still more dependent upon the central direction of the senate. Lastly, he replaced the pontifical and augural colleges in the hands of the senatorial nobles, by enacting that vacancies in them should, as before the *lex* Domitia (104), be filled up by co-optation. It cannot be said that Sulla was **success-**

ful in fortifying the republican system against the dangers which menaced it from without. He accepted as an accomplished fact the enfranchisement of the Italians, but he made no provision to guard against the consequent reduction of the comitia to an absurdity, and with them of the civic government which rested upon them, or to organize an effective administrative system for the Italian communities. In fact he prevented the further registration of the new citizens by abolishing the censorship. Of all men, too, Sulla had the best reason to appreciate the dangers to be feared from the growing independence of governors and generals in the provinces and from the transformation of the old civic militia into a group of professional armies, devoted only to a successful leader, and with the weakest possible sense of allegiance to the State. He had himself, as proconsul of Asia, contemptuously and successfully defied the home Government, and he, more than any other Roman general, had taught his soldiers to look only to their leader, and to think only of booty. Yet, beyond a few inadequate regulations, there is no evidence that Sulla dealt with these burning questions, the settlement of which was among the greatest of the achievements of Augustus. One administrative reform of real importance must, lastly, be set down to his credit. The judicial procedure first established in 149 for the trial of cases of magisterial extortion in the provinces, and applied between 149 and 81 to cases of treason and bribery. Sulla extended so as to bring under it the chief criminal offences, and thus laid the foundation of the Roman criminal law.

Overthrow of the Sullan Constitution.— The Sullan system stood for nine years, and was then overthrown—as it had been established—by a successful soldier. It was the fortune of Cn. Pompey, a favourite officer of Sulla, first of all to violate in his own person the fundamental principles of the constitution re-established by his old chief, and then to overturn it. In Spain the Marian governor Q. Sertorius (see SERTORIUS, QUINTUS) had defeated one after another of the proconsuls sent out by the senate and was in 77 master of all Hither Spain. To meet the crisis, Pompey (*q.v.*), who was not yet 30 and had never held even the quaestorship, was sent out to Spain with proconsular authority. Sertorius held out, until in 73 he was foully murdered by his own officers. The native tribes who had loyally stood by him submitted, and Pompey early in 71 returned with his troops to Italy, where, during his absence in Spain, an event had occurred which had shown Roman society with startling plainness how near it stood to revolution. In 73 Spartacus (*q.v.*), a Thracian slave, escaped with 70 others from a gladiators' training school at Capua. In a startlingly short time he found himself at the head of 70,000 runaway slaves, outlaws, brigands and impoverished peasants, and for two years terrorized Italy, routed the legions sent against him, and even threatened Rome. He was at length defeated and slain by the praetor, M. Licinius Crassus, in Apulia. In Rome itself the various classes and parties hostile to the Sullan system had, ever since Sulla's death in 78, been incessantly agitating for the repeal of his most obnoxious laws, and needed only a leader in order successfully to attack a Government discredited by failure at home and abroad. With the return of Pompey from Spain their opportunity came. Pompey, who understood politics as little as Marius, was anxious to obtain a triumph, the consulship for the next year (70), and as the natural consequence of this an important command in the East. The opposition wanted his name and support, and a bargain was soon struck. Pompey and with him Marcus Licinius Crassus, the real conqueror of Spartacus, were elected consuls, almost in the presence of their troops, which lay encamped outside the gates in readiness to assist at the triumph and ovation granted to their respective leaders. Pompey lost no time in performing his part of the agreemtnt. The tribunes regained their prerogatives. The "perpetual courts" (*quaestiones perpetuae*) were taken out of the hands of the senatorial iudices, who had outdone the equestrian order in scandalous corruption, and finally the censors, the first since 86 B.C., purged the senate of the more worthless and disreputable of Sulla's partisans. The victory was complete; but for the future its chief significance lay in the clearness with which it showed that the final decision in matters political lay with neither of the two great parties in Rome, but with the holder of the military authority. The tribunes ceased to be political leaders and became lieutenants of the military commanders, and the change was fatal to the dignity of politics in the city. Men became conscious of the unreality of the old constitutional controversies, indifferent to the questions which agitated the forum and the curia, and contemptuously ready to alter or disregard the constitution itself when it stood in the way of interests nearer to their hearts.

Pompey, Caesar and Cicero.—When his consulship ended, Pompey impatiently awaited at the hands of the politicians he had befriended the further gift of a foreign command. He declined an ordinary province, and from the end of 70 to 67 he remained at Rome in a somewhat affectedly dignified seclusion. But in 67 and 66 the laws of Gabinius and Manilius gave him all and more than all that he expected (see POMPEY). By the former he obtained the sole command for three years against the Mediterranean pirates. He was to have supreme authority over all Roman magistrates in the provinces throughout the Mediterranean and over the coasts for 50m. inland. Fifteen *legati*, all of praetorian rank, were assigned to him, with 200 ships, and as many troops as he thought desirable. The Manilian law transferred from Lucullus and Glabrio to Pompey the conduct of the Mithridatic War in Asia, and with it the entire control of Roman policy and interests in the East. The unrepublican character of the position thus granted to Pompey, and the dangers of the precedent established, were clearly enough pointed out by such moderate men as Q. Lutatius Catulus, the "father of the senate," and by the orator Hortensius—but in vain. Both laws were Supported, not only by the tribunes and the populace, but by the whole influence of the publicani and negotiatores, whose interests in the East were at stake.

Pompey left Rome in 67. In a marvellously short space of time he freed the Mediterranean from the Cilician pirates and established Roman authority in Cilicia itself. He then crushed Mithradates (*q.v.*), added Syria to the list of Roman provinces, and led the Roman legions to the Euphrates and the Caspian, leaving no power capable of disputing with Rome the sovereignty of western Asia. He did not return to Italy till towards the end of 62. The interval was marked in Rome by the rise to political importance of Caesar (*q.v.*) and Cicero, and by Catiline's attempt at revolution. As the nephew of Marius and the son-in-law of Cinna, Caesar possessed a strong hereditary claim to the leadership of the popular and Marian party. He had already taken part in the agitation for the restoration of the tribunate; he had supported the Manilian law; and, when Pompey's withdrawal left the field clear for other competitors, he stepped at once into the front rank on the popular side. He took upon himself, as their nearest representative, the task of clearing the memory and avenging the wrongs of the great popular leaders, Marius, Cinna and Saturninus. He publicly reminded the people of Marius's services, and set up again upon the Capitol the trophies of the Cimbric War. He endeavoured to bring to justice, not only the ringleaders in Sulla's bloody work of proscription, but even the murderers of Saturninus, and vehemently pleaded the cause of the children of the proscribed. While thus carrying on in genuine Roman fashion the feud of his family, he attracted the sympathies of the Italians by his efforts to procure the Roman franchise for the Latin communities beyond the Po, and won the affections of the populace in Rome and its immediate neighbourhood by the splendour of the games which he gave as curule aedile (65), and by his lavish expenditure upon the improvement of the Appian Way. But these measures were with him only means to the further end of creating for himself a position such as that which Pompey had already won; and this ulterior aim he pursued with an audacious indifference to constitutional forms and usages. His coalition with Crassus, soon after Pompey's departure, secured him an ally whose colossal wealth and wide financial connections were of inestimable value, and whose vanity and inferiority of Intellect rendered him a willing tool. The story of his attempted coup d'ktat in Jan. 65 is probably false, but it is evident that by the beginning of 63 he was bent on reaping the reward of his exertions by obtaining from the people an extraordinary command

abroad, which should secure his position before Pompey's return; and the agrarian law proposed early that year by the tribune P. Servilius Rullus had for its object the creation, in favour of Caesar and Crassus, of a commission with powers so wide as to place its members almost on a level with Pompey himself. It was at this moment when all seemed going well, that Caesar's hopes were dashed to the ground by Catiline's desperate outbreak, which not only discredited every one connected with the popular party, but directed the suspicions of the well-to-do classes against Caesar himself, as a possible accomplice in Catiline's revolutionary schemes.

The same wave of indignation and suspicion which for the moment checked Caesar's rise carried Marcus Tullius Cicero to the height of his fortunes. Cicero (*q.v.*), as a politician, has been equally misjudged by friends and foes. That he was deficient in courage, that he was vain, and that he attempted the impossible, may be admitted at once. But he was neither a brilliant and unscrupulous adventurer nor an aimless trimmer, nor yet a devoted champion merely of senatorial ascendancy[1]. He was a representative man, with a numerous following, and a policy which was naturally suggested to him by the circumstances of his birth, connections and profession, and which, impracticable as it proved to be, was yet consistent, intelligible and high-minded. Born at Arpinum, he cherished like all Arpinates the memory of his great fellow-townsman Marius, the friend of the Italians, the saviour of Italy and the irreconcilable foe of Sulla and the nobles. A "municipal" himself, his chosen friends and his warmest supporters were found among the well-to-do classes in the Italian towns. Unpopular with the Roman aristocracy, who despised him as a *peregrinus,* and with the Roman populace, he was the trusted leader of the Italian middle class, "the true Roman people," as he proudly styles them. It was they who carried his election for the consulship (63), who in 58 insisted on his recall from exile, and it was his influence with them which made Caesar so anxious to win him over in 49. He represented their antipathy alike to socialistic schemes and to aristocratic exclusiveness, and their old-fashioned simplicity of life in contrast with the cosmopolitan luxury of the capital. By birth, too, he belonged to the equestrian order, the foremost representatives of which were indeed still the *publicani* and *negotiatores,* but which since the enfranchisement of Italy included also the substantial burgesses of the Italian towns and the smaller "squires" of the country districts. With them, too, Cicero was at one in their dread of democratic excesses and their social and political jealousy of the *nobiles.* Lastly, as a lawyer and a scholar, he was passionately attached to the ancient constitution. His political ideal was the natural outcome of these circumstances. He advocated the maintenance of the old constitution. but not as it was understood by the extreme politicians of the right and left. The senate was to be the supreme directing council, but the senate of Cicero's dreams was not an oligarchic assemblage of nobles, but a body freely open to all citizens, and representing the worth of the community. The magistrates, while deferring to the senate's authority, were to be at once vigorous and public-spirited; and the assembly itself which elected the magistrates and passed the laws was to consist, not of the "mob of the forum," but of the true Roman people throughout Italy. For the realization of this ideal he looked, above all things, to the establishment of cordial relations between the senate and nobles in Rome and the great middle-class of Italy represented by the equestrian order, between the capital and the country towns and districts. This was the *concordia ordinum,* the *consensus Italiae,* for which he laboured.

Cicero's election to the consulship for 63 over the heads of Caesar's nominees, Antonius and Catiline, was mainly the work of the Italian middle-class, already rendered uneasy both by the rumours which were rife of revolutionary schemes and of Caesar's boundless ambition, and by the numerous disquieting signs of disturbance noticeable in Italy. The new consul vigorously set himself to discharge the trust placed in him. He defeated the insidious proposals of Rullus for Caesar's aggrandizement and assisted in quashing the prosecution of Gaius Rabirius. But with the consular elections in the autumn of 63 a fresh danger arose from a different quarter. The "conspiracy of Catiline" *(see* CATILINE) was not the work of the popular party, and still less was it an unselfish attempt at reform; Catiline himself was a patrician, who had held high office, and possessed considerable ability and courage; but he was bankrupt in character and in purse, and two successive dkfeats in the consular elections had rendered him desperate. To retrieve his broken fortunes by violence was a course which was only too readily suggested by the history of the last 40 years, and materials for a conflagration abounded on all sides. The danger to be feared from his intrigues lay in the state of Italy, which made a revolt against society and the established Government only too likely if once a leader presented himself, and it was such a revolt that Catiline endeavoured to organize. Bankrupt nobles like himself, Sullan veterans and the starving peasants whom they had dispossessed of their holdings, outlaws of every description, the slave population of Rome, and the wilder herdsmen-slaves of the Apulian pastures, were all enlisted under his banner, and attempts were even made to excite disaffection among the newly conquered people of southern Gaul and the warlike tribes who still cherished the memory of Sertorius in Spain. In Etruria, the seat and centre of agrarian distress and discontent, a rising actually took place headed by a Sullan centurion, but the spread of the revolt was checked by Cicero's vigorous measures. Catiline fled from Rome, and died fighting with desperate courage at the head of his motley force of old soldiers, peasants and slaves. His accomplices in Rome were arrested, and, after an unavailing protest from Caesar, the senate authorized the consuls summarily to put them to death.

Coalition **of** Pompey, Caesar and Crassus.—The Catilinarian outbreak had been a blow to Caesar, whose schemes it interrupted, but to Cicero it brought not only popularity and honour, but, as he believed, the realization of his political ideal But Pompey was now on his way home[2], and again as in 70 the political future seemed to depend on the attitude which the successful general would assume; Pompey himself looked simply to the attainment by the help of one political party or another of his immediate aims, which at present were the ratification of his arrangements in Asia and a grant of land for his troops. It was the impracticable jealousy of his personal rivals in the senate, aided by the versatility of Caesar who presented himself not as his rival but as his ally, which drove Pompey once more, in spite of Cicero's efforts, into the camp of what was still nominally the popular party. In 60, on Caesar's return from his propraetorship in Spain, the coalition was formed which is known by the somewhat misleading title of the First Triumvirate. Pompey was ostensibly the head of this new alliance, and in return for the satisfaction of his own demands he undertook to support Caesar's candidature for the consulship. The wealth and influence of Crassus were enlisted in the same cause, and the *publicani* were secured by a promise of release from their bargain for collecting the taxes of Asia. Cicero was under no illusions as to the significance of this coalition. It scattered to the winds his dreams of a stable and conservative republic. The year 59 saw the republic powerless in the hands of three citizens. Caesar as consul procured the ratification of Pompey's acts in Asia, granted to the *publicani* the relief refused by the senate, and carried an agrarian law of the new type, which provided for the purchase of lands for allotment at the cost of the treasury and for the assignment of the rich *ager Campanus.* But Caesar aimed at more than the carrying of laws in the teeth of the senate or any party victory in the forum. An important military command was essential to him. An obedient tribune, P. Vatinius, was found, and by the *lex Vatinia* he was given for five years the command of Cisalpine Gaul and Illyricum, to which was added by a decree of the senate Transalpine Gaul also. This command not only opened to him a great military career, but enabled him, as the master of the valley of the Po, to keep an effective watch on the course of affairs in Italy.

[1] Mommsen is throughout unfair to Cicero. The best estimates of Cicero are those given by Strachan-Davidson in his *Cicero* (1894), by Prof. Tyrrell in his Introductions to his edition of Cicero's *Letters,* and by Petersson, *Cicero, a Biography* (1920).

[2] For the history of the next 18 years, the most important ancient authority is Cicero in his letters and speeches.

Early the next year the attack upon himself which Cicero had foreseen was made. P. Clodius (*q.v.*) as tribune brought forward a law enacting that anyone who had put a Roman citizen to death without trial by the people should be interdicted from fire and water. Cicero, finding himself deserted even by Pompey, left Rome in a panic, and by a second Clodian law he was declared to be outlawed. With Caesar away in his province and Cicero banished, Clodius was for the time master in Rome. But, absolute as he was in the streets, and recklessly as he parodied the policy of the Gracchi by violent attacks on the senate, his tribunate merely illustrated the anarchy which now inevitably followed the withdrawal of a strong controlling hand. A reaction speedily followed. Pompey, bewildered and alarmed by Clodius's violence, at last bestirred himself. Cicero's recall was decreed by the senate, and early in Aug. *57* in the *comitia centuriata,* to which his Italian supporters flocked in crowds, a law was passed revoking the sentence of outlawry passed upon him.

Break-up of the Coalition.—Intoxicated by the acclamations which greeted him, and encouraged by Pompey's support, and by the salutary effects of Clodius's excesses, Cicero's hopes rose high. With indefatigable energy he strove to reconstruct a solid constitutional party, but only to fail once more. Pompey was irritated by the hostility of a powerful section in the senate, who thwarted his desires for a fresh command and even encouraged Clodius in insulting the conqueror of the East. Caesar became alarmed at the reports which reached him that the repeal of his agrarian law was threatened and that the feeling against the coalition was growing in strength; above all, he was anxious for a renewal of his five years' command. He acted at once, and in the celebrated conference at Luca *(56)* the alliance of the three self-constitubed rulers of Rome was renewed. Cicero succumbed to the inevitable and withdrew in despair from public life. Pompey and Crassus became consuls for 55. Caesar's command was renewed for another five years, and to each of his two allies important provinces were assigned for a similar period—Pompey receiving the two Spains and Africa, and Crassus Syria. The coalition now divided between them the control of the empire. For the future the question was, how long the coalition itself would last. Its duration proved to be short. In *53* Crassus was defeated and slain by the Parthians at Carrhae, and in Rome the course of events slowly forced Pompey into an attitude of hostility to Caesar. The year *54* brought with it a renewal of the riotous anarchy which had disgraced Rome in *58–57.* Conscious of its own helplessness, the senate, with the eager assent of all respectable citizens, dissuaded Pompey from leaving Italy; and he accordingly left his provinces to be governed by his legates. But the anarchy and confusion only grew worse, and even strict constitutionalists like Cicero talked of the necessity of investing Pompey with some extraordinary powers for the preservation of order[1]. At last in *52* he was elected sole consul, and not only so, but his provincial command was prolonged for five years more, and fresh troops were assigned him. The rôle of "saviour of society" thus thrust upon Pompey was one which flattered his vanity, but it entailed consequences which it is probable he did not foresee, for it brought him into close alliance with the senate. In the senate there was a powerful party which was resolved to force him into heading the attack upon Caesar that otherwise they could not successlully make. It was known that Caesar, whose command expired in March *49,* but who in the ordinary course of things would not have been replaced by his successor until Jan. *48,* was anxious to be allowed to stand for his second consulship in the autumn of *49* without coming in person to Rome. His opponents in the senate were equally bent on bringing his command to an end at the legal time, and so obliging him to disband his troops and stand for the consulship as a private person, or, if he kept his command, on preventing his standing for the consulship. Through 51 and 50 the discussions in the senate and the negotiations with Caesar continued, but with no result. On Jan. 1, 49, Caesar made a last offer of compromise. The senate replied by requiring him on pain of outlawry to disband his legions. Two tribunes who supported him were ejected from the senate house, and the magistrates with Pompey were authorized to take measures to protect the republic. Caesar hesitated no longer; he crossed the Rubicon and invaded Italy. The rapidity of his advance astounded and bewildered his foes. Pompey, followed by the consuls, by the majority of the senate and a long train of nobles, abandoned Italy as untenable, and crossed into Greece. At the end of March Caesar entered Rome as the master of Italy. Four years later, after the final victory of Munda (45), he became the undisputed master of the Roman world[2].

Dictatorship of Caesar, 48–44.—From the very first moment when Pompey's ignominious retreat left him master of Italy, Caesar made it clear that he was neither a second Sulla nor even the reckless anarchist which many believed him to be. The Roman and Italian public were first startled by the masterly rapidity and energy of his movements, and then agreeably surprised by his lenity and moderation. No proscriptions or confiscations followed his victories, and all his acts evinced an unmistakable desire to effect a sober and reasonable settlement of the pressing questions of the hour; of this, and of his almost superhuman energy, the long list of measures he carried out or planned is sufficient proof. The "children of the proscribed" were at length restored to their rights, and with them many of the refugees who had found shelter in Caesar's camp during the two or three years immediately preceding the war; but the extreme men among his supporters soon realized that their hopes of *novae tabulae* and grants of land were illusory. In allotting lands to his veterans, Caesar carefully avoided any disturbance of existing owners and occupiers, and the mode in which he dealt with the economic crisis produced by the war seems to have satisfied all reasonable men. It had been a common charge against Caesar in former days that he paid excessive court to the populace of Rome, and now that he was master he still dazzled them by the spectacles he provided, and by the liberality of his largesses. But he was no indiscriminate flatterer of the mob. The popular clubs and gilds which had helped to organize the anarchy of the last few years were dissolved. A strict enquiry was made into the distribution of the monthly doles of corn, and the number of recipients was reduced by one-half; finally, the position of the courts of justice was raised by the abolition of the popular element among the indices. Nor did Caesar shrink from the attempt, in which so many had failed before him. to mitigate the twin evils which were ruining the prosperity of Italy—the concentration of a pauper population in the towns and the denudation and desolation of the country districts. He carried out the scheme so often proposed by the popular leaders since the days of Gaius Gracchus, the colonization of Carthage and Corinth. Allotments of land on a large scale were made in Italy; decaying towns were reinforced by fresh drafts of settlers; on the large estates and cattle farms the owners were required to find employment for a certain amount of free labour; and a slight and temporary stimulus was given to Italian industry by the reimposition of harbour dues upon foreign goods.

The reform of the calendar (*q.v.*) completes a record of administrative reform which entitles Caesar to the praise of having governed well, whatever may be thought of the validity of his title to govern at all. But how did Caesar deal with what was after all the greatest problem which he was called upon to solve, the establishment of a satisfactory government for the empire? One point indeed was already settled. Some centralization of the executive authority was indispensable, and this part of his work Caesar thoroughly performed. From the moment when he seized the moneys in the treasury on his first entry into Rome down to the day of his death, he recognized no other authority but his throughout the empire. He alone directed the policy of Rome in foreign affairs; the legions were led, and the provinces governed, not by independent magistrates, but by his legates; and the title *imperator* which he adopted was intended to express the absolute and unlimited nature of the *imperium* he claimed, as distinct

[1] Cicero himself anticipated Augustus in his picture of a *princeps civitatis* sketched in a lost book of the ***De rebublica,*** written about this time, which was based upon his hopes of what Pompey might prove to be; ***Ad Att.*** viii. 11; August ***De civ. Dei,*** v. 13

[2] For the Civil Wars, ***see*** CAESAR, GAIUS JULIUS; CICERO, MARCUS TULLIUS; POMPEY.

from the limited spheres of authority possessed by republican magistrates. In so centralizing the executive authority over the empire at large, Caesar was but developing the policy implied in the Gabinian and Manilian laws, and the precedent he established was closely followed by his successors. It was otherwise with the more difficult question of the form under which this new executive authority should be exercised and the relation it should hold to the republican constitution.

Caesar did not explain to the public what shape he intended ultimately to give to the new system. It could hardly have been the "perpetual dictatorship," which was decreed him by the senate after his victory at Munda (45). The dictatorship was associated with those very Sullan traditions from which Caesar was most anxious to sever himself, and the name had no value in the empire at large. It was rumoured that he intended to follow Alexander's example and at least in the eastern provinces adopt the title of king with the theocratic associations which the title bore in the East. Roman proconsuls who had served in Asia and had seen the ease with which kings ruled when not hampered by constitutions and privileged to utter decrees that were considered sacred, would well have comprehended the advantages of such divine absolutism. Caesar might readily remain in the East for some years after his Parthian campaign, and while busy reorganizing the provinces there he would inure his court and the senators in his train to accept the new *rex*. When the time was ripe he might proclaim the title at Rome, and then, being recognized as more than human and above legal restrictions, he could carry whatever reforms he desired by decree. That these rumours deserve some credit we may believe, not only because Caesar before his death accepted several "divine" honours from the senate, but also because Mark Antony, who knew Caesar's plans, pursued such a course after Caesar's death. It is not unlikely that Caesar intended some day to accept for himself the position of an absolute monarch like Alexander or Ptolemy Philadelphus[1]. But he was well aware that it would require many years of training to prepare the senate for the announcement.

The old constitution was not formally abrogated. The senate met and deliberated; the assembly passed laws and elected magistrates; there were still consuls, praetors, aediles, quaestors and tribunes; and Caesar himself, like his successors, professed to hold his authority by the will of the people. But senate, assembly and magistrates were all alike subordinated to the paramount authority of the dictator; and this subordination was, in appearance at least, more direct and complete under the rule of Caesar than under that of Augustus. For months together Rome was left without any regular magistrates, and was governed like a subject town by Caesar's prefects. At another time a tribune was seen exercising authority outside the city bounds and invested with the *imperium* of a praetor. At the elections, candidates appeared before the people backed by a written recommendation from the dictator, which was equivalent to a command. Finally, the senate itself was transformed out of all likeness to its former self by the raising of its numbers to 900, and by the admission of old soldiers, sons of freedmen and even "semi-barbarous Gauls." But, though Caesar's high-handed conduct in this respect was not imitated by his immediate successors, yet the main lines of their policy were laid down by him. These were: (1) the municipalization of the old republican constitution, and (2) its subordination to the paramount authority of the master of the legions and the provinces. In the first case he only carried farther a change already in progress. Of late years the senate had been rapidly losing its hold over the empire at large. Even the ordinary proconsuls were virtually independent potentates, ruling their provinces as they chose, and disposing absolutely of legions which recognized no authority but theirs. The consuls and praetors of each year had since 81 been stationed in Rome, and immersed in purely municipal business; and, lastly, since the enfranchisement of Italy, the *comitia*, though still recognized as the ultimate source of all authority, had become little more than assemblies of the city populace, and their claim to represent the true Roman people was indignantly questioned, even by republicans like Cicero. The concentration in Caesar's hands of all authority outside Rome completely and finally severed all real connection between the old institutions of the republic of Rome and the Government of the Roman empire. But the institutions of the republic not merely became, what they had originally been, the local institutions of the city of Rome; they were also subordinated even within these narrow limits to the paramount authority of the man who held in his hands the army and the provinces Autocratic abroad, at home he was the chief magistrate of the commonwealth; and this position was marked, in his case as in that of those who followed him, by a combination in his person of various powers, and by a general right of precedence which left no limits to his authority but such as he chose to impose upon himself. During the greater part of his reign he was consul as well as dictator. In 48, after his victory at Pharsalia, he was given the *tribunicia potestas* for life, and after his second success at Thapsus the *praefectura morum* for three years. As chief magistrate he convenes and presides in the senate, nominates candidates, conducts elections, carries laws in the assembly and administers justice in court. Finally, as a reminder that the chief magistrate of Rome was also the autocratic ruler of the empire, he wore even in Rome the laurel wreath and triumphal dress, and carried the sceptre of the victorious imperator.

Nor are we without some clue as to the policy which Caesar had sketched out for himself in the administration of the empire, the government of which he had centralized in his own hands. The much needed work of rectifying the frontiers he was forced, by his premature death, to leave to other hands, but within the frontiers he anticipated Augustus in lightening the financial burdens of the provincials, and in establishing a stricter control over the provincial governors, while he went beyond him in his desire to consolidate the empire by extending the Roman franchise and admitting provincials to a share in the Government. He completed the Romanization of Italy by his enfranchisement of the Transpadane Gauls, and by establishing throughout the peninsula a uniform system of municipal government, which under his successors was gradually extended to the provinces.

The Second Triumvirate, 43–28.—On the eve of his departure for the East, to avenge the death of Crassus and humble the power of Parthia, Caesar fell a victim to the republican nobles; and between the day of his death (March 15, 44) and that on which Octavian defeated Antony at Actium (Sept. 2, 31) lies a dreary period of anarchy and bloodshed.

For a moment, in spite of the menacing attitude of Caesar's self-constituted representative Marcus Antonius (Mark Antony), it seemed to one man at least as if the restoration of republican government was possible. With indefatigable energy Cicero strove to enlist the senate, the people, and above all the provincial governors in support of the old constitution. But, though his eloquence now and again carried all before it in senate house and forum, it was powerless to alter the course of events. By the beginning of 43 civil war had recommenced; in the autumn Antony was already threatening an invasion of Italy at the head of 17 legions. Towards the end of October Antony and his ally M. Aemilius Lepidus coalesced with the young Octavian, who had been recently elected consul at the age of 20, in spite of senatorial opposition; and the coalition was legalized by the creation of the extraordinary commission for the "reorganization of the commonwealth" known as the Second Triumvirate. It was appointed for a period of five years, and was continued in 37 for five years more. The rule of the triumvirs was inaugurated in the Sullan fashion by a proscription, foremost among the victims of which was Cicero himself. In the next year the defeat of M. Iunius Brutus and C. Cassius Longinus at Philippi, by the combined forces of Octavian and Antony, destroyed the last hopes of the republican party. In 40 a threatened rupture between the two victors was avoided by the treaty concluded at Brundisium. Antony married Octavian's sister Octavia, and took command of the eastern half of the empire; Octavian appropriated Italy and the West; while Lepidus was forced to content himself with Africa. For the next 12 years, while Antony was indulging in

[1] E. Meyer, *Kleine Schriften* (2nd ed. i. 449).

dreams of founding for himself and Cleopatra an empire in the East, and shocking Roman feeling by his wild excesses and his affectation of Oriental magnificence, Octavian was patiently consolidating his power. Lepidus, his fellow-triumvir, was in 36 ejected from Africa and banished to Circeii, while Sextus Pompeius, who had since his defeat at Munda maintained a semi-piratical ascendancy in the western Mediterranean, was decisively defeated in the same year, and his death in 35 left Octavian sole master of the West. The inevitable trial of strength between himself and Antony was not long delayed. In 32 Antony openly challenged the hostility of Octavian by divorcing Octavia in favour of the beautiful and daring Egyptian princess, with whom, as the heiress of the Ptolemies, he aspired to share the empire of the eastern world. By a decree of the senate Antony was declared deposed from his command, and war was declared against Queen Cleopatra. On Sept. 2, 31, was fought the battle of Actium. Octavian's victory was complete. Antony and Cleopatra committed suicide (30), and the eastern provinces submitted in 29. Octavian returned to Rome to celebrate his triumph and mark the end of the long-continued anarchy by closing the temple of Janus; at the end of the next year he formally laid down the extraordinary powers which he had held since 43, and a regular Government was established.

III. THE EMPIRE

Period I.: The Principate, 27 **B.C.–A.D.** 284.—**The Constitution of the Principate.**—The conqueror of Antonius at Actium, the great-nephew and heir of the dictator Caesar, was now summoned, by the general consent of a world wearied out with 20 years of war and anarchy, to the task of establishing a Government which should as far as possible respect the forms and traditions of the republic, without sacrificing that centralization of authority which experience had shown to be necessary for the integrity and stability of the empire.

The new system which was formally inaugurated by Octavian in 28–27 B.C. assumed the shape of a restoration of the republic under the leadership of a *princeps*. Octavian voluntarily resigned the extraordinary powers which he had held since 43, and, to quote his own words, "handed over the republic to the control of the senate and people of Rome." The old constitutional machinery was once more set in motion; the senate, assembly and magistrates resumed their functions; and Octavian himself was hailed as the "restorer of the commonwealth and the champion of freedom." But his abdication, in any real sense of the word, would have simply thrown everything back into confusion. Any revival of the kingly title was out of the question, and Octavian himself expressly refused the dictatorship. Nor was any new office created or any new official title invented for his benefit. But by senate and people he was invested according to the old constitutional forms with certain powers, as many citizens had been before him, and so took his place by the side of the lawfully appointed magistrates of the republic—only, to mark his pre-eminent dignity, as the first of them all, the senate decreed that he should take as an additional cognomen that of "Augustus," while in common parlance he was henceforth styled *princeps*, a simple title of courtesy, familiar to republican usage, and conveying no other idea than that of a recognized primacy- and precedence over his fellow-citizens. The ideal sketched by Cicero in his *De Republica*, of a constitutional president of a free republic, was apparently realized; but it was only in appearance. For in fact the special prerogatives conferred upon Octavian gave him back in substance the autocratic authority he had resigned, and as between the restored republic and its new *princeps* the balance of power was overwhelmingly on the side of the latter.

Octavian had held the *imperium* since 43; in 33, it is true, the powers of the triumvirate had legally expired, but he had continued to wield his authority, as he himself puts it, "by universal consent." In 27 he received a formal grant of the *imperium* from the senate and people for the term of ten years. and his *provincia* was defined as including all the provinces in which military authority was required and legions were stationed. He was declared commander-in-chief of the Roman army, and granted the exclusive right of levying troops, of making war and peace, and of concluding treaties. As consul, moreover, he not only continued to be the chief magistrate of the State at home, but took precedence in virtue of his *maius imperium*, over the governors of the "unarmed provinces," which were still nominally under the control of the senate. Thus the so-called "restoration of the republic" was in essence the recognition by law of the personal supremacy of Octavian, or Augustus, as he must henceforth be called.

In 23 an important change was made in the formal basis of Augustus's authority. In that year he laid down the consulship which he had held each year since 31, and could therefore only exert his *imperium pro consule*, like the ordinary governor of a province. He lost his authority as chief magistrate in Rome and his precedence over the governors of senatorial provinces. To remedy these defects a series of extraordinary offices were pressed upon his acceptance; but he refused them all, and caused a number of enactments to be passed which determined the character of the principate for the next three centuries. First, he was exempted from the disability attaching to the tenure of the *imperium* by one who was not an actual magistrate, and permitted to retain and exercise it in Rome. Secondly, his *imperium* was declared to be equal with that of the consuls, and therefore superior to that of all other holders of that power. Thirdly, he was granted equal rights with the consuls of convening the senate and introducing business, of nominating candidates at elections, and of issuing edicts. Lastly, he was placed on a level with the consuls in outward rank. Twelve lictors were assigned to him and an official seat between those of the consuls themselves.

Tribunicia **Potestas.**—Thus the proconsular authority was for the time admitted within the walls of Rome; but Augustus was too cautious a statesman to proclaim openly the fact that the power which he wielded in the city was the same as that exercised in camps and provinces by a Roman military commander. Hence he sought for a title which should disguise the nature of his authority, and found it in the "tribunician power," which had been conferred upon him for life in 36, and was well suited, from its urban and democratic traditions, to serve in Rome as "a term to express his supreme position." From 23 onwards the *tribunicia potestas* appears after his name in official inscriptions, together with the number indicating the period during which it had been held (also reckoned from 23); it was in virtue of this power that Augustus introduced the social reforms which the times demanded; and, though far inferior to the *imperium* in actual importance, it ranked with or even above it as a distinctive prerogative of the emperor or his chosen colleague.

The *imperium* and the *tribunicia potestas* were the two pillars upon which the authority of Augustus rested, and the other offices and privileges conferred upon him were of secondary importance. After 23 he never held the consulship save in 5 and 2 *B.C.*, when he became the colleague of his grandsons on their introduction to public life. He permitted the triumvir Lepidus tc retain the chief pontificate until his death, when Augustus naturally became *pontifex maximus* (12 B.C.). He proceeded with the like caution in reorganizing the chief departments of the public service in Rome and Italy. The *cura annonae, i.e.*, the supervision of the corn supply of Rome, was entrusted to him in 22 *B.C.*, and this important branch of administration thus came under his personal control; but the other boards (*curae*), created during his reign to take charge of the roads, the water-supply, the regulation of the Tiber and the public buildings, were composed of senators of high rank, and regarded in theory as deriving their authority from the senate.

Such was the ingenious compromise by which room was found for the master of the legions within the narrow limits of the old Roman constitution. Augustus could say with truth that he had accepted no office which was "contrary to the usage of our ancestors," and that it was only in *auctoritas*[1] that he took precedence of his colleagues. Nevertheless, as every thinking man must have realized, the compromise was unreal, and its signif-

[1] *See* Ramsay and Primerstein. *Mon. Antioch*, iv. 3 (1927).

icance was ambiguous. It was an arrangement avowedly-of an exceptional and temporary character, yet no one could suppose that it would in effect be otherwise than permanent. The powers voted to Augustus were (like those conferred upon Pompey in 67 B.C.) voted only to him, and (save the *tribunicia potestas)* voted only for a limited time; in 27 he received the *imperium* for ten years, and it was afterwards renewed for successive periods of five, five, ten and ten years. In this way the powers of the principate were made coextensive in time with the life of Augustus, but there was absolutely no provision for hereditary or any other form of succession, and various expedients were devised in order to indicate the destined successor of the *princeps* and to bridge the gap created by his death. Ultimately Augustus associated his stepson Tiberius with himself as co-regent. The *imperium* and the *tribunicia potestas* were conferred upon him, and he was thus marked out as the person upon whom the remaining powers of the principate would naturally be bestowed after the death of his stepfather. But succeeding emperors did not always indicate their successors so clearly, and, in direct contrast to the maxim that "the king never dies," it has been well said that the Roman principate died with the death of the *princeps.*

Changes in the Constitution of the **Principate.**—In theory, at least. the Roman world was governed according to the "maxims of Augustus" (Suet. *Ner.* 10), down to the time of Diocletian. Even in the 3rd century there is still in name at least a republic, of which the emperor is in strictness only the chief magistrate, deriving his authority from the senate and people, and with prerogatives limited and defined by law. The case is quite different when we turn from theory to practice. The division of authority between the republic and its chief magistrate became increasingly unequal. Over the provinces the *princeps* from the first ruled autocratically; and this autocracy reacted upon his position in Rome, so that it became every year more difficult for a ruler so absolute abroad to maintain even the fiction of republican government at home. The republican institutions, with the partial exception of the senate, lose all semblance of authority outside Rome, and even as the municipal institutions of the chief city of the empire they retain but little actual power. The real government even of Rome passes gradually into the hands of imperial prefects and commissioners, and the old magistracies become merely decorations which the emperor bestows at his pleasure. At the same time the rule of the *princeps* assumes an increasingly personal character, and the whole work of government is silently concentrated in his hands and in those of his own subordinates. Closely connected with this change is the different aspect presented by the history of the empire in Rome and Italy on the one hand and in the provinces on the other. Rome and Italy share in the decline of the republic. Political independence and activity die out; their old pre-eminence and exclusive privileges gradually disappear; and at the same time the weight of the overwhelming power of the *princeps,* and the abuses of their power by individual *principes,* press most heavily upon them. On the other hand, in the provinces and on the frontiers, where the imperial system was most needed, and where from the first it had full play, it is seen at its best as developing or protecting an orderly civilization and maintaining the peace of the world.

The decay of the republican institutions had commenced before the revolutionary crisis of 49. It was accelerated by the virtual suspension of regular government between 49 and 28; and not even the diplomatic deference towards ancient forms which Augustus displayed availed to conceal the unreality of his work of restoration. The *comitia* received back from him "their ancient rights" (Suet. *Aug.* 40), and during his lifetime they continued to pass laws and to elect magistrates. But after the end of the reign of Tiberius we have only two instances of legislation by the assembly in the ordinary way[1], and the law-making of the empire is performed either by decrees of the senate or by imperial edicts and constitutions. Their prerogative of electing magistrates was, even under Augustus, robbed of most of its importance by the control which the *princeps* exercised over their choice by means of his rights of nomination and commendation, which effectually secured the election of his own nominees. By Tiberius this restricted prerogative was still further curtailed. The candidates for all magistracies except the consulship were thenceforward nominated and voted for in the senate house and by the senators, and only the formal return of the result *(renuntiatio)* took place in the assembly (Dio lviii. 20). The *princeps* himself as long as the principate lasted, continued to receive the *tribunicia potestas* by a vote of the assembly, and was thus held to derive his authority from the people.

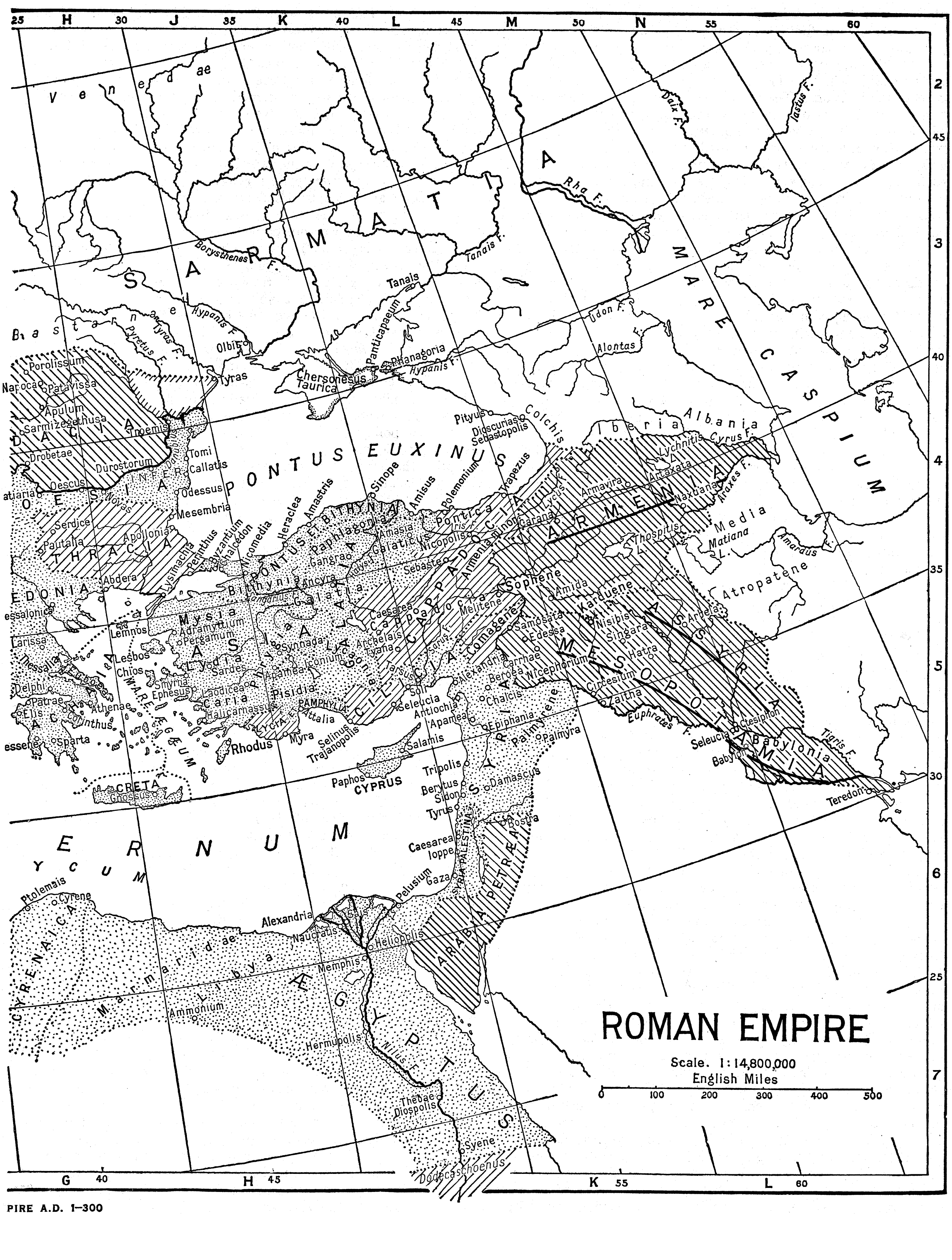
This almost complete effacement of the *comitia* was largely due to the fact that they had ceased to represent anything but the populace of Rome, and the comparatively greater vitality shown by the old magistracies is mainly attributable to the value they continued to possess in the eyes of the Roman upper class. But, though they were eagerly sought (Plin. *Epp.* ii. g, vi. 6), and conferred on their holders considerable social distinction, the magistrates ceased, except in name, to be the popularly chosen executive officers of the Roman State. In the administration of the empire at large they had no share, if we except the subordinate duties still assigned to the quaestor in a province. In Rome, to which their sphere of work was limited, they were overshadowed by the dominant authority of the *princeps,* while their range of duties was increasingly circumscribed by the gradual transference of administrative authority, even within the city, to the emperor and his subordinate officials. .

The senate alone among republican institutions retained some importance and influence, and it thus came to be regarded as sharing the government of the empire with the *princeps* himself. It nominally controlled the administration of Italy and of the "public provinces," whose governors it appointed. It is to the senate, in theory, that the supreme power reverts in the absence of a *princeps.* It is by decree of the senate that the new *princeps* immediately receives his powers and privileges, though he is still supposed to derive them ultimately from the people. After the cessation of all legislation by the *comitia,* the only law-making authority, other than that of the *princeps* by his edicts, was that of the senate by its decrees. Its judicial authority was co-ordinate with that of the emperor, and at the close of the 1st century we find the senators claiming, as the emperor's "peers," to be exempt from his jurisdiction. But in spite of the outward dignity of its position, and of the deference with which it was frequently treated, the senate became gradually almost as powerless in reality as the *comitia* and the magistracies. The senators continued indeed to be taken as a rule from the ranks of the wealthy, and a high property qualification was established by Augustus as a condition of membership; but this merely enabled the emperors to secure their own ascendancy by subsidizing those whose property fell short of the required standard, and who thus became simply the paid creatures of their imperial patrons. Admission to the senate was possible only by favour of the emperor, both as controlling the elections to the magistracies, which still gave entrance to the curia, and as invested with the power of directly creating senators by *adlectio,* a power which from the time of Vespasian onwards was freely used. As the result, the composition of the senate rapidly altered. Under Augustus and Tiberius it still contained many representatives of the old republican families, whose prestige and ancestral traditions were some guarantee for their independence. But this element soon disappeared. The ranks of the old nobility were thinned by natural decay and by the jealous fears of the last three Claudian emperors. Vespasian flooded the senate with new men from the municipal towns of Italy and the Latinized provinces of the West. Trajan and Hadrian, both provincials themselves, carried on the same policy, and by the close of the 2nd century even the Greek provinces of the East had their representatives in the senate. Some, no doubt, of these provincials, who constituted the great majority of the senate in the 3rd century, were men of wealth and mark, but many more were of low birth; on some rested the stain of a servile descent, and all owed alike their present position and their chances of further promotion to the emperor. The procedure of the senate was as completely

[1] The *plebiscita* of Claudius, Tac. *Ann,* xi. 13, 14, and the *lex agraria* of Nerva; *Digest,* xlvii. 21, 3; Dio lxviii. 2; Plin. *Epp.* vii. 31.

DRAWN BY JOHN BARTHOLOMEW

MAP OF THE ROM.


ROMAN EMPIRE
Scale. 1:14,800,000
English Miles
0 100 200 300 400 500
SARMATIA
Venedae
Bastarnae
MARE CASPIUM
PONTUS EUXINUS
MARE ÆGÆUM
DACIA
MOESIA INFER.
THRACIA
MACEDONIA
ACHAIA
ASIA
BITHYNIA
PONTUS ET BITHYNIA
GALATIA
CAPPADOCIA
ARMENIA
MESOPOTAMIA
ASSYRIA
CILICIA
SYRIA
ARABIA PETRÆA
SYRIA PALESTINA
CYRENAICA
ÆGYPTUS
CRETA
CYPRUS
Media
Atropatene
Albania
Iberia
Colchis
Sophene
Commagene
Karduene
Babylonia
Mysia
Lydia
Caria
Pisidia
Lycia
Pamphylia
Paphlagonia
Pontica
Armenia minor
Marmaridae
Libya
Borysthenes F.
Tanais F.
Rha F.
Daix F.
Iastus F.
Hypanis F.
Tyras F.
Pyretus F.
Udon F.
Alontas
Cyrus F.
Araxes F.
Lycus F.
Iris F.
Halys F.
Sangarius F.
Tigris F.
Euphrates F.
Nilus F.
Lychnitis
Thospitis
Matiana L.
Amardus F.
Tanais
Panticapaeum
Phanagoria
Chersonesus Taurica
Olbia
Tyras
Porolissum
Napoca
Potavissa
Apulum
Sarmizegethusa
Drobetae
Troesmis
Tomi
Callatis
Durostorum
Oescus
Odessus
Novae
Mesembria
Serdice
Pautalia
Apollonia
Abdera
Perinthus
Byzantium
Chalcedon
Nicomedia
Lysimachia
Heraclea
Amastris
Sinope
Amisus
Polemonium
Trapezus
Pityus
Dioscurias Sebastopolis
Amasia
Gangra
Ancyra
Nicopolis
Sebaste
Carana
Armavira
Artaxata
Naxuana
Melitene
Amida
Samosata
Edessa
Carrhae
Nisibis
Singara
Hatra
Arbela
Nicephorium
Circesium
Zaitha
Ctesiphon
Seleucia
Babylon
Teredon
Thessalonica
Larissa
Thessalia
Euboea
Delphi
Patrae
Elis
Corinthus
Athenae
Sparta
Messene
Lemnos
Lesbos
Chios
Adramyttium
Pergamum
Smyrna
Ephesus
Sardes
Laodicea
Halicarnassus
Synnada
Apamea
Iconium
Archelais
Tyana
Caesarea
Tarsus
Soli
Seleucia
Antiochia
Apamea
Alexandria
Beroea
Chalcis
Epiphania
Palmyra
Palmyrene
Attalia
Myra
Selinus
Trajanopolis
Rhodus
Cnossus
Salamis
Paphos
Tripolis
Berytus
Sidon
Tyrus
Damascus
Bostra
Caesarea
Ioppe
Gaza
Pelusium
Alexandria
Naucratis
Sais
Heliopolis
Memphis
Ammonium
Hermupolis
Thebae Diospolis
Syene
Dodecaschoenus
Ptolemais
Cyrene
ERNUM
YCUM
H J K L M N
G H K L
25 30 35 40 45 50 55 60
40 45 55 60
2 3 4 5 6 7
45 40 35 30 25

at the mercy of the *princeps* as its composition. He was himself a senator and the first of senators; he possessed the magisterial prerogatives of convening the senate, of laying business before it, and of carrying *senatus consulta;* above all, his tribunician power enabled him to interfere at any stage, and to modify or reverse its decisions. The share of the senate in the government was in fact determined by the amount of administrative activity which each *princeps* saw fit to allow it to exercise, and this share became steadily smaller. The jurisdiction assigned it by Augustus and Tiberius was in the 3rd century limited to the hearing of such cases as the emperor thought fit to send for trial, and these became steadily fewer in number. Its control of the State treasury, as distinct from the imperial *fiscus,* was in fact little more than nominal, and became increasingly unimportant as the great bulk of the revenue passed into the hands of the emperor.

The process by which all authority became centralized in the hands of the *princeps* and in practice exercised by an organized bureaucracy was of necessity gradual; but it had its beginnings under Augustus, who formed the equestrian order (admission to which was henceforth granted only by him) into an imperial service, partly civil and partly military, whose members, being immediately dependent on the emperor, could be employed on tasks which it would have been impossible to assign to senators *(see* EQUITES). From this order were drawn the armies of "procurators'—the term was derived from the practice of the great business houses of Rome—who administered the imperial revenues and properties in all parts of the empire. Merit was rewarded by independent governorships such as those of Raetia and Noricum, or the command of the naval squadrons at Misenum and Ravenna; and the prizes of the knight's career were the prefectures of the praetorian guard, the corn-supply and the city police, and the governorship of Egypt. The household offices and imperial secretaryships were held by freedmen, almost always of Greek origin, whose influence became all-powerful under such emperors as Claudius. The financial secretary *(a rationibus)* and those who dealt with the emperor's correspondence *(ab epistulis)* and with petitions *(a libellzs)* were the most important of these.

Caesar Worship.—This increase of power was accompanied by a corresponding elevation of the *princeps* himself above the level of all other citizens. The comparatively modest household and simple life of Augustus were replaced by a more than regal splendour, and under Nero we find all the outward accessories of monarchy present, the palace, the palace guards, the crowds of courtiers and a court ceremonial. In direct opposition to the republican theory of the principate, members of the family of the *princeps* share the dignities of his position. The males bear the cognomen of Caesar, and are invested, as youths, with high office; their names and even those of the females are included in the yearly prayers for the safety of the *princeps;* their birthdays are kept as festivals; the praetorian guards take the oath to them as well as to the *princeps* himself.

These honours culminate in the "imperial cult" which most definitely marks the vast distance between republican and imperial Rome. Julius Caesar, for policy's sake, had been enticed by Alexander's example to attempt the introduction of autocracy in the only form known in the ancient world. The East was accustomed to accepting commands from the semi-divine king and made no objection, and since half the population of Rome now consisted of the stock of slaves and captives the plan met with noisy applause by the lowest classes at Rome. But Brutus's dagger was the senate's answer to the proposal. Octavian, who rested his hopes of succession on the favour of Caesar's devout soldiers and on the sacred character of Caesar's last will and testament, did all in his power to canonize Julius, and built a temple to *Divus Iulius* in the Forum. This sufficed for his immediate purpose, and when he consolidated his position after Antony's defeat he wisely forbade the bestowal of divine honours upon himself within Italy while welcoming deification in Asia and Egypt where the populace could not understand why the successor of Ptolemies and Seleucid kings should not be a god. However, even in Italy the Oriental ex-slave population, very numerous everywhere, would revert to non-Roman mysticism. Here and there in Italy shrines arose and were permitted, not to Augustus, but to the "genius" of Augustus[1], and in 12 B.C the court devised an organization of ex-slaves in the towns of Italy for devotions to the Augustan *lares.* Thus the Oriental cult crept in gradually. And as the worship of Augustus by the eastern provincial communes seemed to the court to be a pleasing token of loyalty, attempts were also made officially to introduce the worship at the meetings of the provincial gatherings in Gaul, Spain and Africa. But it must be said that, except so far as Orientals took part in the worship, in the West it was and remained to the end merely lip service. As the cult was worked out for Italy after Augustus's death the emperor: were deified only after death and the worship was directed to the *Divi.* But in the provinces the worship of the living ruler continued. The image of the living emperor was on the army standards and was made the object of devotion, and refusal to perform libations to it became the ugly test of treason and of heterodoxy. A few emperors, like Caligula and Domitian, attempted to invite, while living, the honours of *Divi* even in Rome, but with little success. Diocletian was the first emperor who actually brought into the very senate the worship of the emperor as it was practised all through the empire in Asiatic cities, and he had his capital in Asia.

The Frontiers.—To secure peace it was necessary to establish on all sides of the empire really defensible frontiers; and this became possible now that for the first time the direction of the foreign policy of the state and of its military forces was concentrated in the hands of a single magistrate. To the south and west the generals of the republic, and Caesar himself, had extended the authority of Rome to the natural boundaries formed by the African deserts and the Atlantic ocean, and in these two directions Augustus's task was in the main confined to the organization of a settled Roman government within these limits. In Africa the client state of Egypt was ruled by Augustus as the successor of the Ptolemies, and administered by his deputies *(praefecti),* and the kingdom of Numidia (25 B.C.) was incorporated with the old province of Africa. In Spain the hill-tribes of the north-west were finally subdued and a third province, Lusitania, established. In Gaul Augustus (27 B.C.) established in addition to the "old province" the three new ones of Aquitania, Lugdunensis and Belgica, which included the territories conquered by Julius Caesar. Towards the north the republic had left the civilized countries bordering on the Mediterranean with only a very imperfect defence against the threatening mass of barbarian tribes beyond them. The result of Augustus's policy was to establish a protecting line of provinces running from the Euxine to the North sea, and covering the peaceful districts to the south —Moesia (A.D. 6), Pannonia (A.D. 9), Noricum (1 j B C.), Raetia (15 B C.) and Gallia Belgica. Roman rule was thus carried up to the natural frontier lines of the Rhine and the Danube. It mas originally intended to make the Elbe the frontier of the empire; but after the defeat of P. Quintilius Varus (A.D. 9) the forward policy was abandoned. Tiberius recalled Germanicus as soon as Varus had been avenged; and after the peace with Maroboduus, the chief of the Marcomanni on the upper Danube, in the next year (A.D 17), the defensive policy recommended by Augustus was adopted along the whole of the northern frontier. The line of the great rivers was held by an imposing mass of troops. Along the Rhine lay the armies of Upper and Lower Germany, consisting of four legions each; eight more guarded the Danube and the frontiers of Pannonia and Moesia. At frequent intervals along the frontier were the military colonies, the permanent camps and the smaller intervening *castella.* Flotillas of galleys cruised up and down the rivers, and Roman roads opened communication both along the frontiers and with the seat of government in Italy.

In the East, Rome was confronted with a well organized and powerful State whose claims to empire were second only to her own. The victory of Carrhae (53 B.C.) had encouraged among the Parthians the idea of an invasion of Syria and Asia Minor, while it had awakened in Rome a genuine fear of the formidable power which had so suddenly arisen in the East. Caesar was at the moment of his death preparing to avenge the death of Crassus by

[1]L. R. Taylor, in Trans. ***Amer.*** *Phil. Assn. 1920,* 116.

an invasion of Parthia, and Antony's schemes of founding an Eastern empire which should rival that of Alexander included the conquest of the kingdom beyond the Euphrates. Augustus, however, adhered to the policy which he recommended to his successors of "keeping the empire within its bounds"; and the Parthians, weakened by internal feuds and dynastic quarrels, were in no mood for vigorous action. Roman pride was satisfied by the restoration of the standards taken at Carrhae. Four legions guarded the line of the Euphrates, and, beyond the frontiers of Pontus and Cappadocia, Armenia was established as a "friendly and independent ally."

The **Provinces.**—Next in importance to the rectification and defence of the frontiers was the reformation of the administration, and the restoration of prosperity to the distracted and exhausted provinces. The most serious defect of the republican system had been the absence of any effective control over the Roman officials outside Italy. This was now supplied by the general proconsular authority vested in the emperor. The provinces were for the first time treated as departments of a single State, while their governors, from being independent and virtually irresponsible rulers, became the subordinate officials of a higher authority. Over the *legati* of the imperial provinces the control of the emperor was as complete as that of the republican proconsul over his staff in his own province. They mere appointed by him, held office at his good pleasure, and were directly responsible to him for their conduct. The proconsuls of the senatorial provinces were in law magistrates equally with the *princeps,* though inferior to him in rank; it was to the senate that they were, as of old, responsible; they were still selected by lot from among the senators of consular and praetorian rank. But the distinction did not seriously interfere with the paramount authority of the emperor. The provinces left nominally to the senate were the more peaceful and settled districts in the heart of the empire, where only the routine work of civil administration was needed, and where the local municipal governments were as yet comparatively vigorous. The senatorial proconsuls themselves were indirectly nominated by the emperor through his control of the praetorship and consulship. They wielded no military and only a strictly subordinate financial authority, and, though Augustus and Tiberius, at any rate, encouraged the fiction of the responsibility of the senatorial governors to the senate, it was in reality to the emperor that they looked for direction and advice, and to him that they were held accountable. Moreover, in the case of all governors this accountability became under the empire a reality. Prosecutions for extortion (de pecuniis *repetundis*), which were now transferred to the hearing of the senate, were tolerably frequent during the first century of the empire; but a more effective check on maladministration lay in the appeal to Caesar from the decisions of any governor, which was open to every provincial, and in the right of petition. Finally, the authority both of the legate and the proconsul was weakened by the presence of the imperial procurator, to whom was entrusted the administration of the fiscal revenues; while both legate and proconsul were deprived of that right of requisitioning supplies which. in spite of a long series of restrictive laws, had been the most powerful instrument of oppression in the hands of republican governors. The financial reforms of Augustus are marked by the same desire to establish an equitable, orderly and economical system, and by the same centralization of authority in the emperor's hands. The institution of an imperial census or valuation of all land throughout the empire, and the assessment upon this basis of a uniform land tax, in place of the heterogeneous and irregular payments made under the republic, were the work of Augustus, though the system was developed and perfected by the emperors of the 2nd century and by Diocletian. The land tax itself was directly collected, either by imperial officials or by local authorities responsible to them, and the old wasteful plan of selling the privilege of collection to *publicani* was henceforward applied only to such indirect taxes as the customs duties. The rate of the land tax was fixed by the emperor, and with him rested the power of remission even in senatorial provinces. The effect of these reforms is clearly visible in the improved financial condition of the empire. Under the republic the treasury had been nearly always in difficulties, and the provinces exhausted and impoverished. Under the emperors, at least throughout the 1st century, in spite of a largely increased expenditure on the army, on public works, on shows and largesses, and on the machinery of government itself, the better emperors, such as Tiberius and Vespasian, were able to accumulate large sums, while tht provinces showed but few signs of distress. Moreover, while the republic had almost entirely neglected to develop the internal resources of the provinces, Augustus set the example of a liberal expenditure on public works, in the construction of harbours, roads and bridges, the reclamation of waste lands and the erection of public buildings.

The **Julio-Claudian** Line.—Augustus founded a dynasty which occupied the throne for more than half a century after his death. The first and by far the ablest of its members was Tiberius (**A.D.** 14–37). He was undoubtedly a capable and vigorous ruler, who enforced justice in the government of the provinces, maintained the integrity of the frontiers and husbanded the finances of the empire, but he became intensely unpopular in Roman society, and was painted as a cruel and odious tyrant. His successor, Gaius (**A.D.** 37–41), generally known as Caligula, was the slave of his wild caprices and uncontrolled passions, which issued in manifest insanity. He was followed by his uncle, Claudius (**A.D.** 41–54), whose personal uncouthness made him an object of derision to his contemporaries, but who was by no means devoid of statesmanlike faculties. His reign left an abiding mark on the history of the empire, for he carried forward its development on the lines intended by Augustus. Client-states were absorbed, southern Britain was conquered, the romanization of the West received a powerful impulse, public works were executed in Rome and Italy, and the organization of the imperial bureaucracy made rapid strides. Nero (**A.D.** 54–68), the last of the Julio-Claudian line, has been handed down to posterity as the incarnation of monstrous vice and fantastic luxury. But his wild excesses scarcely affected the prosperity of the empire at large; the provinces were well governed, and the war with Parthia led to a compromise in the matter of Armenia which secured peace for half a century.

The **Antonine** Empire.—The fall of Nero and the extinction of the "progeny of the Caesars" was followed by a war of succession which revealed the military basis of the principate and the weakness of the tie connecting the emperor with Rome. Galba, Otho, Vitellius and Vespasian represented in turn the legions of Spain, the household troops, the army of the Rhine, and a coalition of the armies of the Danube and the Euphrates; and all except Otho were already de facto emperors when they entered Rome. The final survivor in the struggle, Vespasian (**A.D.** 70–79), was a man of comparatively humble origin, and as the principate ceased to possess the prestige of high descent it became imperatively necessary to remove, as far as possible, the anomalies of the office and to give it a legitimate and permanent form. Thus we find an elaborate and formal system of titles substituted for the personal names of the Julio-Claudian emperors, an increasing tendency to insist on the inherent prerogatives of the principate (such as the censorial power), and an attempt to invest Caesarism with an hereditary character, either by natural descent or by adoption, while the worship of the *Divi,* or deified Caesars, was made the symbol of its continuity and legitimacy. The dynasty of Vespasian and his sons (Titus. **A.D.** 79–81. Domitian, **A.D.** 81–96) became extinct on the murder of the last named, whose high-handed treatment of the senate earned him the name of a tyrant: his successor, Nerva (**A.D.** 96–98), opened the series of "adoptive" emperors (Trajan, **A.D.** 98–117, Hadrian, 117–138, Antoninus Pius, 138–161, Marcus Aurelius 161–180) under whose rule the empire enjoyed a period of internal tranquillity and good government. Its boundaries were extended by the subjugation of northern Britain by Agricola, **A.D.** 78–84 (see **BRITAIN**: *Roman*), by the annexation of the districts included in the angle of the Rhine and Danube under the Flavian emperors, and by the conquest of Dacia (the modern Transylvania) under **Trajan** (completed in **A.D.** 106). Trajan also annexed Arabia

Petraea and in his closing years invaded Parthia and formed provinces of Armenia, Mesopotamia and Assyria; but these conquests were surrendered by his successor, Hadrian, who set himself to the task of consolidating the empire and perfecting its defences. To him is due the system of permanent *limites* or frontier fortifications, such as the wall which protected northern Britain and the palisade which replaced the chain of forts established by the Flavian emperors from the Rhine to the Danube. The construction of these defences showed that the limit of expansion had been reached, and under M. Aurelius the tide began to turn. A great part of his reign was occupied with wars against the Marcomanni, Quadi, Sarmatians, etc., whose irruptions seriously threatened the security of Italy, Henceforth Rome never ceased to be on the defensive.

Within the frontiers the levelling and unifying process commenced by Augustus had steadily proceeded. A tolerably uniform provincial system covered the whole area of the empire. The client-states had one by one been reconstituted as provinces, and even the government of Italy had been in many respects assimilated to the provincial type. The municipal system had spread widely; the period from Vespasian to Aurelius witnessed the elevation to municipal rank of an immense number of communities, not only in the old provinces of the West, in Africa, Spain and Gaul, but in the newer provinces of the North, and along the line of the northern frontier; and everywhere under the influence of the central imperial authority there was an increasing uniformity in the form of the local constitutions, framed and granted as they all were by imperial edict. Throughout the empire again the extension of the Roman franchise was preparing the way for the final act by which Caracalla assimilated the legal status of all free-born inhabitants of the empire, and in the west and north this was preceded and accompanied by the complete romanizing of the people in language and civilization. Yet, in spite of the internal tranquillity and the good government which have made the age of the Antonines famous, we can detect signs of weakness. It was in this period that the centralization of authority in the hands of the *princeps* was completed; the "dual control" established by Augustus, which had been unreal enough in the 1st century, was now, though not formally abolished, systematically ignored in practice. The senate ceased to be an instrument of government, and became an imperial peerage, largely composed of men not qualified by election to the quaestorship but directly ennobled by the emperor. The restricted sphere of administration left by Augustus to the old magistracies was still further narrowed; their jurisdiction, for example, tended to pass into the hands of the Greek officers appointed by Caesar—the prefect of the city and the prefect of the guards. The complete organization of Caesar's own administrative service, and its recognition as a state bureaucracy, was chiefly the work of Hadrian, who took the secretaryships out of the hands of freedmen and entrusted them to procurators of equestrian rank. All these changes, inevitable, and in some degree beneficial, as they were, brought with them the attendant evils of excessive centralization. Though these were hardly felt while the central authority was wielded by vigorous rulers, yet even under Trajan, Hadrian and the Antonines we notice a failure of strength in the empire as a whole, and a corresponding increase of pressure on the imperial Government itself. The reforms of Augustus had given free play to powers still fresh and vigorous. The ceaseless labours of Hadrian were directed mainly to the careful husbanding of such strength as still remained, or to attempts at reviving it by the sheer force of imperial authority. Among the symptoms of incipient decline were the growing depopulation, especially of the central districts of the empire, the constant financial difficulties, the deterioration in character of the local governments in the provincial communities, and the increasing reluctance exhibited by all classes to undertake the now onerous burden of municipal office.

It is to such facts as these that we must look in passing a final judgment on the imperial Government, which is admittedly seen in its best and most perfect form in the Antonine period. In our review of the conditions which brought about the fall of the Roman republic, we saw that the collapse of the city-state made Caesarism inevitable, since the extension of federal and representative institutions to a heterogeneous world-empire was out of the question. The benefits which Caesarism conferred upon mankind are plain. In the first place, the Roman world, which had hitherto not been governed in the true sense of the word, but exploited in the interests of a dominant clique, now received an orderly and efficient government, under which the frightful ravages of misrule and civil strife were repaired. The financial resources of the empire were husbanded by skilled and, above all *trained* administrators, to whom the imperial service offered a *carrière ouverte aux talents;* many of these were Greeks, or half-Greek Orientals, whose business capacity formed an invaluable asset hitherto neglected. Augustus caused an official survey of the empire to be made, and a scientific census of its resources was gradually carried out and from time to time revised; thus the balance of revenue and expenditure could be accurately estimated and adjusted, and financial stability was established. The system of tax-farming was gradually abolished and direct collection substituted; commerce was freed from vexatious restrictions, and large customs-districts were formed, on whose borders duties were levied for revenue only. The Government took even more direct measures for the encouragement of industry and especially of agriculture. The most remarkable of these were the "alimentary" institutions, originally due to Nerva and developed by succeeding emperors. Capital was advanced at moderate rates of interest to Italian landowners on the security of their estates, and the profits of this system of land banks were devoted to the maintenance and education of poor children. The foundation of colonies for time-expired soldiers, who received grants of land on their discharge, contributed something to the formation of a well-to-do agricultural class; and although the system was not successful in lower Italy, where economic decline could not be arrested, there can be no doubt that central and northern Italy, where the vine and olive were largely cultivated, and manufacturing industries sprang up, enjoyed a considerable measure of prosperity. The extension of the Roman municipal system to the provinces, and the watchful care exercised by the imperial Government over the communities, together with the profuse liberality of the emperors, which was imitated by the wealthier citizens of the towns, led to the creation of a flourishing municipal life still evidenced by the remains which in districts such as Asia Minor or Tunis stand in significant contrast with the desolation which was brought about by centuries of barbaric rule. Mommsen[1] has, indeed, expressed the opinion that "if an angel of the Lord were to strike the balance whether the domain ruled by Antoninus were governed with the greater intelligence and the greater humanity at that time or in the present day, whether civilization and national prosperity generally had since that time advanced or retrograded, it is very doubtful whether the decision would prove in favour of the present."

But there is another side to the picture. During the last two centuries of the republic Rome, by introducing slaves and captives to perform the hard labour of Italy while the free population spent itself in war or lost itself in the provinces, had thoroughly changed the Italian stock. Had the change come gradually and had Rome received the newcomers into schools that might have trained them into a consistent tradition this introduction of a varied stock might perhaps have enriched the spirit of Rome. But this was not to be. Such an amalgam requires time to eliminate the products of incongruous physical mixture,[2] to unify the peoples of a dozen languages until they can comprehend each other and effectually shape common ideals, to distil and throw off the hatred, servility and unsocial hostility to the community bred by years of suffering in slavery, and in a word to create a new people homogeneous enough to act together. The invasion was so rapid and the time so short that such a process of unification never completed itself at Rome. And when Rome, which was the heart of the empire, lost its rhythm and balance, when Rome no longer had a definite culture, a certain inspiration to impart to the provinces, when Rome's religion suc-

[1] *Provinces*, i. p. 5.
[2] M. P. Nilsson, in *Hereditas* (1921), 370.

cumbed to the several mystical cults brought in by her slaves, when her moral standards yielded before a dozen incongruous traditions, and her literature lost itself in blind gropings after a bygone tradition of a freer day, the provincials in despair abandoned her guidance.

Furthermore, the empire brought into being in the provinces a new nationality, due to the partial fusion of Roman ideas with Hellenic culture, beside which other elements, saving only, as we shall see, those contributed by the Oriental religions, were insignificant. This new nationality grew in definition through the gradual disappearance of distinctions of language and manners, the assimilating influence of commercial and social intercourse, and the extinction of national jealousies and aspirations. But the cosmopolitan society thus formed was compacted of so many disparate elements that a common patriotism was hard to foster, and doubly hard when the autocratic system of government prevented men from aspiring to that true political distinction which is attainable only in a self-governing community. It is true that there was much good work to be done, and that much good work was done, in the service of the emperors; true, also, that the *carrière ouverte* aux talents was in large measure realized. Distinctions of race were slowly but steadily efiaced by the grant of citizen rights to provincials and by the manumission of slaves; and the career open to the romanized provincial or the liberated slave might culminate in the highest distinctions which the emperor could bestow. In the hierarchy of social orders — senate, *equites* and plebs — ascent was easy and regular from the lower grade to the higher; and the more enlightened of the emperors — especially Hadrian — made a genuine endeavour to give a due share in the work of government to the various subject races. But nothing could compensate for the lack of self-determination, and although during the first century and a half of imperial rule a flourishing local patriotism in some degree filled the place of the wider sentiment, this gradually sank into decay and became a pretext under cover of which the lower classes in the several communities took toll of their wealthier fellow-citizens in the shape of public works, largesses, amusements, etc., until the resources at the disposal of the rich ran dry, the communities themselves in many cases became insolvent, and the inexorable claims of the central Government were satisfied only by the surrender of financial control to an imperial commissioner. Then the organs of civic life became atrophied, political interest died out, and the whole burden of administration, as well as that of defence, fell upon the shoulders of the bureaucracy, which proved unequal to the task.

The **Empire**, 180–284.—Marcus Aurelius died in 180, and the reign of his worthless son, Commodus (A.D. 180–192), was followed by a century of war and disorder, during which nothing but the stern rule of soldier emperors saved the empire from dissolution. The first and ablest of these was Septimius Severus (193–211), whose claims were disputed by Clodius Albinus in the West, and by Pescennius Niger in the East; in these struggles rival Roman forces, for the first time since the accession of Vespasian, exhausted each other in civil war. Severus emphasized strongly the military character of the principate; he abstained from seeking confirmation for his authority from the senate, and deprived that body of most of the share in the government which it still retained; he assumed the title of proconsul in Rome itself, made the prefect of the guard the vicegerent of his authority, and heaped privileges upon the army, which, although they secured its entire devotion to his family, impaired its efficiency as a fighting force and thus weakened Rome in face of the barbarian invader. He succeeded in founding a short-lived dynasty, which ended with the attempt of the virtuous but weak Alexander (222–235) to restore the independence of the senate. This led to a military reaction, and the elevation of the brutal Maximinus, a Thracian peasant, to the throne. The disintegration of the empire was the natural result; for the various provincial armies put forward their commanders as claimants to the purple. These "tyrants," as they were called when unsuccessful, sprang up in ever-increasing numbers, and weakened Rome's power of resistance to the new enemies who were threatening her frontiers — the Alamanni and Franks, who broke through the German *limes* in 236; the Goths, who crossed the Danube in 247, raided the Balkan provinces, and defeated and slew the emperor, Decius, in 251, and the restored Persian kingdom of the Sassanidae (see PERSIA), whose rulers laid claim to all the Asiatic possessions of Rome and in 260 captured Antioch and made the emperor, Valerian, a prisoner. During the reign of Gallienus, the son of Valerian (260–268), the evil reached its height. The central authority was paralysed; the romanized districts beyond the Rhine were irrevocably lost; the Persians were threatening to overrun the eastern provinces; the Goths had formed a fleet of 500 sail which harried Asia Minor and even Greece itself, where Athens, Corinth, Sparta and Argos were sacked; and the legions on the frontiers were left to repel the enemies of Rome as best they could. A provincial empire was established by M. Cassianius Latinius Postumus in Gaul and maintained by his successors, M. Piavonius Victorinus and C. Pius Esuvius Tetricus. Their authority was acknowledged, not only in Gaul and by the troops on the Rhine, but by the legions of Britain and Spain; and under Postumus at any rate (259–269) the existence of the Gallic empire was justified by the repulse of the barbarians and by the restoration of peace and security to the provinces of Gaul. On the Danube, in Greece and in Asia Minor none of the "pretenders" enjoyed more than a passing success. In the Far East, the Syrian Odaenathus, prince of Palmyra (*q.v.*), though officially only the governor of the East (dux Orientis) under Gallienus, drove the Persians out of Asia Minor and Syria, recovered Mesopotamia, and ruled Syria, Arabia, Armenia, Cappadocia and Cilicia with all the independence of a sovereign. Odaenathus was murdered in 266. His young son Vaballathus (Wahab-allath) succeeded him in his titles, but the real power was vested in his widow Zenobia, under whom not only the greater part of Asia Minor but even the province of Egypt was forcibly added to the dominions governed by the Palmyrene prince, who ceased to acknowledge the supremacy of Rome.

Gallienus was murdered at Milan in 268, and after the brief reign of Claudius II. (A.D. 268–270), who checked the advance of the Goths, Aurelian (270–275) restored unity to the distracted empire. Palmyra was destroyed and Zenobia led a prisoner to Rome (273) and in the next year the Gallic empire came to an end by the surrender of Tetricus. Aurelian, it is true, abandoned the province of Dacia, but the defences of the Danube were strengthened, and in 276 Probus repulsed the Franks and Alamanni, who had been pressing on the Rhine frontier for some 40 years. Finally, Carus (282) recovered Armenia and Mesopotamia from the Persians and restored the frontier fixed by Septimius Severus.

The Empire at the Close of the 3rd Century.—Although any serious loss of territory had been avoided, the storms of the 3rd century had told with fatal effect upon the general condition of the empire. The "Roman peace" had vanished; not only the frontier territories, but the central districts of Greece, Asia Minor, and even Italy itself, had suffered from the ravages of war, and the fortification of Rome by Aurelian was a significant testimony to the altered condition of affairs. War, plague and famine had thinned the population and crippled the resources of the provinces. On all sides land was running waste, cities and towns were decaying and commerce was paralysed. Only with the greatest difficulty were sufficient funds squeezed from the exhausted taxpayers to meet the increasing cost of the defence of the frontiers. The old established culture and civilization of the Mediterranean world rapidly declined, and the mixture of barbaric rudeness with Oriental pomp and luxury which marked the court, even of the better emperors, such as Aurelian, was typical of the general deterioration, which was accelerated by the growing practice of settling barbarians on lands within the empire and of admitting them freely to service in the Roman army.

Period **II.**: The Dominate, A.D. **284–476. (a)** From the Accession of Diocletian to the Death of Theodosius **(A.D. 284–395).**—The work of fortifying the empire alike against internal sedition and foreign invasion, begun by Aurelian and Probus, was completed by Diocletian and Constantine the Great,

whose system of government, novel as it appears at first sight, was in reality the natural and inevitable outcome of the history of the previous century. Its object was two-fold, to give increased stability to the imperial authority itself and to organize efficient administrative machinery throughout the empire. In the second year of his reign Diocletian associated Maximian with himself as colleague, and six years later (293) the hands of the two "Augusti" were further strengthened by the proclamation of Constantius and Galerius as "Caesares." Precedents for such an arrangement were to be found in the earlier history of the principate; and it divided the burdens and responsibilities of government without sacrificing the unity of the empire; for, although to each of the Augusti and Caesars a separate sphere was assigned, the Caesars were subordinate to the higher authority of the Augusti, and over all his three colleagues Diocletian claimed to exercise a paramount control. It also reduced the risk of a disputed succession by establishing in the two Caesars the natural successors to the Augusti, and it satisfied the jealous pride of the rival armies by giving them *imperatores* of their own. The distribution of power between Diocletian and his colleagues followed those lines of division which the feuds of the previous century had marked out. The armies of the Rhine, the Danube and of Syria fell to the lot respectively of Constantius, Galerius and Diocletian, the central districts of Italy and Africa to Maximian.

Diocletian's Reforms.—In the new system the imperial authority was finally emancipated from all constitutional limitation and control and the last traces of its republican origin disappeared. The emperors from Diocletian onwards were autocrats in theory as well as in practice. This avowed despotism Diocletian, following in the steps of Aurelian, hedged round with all the pomp and majesty of Oriental monarchy. The final adoption of the title *dominus,* the diadem on the head, the robes of silk and gold, the replacement of the republican salutation of a fellow-citizen by the adoring prostration even of the highest in rank before their lord and master, were all significant marks of the new régime. In the hands of this absolute ruler was placed the entire control of an elaborate administrative machinery. Most of the old local and national distinctions, privileges and liberties which had once flourished within the empire had already disappeared under the levelling influence of imperial rule, and the process was now completed. Roman citizenship had, since the edict of Caracalla, ceased to be the privilege of a minority. Diocletian finally reduced Italy and Rome to the level of the provinces: the provincial land-tax and provincial government were introduced into Italy, while Rome ceased to be even in name the seat of imperial authority.[1] Throughout the whole area of the empire a uniform system of administration was established, the control of which was centred in the imperial palace. Between the civil and military departments the separation was complete. At the head of the former were the praetorian prefects, next below them the *vicarii,* who had charge of the *dioceses;* below these again the governors of the separate provinces (*praesides, correctores, consulares*), under each of whom was a host of minor officials. Parallel with this civil hierarchy was the series of military officers, from the *magistri militum,* the *duces* and *comites* downwards. In both there is the utmost possible subordination and division of authority. The subdivision of provinces, begun by the emperors of the 2nd century, was systematically carried out by Diocletian, and each official, civil or military, was placed directly under the orders of a superior; thus a continuous chain of authority connected the emperor with the meanest official in his service. Finally, the various grades in these two imperial services were carefully marked by the appropriation to each of distinctive titles, the highest being that of *illustris,* which was confined to the prefects and to the military *magistri* and *comites,* and to the chief ministers.

There can be little doubt that on the whole these reforms prolonged the existence of the empire, by creating a machinery which enabled the stronger emperors to utilize effectively all its available resources, and which even to some extent made good the deficiencies of weaker rulers. But in many points they failed to attain their object. Diocletian's division of the imperial authority among colleagues, subject to the general control of the senior Augustus, was effectually discredited by the 20 years of almost constant conflict which followed his own abdication (305–323). Constantine's partition of the empire among his three sons was not more successful in ensuring tranquillity, and in the final division of the East and West between Valens and Valentinian (364) the essential principle of Diocletian's scheme, the maintenance of a single central authority, was abandoned. The "tyrants," the curse of the 3rd century, were far from unknown in the 4th. The system, moreover, while it failed altogether to remove some of the existing evils, aggravated others. The already overburdened financial resources of the empire were strained still further by the increased expenditure necessitated by the substitution of four imperial courts for one, and by the multiplication in every direction of paid officials. The gigantic bureaucracy of the 4th century proved, in spite of its undoubted services, an intolerable weight upon the energies of the empire.

The Division of the **Empire.**—Diocletian and Maximian formally abdicated their high office in 305. Nineteen years later Constantine I. the Great, the sole survivor of six rival emperors, united the whole empire under his own rule. His reign of 14 years was marked by two events of first-rate importance—the recognition of Christianity as the religion of the empire and the building of the new capital at Byzantium. The alliance which Constantine inaugurated between the Christian Church and the imperial Government, while it enlisted on the side of the State one of the most powerful of the new forces with which it had to reckon, imposed a check, which was in time to become a powerful one, on the imperial authority. The establishment of the new "City of Constantine" as a second Rome paved the way for the final separation of East and West by providing the former for the first time with a suitable seat of government on the Bosporus. The death of Constantine in 337 was followed, as the abdication of Diocletian had been, by the outbreak of quarrels among rival Caesars. Of the three sons of Constantine who in 337 divided the empire between them, Constantine the eldest fell in civil war against his brother Constans; Constans himself was, ten years afterwards, defeated and slain by Magnentius; and the latter in his turn was in 353 vanquished by Constantine's only surviving son Constantius. Thus for the second time the whole empire was united under the rule of a member of the house of Constantine. But in 3jj Constantius granted the title of Caesar to his cousin Julian and placed him in charge of Gaul, where the momentary elevation of a tyrant, Silvanus, and still more the inroads of Franks and Alamanni, had excited alarm. But Julian's successes during the next five years were such as to arouse the jealous fears of Constantius. In order to weaken his suspected rival the legions under Julian in Gaul were suddenly ordered to march eastward against the Persians (360). They refused; and when the order was repeated, replied by proclaiming Julian himself emperor and Augustus. Julian, with probably sincere reluctance, accepted the position, but the death of Constantius in 361 saved the empire from the threatened civil war. Julian's attempted restoration of pagan and in especial of Hellenic worships had no more permanent effect than the war which he courageously waged against the multitudinous abuses which had grown up in the luxurious court of Constantius. But his vigorous administration in Gaul undoubtedly checked the 'barbarian advance across the Rhine, and postponed the loss of the western provinces; on the contrary, his campaign in Persia, brilliantly successful at first, ended in his own death (363), and his successor, Jovian, immediately surrendered the territories beyond the Tigris won by Diocletian 70 years before. Jovian died on Feb. 17, 364; and on Feb. 26, Valentinian was acknowledged as emperor of the army at Nicaea In obedience to the wish of the soldiers that he should associate a colleague with himself, he conferred the title of Augustus upon his brother Valens, and the division of the empire was at last effected—Valentinian became emperor of the West, Valens of the East. Valentinian maintained the integrity of the empire until his death (in 375), which deprived the weaker Valens of a trusted

[1] The seats of government for Diocletian and his three colleagues were Nicomedia, Mediolanum, Augusta Trevirorum, and Sirmium.

counsellor and ally, and was followed by a serious crisis on the Danube. In 376 the Goths, hard pressed by their new foes from the eastward, the Huns, sought and obtained the protection of the Roman empire. They were transported across the Danube and settled in Moesia, but, indignant at the treatment they received, they rose in arms against their protectors. In 378 at Adrianople Valens was defeated and killed, and the victorious Goths advanced eastwards to the very walls of Constantinople. Once more, however, the danger passed away. The skill and tact of Theodosius, who had been proclaimed emperor of the East by Gratian, conciliated the Goths; they were granted an allowance, and in large numbers entered the service of the Roman emperor. The remaining years of Theodosius's reign (382–395) were mainly engrossed by the duty of upholding the increasingly feeble authority of his western colleague against the attacks of pretenders. Maximus, the murderer of Gratian (383), was at first recognized by Theodosius as Caesar, and left in undisturbed command of Gaul, Spain and Britain; but, when in 386 he proceeded to oust Valentinian II. from Italy and Africa, Theodosius marched westwards, crushed him and installed Valentinian as emperor of the West. In the very next year, however, the murder of Valentinian (392) by Arbogast, a Frank, was followed by the appearance of a fresh tyrant in the person of Eugenius, a domestic officer and nominee of Arbogast himself. Once more Theodosius marched westwards, and near Aquileia decisively defeatrd his opponents. But his victory was quickly followed by his own illness and death (395), and the fortunes of East and West passed into the care of his two sons Arcadius and Honorius.

(b) From the Death of Theodosius to the Extinction of the Western Empire (395–476).—Through more than a century from the accession of Diocletian the Roman empire had succeeded in holding at bay the swarming hordes of barbarians, But, though no province had yet been lost, as Dacia had been lost in the century before, and though the frontier lines of the Rhine and the Danube were still guarded by Roman forts and troops, there were signs in plenty that a catastrophe was at hand.

From all the writers who deal with the 4th century we have one long series of laments over the depression and misery of the provinces.[1] To meet the increased expenditure necessary to maintain the legions, to pay the hosts of officials and to keep up the luxurious splendour of the imperial courts, not only were the taxes raised in amount but the most oppressive and inquisitorial methods were adopted in order to secure for the imperial treasury every penny that could be wrung from the wretched taxpayer. The results are seen in such pictures as that which the panegyrist Eumenius draws of the state of Gaul (306–312) under Constantine, in the accounts of the same province under Julian 50 years later, in those given by Zosimus early in the 5th century, and in the stringent regulations of the Theodosian code, dealing with the assessment and collection of the taxes. Among the graver symptoms of economic ruin were the decrease of population, which seriously diminished not only the number of taxpayers, but the supply of soldiers for the legions; the spread of infanticide; the increase of waste lands whose owners and cultivators had fled to escape the tax collector; the declining prosperity of the towns; and the constantly recurring riots and insurrections, both among starving peasants, as in Gaul, and in populous cities like Antioch. The distress was aggravated by the civil wars, by the rapacity of tyrants, such as Maxentius and Maximus, but above all by the raids of the barbarians, who seized every opportunity afforded by the dissensions or incapacity of the emperors to cross the frontiers and harry the lands of the provincials. Constantine (306–312), Julian (356–360) and Valentinian I. (364–375) had each to give a temporary breathing-space to Gaul by repelling the Franks and Alamanni. Britain was harassed by Picts and Scots from the north (367–370), while the Saxon pirates swept the northern seas and the coasts both of Britain and Gaul. On the Danube the Quadi, Sarmatae, and above all the Goths, poured at intervals into the provinces of Pannonia and Moesia, and penetrated to Macedon and Thrace. In the East, in addition to the constant border feud with Persia, we hear of ravages by the Isaurian mountaineers, and by a new enemy, the Saracens.

Even more ominous of coming danger was the extent to which the European half of the empire was becoming barbarized. The policy which had been inaugurated by Augustus himself of settling barbarians within the frontiers had been taken up on a larger scale and in a more systematic way by the Illyrian emperors of the 3rd century, and was continued by their successors in the 4th. In Gaul, in the provinces south of the Danube, even in Macedon and Italy, large barbarian settlements had been made — Theodosius in particular distinguishing himself by his liberality in this respect. Nor did the barbarians admitted during the 4th century merely swell the class of half-servile *coloni*. On the contrary, they not only constituted to an increasing extent the strength of the imperial forces, but won their way in ever-growing numbers to posts of dignity and importance in the imperial service. Under Constantine the palace was crowded with Franks. Julian led Gothic troops against Persia, and the army with which Theodosius defeated the tyrant Maximus (388) contained large numbers of Huns and Alans, as well as of Goths. The names of Arbogast, Stilicho and Rufinus are sufficient proof of the place held by barbarians near the emperor's person and in the control of the provinces and legions of Rome; and the relations of Arbogast to his nominee for the purple, Eugenius, were an anticipation of those which existed between Ricimer and the emperors of the latter half of the 5th century.

Barbaric Invasions. — It was by barbarians already settled within the empire that the first of the series of attacks which finally separated the western provinces from the empire and set up a barbaric ruler in Italy was made, and it was in men of barbarian birth that Rome found her ablest and most successful defenders. The Visigoths whom Alaric led into Italy had been settled south of the Danube as the allies of the empire since the accession of Theodosius. But, like the Germans of the days of Caesar, they wanted land for their own, and Alaric aspired to raise himself to the heights which had been reached before him by the Vandal Stilicho at Ravenna and the Goth Rufinus at Constantinople. The jealousy which existed between the rulers of the western and eastern empires furthered his plans. In the name of Arcadius, the emperor of the East, or at least with the connivance of Arcadius's minister Rufinus. he occupied the province of Illyricum, and from thence ravaged Greece, which, according to the existing division of provinces, belonged to the western empire. Thence in 396 he retreated before Stilicho to Illyricum, with the command of which he was now formally invested by Arcadius; he thus gained a base of operations against Italy. In 400 he led his people, with their wives and families, their wagons and treasure, to seek lands for themselves south of the Alps. But in this first invasion he penetrated no farther than the plains of Lombardy, and after the desperate battle of Pollentia (402 or 403) he slowly withdrew from Italy, his retreat being hastened by the promises of gold freely made to him by the imperial Government. Not until the autumn of 408 did Alaric again cross the Alps. Stilicho was dead; the barbarian troops in Honorius's service had been provoked into joining Alaric by the anti-Teutonic policy of Honorius and his ministers, and Alaric marched unopposed to Rome. The payment of a heavy ransom, however, saved the city. Negotiations followed between Alaric and the court of Ravenna. Alaric's demands were moderate, but Honorius would grant neither lands for his people nor the honourable post in the imperial service which he asked for himself. Once more Alaric sat down before Rome, and the citizens were forced to agree to his terms. Attalus, a Greek, the prefect of the city, was declared Augustus, and Alaric accepted the post of commander-in-chief. But after a few months Alaric formally deposed Attalus, on account of his incapacity, and renewed his offers to Honorius. Again they were declined, and Alaric marched to the siege and sack of Rome (410). His death followed hard on his capture of Rome. Two years later (412) his successor Ataulf led the Visigoths to find in Gaul the lands which Alaric had sought in Italy. It is characteristic of the anarchical condition of the West that Ataulf and his Goths should have fought for Honorius in Gad

[1] Rostovtzeff, *Social and Economic History of Rome*, ch. 12.

against the tyrants and in Spain against the Vandals, Suebi and Alani; and it was with the consent of Honorius that in 419 Wallia, who had followed Ataulf as king of the Visigoths, finally settled with his people in south-western Gaul and founded the Visigothic monarchy.

It was about the same period that the accomplished fact of the division of Spain between the three barbarian tribes of Vandals, Suebi and Alani was in a similar manner recognized by the paramount authority of the emperor of the West. These peoples had crossed the Rhine at the time when Alaric was making his first attempt on Italy. A portion of the host led by Radagaisus actually invaded Italy, but was cut to pieces by Stilicho near Florence (405); the rest pressed on through Gaul, crossed the Pyrenees, and entered the as yet untouched province of Spain.

Honorius died in 423. With the single exception of Britain,[1] no province had yet formally broken loose from the empire. But over a great part of the West the authority of the emperors was now little more than nominal; throughout the major part of Gaul and in Spain the barbarians had settled, and barbarian states were growing up which recognized the supremacy of the emperor, but were in all essentials independent of his control.

The long reign of Valentinian III. (423–45j) is marked by two events of first-rate importance — the conquest of Africa by the Vandals[2] and the invasion of Gaul and Italy by Attila. The Vandal settlement in Africa was closely akin in its origin and results to those of the Visigoths and of the Vandals themselves in Gaul and Spain. Here, as there, the occasion was given by the jealous quarrels of powerful imperial ministers. The feud between Boniface, count of Africa, and Aetius, the "master-general" or "count of Italy," opened the way to Africa for the Vandal king Gaiseric (Genseric), as that between Stilicho and Rufinus had before set Alaric in motion westwards, and as the quarrel between the tyrant Constantine and the ministers of Honorius had paved the way for the Vandals, Suebi and Alani into Spain. In this case, too, land-hunger was the impelling motive with the barbarian invader, and in Africa, as in Gaul and Spain, the invaders' acquisitions were confirmed by the imperial authority which they still professed to recognize. In 429 Gaiseric, king of the Vandals, crossed with his warriors, their families and goods, to the province of Africa, hitherto almost untouched by the ravages of war. Thanks to the quarrels of Boniface and Aetius, their task was an easy one. The province was quickly overrun. In 435 a formal treaty secured them in the possession of a large portion of the rich lands which were the granary of Rome, in exchange for a payment probably of corn and oil. Carthage was taken in 439, and in the following year the Vandal kingdom was firmly established over a wide area in the ancient Roman realm.

Eleven years later (451) Attila invaded Gaul, but this Hunnish movement was in a variety of ways different from those of the Visigoths and Vandals. Nearly a century had passed since the Huns first appeared in Europe and drove the Goths to seek shelter within the Roman lines. Attila was now the ruler of a great empire in central and northern Europe and, in addition to his own Huns, the German tribes along the Rhine and Danube and far away to the north owned him as king. He confronted the Roman power as an equal; and, unlike the Gothic and Vandal chieftains, he treated with the emperors of East and West as an independent sovereign. His advance on Gaul and Italy threatened, not the establishment of one more barbaric chieftain on Roman soil, but the subjugation of the civilized and Christian West to the rule of a heathen and semi-barbarous conqueror. But the Visigoths in Gaul, Christian and already half romanized, rallied to the aid of the empire against a common foe. Attila, defeated at Châlons by Aëtius, withdrew into Pannonia (451). In the next year he overran Lombardy, but penetrated no farther south, and in 453 he died. With the murder of Valentinian III. (455) the western branch of the house of Theodosius came to an end, and the next 20 years witnessed the accession and deposition of nine emperors.

The End. — Under the three months' rule of Maximus, the Vandals under Gaiseric invaded Italy and sacked Rome. From 456–472 the actual ruler of Italy was Ricimer, the Suebe. Of the four emperors whom he placed on the throne, Majorian (457–461) alone played any imperial part outside Italy. Ricimer died in 472, and two years later a Pannonian, Orestes, attempted to fill his place. He deposed Julius Nepos and proclaimed as Augustus his own son Romulus. But the barbarian mercenaries in Italy determined to secure for themselves a position there such as that which their kinsfolk had won in Gaul and Spain and Africa. Their demand for a third of the lands of Italy was refused by Orestes, and they instantly rose in revolt. On the defeat and death of Orestes they proclaimed their leader, Odoacer the Rugian, king of Italy. Romulus Augustulus laid down his imperial dignity, and the court at Constantinople was informed that there was no longer an emperor of the West.

The installation of a barbarian king in Italy was the natural climax of the changes which had been taking place in the West throughout the 5th century. In Spain, Gaul and Africa barbarian chieftains were already established as kings. In Italy, for the last 20 years, the real power had been wielded by a barbarian officer. Odoacer, when he decided to dispense with the nominal authority of an emperor of the West, placed Italy on the same level of independence with the neighbouring provinces. But the old ties with Rome were not severed. The new king of Italy formally recognized the supremacy of the one Roman emperor at Constantinople, and was invested in return with the rank of "patrician," which had been held before him by Aetius and Ricimer. In Italy too, as in Spain and Gaul, the laws, the administrative system and the language remained Roman. But the emancipation of Italy and the western provinces from direct imperial control, which is signalized by Odoacer's accession, has rightly been regarded as marking the opening of a new epoch. It made possible in the West the development of a Romano-German civilization; it facilitated the growth of new and distinct states and nationalities; it gave a new impulse to the influence of the Christian Church and laid the foundations of the power of the bishops of Rome.

Chronological Table of the Roman Emperors

B.C.
27. Augustus.

A.D.
14. Tiberius.
37. Gaius.
41. Claudius.
54. Nero.
68, 69. Galba. Otho. Vitellius.
69. Vespasian.
79. Titus.
81. Domitian.
96. Nerva.
98. Trajan.
117. Hadrian.
138. Antoninus Pius.
161. Marcus Aurelius.
180. Commodus.
193. Pertinax. Didius Iulianus. Septimius Severus.
211. Caracalla.
217. Macrinus.
218. Elagabalus.
222. Alexander Severus.
23j. Maximinus.
238. The two Gordiani. Pupienus and Balbinus. Gordian III.
244. Philip.
249. Decius.
251. Gallus.
253. Aemilianus.
260. Valerian. Gallienus.
268. Claudius.
270. Quintillus. Aurelian.
275. Tacitus.
276. Probus.
282. Carus.
283. Carinus and Numerian.
284. Diocletian (Maximian associated with him, 286).
305. Constantius and Galerius.
311. Licinius. Constantine I.
324. Constantine I.
337. Constantine II. Constantius II. Constans.
350. Constantius II., sole emperor.
361. Julian.
363. Jovian.

[1] The Roman troops were withdrawn from Britain by Constantine in 407; Mommsen, Chron. *min.* i, 465.

[2] Hodgkin vol. ii. bk. iii., chap. ii.; Gibbon ii. 400 *sqq.*; Jung, *183.* The leading ancient authority is Procopius. See Ranke iv. (2) 285; Papencordt, *Gesch. d. Vandal, Herrschaft in Africa.*

Division of the Empire

West	*East.*
A.D.	A.D.
364. Valentinian I.	364. Valens.
375. Gratian and Valentinian II.	379. Theodosius I.
383. Valentinian II.	
	392. Theodosius I.
395. Honorius.	395. Arcadius.
423. Valentinian III.	408. Theodosius II.
455. Maximus.	450. Marcian.
455. Avitus.	
457. Majorian.	457. Leo I.
461. Severus.	
467. Anthemius.	
472. Olybrius.	
473. Glycerius.	
474. Julius Nepos.	474. Leo II.
475. Romulus Augustulus.	

For subsequent events *see* BYZANTINE EMPIRE.

BIBLIOGRAPHY.—I. REPUBLICAN PERIOD: *Ancient Sources.* No history of Rome was written till Fabius Pictor issued his Annals about 200 B.C. His sources were inscribed laws, treaties and *senatus consulta,* a great many of which had been preserved, the annual priestly records of important events requiring thank-offerings and atonements—tablets that contained the lists of magistrates from the early republic—family records that did not go far back, some inscriptions on public buildings, some records of early colonies and oral tradition. Recent excavations indicate that the substructure of history which he gave from the early republic is fairly sound. But the traditional account of the regal period must be considered legendary, as indeed the Roman historians assumed that it was. The early historians, Fabius, Cincius, Acilius and Postumius, were all statesmen who seem to have written with a keen sense of responsibility. Those who followed, Cato the Elder, Calpurnius Piso, Cassius Hemina, Tuditanus and Fannius (who wrote of the Gracchan period), were also well informed, and wrote chiefly regarding contemporary events. At the same time the Greek statesman, Polybius, wrote an accurate history from the time of the first Punic War, valuable portions of which have survived. After the Gracchi, historians like Gnaeus Gellius began to insert family legends into the dry annals of the early period and he was followed by diffuse and rhetorical writers like Claudius Quadrigarius and Valerius Antias who composed popular accounts with little regard for accuracy. During the same period numerous apologetic autobiographies, memoirs and political pamphlets appeared which unduly coloured later accounts of Rome. Of all that we have mentioned (except Polybius) only brief fragments are extant, but the substance of all these books went into later histories that have survived. We have two valuable pamphlets of the amateur historian Sallust, the excellent commentaries of Julius Caesar (*q.v.*), the exceedingly important correspondence of Cicero (*q.v.*) as well as many of his speeches. In the Ciceronian period much valuable antiquarian work was done by men like Varro, Pomponius Atticus, and others which aided later writers to correct the mistakes of their predecessors.

In the Augustan age the materials accumulated by previous generations were worked up by compilers whose works are in some cases preserved. The work of Livy (*q.v.*) covered the history of Rome from its foundation to 9 B.C. in 142 books; of these only 35 are preserved in their entirety, while the contents of the rest are known in outline from an epitome (*periochae*) and from the compendia of Florus and later authors. Diodorus Siculus (*q.v.*) of Agyrium in Sicily followed the earlier annalists in the sections of his *Universal History* (down to Caesar) which dealt with Roman affairs; Dionysius Halicarnassensis (*q.v.*), in his *Roman Archaeology* (published in 7 B.C.), treated early Roman history in a more ambitious and rhetorical style, with greater fullness than Livy, whose work he seems to have used. Universal histories were also written in the Augustan age by Trogus Pompeius, whose work is known to us from the epitome of Justin (2nd century A.D.), and Juba, the learned king of Mauretania. Strabo (*q.v.*), whose *Geography* is extant, was the author of a continuation of Polybius's history (to 27 B.C.). The learning of the time was enshrined in the encyclopaedia of Verrius Flaccus, of which we possess part of Festus's abridgement (2nd century A.D.), together with an epitome of Festus by Paulus Diaconus (*temp.* Charlemagne). An official list of the consuls and other chief magistrates of the republic was inscribed on the walls of the Regia (rebuilt 36 B.C.), followed somewhat later by a similar list of *triumphatores;* the former of these is known as the *Fasti Capitolini* (C.I.L.I.^{2},I. *sqq.*), since the fragments which have been recovered are preserved in the palace of the Conservatori on the Capitol.

Among writers of the imperial period who dealt with republican history the most important are Velleius Paterculus, whose compendium of Roman history was published in A.D. 30; Plutarch (*c.* A.D. 45–125), in whose biographies much contemporary material was worked up; Appian, who wrote under the Antonines and described the wars of the republic under geographical headings (partly preserved) and the civil wars in five books, and Dio Cassius (*v. infra*), of whose history only that portion which deals with events from 69 B.C. onwards is extant.

The evidence of inscriptions (*q.v.*) and coins (*see* NUMISMATICS) begins to be of value during the last 150 years of the republic. A series of laws and *Senatus consulta* (beginning with the *Senatus consultum de Bacchanalibus,* 189 B.C.) throws light on constitutional questions, while the coins struck from about 150 B.C. onwards bear types illustrative of the traditions preserved by the families to which the masters of the mint (*triumviri monetales*) belonged.

MODERN AUTHORITIES.—The criticism of early Roman history begins with Giambattista Vico, 1725, and Louis de Beaufort, 1738, Niebuhr (1811–12) and Schwegler (1853–58) laid a sound foundation for the historical reconstruction of Theodore Mommsen, whose great history appeared in 1854–56. In Roman constitutional history Mommsen's *Staatsrecht* (1st ed. 1872–75) has not been superseded, though Lange's *Römische Alterthümer* (1856–71) is still serviceable. The soundest modern history of republican Rome (incomplete) is De Sanctis, *Storia dei Romani* (1907–). Heitland's *Roman Republic* (3 vols., 1909) is a fresh and independent work. Groebe's recent revision of Drumann is of value for its accumulation of references for the later period. Other briefer histories devoted to special topics are Greenidge, *History of Rome* vol. i. (for the Gracchan period); several volumes of Pais chiefly concerned with criticism; E. Meyer, *Caesars Monarchie und der Principat des Pompeius;* Homo, *L'Italie Primitive;* Holleaux, *Rome, la Grèce;* Beloch, *Römische Geschichte;* Holmes, *The Roman Republic* (chiefly military history of the late republic); Rostovtzeff, *Rome;* Frank, *Roman Imperialism* and *An Economic History of Rome;* and finally the chapters devoted to Rome in volumes vii.–ix. of the *Cambridge Ancient History.* (*See* VICO, GIAMBATTISTA.)

II. IMPERIAL PERIOD: *Ancient Sources.*—The memoirs of Augustus as well as those of his contemporaries (Messalla, Agrippa, Maecenas, etc.) and successors (Tiberius, Agrippina the younger, etc.) have perished, but we possess the *Res gestae divi Augusti* inscribed on the walls of his temple at Ancyra (ed. Mommsen, 1883, Ramsay and Premerstein's *Mon. Antiochenum,* 1927, includes the fragments recently found at Antioch). Aufidius Bassus wrote the history of the civil wars and early empire, perhaps to A.D. 49, and this was continued by Pliny the Elder (*q.v.*) in 31 books, probably to the accession of Vespasian. These works and others were used by Cornelius Tacitus (*q.v.*), whose *Annals* (properly called *ab excessu divi Augusti*) and *Histories,* carried the story of the empire down to A.D. 96. Pliny's correspondence with Trajan about the affairs of Bithynia, which he administered in A.D. 111–113, is of great historical value. Suetonius (*q.v.*), who was for some time secretary of state to Hadrian, wrote biographies of the emperors from Julius Caesar to Domitian. Arrian, a Bithynian Greek, wrote on Rome's policy and wars in the East. Appian (*v. supra*) dealt with the wars waged under the early empire in the closing books of his work, which have not been preserved. Dio Cassius, a Bithynian, wrote a history of Rome to the death of Elagabalus in 80 books. We possess only epitomes and excerpts of the portion dealing with events from A.D. 46 onwards, except for parts of the 78th and 79th books, in which Dio's narrative of contemporary events is especially valuable. Herodian, a Syrian, wrote a history of the emperors from Commodus to Gordian III., which as the work of a contemporary is not without value. The *Historia Augusta* (*see* AUGUSTAN HISTORY), upon which we are obliged to rely for the history of the 3rd century A.D., consists in a series of lives of the emperors (including most of the pretenders to that title) from Hadrian to Carinus, professedly written by six authors, under Diocletian and Constantine. Modern criticism has shown that (at least in its present form) it is an unreliable compilation made in the latter half of the 4th century. The fragments of Dexippus, an Athenian who successfully defended his native town against Goths, throw much light on the barbaric invasions of the 3rd century. The most important historian of the 4th century was Ammianus Marcellinus, a native of Antioch and an officer in the imperial guard, who continued the work of Tacitus (in Latin) to the death of Valens. We possess the last 18 books of his history which cover the years A.D. 353–378. Two compendia of imperial history pass under the name of Aurelius Victor, the *Caesares,* or lives of the emperors from Augustus to Julian, and the *Epitome de Caesaribus* (not by the same author) which goes down to Theodosius I. Similar works are the *Breviarum* of Eutropius (secretary of state under Valens) and the still more brief epitome of Festus. The writings of the Emperor Julian and of the rhetoricians Libanius, Themistius and Eunapius—the last-named continued the history of Dexippus to A.D. 404—are of great value for the latter part of the 4th century A.D. They wrote as pagans, while the Christian version of events is given by the three orthodox historians Socrates, Sozomen and Theodoret, and the Arian Philostorgius, all of whom wrote in the 5th century. An imperial official, Zosimus, writing in the latter half of that century, gave a sketch of imperial history to A.D. 410; the latter part is valuable, being based on contemporary writings. The bishops Synesius and Palladius, who lived under Arcadius and Theodosius II., furnish valuable information as to their own times;

while the fragments of Priscus tell us much of Attila and the Hunnish invasions. Mention must also be made of the poets and letter-writers of the 4th and 5th centuries—Ausonius, Claudian, Symmachus, Paulinus of Nola, Sidonius Apollinaris, Prudentius, Merobaudes and others—from whose writings much historical information is derived. Cassiodorus, the minister of Theodoric, wrote a history of the Goths, transmitted to us in the *Historia Gotlzorum* of Jordanes (*c.* A.D. 550), which gives an account of the earlier barbaric invasions. Several chronological works were compiled in the 4th and 5th centuries. It will suffice to name the *Clzronology of Eusebius* (to A.D. 324), translated by Jerome and carried down to A.D. 378, and the *Chronography of* A.D. *354,* an illustrated calendar containing miscellaneous information.

The codes of law, especially the *Codex Theodosianus* (A.D. 438) and the code of Justinian, as well as the army list of the early 5th century, known as the *Notitia Dignitaturn,* possess great historical value. For the inscriptions of the empire, which are of incalculable importance as showing the working of the imperial system in its details, *see* INSCRIPTIONS; the coins *(see* NUMISMATICS) also throw much light on the dark places of history in the lack of other authorities. Egyptian papyri are not only instructive as to legal, economic and administrative history, but also contribute to our general knowledge of events. *(See* especially Mitteis-Wilcken, *Chrestomatie,* 1912, and bibliography in Rostovtzeff, *Social and Economic History of Rome,* 1926.) The *Zeitschrift fur Papyrusforschung,* ed. by U. Wilcken, gives an account of progress in this branch of study.

MODERN AUTHORITIES.—Tillemont's *Histoire des empereurs* (6 vols., 1690–1738), supplemented by his *Mémoires,* furnished Gibbon with material for his *Decline and Fall of the Roman Empire* (1776–78), which has never been superseded as a history of the entire imperial period, and has been rendered adequate for the purposes of the modern reader by Prof. J. B. Bury's edition (1897–1900). The history of the empire has yet to be written in the light of recent discoveries. Mommsen's fifth volume (Eng. trans., as *Provinces of the Roman Empire,* 1886) is not a narrative, but an account of Roman culture in the various provinces. H. Schiller's *Geschichte der romischen Kaiserzeit* (1883–88) is a useful handbook. Rostovtzeff's *Social and Economic History of Rome* (1926) is very valuable for its thorough siiting of inscriptions and papyri, while Dessau's *Gesch. der romischen Kaiserzeit* (1924), two volumes of which have appeared, promises to give a good survey of political history. H. S. Jones, *The Roman Empire* (1908) and Chapot, *Le Monde romain* (1927) are brief but sound and independent, For the later period we have Seeck, *Gesch. des Untergangs der antiken Welt* (6 vols., 1897–1920), Bury's *History of tlze Later Roman Empire* (1889), beginning from A.D. 395, and *Constitution of tlze Later Empire* (1910), and T. Hodgkin's *Italy and her Invaders* (8 vols., 1880–99), which tells the story of the barbaric invasions at great length. The imperial constitution is described by Mommsen in the second volume of his *Staatsrecht* (v. *supra);* divergent views mill be found in Herzog's *Geschichte und System der romischen Staatsverfassung* (1884–91); the working of the imperial bureaucracy is treated by O. Hirschfeld, *Die römischen Yerwaltungsbeamten* (1905). The *Prosopographia Imperii Romani,* compiled by Dessau and Klebs (1897–98), is a mine of information, as is the new edition of Pauly's *Realencyklopadie der classischen Alterthumswissenschaft* (in progress). Other useful books are: Greenidge, *Roman Public Life* (1901); Abbott and Johnson, *Municipal Administration in the Roman Empire* (1926); Dill, *Roman Society in the Last Century* (1906), Paribeni, *Trajano* (1927); Mattingly, *Roman Coins* (1928). *(H.* F. P.; H. S.-J.; T. F.)

MEDIAEVAL HISTORY

The history of the city of Rome during the middle ages was overshadowed by the history of the papacy. The latter has left many documents; for the city there are very few, especially for the period before the 13th century. As the foundations were so ill-defined there was opportunity for historians to theorize on what the superstructure had been; and the theories were influenced by the ideas, patriotic or otherwise biased, held in the 19th century. One favourite theory was the existence of an aristocratic republic contending against the popes until overthrown by the popular revolution in 1143, when the commune arose. Of this aristocratic republic the consuls were thought to have been the heads, and the existence and functions of the senate were much discussed. This theory was held by some of the leading historians: Hegel, Gregorovius and Villari.

These views are no longer held. Some important documents have been discovered and made accessible by publication. Halphen and others whose works are cited in the bibliography have done much to elucidate the early history. Much still remains to be done, but it is probable that the analogies drawn in the past between the history of Rome and that of the other cities in Italy are misleading. The deserted Campagna surrounding the city checked any notable increase of trade or industry and prevented the establishment of gilds on the footing that elsewhere made them the basis and support of a commune. Moreover, the Campagna was unhealthy and ill-fitted for agriculture. The population of the city was very small. There was no strong middle class among its citizens, whose leaders were usually rude, illiterate nobles. Only slowly did the forces which were at work elsewhere in Italy penetrate into the city and cause the rise of a belated commune. What part mas played by the memory of the traditions of republican Rome is a mooted question. The city was styled *respublica;* the titles senator, consul, prefect, occur repeatedly; but it is necessary to be on one's guard against drawing inferences from the long-continued or revived use of old terms.

Gothic and Byzantine Rule.—The removal of the seat of empire to Constantinople effected a radical change in the political situation of Rome, but the civil administration remained unaltered. The Gothic rule merely superimposed upon the Roman social order a Teutonic stratum that never penetrated beneath its surface. The senate, the principal magistrates, both provincial and municipal, the prefect of the city, and the Roman judges enforcing the enactments of the Roman law, were all preserved. Hence there was no visible change in the constitution of the city. The wars of Belisarius and Narses against the Goths (A.D. 535–555) caused terrible slaughter and devastation in Italy, and finally subjected her to Constantinople. In place of a Gothic king she was ruled at first by a pretorian prefect and later by an exarch (first mentioned in 584), who had his seat of government at Ravenna. The pragmatic sanction (554), promulgating the Justinian code, separated the civil from the military power, and, by conferring on the bishops the authority over the provincial and municipal government, soon led to the increase of the power of the Church.

Roman institutions were altered; but their original features were still to be traced, and no heterogeneous element had been introduced. The dawn of a new epoch can be dated from the invasion of the Lombards (568–572). Their conquest of a large portion of Italy reduced the inhabitants almost to slavery. But, in the unsubdued parts of the country—namely, in Ravenna, Rome and the maritime cities—a very different state of things prevailed. The necessity for self-defence and the distance of the empire, now too weak to render any assistance, compelled the inhabitants to depend solely on their own strength. In Rome we behold the rapid growth of the papal power and the continual increase of its political influence. Not only the superintendence but often the nomination of public functionaries and judges was in the hands of the popes. And the accession to St. Peter's chair of a man of real genius in the person of Gregory I., surnamed the Great, marked the beginning of a new era. By force of individual character this pope was the true representative of the city, the born defender of Church and State. His ecclesiastical authority, already great throughout Italy, was specially great in the Roman diocese and in southern Italy. The offerings of the faithful had endowed the Church with enormous possessions in the province of Rome, in Sicily, Sardinia, and other parts. The administration of this property assumed the shape of a small government council in Rome. The use made by the pope of his revenues greatly contributed to the increase of his moral and political authority. When the city was besieged by the Lombards and the emperor left his army unpaid, Gregory supplied the required funds and thus made resistance possible. And when the defence could be no longer maintained he alone, by the weight of his personal influence and the payment of large sums, induced the Lombards to raise the siege. He negotiated in person with Agilult and was recognized by him as the true representative of the city.

A prefect of Rome is not mentioned between 599 and 772, and then again there is silence until the time of the Ottos. It is impossible to say whether the office was discontinued. In the later days the prefect was an official of the pope, who had taken over the care of the aqueducts and the preservation of the city walls. There is also much doubt about the existence of a senate. We know that many senators had lost their lives in the long war. The pragmatic sanction of 554 did mention the senate, but this

was the last formal recognition of it as a governing body; and, if we may trust a despairing cry of Gregory the Great, it had disappeared, or at least was reduced to a shadow.

The popes now make common cause with the people against the Lombards on the one hand and the emperor on the other. This alliance was cemented by the religious disputes of the East and the West; for Pope Gregory II. (715–731) opposed the celebrated edict of the iconoclastic emperor Leo the Isaurian, and Venice, Ravenna, the Pentapolis and Rome took up arms against the emperor and elected dukes of their own.

Duchy of Rome.—In the midst of these warlike tumults a new constitution was being set up in Rome. In 711 the *Liber Pontificalis* makes the first mention of the duchy of Rome, and we find the people struggling to elect a duke of their own. In the early days of the Byzantine rule the territory appertaining to the city was no greater than under the Roman empire; but, partly through the weakness of the government of Constantinople, and above all through the decomposition of the provinces under the Lombards, this dukedom was widely extended; its limits were always changing in accordance with the course of events. At the beginning of the 8th century it had almost the same extent, except on the north, that the papal states had in 1860–70.

In the provinces, the administrators of church lands were important personages, and exercised both judicial and political functions. It was very natural that the heads of this vast administration resident in Rome should have a still higher standing and, in fact, from the 6th century, their power increased to such an extent that in the times of the Franks they already formed a species of papal cabinet with a share and sometimes a predominance in the affairs of the republic. The pope was thus at the head of a large administrative body and, in addition, was possessed of enormous revenues. He considered himself the real representative of the Roman republic. Gregory II. (715–731) accepted in the name of the republic the submission of other cities and protested against the conquest by the Lombards of those already belonging to Rome. The empire was now powerless in Italy, while the advance of the Lombards was becoming more and more threatening; they seized Ravenna in 751, thus putting an end to the exarchate, and next marched towards Rome, which had only its own forces and the aid of neighbouring cities to rely upon. To avoid being conquered Stephen II. (752–757) appealed to Pippin, king of the Franks, and concluded an alliance with him. The pope consecrated Pippin king of the Franks and named him *patricius Romanorum*. This title was given to Pippin as defender of the Church, for the pope styled him at the same time *defensor* or *protector ecclesiae*. And the king pledged himself not only to defend the Church but also to wrest the exarchate and the Pentapolis from the Lombards and give them to the pope. Pippin brought an army (754–755) and fulfilled his promise. The pope accepted the donation in the name of St. Peter and as the visible head of the Church. Thus in 755 central Italy broke its connection with the empire; thus was inaugurated the temporal power of the papacy.

Charles the Great.—In the years immediately succeeding the popes vacillated in their policy but it was soon apparent that their hopes must be placed on renewed aid from the Franks in order to check the constantly threatened danger from the Lombards, who were seeking to recover the territory which they had lost and also to seize Rome. Adrian I. (772–795) besought the assistance of Charlemagne, who made a descent into Italy in 773, destroyed the Lombard kingdom, and seized the iron crown. Entering Rome in 774, he confirmed the donation of Pippin. The pope was now regarded and regarded himself as master of Rome; he always spoke of Rome and the Romans as "our city," "our republic," "our people." It is true that Charlemagne held the supreme power, but this power was only occasionally exercised in Rome. The pope was most tenacious of his own authority, made vigorous protest whenever rebels fled to Charlemagne or appealed to that monarch's arbitration, and contested the supremacy of the imperial officials in Rome. Yet the pope was no absolute sovereign, nor, in the modern sense of the term, did any then exist. The Roman nobles were different from other aristocratic bodies elsewhere. Their power was chiefly derived from the high offices and large grants of money and land conferred on them by the popes. Every pope aggrandized his own kindred and friends, and these were the natural and often open adversaries of the next pontiff and his favourities. Thus the Roman nobility was powerful, divided, restless, and turbulent; the pope needed the support of an effective force for his own preservation; hence the necessity of creating an empire of the West.

Leo III. (795–816) further strengthened the ties between Charlemagne and the Church by sending the former the keys of the grave of St. Peter and the banner of Rome. Charlemagne had already joined to his office of patrician the function of high justice. The pope urged him to despatch an envoy to receive the oath of fealty from the Romans. Leo had antagonized the Romans, and during a procession had been attacked and barbarously maltreated (799). He fled to Charlemagne and returned guarded by his envoys; Charlemagne himself went to Rome in Nov. 800. As there was no one authorized to try a pope, Leo was permitted to clear himself of the charges against him by taking an oath on three altars. Then, on Christmas day, in St. Peter's, before an assemblage of Roman and Frankish lords, clergy, and people, the pontiff placed the imperial crown on Charlemagne's head and all proclaimed him emperor. Thus the new emperor was accepted by the Romans and consecrated by the pope. Yet Charlemagne was not sovereign of Rome; he possessed scarcely any regalia there, and was not in command of the army.

The death of Charlemagne in 814 was the signal for a further conspiracy of the nobles against the pope, who instantly put the ringleaders to death. He was severely blamed by the new emperor Louis for this violation of the imperial prerogative, as the emperor was determined to have his power recognized in Rome, and especially to insure that his assent must be secured for the election of a pope. To assure this he sent his son Lothair to be king of Italy, and the latter was crowned co-emperor in 823. In the following year Lothair promulgated a new constitution, to which Pope Eugenius II. (824–827) had to give his oath of adherence. The more direct power was to appertain to the pope—the supreme authority, presidency of the tribunals, and final judgment on appeal to the emperor. The new constitution also established the right of contending parties to select either the Roman or a Teutonic code for settlement of their disputes.

This is a convenient point to attempt a summary of the relations of the papacy with the City of Rome. By the donations and aid of the Franks it had become legal as well as actual ruler of the city. Charles the Great as emperor was the sovereign, but he never wished to take the place of the pope as chief of the Roman administration. The imperial *missus* of the constitution of 824 had as an associate a papal *missus*, and the two were ordered to refer all matters first to the pope; the emperor reserved a right of appeal to himself. But the power of the pope was secure only when he had outside support. At other times there was always danger that the nobles in the city would either revolt against him or, and more frequently, put in their own pope and use him for their own advantage. It must be noted, however, that the nobility as such never, before the middle of the 12th century, played a constitutional rôle in the administration of the city.

The City Officials.—The principal official was the prefect, who was the chief of police and judge in criminal matters. In civil cases he presided over the court and announced the decision, but was not himself a judge. He held his power from the pope except during periods of strife between an emperor and a pope, when the former sometimes usurped the right of appointment. Next in rank were the consuls of the Romans, or the dukes. They were nobles employed by the popes for special duties such as presiding over tribunals. Apparently the titles were applied to the same office, "duke" being used before the 11th century and "consul of the Romans" later, although in the period of transition the same man was sometimes styled both "duke" and "consul." Then there were "the seven judges," the *primicerius* and the *secundicerius*, who may be roughly described as first and under secretaries of state; the *arcarius*, or papal receiver; the *sacellarius*, or cashier;

the *protoscriniarius,* who was at the head of the papal chancery; the *primus* defensor, who was the advocate of the Church and administered its possessions; and the nomenclator, who pleaded the cause of widows, orphans and paupers. These men were called judges, a term then used generally for officials. (For example, the judices de *militia* were military officials and not judges at all.) These seven officials had apparently been created as need arose; the *primicerius* is mentioned in the 4th century, the *protoscriniarius* not until the ninth. They gradually ceased to be chiefs of administration and by the middle of the 11th century were thought of only as civil judges. For example, the camerarius, or treasurer, had taken over the duties of both the arcarius and *sacellarius.* In addition there were other civil judges, the judices dativi, who assisted the seven, but could not give judgment without the consent of some of "the seven ordinary judges." The latter were always members of the clergy; the judices dativi were not. For administrative purposes the city was divided into 12 districts. These 12 had succeeded the division of the city in the 6th century into 14 districts for civil administration and seven for ecclesiastical. Just when the change was made is uncertain, but Duchesne thinks it goes back to the time of the Byzantine rule. Finally it may be noted that "senator" was merely a title of honour carrying no power except when a usurping aristocrat bore the title. These statements as to the officials are based mainly on Halphen's study, which has done so much to correct former erroneous notions. Many details are still in doubt, but in general this outline applies to the period before the rise of the commune.

The fall of the Frankish empire left all Italy a prey to anarchy and torn by faction fights. The Saracens were advancing from the south, the Hungarians from the north. Anarchy was at its climax in Rome. The aristocracy gained strength and wrested fresh privileges from the pontiffs. Early in the 10th century Theophylact, who had been an official of the Sacred palace, was the chief of the Roman nobles. He was a senator, and his wife Theodora was styled "senatrix." She and her daughter Marozia were influential, and tradition has assigned to them both greater influence and more vice than can be proved by historical data. Marozia's husband was Alberic, the marquis of Spoleto. After Theophylact, Theodora and Alberic were all dead Marozia became the leader of the noble faction, and added to her power by marrying Guy, marquis of Tuscany. The pope was imprisoned by her and soon died, possibly murdered. Marozia was supreme, and raised her son to the papacy as John XI. When on Guy's death she married King Hugh of Italy (932), a revolt against her and her new husband was led by Alberic, her son; he was successful and became the ruler of the city. Of Marozia no more is heard,

Otto the Great.—Alberic, as "prince and senator of all the Romans," ruled Rome and the duchy until his death in 954. "His yoke was heavy on the Romans and on the Holy Apostolic See"; but the popes were docile and the nobles were kept in order by a stem hand. Alberic was so completely master of Rome that he may have dreamed of creating an hereditary dynasty. He gave his son the name of Octavian, and on his deathbed he made the nobles swear to elect Octavian pope at the next vacancy. The lad was then 16 years old, and the following year was elected pope with the name of John XII. His palace was the scene of scandalous licence, while his public acts were those of a tyrant. He desired to be both pope and prince, but utterly failed to be either. In 960, realizing the impossibility of maintaining his power without outside aid, he sought help from Otto I. and promised him the imperial crown. Otto vowed to defend the Church, to restore her territories, to refrain from usurping the power of the pope or the republic, and was crowned on Feb. 2, 962. Otto confirmed to the pope the territories granted by the Carolingians and even enlarged them, but he also revived the constitution of 824, by which the election of a pope required the imperial confirmation, and he reserved for himself the suzerainty over the papal territory as the Carolingians had done. John XII., finding a master in the protector he had invoked, joined the discontented nobles who were conspiring against the emperor. But the latter hastened to Rome in Nov. 963, assembled the clergy, nobles and heads of the people, and made them take an oath never again to elect a pope without his consent and that of his son. He also convoked a synod presided over by himself in St. Peter's, which judged, condemned and deposed Pope John and elected Leo VIII. (963–965), a Roman noble, in his stead. All this was done at the direct bidding of the emperor, who thus deprived the Romans of their most valued privilege, the right of choosing the pope. Moreover, Otto was hated as a foreign ruler and the clergy were resentful at the uncanonical deposition of a pope and the equally uncanonical election of a layman. On Jan. 3, 964, the Romans attacked the Vatican, where the emperor was lodged. The German knights repulsed them with much slaughter, but Otto departed in February, and John XII. returned with an army of followers and compelled the defenceless Leo VIII. to seek safety in flight. Soon afterwards Leo was deposed and excommunicated by a new synod, and many of his adherents were cruelly murdered. When on May 14, 964, John suddenly died, the Romans, amid violent struggles and tumults, elected Benedict V., and procured his consecration in spite of the emperor's veto. Otto appeared at the head of an army, besieged the city, reduced it by famine and, after holding a council which deposed Benedict, restored Leo VIII. to the papal throne.

The emperor's arbitrary exercise of power roused a long and obstinate resistance. When Leo VIII. died in 965, the imperial party elected John XIII. (965–972), who tried to create a party of nobles to offset the power of the party of Alberic. Upon this there was a general revolt. The nobles were led by Peter, prefect of Rome. The leaders of the people were 12 decarconi, a term of unknown derivation but probably indicating chiefs of the 12 regions. The new pope was seized and imprisoned; but the emperor quickly marched against Rome, and this was sufficient to produce a reaction which recalled the pope (Nov. 966), sent the prefect into exile and put several of the rebellious nobles to death. Shortly after the emperor sacked the city; many Romans were exiled, some tortured, others, including the 12 decarconi, killed.

The Crescentii.—Pope John XIII. was succeeded by Benedict VI. (973–974) and Otto I. by his son Otto II., a youth of 18. Thereupon the Romans, who had supported the election of another pope, and were in no awe of the new emperor, rose to arms under the command of Crescentius, a rich and powerful noble. They not only seized Benedict VI. by force, but strangled him in the castle of St. Angelo. The factions then successively elected popes who were either exiled or persecuted, and one of them is said to have been murdered. During this turmoil the anti-imperial party, led by Crescentius II., son of the Crescentius mentioned above, had taken possession of the government. Crescentius assumed the title of patrician and sought to imitate Alberic. Fortunately for him, the reigning pope was a detested tyrant, and the emperor Otto III. a child entirely guided by his mother. But the emperor was backed by a powerful party, and on coming to Rome in 996 was able, although only aged 15, to quell the rebellion, oust Crescentius from public life, and elect as successor to John XV. his own cousin, Gregory V. (996–999). This first German pope surrounded himself with compatriots, and by raising them to lofty posts even in the tribunals excited a revolt that drove him from the throne (Sept. 29, 996). Crescentius, being master of the castle of St. Angelo, resumed the title of patrician, expelled the German judges, reconstituted the government and created a new pope. The following year Otto III. came to Rome, and his party opened the gates to him. Although deserted by nearly all his adherents, Crescentius held the castle valiantly against its besiegers, until, on April 29, 998, he was forced to make terms, and the imperialists, violating their pledges, first put him to torture and then hurled him from the battlements.

Thus Otto III. was enabled to establish his mastery of Rome. He wished to reconstitute a Romano-Byzantine empire with Rome for his capital. Nevertheless he was German, and during his reign Germanic institutions made progress in Rome and many families of feudal barons arose. The Church made grants of lands, cities and provinces in the feudal manner, while the bishops, like feudal barons, became actual counts. Meanwhile the Roman barons were growing more and more powerful, and were neither submissive nor faithful to the emperor. On the contrary, they

resented his attitude as a master of Rome, and, when he subjected Tivoli to the Holy See, attacked both him and the pope with so much vigour as to put both to flight (Feb. 16, 1001).

By the emperor's death in Jan. 1002 the family of the Ottos became extinct; the papacy then began to decline, and the nobles, divided into an imperial and an anti-imperial party, were again predominant. They reserved to themselves the office of patrician, and, electing popes from their own ranks, obtained enlarged privileges and power. John Crescentius was elected patrician; one of his kinsmen was invested with the office of prefect, and the new pope John XVIII. (1003–09) was one of his creatures. His power lasted for ten years, until his death in 1012. Pope Sergius IV. having died the same year, the count of Tusculum compassed the election of Benedict VIII. (1012–24), one of his own kin. This pope expelled the Crescentii, changed the prefect and reserved the title of patrician for Henry II. whom he consecrated emperor on Feb. 14, 1014. He also succeeded in placing his own brother, Romano, at the head of the republic with the title of "Senator of all the Romans." The prefect still retained his authority, and the emperor was by right supreme judge; but when a violent revolt broke out the emperor only stayed to suppress it and then went to Germany in disgust. The pope, aided by his brother, conducted the government with energy; he awed the party of Crescentius and waged war against the Saracens in the south. When he died in 1024 there was a repetition of the same events that had followed the death of Alberic, and with no less fatal consequences. Benedict's brother, Romano, head of the republic, was, although a layman, elected pope. He took the name of John XIX. (1024–33), and in 1027 conferred the imperial crown on Conrad the Salic. The latter abolished the Lotharian edict of 824 and decreed that throughout Rome and its territory justice should be administered solely by the Justinian code.

The Three **Rival** Popes.—John XIX. was succeeded by his nephew, Benedict IX. (1033–45), whose brother became head of the republic. Thus Church and State assumed the aspect of hereditary possessions in the powerful house of the counts of Tusculum. The vices and excesses of Benedict were so monstrous that he was driven from the city and Sylvester III. elected by his opponents. Benedict still had some support and succeeded in driving out Sylvester; then, finding his position untenable, he sold the papacy to a reformer who took the name of Gregory VI. Benedict soon attempted to regain his office, and in 1045 three popes were struggling for the tiara in the midst of scandal and anarchy. The streets and neighbourhood of Rome swarmed with thieves and assassins; pilgrims were plundered; citizens trembled for their lives, and petty barons threatened the rival popes, who were obliged to defend themselves by force. This state of things lasted until Henry III. came to re-establish order. He summoned a synod which deposed the three popes, and then, with the consent of the Romans, assuming the right of election, proposed a German, Clement II., who was consecrated at Christmas 1046. Henry III. was then crowned, and also took the title of patrician.

Henry III. procured the election of four German popes in succession. But the fourth German pope, Victor II., died in 1057, and Henry III. had been succeeded in 1056 by the young Henry IV. under the regency of a weak woman, the empress Agnes. The nobles by violence and bribery brought about the election of Benedict X. The cardinals were opposed to him and, fleeing from the city, elected Nicholas II. (1059–61). This pope could only enter Rome when escorted by the troops of Godfrey of Tuscany. When Nicholas died the nobles, assisted by some Lombard bishops, elected Honorius II. and sought aid from the German king, while the cardinals chose Alexander II. (1061–73). Although supported by an armed force of Normans, the latter had to fight his way into Rome, whither Honorius II. soon followed and won a battle against the forces of Alexander II. with much slaughter. Both candidates were compelled to withdraw from the city until their claims were settled by the German court. Strife continued, but Alexander II. finally was recognized as pope and attempted to reform the church, though he had little power in the city.

At Alexander's funeral Hildebrand was seized by the crowd and acclaimed as pope. The cardinals who were favourable to him, hastened to go through the form of an election in order to give a legal warrant to what had been done by popular violence; he chose the name of Gregory VII. (1073–85) and secured recognition from Henry IV. Gregory confirmed his predecessor's decrees against simoniacal and non-celibate priests and forbade the clergy to receive investiture at the hands of laymen. As the high ecclesiastical dignitaries held much territory and were also high officials of the empire, this decree was certain to cause a fierce contest between the emperor and the pope. Some of the nobles had already shown their hostility to Gregory; at Christmas 1075 the prefect Cencius and other nobles seized Gregory while he was celebrating mass in Santa Maria Maggiore and dragged him away to imprisonment. The people were incensed at this outrage and fear of popular wrath compelled Cencius to release Gregory. About the same time Henry IV., exasperated by a letter in which Gregory had sharply rebuked him for his sins, declared Gregory deposed from the papacy, and Gregory in turn decreed the excommunication and deposition of the emperor. That monarch afterwards made submission to Gregory at Canossa (1077), then again turned against him and was again excommunicated. In 1081, with his anti-pope Clement III., he besieged Rome in vain. He was equally unsuccessful in each of the two following years, but at last forced his way into the city (March 1084) and compelled Gregory to seek refuge in the castle of St. Angelo. The emperor, as master of Rome, procured the consecration of Clement III., by whom he was crowned in turn. He then attacked and seized the capitol and assaulted the castle of St. Angelo in the hope of capturing the pope. But Robert Guiscard brought his Norman army to the rescue. Emperor and anti-pope fled; the city was taken, the pope liberated, and Rome was brutally sacked for three days by the Normans. After this Gregory, broken with grief and hated by the Romans, had to go away with the Normans and died at Salerno on May 25, 1085.

Victor III. was elected only after an interval of *a* year and reigned only a short time. He was consecrated in St. Peter's but was unable to maintain his position in Rome. Urban II. (1088–99), the next pope elected, also had little power in Rome, as the city was usually in the hands of the supporters of the anti-pope. It was not until 1096, when he had won prestige by preaching the crusade, that he could enter the city as its master, and even then the castle of St. Angelo was held by the followers of the anti-pope, until 1098.

Revolt Under **Paschal** II.—Pope Paschal II. (1099–1118) tried to rule the city through the faction of nobles who favoured him, but with little success, as the imperial party frequently had the upper hand. When Henry V. seized the pope in 1111 the people rose in his defence and forced Henry to leave the city; but under ordinary circumstances Paschal could not count on any hearty support. In 1116, when he wished to make one of the Pierleoni prefect, there was a bloody revolt and a rival was put in as prefect by the imperial partisans. Soon after this Henry V. came to Rome and Paschal had to flee. Later he returned with Norman troops but could not put down the revolt, and the opposition still held the capitol when Paschal died.

The cardinals met in haste and secretly elected Gelasius II. The election had scarcely been completed when Cencius Frangipani broke into the assembly, seized the pope and carried him bleeding to one of the Frangipani towers. As they had done when another Cencius had seized Gregory VII., the people of the 12 districts rose in their wrath and, led by the prefect (whose election Paschal had opposed), forced the Frangipani to give up their prisoner. The Frangipani fled to the emperor and he came to Rome. Gelasius had to flee to his native city of Gaeta, where he was safe under Norman protection. An anti-pope was chosen by the imperial party; but when Henry left Rome Gelasius was able to return, although the anti-pope was also in Rome and a new revolt threatened the life of Gelasius.. Consequently he fled to France, where he died in 1119, having been pope a year and a few days.

Calixtus was next chosen and restored peace. The Frangipani succeeded in electing his successor Honorius II. (1124–30), who was quietly accepted by the Roman people. At his death some **of**

the cardinals chose Innocent II.; others, and the more numerous part, elected one of the Pierleoni, who took the name of Anaclete II. The greater part of the people now favoured the Pierleoni, and his rival, who was supported by the Frangipani, had to flee. He secured support in France and Germany, especially through the aid of Bernard of Clairvaux, and was finally recognized as pope almost everywhere except in Rome and among the Normans in Italy. Anaclete II. retained the upper hand in the city almost until the time of his death in 1138. In the following year Innocent attempted a military campaign against Roger of Sicily, but was captured by him and compelled to acknowledge his kingship, with which he had been invested by Anaclete. Humiliated, Innocent returned to Rome and there he was to suffer further humiliation.

Rise of the Commune. — Throughout upper and central Italy the cities were being organized as free and independent communes on a democratic basis. Their example was followed in the ancient duchy of Rome and almost in the immediate neighbourhood of the city. The same tendencies were at work in Rome. Gradually in the troubled times when the factions of the nobles were contending together and the papal rule was so weak, a lesser nobility had grown into power in the city, in alliance with the people, with whose interests they had much in common. They were irritated against the pope by his submission to the Normans and this irritation was greatly increased by his attitude toward Tivoli. In 1142 this city openly rebelled against the mother city, and the pope sent the Romans to subdue it. They were not only repulsed, but ignominiously pursued to their own gates Afterwards, returning to the assault in greater numbers, they conquered the hostile town. Its defenders surrendered to the pope, and he immediately concluded a treaty of peace without consulting the people. The soldiery, still flushed with victory, were furious at this slight. They demanded the submission of Tivoli to the Roman people, as well as permission to demolish its walls and dwellings and expel its population. Innocent II. refused his consent and a revolution ensued. In 1143 the rebellious people rushed to the capitol, proclaimed the republic, reconstituted the senate, with the almost entire exclusion of the nobles, and declared the abolition of the temporal power. Just after this Innocent died.

The pontificates of the next two popes, together, lasted less than 17 months. The second, Lucius II. (1144–45), tried to withstand the revolution by seeking Norman aid and throwing himself into the arms of the feudal party, but this only precipitated the course of events. The people, after having excluded nearly all aristocrats from the senate, now placed at its head the noble Jordan Pierleoni, who had joined the revolutionary party. They named him patrician, and also conferred on him the judicial powers appertaining to the aristocratic and imperial office of prefect. The pope was requested to resign the temporal power, the regalia and every other possession and content himself with the tithes and offerings of the faithful. He indignantly refused, marched at the head of the nobles against the capitol, but was repulsed, and received a blow on the head from a stone, which is supposed to have caused his speedy death, Feb. 15, 1145. Eugenius III. was then elected (1145–53), but soon had to flee to Viterbo in quest of armed assistance, in consequence of the senate's resolve to prevent by force his consecration until he recognized the new state of things in the Eternal City.

It was at this time that Arnold of Brescia (*q.v.*) was absolved by the pope and ordered to make a pilgrimage to Rome. An arch-revolutionist, he began to preach and his eloquence brought him fame. But his influence on events has been greatly exaggerated in most accounts. The people had already formed an equestrian order, which was probably a mounted force of the lesser nobility, and also were fortifying the capitol. The revolution spread beyond the walls, several cities of the state proclaimed their independence, and the barons of the Campagna profited by the opportunity to act as independent sovereigns. Thus the whole domain of the Church was threatened with dissolution. The pope marched towards Rome with an army, but hoped to come to terms. The Romans in fact recognized his authority, and he in his turn recognized the republic. The office of patrician was abolished, and the prefect was revived. The senators received investiture from the pope, who returned to Rome at Christmas 1145.

The Commune Fully Constituted. — The commune now seems to have been fully constituted, so a short sketch will be given here of its more important features. The senate was dra n, at least in part, from the lower classes and the petty nobility, and this was the special characteristic of the new revolution. In 1144 there were 56 senators, but the number often varied. In 1151 there were 50; in 1163 only 25; in 1181 again 56, and still more in 1191. After that it was more usual to have only one or two senators and these were generally chosen from the aristocracy. From the few existing documents of the period we learn that the senators were divided into *senatores consiliarii* and ordinary senators. The former constituted a smaller council, which consulted with the head or heads of the republic on the more urgent and secret affairs of the State. The senate exercised its powers under the control of the council and parliament. The former was a deliberative assembly called together by the senate to discuss important affairs such as treaties or declarations of war. The councillors varied in number — at times nine, once as many as 84. Their advice was taken but not necessarily followed by the senate. The parliament was an assemblage of all the citizens. In it there was no discussion of the matters brought before it by the senate, but each matter was accepted or rejected by the people. Senators held office for only one year. They were elected usually by the whole people; but at times the pope was allowed to appoint an elector or electors to choose the senator or senators; in this latter case, however, the choice apparently had to he submitted to the popular assembly for ratification. The pope also was compelled to pay salaries to the senators and their officials.

The senate had usurped the right of coinage; and although by a treaty of 1188 it agreed to restore this right to the pope on condition that one-third of the money coined should be given to the senate, the pope did not take advantage of the retrocession and all the money was coined by the senate; Innocent III. even decreed that only senatorial coins should be used in the whole of the Campagna. The senate also seized for its own advantage the right of levying taxes on merchandise brought into the city. It also took over the appointment of judges, but in place of seven appointed a single Palatine judge for a term of three months. He was assisted by a *judex dativus*. Thus it is seen that while the pope still exercised certain rights he had actually lost control of the city.

The agreement with Pope Eugenius was of short duration. The revolution could not be checked; the Romans desired independence, and their spiritual lord fled to France, whence, in 1147, he proclaimed a new crusade, while the Romans were employed in demolishing Tivoli, banishing its inhabitants and waging war on other cities. Jordan Pierleoni was head of the republic, and Arnold, supported by the popular favour and the enthusiasm of the lower clergy, was preaching with even greater fervour than before. The new pope now re-entered Italy, proclaimed Arnold a schismatic, and advancing to Tusculum assembled an army in order to attack Rome. In this emergency the Romans applied to Conrad III., the first emperor of the house of Hohenstaufen; and their letters are expressive of Arnold's theories and his medley of ancient and modern, sacred and profane, ideas. "Rome," so they said, "is the fountain of the empire confided to you by the Almighty, and we seek to restore to Rome the power possessed by her under Constantine and Justinian. For this end we conquered and destroyed the strongholds of the barons who, together with the pope and the Normans, sought to resist us. These are now attacking us on all sides. Haste to Rome, the capital of the world, thus to establish thy imperial sway over the Italian and German lands." After long delay the king of the Romans replied to these appeals, stating that he would come "to re-establish order, reward the faithful and punish the rebellious." These words promised ill. In fact, Conrad had already arranged terms with the pope; but his life came to an end on Feb. 15, 1152.

Frederick **Barbarossa.**—He was succeeded by Frederick I., surnamed Barbarossa, who took no notice of letters urging him to come and receive the empire from the Roman people. In accord.

ance with his design of subduing all the independent cities, he made an agreement with the pope, in which he vowed to give no truce to the Romans, but subject them to their spiritual lord, whose temporal power should be restored. The pope, on his side, promised to crown him emperor. Thereupon the people again rose to. arms and broke off all negotiations with Eugenius III. Frederick was in command of a powerful army, and was no friend of half measures. To increase the gravity of the situation, an English pope, Adrian IV., was elected (1154–59), who was also a man of strong and resolute temper. In fact, even before he was able to take possession of the Lateran, he requested the Romans to banish Arnold, who was directing his thunders against the papacy. These utterances increased the wrath of Adrian, who, encouraged by the knowledge that Frederick and his host were already in Italy, at last launched an interdict against Rome. It was the first time that a pope had laid an interdict on the Eternal City. This put a summary stop to the religious life of the inhabitants and men's minds were seized with terror; a fierce tumult broke out. Thereupon the senators implored pardon; but Adrian demanded the expulsion of Arnold before consenting to raise the interdict. Arnold was therefore obliged to leave Rome, and, abandoned by all, was forced to wander from castle to castle, until given up to Frederick Barbarossa and then consigned by the latter to the papal legates. The pope in his turn gave the reformer into the hands of the prefect, who hanged his prisoner, burnt his body at the stake, and cast his ashes into the Tiber.

But the Romans would not give up their commune. Their envoys went to meet Frederick near Sutri, and made an address in the usual fantastic style on the privileges of the Roman people and its sole right to confer the imperial crown. Frederick indignantly cut short their harangue, and they had to depart full of rage. He then continued his march, and, entering Rome on June 18, 1155, was forthwith crowned in St. Peter's by the pope. Thereupon the Romans rushed to arms and made a furious attack on the Leonine city and the imperial camp. A desperate battle went on throughout the day; many Romans perished by the sword or by drowning, but their fellow-citizens made such determined preparations to continue the struggle that Frederick, on June 19, hastily retreated, or rather fled, together with the pope and the cardinals. The commune still survived. Its existence was in truth favourable rather than injurious to Frederick, but he had not yet discerned that his best policy would be to support the commune against the pope. The latter, with keener acumen, made alliance with the communes of Lombardy and encouraged them in their resistance to the emperor. Adrian IV. died in 1159, and the anti-imperial party elected Alexander III. (1159–81), who energetically opposed the pretensions of Frederick, but, having to struggle with three anti-popes successively raised against him by the imperial party, was repeatedly driven into exile. During these schisms the senate quietly carried on the government, administered justice and made war on some neighbouring cities and barons. An army comprising many nobles marched against Tusculum, but found it defended by several valiant officers and a strong band of German soldiery, who, on May 29, 1167, inflicted on the Romans so severe a defeat that it is styled by Gregorovius "the Cannae of the middle ages." Shortly afterwards the emperor arrived in Rome with his anti-pope Paschal III., and Alexander had to flee. Then, at last, Frederick came to terms with the commune, recognized the senate, which accepted investiture at his hands, re-established the prefecture as an imperial office, and bestowed it on John, son of Peter di Vico. He departed hastily, as a deadly fever broke out and decimated his army.

Concord between **Pope and** Commune.—Meanwhile Pope Alexander continued Adrian's policy with better success, however, for the Lombard cities had now formed a league and inflicted a signal defeat on the emperor at Legnano on May 29, 1176. One of the results of this battle was the conclusion of an agreement between the pope and the emperor, the latter resigning his pretensions on Rome and yielding all that he had denied to Adrian. By the Treaty of Venice (Aug. 1, 1177), the anti-pope was forsaken, Alexander III. recognized and hailed as the legitimate pontiff and the prefect of Rome was again to be nominated by the pope, to whom the emperor restored the temporal power, acknowledging him the independent sovereign of Rome and of the ecclesiastical State. Frederick's troops accompanied the pope to Rome, where the commune was forced to make submission to him. But, proudly conscious as it still was of its strength, its surrender wore the aspect of a voluntary concession, and its terms began with these words: "It has been decreed by the council and deliberation of the whole Roman people," etc. The senators, elected yearly in November, had to swear fealty to the pope. On his return to Rome Alexander received a solemn welcome from all. He died on Aug. 30, 1181. The fact that between 1181 and 1187 there were three popes always living in exile proves that the commune was by no means crushed. On Dec. 20, 1187, Clement III. (1187–91) made a solemn agreement with the government of the capitol before coming to Rome. And this peace or *concordia* had the air of a treaty between potentates of equal importance. Rome confronted the pope from the same standpoint from which the Lombard cities had confronted the emperor after Legnano. This treaty was confirmed on the last day of May 1188 (*Anno XLIV.* of the senate). The pope was recognized as supreme lord, and invested the senators with their dignity. Almost all the old pontifical rights and prerogatives were restored to him. The pope might employ the Roman militia for the defence of his patrimony, but was to furnish its pay. The rights of the Church over Tivoli and Tusculum were confirmed; but the commune reserved to itself the right of making war on those cities, and declared its resolve to dismantle and destroy the walls and castle of Tusculum. In this undertaking the pope was to co-operate with the Romans, even should the unhappy city make surrender to him alone.

From all this it is clear that the Church had been made independent of the empire, and that the commune, despite its numerous concessions, was by no means subject to the Church. The republic had no patrician nor any other imperial magistrate and preserved its independence even as regarded the pope, who merely granted investiture to magistrates freely chosen by the people and had no legislative nor administrative power in the city. His temporal dominion was limited to his great possessions, to his regalia, to a supreme authority that was very indefinite, and to a feudal authority over the barons of the Campagna and many cities of a State that seemed ever on the point of dissolution. The senate continued to frame laws, to govern, and to administer justice. The army carried on the wars of the commune, as we see by the tragic fate of Tusculum, which was razed to the ground on April 19, 1191. In consequence, the nobles, seeing that the commune remained firmly established, began to adhere to it and succeeded in obtaining admission to the senate. In fact, whereas since 1143 plebeians and petty nobles had prevailed in its ranks, nobles of ancient descent are now found outnumbering the knights and burghers. In 1191 this state of things caused a sudden popular outbreak which abolished the aristocratic senate and gave the headship of the commune to a single senator, of unknown origin. During the two years he remained in office this personage stripped the pope of his revenues, despatched *justitiarii* even. to the provinces, and with the aid of the parliament and council promulgated laws and statutes. He was overthrown by a counter-revolution; John Capoccio of the party of the nobles became senator for two years, and had been succeeded by one of the Pierleoni when, in 1197, a fresh revolution re-established a senate of 56 members, chiefly consisting of feudal barons in high favour with Henry VI., who had revived the imperial faction in Rome. But this emperor's life ended the same year, and the pope's in 1198, and the new pontiff, Innocent III. (1198–1216), began to make war on the nobles, who were again masters of the commune. Their leader was the prefect Peter di Vico. Owing to the revolution of 1143, most of the prefectorial attributes were now vested in the senate; nevertheless, Peter still retained a tribunal of police both within and without the city, and derived great strength from the vast possessions of the Vico family, in which the office of prefect now became hereditary. Very soon* after this, however, the independent municipal office lost its true character. Then the popes made a point of according great pomp and dignity to this nominal

prefect, in order to overshadow the senator, who still represented the independence of the republic.

Innocent III., dissatisfied with this state of things, contrived by bribing the people to arrogate to himself the right of appointing a commissioner to elect the senator, who had to swear fealty and submission to the pope, and also that of nominating the provincial *justitiarii,* formerly chosen by the government of the capitol. This was a deadly blow to the commune, for the principal rights of the people—*i.e.,* the election of pope, prefect, and senate—were now lost. The general discontent provoked fresh revolutions, and the people made a loud outcry for a senate of 56 members; the pope, making a virtue of necessity, caused that number to be chosen by 12 mediani specially named by him for the purpose. Even this did not calm the popular discontent, and when, six months later, the pope again had a single senator elected the Romans rose to arms and in 1204 formed a government of "Good Men" (Buoni Uomini) in opposition to that created by the pope. But an amicable arrangement being concluded, the pope once more had 56 senators nominated; and when, soon after, he again reduced them to one, the people were too weary to resist (1205).

Pretensions of the Commune.--On Nov. 22, 1220, Honorius III. (1216–27) conferred the imperial crown on Frederick II., who confirmed to the Church the possession of her former States, of those bequeathed to her by Countess Matilda, and even of the March of Ancona. But it was soon seen that he sought to dominate all Italy, and was therefore a foe to be dreaded. The successor of Honorius, Pope Gregory IX. (1227–41), was speedily insulted and put to flight by the Ghibelline nobles, whose courage had revived, and the republic began to subdue the Latian cities on its own account. Peace was several times made and unmade by pope and people; but no enduring harmony was possible between them, since the former wished to subject the entire State to the Church, and the latter to escape from the rule of the Church and hold sway over "the universal land from Ceprano to Radicofani" formerly belonging to the duchy. Accordingly, the Roman people appointed judges, imposed taxes, issued coin, and made the clergy amenable to secular tribunals. In 1234 the senator Luca Savelli published an edict declaring Tuscia and Campania territories of the republic, and sent judges thither to exact an oath of obedience. He also despatched the militia to the coast, where it occupied several cities and erected fortresses; and columns were raised everywhere inscribed with the initials S.P.Q.R. The pope, unable to prevent but equally unable to tolerate these acts, fled from Rome, hurling his anathema against Savelli and his associates. The Romans sacked the Lateran and the houses of many cardinals and marched on Viterho, but were driven back by the papal troops. The people had to make peace and submission in 1235, and were obliged to give up their pretensions of subjecting the clergy to ordinary tribunals and the urban territory to the commune. Thus matters were virtually settled on the footing established by Innocent III., thanks to the aid given to the pope by Frederick II., who had previously aided the rebellion.

Meanwhile the struggle between Frederick II. and the pope was once more renewed. The nobility was again split into a Guelph party headed by the Orsini and a Ghibelline party under the Colonna. In 1238 it was deemed advisable to elect two senators instead of one, in the hope of conciliating both factions by simultaneously raising them to power. Afterwards one only was elected, alternately an Orsini and a Colonna, then again two, and so on. But all these changes failed in their aims, since the struggle between emperor and pope exasperated party feeling in Rome. Frederick desired to emancipate the State from the Church, but he was opposed to the communal democracy, which was then the chief strength of the secular State in Italy. Thus, although he had a strong party in Rome, it seemed to dissolve at his approach, inasmuch as all feared that he might abolish the statutes and liberties of the commune. In fact, when he advanced towards Rome on the death of Gregory IX. in 1241, he was energetically repulsed by the people, and later even by Viterbo, a city that had always been faithful to him. After he had withdrawn, his adherents gained strength and put to flight his opponent, Innocent IV. (1243–54), the newly elected pope, who then from Lyons hurled an excommunication against him. On Frederick's death in Dec. 1250 the pope instantly returned to Rome with the set purpose of destroying the power of the Hohenstaufens.

Brancaleone.—The commune meanwhile being harassed by the factiousness of the nobility in 1252 decided on the election of an alien senator armed with ample powers, precisely as other communes gave the government into the hands of a podesta. Accordingly a Bolognese noble, Brancaleone degli Andalo, count of Casalecchio, and a Ghibelline, was invited to Rome. Before accepting office he insisted on making definite terms; he desired to hold the government for three years; and this although contrary to the statutes, was granted. Further, to insure his personal safety, he demanded that many scions of the noblest Roman houses should be sent as hostages to Bologna; and to this also the commune consented. Then, in Aug. 1252, he came with his judges and notaries, made oath to observe justice and the laws, and began to govern. He was head of the republic in peace and in war, supreme judge and captain in chief. He nominated the podestas of subject territories, despatched ambassadors, issued coin, concluded treaties, and received oaths of obedience. He convoked the council as seldom as was possible, although he frequently assembled the people in parliament. The chief complaint made against him was of undue severity in the administration of justice. He rendered the clergy amenable to secular tribunals, subdued the neighbouring cities of Tivoli, Palestrina, etc., and commanded in person the attacking force. But his greatest energy was directed to the repression of the more turbulent nobles, hanging some and banishing others. He recognized the expediency of winning the popular favour and was the first senator to add to his title that of "captain of the people." He befriended the people by promoting the organization of gilds, 13 in all. The admission of their heads into the councils of the commune in 1267 shows how far their interests had been promoted by Brancaleone.

When, on the expiration of his three years' term of office, Brancaleone's re-election was proposed, his enemies rose against him, accused him, threw him into prison, and vehemently protested against the continuance of "foreign tyranny." His life was spared only on account of the hostages sent to Bologna. The next senator chosen was a Brescian Guelph, Emanuele de Madio, a tool of the nobles, who were masters of the situation. But soon afterwards, in 1257, the people rose in revolt, drove the nobles from power, put the pope to flight, and recalled Brancaleone for another three years' term. He ruled more sternly than before, hung several nobles, and made alliance with Manfred, the representative of the Swabian party in Italy. This rendered him increasingly odious to the pope and procured his excommunication. But, disregarding the thunders of the Church, he marched against Anagni, the pope's birthplace, and Alexander was quickly obliged to humiliate himself before the senator of Rome. Brancaleone next set to work to destroy the fortified towers of the nobility, and in razing them to the ground ruined many of the adjacent dwellings. In 1258 Brancaleone died. Thus ended the career of a truly remarkable statesman. He was succeeded by his uncle, Castellano degli Andalo, who only retained office until the following spring (1259). Then the people, being bribed by the pope, joined with the nobles and overthrew him. His life too was saved by having followed his nephew's shrewd plan of sending hostages to Bologna. Two senators of Roman birth were next elected.

Charles of **Anjou** Senator— At this period the fall of the empire had induced many Italian republics to seek strength by placing their governments in the hands of some prince willing to swear respect for their laws and to undertake their defence. In Rome the Guelphs and Ghibellines proposed various candidates for this office, and after many fierce quarrels ended by electing a committee of *boni* homines, charged with the revision of the statutes, reorganization of the city, and choice of a senator. This committee sat for more than a year without nominating anyone; then, the Guelph party being predominant, the majority agreed on the election as senator of Charles of Anjou, who after a long delay became senator, but held office for less than a year. Two Romans were elected in his stead, but soon

fell out with the pope, because the Guelph nobles again tried to exercise tyranny. The people, however, profited by these disturbances to rise on their own account, and formed a democratic government of 26 *boni homines* with Angelo Capocci, a Ghibelline, as its captain. By this government Don Henry, son of Ferdinand III., of Castile, was elected senator (1267). The rule of the new senator was very energetic, for he kept down the clergy, subdued the Campagna, persecuted the Guelph nobles, made alliance with the Tuscan Ghibellines, forcibly drove back the troops of King Charles, who was advancing towards Rome, and gave a splendid reception to Conradin. But the battle of Tagliacozzo (Aug. 23, 1268), followed by the murder of Conradin, proved fatal to the Ghibelline party. Charles was re-elected senator immediately after the battle, and the pope confirmed his powers for a term of ten years.

In 1278, the ten years' term having expired, the pope, after declaring that he left to the people the right of electing the senator, promulgated a new constitution (July 18, 1278), which, while confirming the rights of the Church over the city, prohibited the election of any foreign emperor, prince, marquis, count or baron as senator of Rome. Thus the Colonna, Savelli, Orsini, Annibaldi and other Roman nobles again rose to power, and the republic was again endangered and plunged into disorder. The Romans then gave the reconstitution of the city into the pope's hands by yielding to him the right of nominating senators. So Nicholas proceeded to name senators, alternating a Colonna with an Orsini, or simultaneously choosing one of each faction. The same power over the senate was granted with the same restriction to Martin IV. (1281–85), and he at once re-elected Charles of Anjou. Thus, greatly to the disgust of the Romans, the capitol was again invaded by French vicars, notaries, judges and soldiery. But the terrible blow dealt at Charles's power by the Sicilian Vespers (March 31, 1282) resounded even in Rome. The Orsini, backed by the people, rose in arms, massacred the French garrison, and quickly re-established a popular government. John Cencio, a kinsman of the Orsini, was elected captain and defender of the people, and ruled the city with the co-operation of the senator and a council of priors of the gilds. This government was of brief duration, for, although the pope had professed his willingness to tolerate experiment, he quickly arranged fresh terms, and, forsaking Charles of Anjou, again nominated two Roman senators. Pope and king both died in 1285, and Nicholas IV. (1288–92), also holding sway over the senate, favoured the Colonne in order to curb the growing mastery of the Orsini. But thus there were two powerful houses instead of one. In fact, John Colonna, when elected senator, ruled from the capitol as an independent sovereign, conducted in person the campaign against Viterbo, and subjected that city to the republic on May 3, 1291.

Boniface VIII. (1294-1303) tried to reduce the power of the Colonna family and succeeded for a time in exercising more power in Rome than any of the recent popes. This was due largely to the Jubilee which brought thousands of pilgrims to Rome. The citizens wished to profit by the gold which the pilgrims brought and for that reason were ready to postpone their rivalries.

Removal of the Popes to **Avignon.**—When the popes removed to Avignon the city was left almost entirely to govern itself. There was the same strife between the "ins" and the "outs," who persisted in using the names Guelphs and Ghibellines, although these names had lost their old meaning since the fall of the Hohenstaufens. The commune employed its freedom in trying to hold its own against the nobles, whose power was much lessened by the absence of the pope, and endeavoured to gain fresh strength by organizing the 13 regions. Accordingly, in 1305, a captain of the people was elected with 13 elders and a senator, Paganino della Torre, who governed for one year. The pope was opposed to these changes at first, but in 1310 he issued a brief granting Rome full permission to select its own form of government. Thus, the first pope in Avignon restored the rights of the Romans. The latter still considered Rome the Eternal City, the source of all law, and the only natural seat of the spiritual and temporal government of the world. To their republic, they thought, appertained a new and lofty destiny. In 1312, in spite of the opposition of the nobles, they insisted upon the coronation of the emperor Henry VII. In the same year, after a brief interval of rule by the nobles, the popular party again got the upper hand, only to be overthrown the following year.

Then the pope appointed King Robert of Naples as senator. Affairs took a fresh turn under Pope John XXII. (1316–34). Rome was still ruled by the vicars of King Robert; but, owing to the continued absence of the pope, matters grew daily worse. Trade and industry declined, revenue diminished, the impoverished nobles were exceedingly turbulent, deeds of murder and violence occurred on all sides; even by day the streets of the city were unsafe. Hence there was universal discontent. Accordingly the Italian Ghibellines hailed Louis the Bavarian as they had previously hailed Henry. The Roman people were roused to action, and, driving out the representatives and partisans of King Robert, in the spring of 1327 seized on the castle of St. Angelo and again established a democratic government. Regardless of the reproofs of the pope, they elected a haughty Ghibelline, Sciarra Colonna, captain of the people and general of the militia, with a council of 52 *popolani,* four to each region. Then ranged under the standards of the militia, the Romans gave chase to the foes of the republic, and Sciarra, returning victorious, ascended to the capitol, and invited Louis the Bavarian to Rome.

Encircled by a crowd of heretics, reformers and Minorite brethren, Louis convoked a parliament on the capitol, asking that the imperial crown might be conferred upon him by the people, from whom alone he wished to receive it. And the people proclaimed him their captain, senator and emperor. On Jan. 17, his coronation took place in St. Peter's. But, as he had neither money nor practical sense, his method of taxation and the excesses committed by himself and his over-excited philosophers speedily aroused the popular discontent. His ecclesiastical vicar, Marsilius of Padua, and John Janduno placarded the walls with insulting manifestos against the pope, whom the Minorites stigmatized as a heretic and wished to depose. The emperor decreed that henceforth the popes must reside in Rome — that if, when invited, they should fail to come they would be thereby held deposed from the throne. As a logical consequence, proceedings were immediately begun for the election of a new pope, Nicholas V., who on May 12 was proclaimed by the popular voice in St. Peter's square, and received the imperial sanction. But this ephemeral drama came to an end when the emperor departed with his anti-pope on Aug. 4. This caused the immediate downfall of the democratic government. A new parliament cancelled the emperor's edicts, and had them burnt by the public executioner. Meanwhile King Robert was again supreme in Rome, and being re-elected senator appointed vicars there as before. Anarchy reigned.

After the election of Benedict XII. (1334–42) confusion reached so great a pitch that, on the expiration of Robert's senatorial term, the Romans named 13 heads of regions to carry on the government with two senators, while the king still sent vicars as before. The people, for the sake of peace, once more granted the supremacy of the senate to the pope, and he nominated two senators. But in 1339 the Romans attacked the capitol, named two senators of their own choice, re-established a democratic government, and sent ambassadors to Florence to ask for the ordinances of justice by which that city had broken the power of the nobles, and also that a few skilled citizens should lend their help in the reconstitution of Rome. Accordingly some Florentines came with the *ordinamenti,* some portions of which may be recognized in the Roman statutes, and, after first rearranging the taxes, elected 13 priors of the gilds, a gonfalonier of justice, and a captain of the people after the Florentine manner. But there was a dissimilarity in the conditions of the two cities. The gilds having little influence in Rome, the projected reform failed, and the pope, who was opposed to it. re-elected the senators. Thereupon public discontent swelled. Another revolution in Rome re-estabiished the government of the 13 elders and the two senators.

Cola di Rienzi.—The people, anxious to show their intention of respecting the papal authority, had despatched to Avignon as ambassador of the republic, in 1343, Cola di Rienzi (*q.v.*), who

begged the pope to return to Rome, to allow the city to celebrate a jubilee every 50 years, and then, as a personal request, asked to be nominated notary to the urban chamber. The pope consented to everything, and Rienzi communicated this good news to Rome in an emphatically worded epistle. After Easter, in 1344, he returned to Rome and found that the city was a prey to the nobles. He secretly built up a party of conspirators and in May 1347 convoked a parliament of the people and obtained its sanction for the following proposals: that all pending lawsuits should be at once decided; that justice should be equally administered to all; that every region should equip 100 foot soldiers and 25 horse; that the dues and taxes should be rearranged; that the forts, bridges, and gates of the city should be held by the rector of the people instead of by the nobility; and that granaries should be opened for public use. On the same day, amid general homage and applause, Rienzi was proclaimed head of the republic, with the title of tribune and liberator of the Holy Roman Republic, "by authority of the most merciful Lord Jesus Christ." The nobles withdrew scoffing but alarmed. Rienzi engaged a bodyguard of 100 men, and assumed the command of the 1,300 infantry and 390 light horse; he abolished the office of senator, retained the Thirteen and the general and special councils, and set the administration on a new footing. These measures and the prompt submission of the other cities of the State brought an instant increase of revenue to Rome.

The pope, willingly or unwillingly, accorded his approval to Rienzi's deeds. The provincial cities did homage to Rome and her tribune, and almost all the rest of Italy gave him its enthusiastic adherence. Great men like Petrarch were transported with joy. But on the convocation of a national parliament few representatives obeyed the summons and the scheme was a failure. Nevertheless, on Aug. 15, Rienzi caused himself to be crowned tribune with great pomp, and confirmed the rights of Roman citizenship to all natives of Italy. The nobles remained steadily hostile; conflict was unavoidable. At first Rienzi succeeded in vanquishing the Gaetani by means of John Colonna; he next endeavoured to suppress the Guelph and Ghibelline factions, and to restore Italy to "holy union."

The pope, however, was weary of toleration, and, coming to terms with the nobles, incited them to war. A battle took place in which 80 nobles, chiefly of the Colonna clan, were left dead; the aristocracy never again achieved the rule of the republic. Rienzi's head was turned by this sudden success, and in his great need of money he began to play the tyrant by levying taxes and exacting instant obedience. The papal legate saw his opportunity and seized it, by threatening to bring a charge of heresy against the tribune. Rienzi was dismayed. He declared himself friendly to the pope and willing to respect his authority; and he even sought to conciliate the nobles. At this moment certain Neapolitan and Hungarian captains, after levying soldiers with the tribune's consent, joined the nobles and broke out in revolt. On their proving victorious in a preliminary encounter with some of Rienzi's guards, the tribune suddenly lost heart, resigned the power he had held for seven months, and fled to Naples.

Meanwhile the Romans remained tranquil, intent on making money by the jubilee; but no sooner was this over than disorders broke out and the tyranny of the baronage recommenced. To remedy this state of things, application was made to the pope. He consulted with a committee of cardinals, who sought the advice of Petrarch, and the poet suggested a popular government, to the complete exclusion of the nobles, since these, he said, were strangers who ruined the city. The people had already elected the Thirteen, and now, encouraged by these counsels, on Dec. 26, 1351, chose John Perrone as head of the commune. But the new leader was unable to withstand the hostilities of the nobles; and in Sept. 1353 Francis Baroncelli was elected tribune. He was a follower of Rienzi, and did little beyond imitating his mode of government and smoothing the way for his return.

Rienzi, after various adventures, was at Avignon in confinement. Innocent VI. (1352–62) decided to send Cardinal Albornoz to Italy, in order to bring the State into subjection to the Church; and he further decided that Rienzi should accompany him to give him the support of his own popularity in Rome. In fact, directly the pair arrived Baroncelli was overthrown, the supremacy of the senate granted to the pope, and the government confided to Albornoz, who, without concerning himself with Rienzi, nominated a senator. Rienzi, profiting by his prestige and the apparent favour of the pope, was able to collect a band of 500 soldiers of mixed nationalities and on Aug. 1, 1354, took possession of the government. But his money ran short, and he resorted to violence to fill his purse. The result was a sudden revolt on Oct. 8, when the people stormed the capitol with cries of "Death to the traitor." Rienzi was killed.

Foreign Senators and the **Banderesi.**—Rome submitted to the pontiff, and the pope, instead of two senators, hastened to name a single one of foreign birth. This was a shrewd device of Albornoz and another blow to the nobles, with whom he was still at war. Thus was inaugurated, in 1358, a series of foreign senators, fulfilling the functions of a podesta, and changed every six months together with their staff of judges, notaries, and knights. The people approved of this reform as being inimical to the nobles and favourable to the preservation of liberty.

Hitherto the senators had been assisted, or rather kept in check, by the 13 representatives of the regions. In 1360 these were replaced by seven reformers, who soon became the veritable chiefs of the republic and were elected by ballot every three months, and the nobles, already shut out from power, were also excluded from the militia, which had been reorganized on the democratic system. Three thousand men, mostly archers, were enrolled under the command of two *banderesi,* with four *antepositi,* or lieutenants, constituting a supreme council of war. And the whole body was styled the *"Felix societas balestrariorum et pavesatorum."* It was instituted to support the reformers and re-establish order in the city and Campagna, to keep down the nobles and defend the republic. It fulfilled these duties with much severity. *Banderesi* and *antepositi* had seats in the special council beside those of the reformers, the gonfaloniers of the companies were seated beside the priors. Later these officials constituted the so-called *signoria dei banderesi.* When in 1362 the nobles made a riot in Rome, the *banderesi* drove them all from the city. The fight became so furious that all Rome was in arms, and even mercenaries were hired. Finally renewed submission was made to the pope.

On the death of Innocent VI. in 1362, an agreement was concluded with his successor, Urban V. (1362–70), who was obliged to give his sanction to the government of the reformers and *banderesi.* And then, Albornoz being recalled in disgrace to Avignon and afterwards sent as legate to Naples, these Roman magistrates were able, with or without the co-operation of the foreign senator, to rule in their own way. They did justice to the nobles by hanging a few more; and they defended the city from the threatening attacks of the mercenaries, who had become Italy's worst foes. It was at this period that the Roman statutes were revised and rearranged in the compilation which has come down to us supplemented by alterations of a later date.

Urban V. Begins to Destroy the Republic.—Urban V. (1362–70), no longer in safety at Avignon, decided to return to Italy. The Romans implored him to do so, and he was urged to it by the Italian *literati,* with Petrarch at their head. In April 1367 he left Avignon, and, entering Rome on Oct. 16, was given the lordship of the city. He showed much acumen in profiting by the first burst of popular enthusiasm to effect quick and dexterous changes in the constitution of the republic. After naming a senator, he abolished the posts of reformers and *banderesi,* substituting three conservators, or rather a species of municipal council, alone charged with judicial and administrative powers. The 13 leaders of the regions and the consuls of the gilds still sat in the councils, which were left unsuppressed. But all real power was in the hands of the pope, who, in Rome as in his other cities, nominated the principal magistrates. Thus, by transforming political into civil institutions, and concentrating the supreme authority in his own grasp, Urban V. dealt a mortal blow to the liberties of Rome. Yet he felt no sense of security among a people who, after the first rejoicings over the return of the Holy See, were

always on the brink of revolt. Besides, he felt himself a stranger in Italy, and was so regarded. Accordingly, in 1370 he decided to return to France, and died there on Dec. 19.

The Romans retained the conservators, conferring on them the political power of the reformers; they re-established the *banderesi* and the four *antepositi.* The new French pope, Gregory XI. (1370–78), had to be content with obtaining supremacy over the senate and the possession of the castle of St. Angelo. In Feb. 1376 the Romans nominated John Cenci captain of the people and gave him uncontrolled power over the towns of the patrimony and the Sabine land. The two councils were preserved, and a new magistracy was created, the "Three Governors of the Peace and Liberty of Rome."

Gregory XI. decided in 1376 to return to Rome and entered into a treaty with the republic, which, anxious for his return, promised him the same powers that Urban V. had had. He returned early in 1377, but was not able to get control of the government before his death in the following year. The next pope, Urban VI. (1378–89), whose election and acts provoked the Great Schism (1378–1417), had much trouble, but finally got himself recognized as supreme in Rome by promising a jubilee in 1389. He died before it could take place, and was succeeded by Boniface IX. (1389–1404). The latter was very shrewd. He crowned Ladislaus and by a skilful use of jubilees, of which he celebrated two, succeeded in bringing the city wholly under his power; he also reduced the Colonna to submission.

The next pope, Innocent VII. (1404–6), aided by Ladislaus of Naples, put down a revolt of the people, but had to make a concession that they might elect "seven governors of the liberty of the Roman republic." After Innocent's death King Ladislaus seized Rome, sacked it brutally and held sway over it until his death in 1414. Then the Romans revolted against the Neapolitans, and with the aid of the papal legate established a new government of 13 conservators.

Martin V. Supreme.—When after the Schism Martin V. was elected pope he made peace with Joanna, queen of Naples, who yielded Rome to him. Martin V. reduced the remains of the free Roman government to a mere civil municipality. Following the method of the other despots of Italy, he allowed the old republican institutions to retain their names and forms, their administrative and some of their judicial attributes, while all their political functions were transferred to the new government. Order was re-established and justice rigidly observed. Rome was in ruins; nobility and burghers were equally disorganized, the people unable to bear arms and careless of their rights, while the battered walls of the capitol recorded the fall of two republics.

Eugenius IV. (1431–47) was forced by a revolt to flee from Rome, and then the people re-established the "Seven Governors of Liberty.". Later Eugenius recovered control over Rome. Under Nicholas V. (1447–55) there were conspiracies to restore the republic, headed by Stephen Porcari, who attempted to play the part of a Rienzi. He was pardoned the first time, but was executed after a second attempt. After that the Popes ruled Rome. Under Paul II. some scholars were seized on the charge of desiring to re-establish paganism in the republic. Under Sixtus IV. (1471–84) the Colonna were either put to death or made powerless, and the Orsini met the same fate under Alexander VI. (1492–1503). There was still a senator of Rome, whose nomination was entirely in the hands of the pope, still three conservators, and an elected council of 26 citizens. Now and then also a shadowy semblance of a popular assembly was held to cast dust in the eyes of the public, but even this was not for long. All these officials, together with the judges of the capitol, retained various attributes of different kinds. They administered justice and gave sentence. There were numerous tribunals, all with undefined modes of procedure, so that it was very difficult for the citizens to ascertain in which court justice should be sought. But in last resort there was always the supreme decision of the pope. Thus matters remained up to 1789. For Modern City *see* p. 472.

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(D. C. M.; X.)

ROME, a city of Georgia, U.S., the seat of Floyd county, is located at the confluence of the Etowah and Oostanaula rivers, 70 mi N.W. of Atlanta.

Founded in 1834 at the southern gateway of Georgia's valley region, it was an important connecting link between the middle Georgia cotton belt and Tennessee, serving as a clearinghouse for corn, wheat and livestock from the north and cotton from the Coosa river valley which begins just west of the city. The surrounding agricultural area, once devoted primarily to cotton, later became diversified, with livestock and poultry of leading importance. Considerable forest land, two-thirds of which is in pine. provides saw timber and pulpwood. Mining is of some importance, including bauxite, shales and limestones. Textile products have long been a major segment of the city's economy but other manufactured products include paper, furniture, agricultural implements, boats, cotton gins, casket shells, aluminum products and stoves.

The city has a council-manager form of government, in effect since 1919. Near Rome is Berry college, a private liberal arts college founded in 1903, whose students all participate in a work experience program on the campus; in the city is Shorter college. a coeducational liberal arts institution chartered in 1873 and affiliated with the Baptist Church, and Darlington, a private preparatory school for boys. For comparative population figures *see* table in GEORGIA: *Population.* (Js. C. B.)

ROME, a city of Oneida county, east-central New York, U.S. 15 mi, N.W. of Utica (*q.v.*) on the Mohawk river, Wood creek, the State Barge canal and the thruway. With a 1960 population of 51.646 it is the second city of the Utica-Rome standard metropolitan statistical area, comprising Herkimer and Oneida counties (pop. 330.771).

Highlights of its history revolve around colonial and Revolutionary War events. Several forts were built by the British to protect the settlement in 1755, but the most famous was Ft. Stanwix built in 1758 by the general whose name it bore. It was the scene of an important treaty (1768) between Sir William Johnson and Indians of the Six Nations in which lands of western

Pennsylvania, Kentucky and West Virginia were surrendered to the crown. The fort was dismantled thereafter and rebuilt in 1776 by order of Gen. Philip Schuyler, for whom it was named (causing the original Ft. Schuyler to be renamed Old Ft. Schuyler, before becoming Utica), but the original name: Stanwix, continued in popular usage. The fame of the fort arose from its role in the battle of Oriskany (*q.v.*), 6 mi. E. on Aug. 6, 1777, a turning point in the American Revolution, when the British advance into the Mohawk valley was stopped. According to local tradition the "Stars and Stripes" was raised in battle there for the first time, but this flag had no stars *(see* FLAG: *Flags of the United States).*

The first earth was turned there for the Erie canal in 1817. Rome later achieved industrial importance as the "copper city" through the manufacture of wire, brass, cable and other copper products. Various metals and machinery industries (vacuum cleaners, radiators, air-conditioning equipment) have since developed but the most important facility after World War II was the Griffiss air force base, a national procurement centre. With employment of thousands of civilian and military personnel it has fundamentally changed the economic and social life of Rome.

The township of Rome was organized in 1796, receiving its name "from the heroic defense of the republic made here." The village of Rome was incorporated in 1819, and in 1870 it was chartered as a city. Rome tried city-manager government between 1954 and 1958 but returned to the mayor-and-council system.

For comparative population figures *see* table in NEW YORK: *Population.* (V. C. C.)

ROMFORD, a market town, municipal (1937) and parliamentary borough. and residential centre in Essex. Eng., 12 mi. E. of London by road. Pop. (1921) 19,448; (1961) 114,579. Area 14.6 sq.mi.

Romford is a shopping centre for adjoining localities and includes the London County council quasi-satellite town of Harold Hill which was begun in 1947 and by 1956 had an estimated population of 30,000. Romford has a brewery and there are a number of light industries.

ROMILLY, SIR SAMUEL (1757–1818), English law reformer whose chief efforts were devoted to the reform of English criminal law and procedure, was born in London March 1, 1757; he was the second son of Peter Romilly, an English tradesman of Huguenot stock. In the years that followed his call to the bar in 1783, he rose in his profession to become the outstanding chancery advocate in England. He early became identified with the liberal movement of his time. He gave assistance and sympathetic support to the early leaders of the French revolution and became associated with Jeremy Bentham (*q.v.*) and the circle of English law reformers. In 1806 he became solicitor-general in the Ministry of All the Talents and entered the house of commons where he attacked the savage penal laws of the period which indiscriminately authorized the sentence of death in a host of minor felonies. Romilly's program for mitigation of the law was founded on utilitarian assumptions similar to those expressed in the writings of Bentham and Cesare Beccaria (*q.v.*). However, his efforts were obstructed by the conservative reaction in parliament to the French revolution and its aftermath, perhaps best exemplified by the attitudes of Lord Ellenborough in the house of lords. and his immediate successes were not impressive. In 1808 he managed to achieve repeal of an Elizabethan statute that imposed capital punishment on theft from the person. He likewise secured elimination of the punishment of transportation for stealing from bleaching-grounds and the death penalty for soldiers and sailors found begging without a permit. Though frustrated in his larger efforts, Romilly's writings and speeches eventually produced a profound effect and contributed importantly to the reforms effected in the years following his death. Distracted by the death of his wife, he committed suicide on Nov. 2, 1818, in London. His *Memoirs,* with a selection from his correspondence, appeared in three volumes in 1840; a two-volume edition of *The Speeches of Sir Samuel Romilly in the House of Commons* was published in 1820.

See also "Life and Work of Sir Samuel Romilly" by Sir W. J. Collins, in *Trans. of the Huguenot Society* (1908); *C.* Phillipson, *Three Criminal Law Reformers* (1923). (F. A. A.)

ROMMEL, ERWIN (1891–1944), German army officer, outstanding field commander and desert-warfare tactician in World War II. was born of a schoolmaster father at Heidenheim, near Ulm, on Nov. 15, 1891. He entered the army as a cadet in 1910 and distinguished himself in World War I. After serving mostly as infantry regimental officer and instructor between World Wars I and II, Rommel took command of Hitler's bodyguard battalion in 1939. He commanded the 7th panzer division, which led the rapid advance to the channel in May 1940. In Feb. 1941 he became commander of German troops in Libya and quickly pushed British forces back into Egypt.

Known as the "Desert Fox," he was highly respected by both sides. Despite German and Italian reinforcements, he was compelled by logistic difficulties and superior British strength to withdraw to Tunisia, whence he was evacuated on Hitler's orders. As a field marshal Rommel then commanded army group B in France, under Gerd von Rundstedt; wounded in an air raid on July 17, he was sent home to recover.

Rommel had become increasingly disillusioned with Hitler's highhanded conduct of the war and the atrocities ordered by Hitler's headquarters. He therefore did not oppose the conspiracy to remove Hitler, although favouring arrest rather than assassination. He would have been proclaimed chief of state if the assassination attempt against Hitler of July 20, 1944, had succeeded; the investigation of the plot revealed this.

On Oct. 14, 1944, Rommel was taken from his home and forced to swallow poison.

Rommel wrote *Infanterie greift an* (1937) and *Krieg ohne Hass* (1950), published in English as *The Rommel Papers* (1953).

See Lutz Koch, *Die Wandlung eines grossen Soldaten* (1950); Desmond Young, *Rommel,* in English (1950). (P. N. T.)

ROMNEY, GEORGE (1734–1802), English history and portrait painter, next in importance after Reynolds and Gainsborough during the latter half of the 18th century, was born at Dalton-in-Furness. Lancashire, on Dec. 15, 1734. the son of a cabinetmaker. After working in his father's studio, in 1755 he became the pupil for two years of an itinerant portrait and genre painter. Christopher Steele, at Kendal, Westmorland. Romney's early work is a harder and provincial variant on the style of Joseph Highmore and much less accomplished than Steele's. Having married and set up as a portrait painter, he toured the northern counties, producing likenesses for a few guineas each. A series of about 20 figure compositions were exhibited in Kendal and afterward sold by lottery.

In 1762, having saved about £100, he left a portion of this sum for his wife and children and went to London, never returning, except for brief visits. until he came in 1798. a broken-down and aged man, to die. He quickly gained notice when in 1763 he won an award from the Society of Arts for a "Death of Wolfe." It was judged worthy of the second prize but, after a recommendation from Sir Joshua Reynolds in favour of J. H. Mortimer's "Edward the Confessor." Romney had to be content with a donation of £50. This incident led to a subsequent coldness between him and the president and thereafter he held aloof from the Academy. However. Romney was an ambitious yet nervous and introspective character, shunning society and the company of his fellow artists.

He paid his first visit to Paris in 1764, where he was befriended by Joseph Vernet and, significantly, admired the work of Nicolas Le Sueur; Romney had not yet seen Raphael, and Le Sueur's use of the antique would have strongly appealed to him. In all his portraits Romney avoids any suggestion of the positive characteristics or sensibilities of the sitter and, although himself unsociable, ironically his great success with society sitters depended largely upon just this ability for dispassionate flattery.

Line rather than colour dominates; it is the flowing rhythms and easy poses of Roman classical sculpture which underlie the smooth papery patterns of his compositions. Among the works exhibited at the Society of Artists from 1763 to 1772 (this is the only period that he did exhibit publicly) are the "Sir George and Lady Warren and Their Daughter" (1769) and "Mrs. Yates as The Tragic Muse" (1771), in which the figures are abnormally elongated and trapped out in pretentious classical poses. He kept his fees low

and soon acquired a large clientele, rivaling in popularity Reynolds, whose near neighbour he had become in Great Newport street. A more intimate portrait group is the "Peter and James Romney" of 1766; and the "Mr. and Mrs. William Lindotv" (1772, Tate gallery, London) is one of this period's maturest works.

Romney spent more than two years in Italy, leaving for Rome with the miniature painter Ozias Humphrey in 1773. He studied chiefly the Stanze figures by Raphael, although several months were spent studying Titian in Venice and Correggio at Parma. The year following his return to London in 1775 he bought Francis Cotes's fine house in Cavendish square. The months abroad had matured his art and a new gracefulness appears in portraits such as "Mrs Carwardine and Son" (1775, Lord Hillingdon collection); the bland, handsome "Earl Grey" (1784, Eton college); and the conscious elegance of the large full-length "Sir Christopher and Lady Sykes" (1786, Sledmere, Yorkshire). His best years are 1775–85, although the seeds of decline were sown at the time of his meeting nith Emma Hart (later Lady Hamilton) about 1781–82 and his acquaintance with the poet William Hayley. Lady Hamilton exercised a morbid fascination over Romney and she became for him a means of escape into an imaginary, ideal world. His "divine Emma" appears in over 50 paintings, in the roles of Cassandra. Circe. Calypso, a Bacchante, a Magdalene or Joan of Arc. John Flaxman, his friend in later years. attests that Romney disliked the drudgery of face painting and longed to do ideal subjects, but little remains of these except a large collection of drawings for ambitious history pieces (mainly in the Fitzwilliam museum, Cambridge) and a few unattractive compositions for John Boydell's Shakespeare gallery of 1787 onward.

Although Romney's fashionable portraits fell off in the last years of his career, his own unhappiness had given him an insight into a mature character, and the "Warren Hastings" (1795, former India office) is a grave and noble work. For Romney it was a swan song. In 1797 he moved to a large studio in Hampstead with the fine collection of casts from the antique which Flaxman had gathered for him in Italy. But he soon retired to Kendal, where he died on Nov. 15, 1802.

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ROMNEY, HENRY SIDNEY, EARL OF (1641–1704), was born in Paris in 1641. In 1672 he was sent on a mission of congratulations to Louis XIV, and in 1677 became master of the robes to Charles II. He entered parliament in 1679, and became a close political ally of his nephew Sunderland. Sidney mas sent in 1679 on a mission to urge William of Orange to visit England, a task he discharged nhile acting as the official envoy of Charles II at The Hague. Recalled in 1682, he was again sent to Holland in 1685. He returned to England in 1688, and sought support for the prince of Orange in the event of his landing. He was allowed to leave England on giving his word not to visit The Hague, but he broke his promise and conveyed to William a duplicate of the invitation addressed to him by the English nobility, together with intelligence of affairs of state. He landed with William at Torbay, and received substantial rewards for his undoubted services. including the titles of Baron Milton and Viscount Sidney of Sheppey. William made him secretary of state in 1690. and in 1692, lord-lieutenant of Ireland. His inability to cope with the difficulties of this position led to his recall in the next year, when he became master-general of the ordnance. He was created earl of Romney in May 1694. On Anne's accession he was dismissed from his various offices. He died on April 8, 1704.

ROMNEY (Kent. England): *see* NEW ROMNEY.

ROMSEY, a market tonn and municipal borough in the Winchester parliamentary division of Hampshire, Eng., 9 mi. N.W of Southampton by road. Pop. (1951) 6,278. Area 1.9 sq.mi. The town received its first charter from James I in 1607. the year he visited Broadlands, which is situated on the outskirts of the town and is the home of Earl Mountbatten, the town's high steward. This house. though originally a Tudor building, was largely built in the 18th century by the 1st viscount Palmerston and has been held by the Temple and Ashley families. Romsey received a second charter from William III in 1698, and its ancient buildings have considerable character and beauty. Romsey abbey (which replaces a wooden original) was built in the 12th century and owns many treasures including a 14th-century illuminated Romsey psalter. King John's hunting lodge, near the abbey, dates from 1206 and is registered as an ancient monument; it is now used as a museum. Embley house (2 mi. W.), the home of Florence Nightingale, is now a college. Situated on the edge of the New forest, Romsey is only 20 mi. from the sea coast at Milford-on-Sea and is surrounded by beautiful country including the valley of the Test, beloved of Izaac Walton. The town's chief industries are brewing and market gardening but in the 16th century it was famous for the making of a cloth called shalloon.

ROMUALD, SAINT (c. 950–1027), founder of the Camaldolese Benedictines (Hermits), was born at Ravenna of the ducal family (Onesti). After witnessing his father kill a relative in a duel, he retired to the monastery of St. Apollinaris near Ravenna and later took the habit. Romuald's life throughout was marked by great austerity. In 975 he went to Catalonia, and seems to have been greatly impressed by the vigorous life in the monasteries. In 996 he was appointed abbot of St. Apollinaris, but left after three years and for the next 30 years wandered through Tuscany, Romagna and southern France reforming old or establishing new monasteries. The most important was Camaldoli. near Arezzo. in Tuscany, which he founded about 1012 and which became the mother house of the new order. The order combined cenobitic and eremitical elements. though Romuald's own aim seems to have been only for a more austere following of the Benedictine rule than currently obtained. He attempted to go to Hungary, but was prevented by illness; however, a monastery founded there for him and St. Bruno of Querfurt, by Otto III, was important for missions to the Slavs and Prussians. Romuald stayed for many years in solitude on Mt. Sitria, but in 1026 returned to Val di Castro, where he died, alone in his cell, on June 19, 1027. His chief feast is Feb. 7, since on that date in 1481 his relics were taken to Fabriano. *See* also CAMALDULIANS.

See H Thurston and D. Attwater (eds.), *Butler's Lives of the Saints,* p. *266* ff (1957). (Fs. P. C.)

ROMULUS, together with Remus, the legendary founder of Rome. Traditionally they were the sons of Rhea Silvia (Ilia), daughter of Numitor, king of Alba Longa. Numitor had been deposed by his younger brother Amulius and his daughter made a Vestal Virgin to prevent offspring contenders. When Rhea gave birth to tnins claiming Mars as their father, Amulius ordered them thrown into the Tiber. The trough in which they were placed came to ground at the site of the future Rome near the *Ficus Ruminalis,* a sacred fig tree of historical times. There a she-wolf and a woodpecker (both sacred to Mars (*q.v.; cf.* PICUS), suckled and fed them. Later they were found and brought up by the herdsman Faustulus and his wife Acca Larentia (*q.v.*). They became leaders of a band of adventurous youths and eventually, recognized as the grandsons of Numitor, they killed Amulius and restored their grandfather to the throne. Later they founded the city of Rome. Romulus surrounded the city uith a wall, but Remus in contempt jumped over it and Romulus slew him nith the uords "thus perish any other who leaps over my malls." Thus Romulus ruled supreme and the city was named for him. Romulus added to the population of the new city by offering asylum to fugitives and exiles. Because of a shortage of women, he invited the neighbouring Sabines to a festival and carried off their women. The intermarriage of Roman and Sabine was followed, after some hostility, with a political union under Romulus and Titus Tatius (*q.v.*), king of the Sabines. Titus Tatius' early death left Romulus in complete control. After a long rule he one day mysteriously disappeared in a storm. He was believed to have been changed into a god and was worshipped as Quirinus (*q.v.*) by the Roman people.

This legend, probably originating in the 4th century B.C. and set down in coherent form by the early annalists at the end of the 3rd century B.C., is of course artificial and shows a strong Greek influence. Rationalizations of various aspects of the story have been made in both ancient and modern times. The theme of

exposed children is a familiar one in Greek legend and literature. The name Romulus (and perhaps also Remus) is derived from Rome and is consonant with the Greek practice of seeking an eponymous hero who of course is inevitably deified. The story is well adapted to the topography of ancient Rome, but the places mentioned are clearly introduced to account for sacred areas of historical time. The *ficus ruminalis* ("the suckling fig"?) and the nearby Lupercal ("wolf's den"?) may have themselves suggested the suckling by the she-wolf. Livy gives an interesting rationalizing version: that Larentia, because of her loose morals, had got the nickname "she-wolf" among the shepherds. The story of the asylum was clearly invented to explain the name of the depression between the Arx and the Capitol. The rape of the Sabine women explains the custom of simulated capture in the Roman marriage ceremony as well as the historical admixture of Sabine elements in the Roman population.

The importance of Mars in the legend is an obvious attempt of Romans to connect their origins with this principal Italian deity, and it is perhaps no coincidence that Romulus is apotheosized into Quirinus, a god not unrelated to Mars. On earth Romulus, a warlike king, was founder of many of the Roman military and political institutions.

BIBLIOGRAPHY.—J. Carter in Roscher's *Lexikon,* s.v.; E. Pais, *Ancient Legends of Roman History (1906)*; Hugh Last in *Cambridge Ancient History,* vol. vii, pp. 363 ff., *370* ff. (R. B. LD.)

ROMULUS AUGUSTULUS, last Roman emperor of the West (Oct. 31, A.D. 475, to Sept. 4, 476), was elevated to the throne by his father, Orestes, "master of the soldiery" (Jordanes), who drove the emperor Julius (Nepos) to Dalmatia in 475.

The reins of power were held for him by his father, and there is no event of his reign worthy of record except the conclusion of peace with Gaiseric the Vandal. Shortly after his elevation to the throne, barbarian mercenaries presented to Romulus's father a demand that they be allotted one-third of the lands of all Italy. Orestes refused: the mercenaries revolted under Odoacer (Aug. 23, 476). Orestes was defeated and beheaded and the Western empire came to an end. Romulus retired to the villa built by Lucullus four centuries before, near Naples. There he died at a date unknown.

RONALDSHAY, LAWRENCE JOHN LUMLEY DUNDAS, EARL OF (1876–1961). British administrator. and a leading authority on India. was born on June 11, 1876. the eldest surviving son of the 1st marquess of Zetland, and was educated at Harrow and Trinity college, Cambridge. From 1898 to 1907 he traveled extensively in Ceylon, India. Persia, Asiatic Turkey. Central Asia. Siberia. Japan. China and Burma. In 1900 he was appointed aide-de-camp to the staff of. the viceroy. Lord Curzon. in India. He sat in the house of commons as Conservative member for the Hornsey division from 1907 to 1916. He was a member of the royal commission on the public services in India. 1912–14. and governor of Bengal, 1916–22. He succeeded to the marquessate of Zetland in 1929. Ronaldshay was secretary of state for India. 1935–40, and, in addition. for Burma, 1937–40. He died on Feb. 6. 1961, at Richmond, Yorkshire.

Lord Ronaldshay published several books about India and the east, notably the trilogy, *Lands of the Thunderbolt* (1923). *India: a Bird's Eye View* (1924) and *The Heart of Aryavarta* (1925). He also wrote *The Life of Lord Curzon,* three volumes (1927–28); *Lord Cromer* (1932); and *Essayez,* a volume of memoirs (1957).

RONCESVALLES (Fr. RONCEVAUX), a village of northern Spain, in the province of Navarre; situated among the Pyrenees within five miles from the French frontier. Pop. (1950) 106. Roncesvalles is famous in history and legend for the defeat of Charlemagne and the death of Roland in 778. The battle is said to have been fought in the valley known as Valcarlos.

RONDA, a town of southern Spain, in the province of Málaga; on the river Guadiaro. Pop. (mun., 1950) 30,653. Ronda is nearly surrounded by the Guadiaro or Guadalevin. which flows through an abrupt chasm. There is trade in leather, saddlery, horses, soap. flour, chocolate. wine and hats. Remains of an aqueduct and theatre. about 7 mi. N. of Ronda, are supposed to represent the Acinipo or Arunda of ancient geographers. Ronda gives its name to the Sierra or Serrania de Ronda. one of the main sections of the coast mountains.

RONDEAU (Old French, RONDEL), the general name in French for verse forms which develop from the *rondet de carole,* originally evolved as an accompaniment for the *ronde,* a round dance with soloist and chorus and, sometimes, a viol player. A few *rondets* are found incorporated in 13th-century romances *(Le Châtelain de Coucy, Cleomadès)*; they closely resemble the early rondels of Adam de la Halle (first to use the name *rondel)* and Guillaume d'Amiens who wrote the following *(AB aA abAB,* capitals indicating repeated lines, printed in italics below):

Hareu! commant m'i maintendrai
Qu'Amors ne m'i laissent durer?

Apansez sui que j'en ferai;
Hareu! commant m'i maintendrai?

A ma dame consoil prendrai
Que bien me le savra doner.
Hareu! commant m'i maintendrai
Qu'Amors ne m'i laissent durer?

This type of *rondel* (identical in form with the 15th-century *triolet),* treated as a literary form governed by rules, is one of three types. composed however in decasyllabics instead of octosyllabics, admitted by Eustache Deschamps (*q.v.*) in 'his *Art de Dictier* (1392) and there called the *rondel sangle* (simple). The second type, apparently peculiar to the 14th century, is of 13 lines (A^1BA^2 abA^1B $abaA^1BA^2$ or AB^1B^2 $abAB^1$ $abbAB^1B^2$, numbered capitals indicate repeated lines which rhyme). The third type, the *rondel double,* is of 16 lines ($A^1B^1A^2B^2$ abA^1B^1 $ababA^1B^1A^2B^2$ or $A^1B^1B^2A^2$ abB^2A^2 $abbaA^1B^1B^2A^2$). Christine de Pisan (*c.* 1363–c. 1430) introduces up to eight lines in the first strophe. curtails the refrain, repeating only one or two lines throughout. and sometimes uses lines of unequal length. Rondeaux with strophes of more than four lines becoming known as *rondeaux doubles;* those having *16* lines (Desportes' *rondel double*) are renamed *rondeaux quatrains,* of which this well-known example, in its full form, by Charles d'Orléans (1391–1465) is an excellent specimen:

Le temps a laissié son manteau
De vent, de froidure et de pluye,
Et s'est vestu de brouderie,
De souleil luisant, cler et beau.

Il n'y a beste, ne oyseau,
Qu'en son jargon ne chante ou crie:
Le temps [a laissié son manteau
De vent, de froidure et de pluye.]

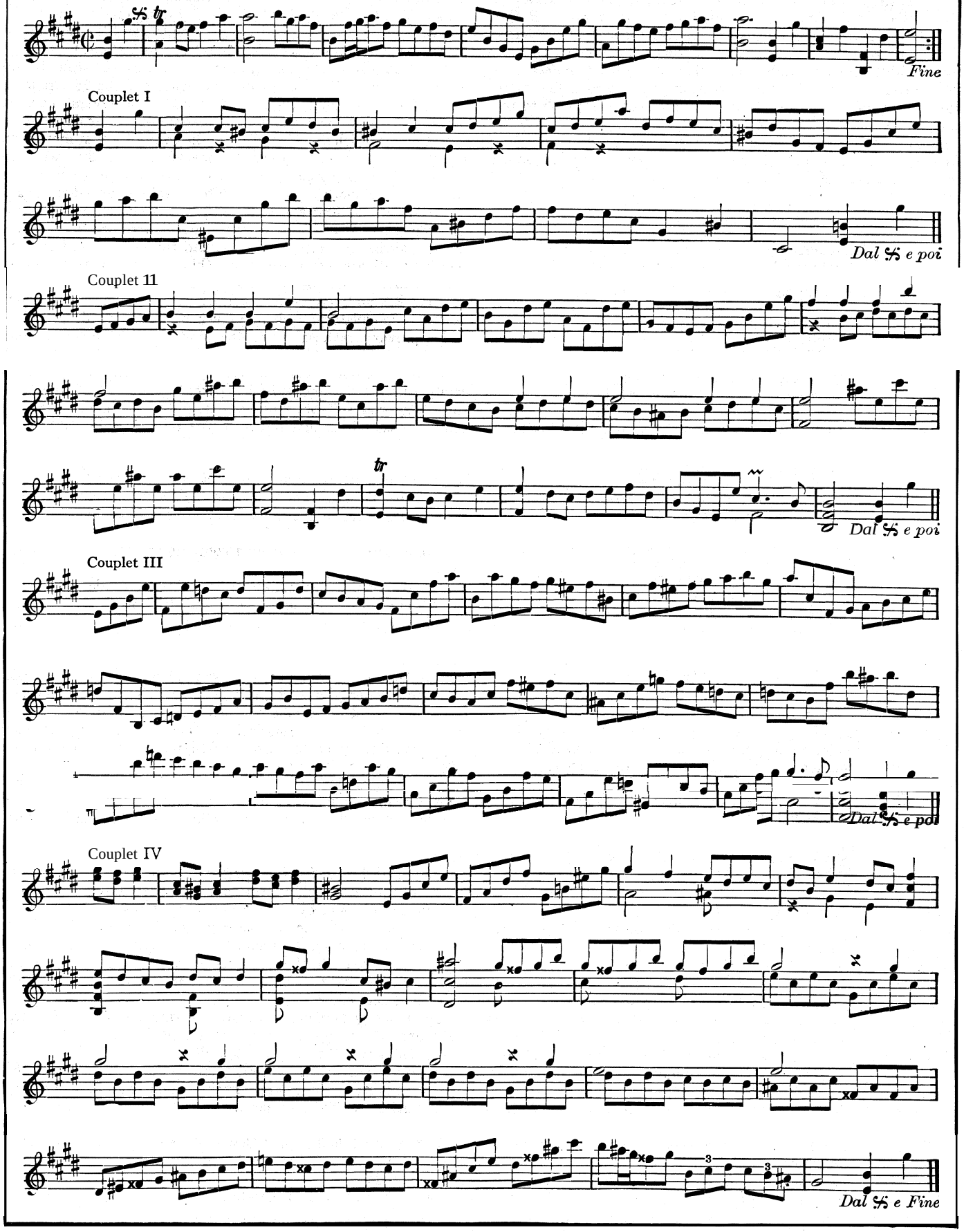
Rivière, fontaine et ruisseau
Portent, en livree jolie,
Gouttes d'argent d'orfavrerie,
Chascun s'abille de nouveau:
Le temps la laissié son manteau
De vent, de froidure et de pluye,
Et s'est vestu de brouderie,
De souleil luisant, cler et beau.]

Copyists being content, as in the manuscript of the above poem, to give only the first two or three words of a refrain (the *rentrement),* they seem to have prompted a reduction of that element, the substitution of two *rentrements* for six refrain lines to produce a 12-line rondeau from the *rondeau quatrain* (a new *rondeau* simple abandoned in the 16th century), or of two *rentrements* for the eight refrain lines of a 21-line type (*aabba aabAAB aabbaAABBA*) to create the 15-line rondeau (*aabba aabR aabbaR*) which became the standard form in the 16th century: good examples are Clément Marot's "Xu bon vieulx temps" *(see* L. E. Kastner in *Bibliography).* The 17th-century *précieux* revived this form, neglected by the Pléiade.

Not until the 19th century did the rondeau, rejected by the classical school. reappear first in irregular form with Alfred de Musset (*ababa* for *aabba*), then in regular form with Théodore de Banville (*e.g.,* "Sa mère"), who also revived the *rondeau quatrain,* and with Maurice Rollinat (1853–1903) who composed more than a hundred.

In German. G. R. Weckherlin composed regular rondeaux (the form was called *Rundum* or *Ringelgedicht*), J. N. Götz and Johann Fischart, less regular ones.

Ex. 1 ***Gavotte en*** *Rondeau* (Rondeau en Couplets) from Bach's Sixth Violin Solo.



With the exception of Anthony Hamilton (1646–1720), who wrote in French (his "Mal-à-propos," quoted by Kastner, is a perfect imitation of Marot's manner). and of a set of rondeaux in the *Rolliad,* attributed by Edmund Gosse to Edward Burke's friend, F. Laurence, Englishmen had little success with either rondel or rondeau until the 19th century when they enjoyed a considerable vogue. Swinburne. in his *Century* of Roundels, made the shortened first-line refrain rhyme with the second line of the poem and suppressed the refrain after the second strophe to produce an 11-line poem (*abaR* bab *abaR*).

Regular rondels have been written by Robert Bridges, Austin Dobson, Gosse and W. E. Henley. The following, by Dobson, is an excellent example of the English rondel:

Love comes back to his vacant dwelling,—
The old, old Love that we knew of yore!
We see him stand by the open door,
With his great eyes sad, and his bosom swelling,
He makes as though in our arms repelling
He fain would lie as he lay before;—
Love comes back to his vacant &telling,—
The old, old Love that we knew of yore!
Ah! who shall help us from over-spelling
That sweet, forgotten, forbidden lore?
E'en as we doubt, in our hearts once more,
With a rush of tears to our eyelids welling,
Love comes back to his vacant dwelling,
The old, old Love that we knew of yore!

Crosbie Garstin's *On* Newlyn *Hill* is, structurally, a good example of the regular rondeau:

On Newlyn Hill the gorse is bright;
Upon the hedgerows left and right
Song-dizzy birds the Spring-time greet;
The bluebells weave a perfect sheet;
Primroses star the lanes' green night.

Across the Bay each moorland height
Glows golden in the evening light,
And Dusk walks violet-eyed and sweet
On Newlyn Hill.

A swarm of lights, pearl-soft and white,
A fairy-lamp-land exquisite,
Opens its star-eyes at the feet
Of hills where shore and wavelets meet;
Then dreams come, mystic, infinite,
On Newlyn Hill.

As Banville says, these verse forms are useless unless the refrain is reintroduced in a gay and natural way, appears inevitable and gives the reader a new point of view. Properly used, it knits the structure together and intensifies the emotional energy of the poem. The rondeau's greatest weakness lies, however, not in the refrain, but in the recurrent rhyme which must be used very skilfully to give an impression of grace, delicacy and rhythm.

See L. E. Kastner, *History of French Versification,* pp. 249–261 (1903); Gaston Raynaud's introduction to *Rondeaux et autres poésies du XVe siècle,* Société des Anciens Textes Français (1889).

(F. J. WE.)

RONDO, a musical form originally derived from the rondel in verse; as may be seen, long before the development of instrumental forms, in some of the chansons of Orlando di Lasso. The rondeau en couplets of Couperin and his contemporaries shows the same connection with verse. It consists of a single neatly rounded phrase alternating with several episodes (the *couplets*) without any important change of key. Example 1 (p. 523) shows Bach's handling of this early form.

The later rondo is an important member of the sonata forms (*q.v.*), chiefly found in finales; but rondo form sometimes occurs in slow movements. Example 2 (pp. 525–526) is not more elaborate than the adagio of Beethoven's Fourth Symphony. Philipp Emanuel Bach invented an extraordinary kind of rondo, not part of a sonata, but on a voluminous scale with wildly incoherent episodes and modulations.

Later Forms.—The later sonata style rondo forms may be divided into two main classes:

1. Sectional rondos (*i.e.,* with little or no development or transition between episodes and the main theme) are characteristic of Haydn, who, however, may run away with it in unexpected developments. The name rondo implies at least two episodes and a sectional rondo may have more. Beethoven in his early works shows the influence of Haydn in this type of rondo—the finales of sonatas, opp. 10, no. 3 and 14, no. 1 and 2, and the slow movements of the sonatas, opp. 2, no. 2 and 13 (*Pathétique*).

The sectional rondo last appears on a gigantic scale in the finale of Brahms' G minor pianoforte quartet, Opus 25. It lends itself, like the cognate idea of a dance with several trios to Schumann's pianoforte pieces and to some of his finales.

2. Rondos which are influenced by the form of a first movement (see SONATA FORMS). In the normal scheme for this, which is Mozart's favourite rondo form, the rondo theme (which may contain several clauses) is followed by a well-organized transition to the key of the first episode, which key is chosen as if for the complementary key of a first movement. The return to the rondo theme may be elaborate or abrupt, and the theme itself may be reduced to its first complete clause (but not to a mere fragment, without loss of the rondo effect). The second episode will be in a new key and may be followed by wide modulations, or itself be widely modulatory, or it may even be entirely a development of the previous material, as in the rondo of Beethoven's Sonata Opus 90. (example 2).

When the rondo theme returns again it is followed by a recapitulation of the first episode (perhaps preceded by the transitional passage suitably modified? in the tonic; after which the coda may contain a final return of the rondo theme. When the second episode is concentrated on development the only difference between the rondo and a first movement is the slender fact that the whole first theme returns immediately after the first episode. Yet the rondo style can be recognized from the outset by the tunelike character of the main theme, and also by the fact that, unlike the most tuneful openings of first movements. it comes to a definite close instead of swinging continuously into the transition passage.

A rondo with a development in its middle episode may return to the tonic with an immediate recapitulation of the first episode, omitting the expected second return of the main theme, thus: A, B (new key), A, C (development), B (tonic), A, coda (where A is the rondo theme and B and C the episodes). Mozart, Schubert and Brahms have a form, always worked on a very large scale, which consists only of A, B (new key), A, B (tonic), coda; where a certain amount of development is edged in apropos of the transition passage on its recapitulation. Only the style of the main theme can distinguish this from a first movement that omits its normal development section.

In the rondos of classical concertos (*q.v.*) the orchestra (especially in Mozart) finds its opportunity in a series of accessory themes announced as soon as the solo instrument has given out the rondo theme. These accessories are then held in reserve for the coda.

RONDÔNIA, a federal territory in the central-west region of Brazil, bounded north by Amazonas, east by Mato Grosso, west by Bolivia and south by Bolivia and Mato Grosso. Pop. (1950) 36.935; area 93.816 sq.mi. The territory, established in 1943 as Guaporé, was renamed Rondônia in 1956 after Marshal Candido Mariano Rondon, Brazil's famous explorer. The area was important during the Amazon rubber boom, but declined after the collapse of the industry. in 1912.

The Madeira-Mamoré railroad. operational between Pbrto Velho and Guajará Mirim, was built there in connection with the rubber industry. Rubber exports still provide the territory with a large part of its income. Brazil nuts are also an important export commodity. Mineral resources include diamonds, mercury, gold. bauxite, gypsum and quartz.

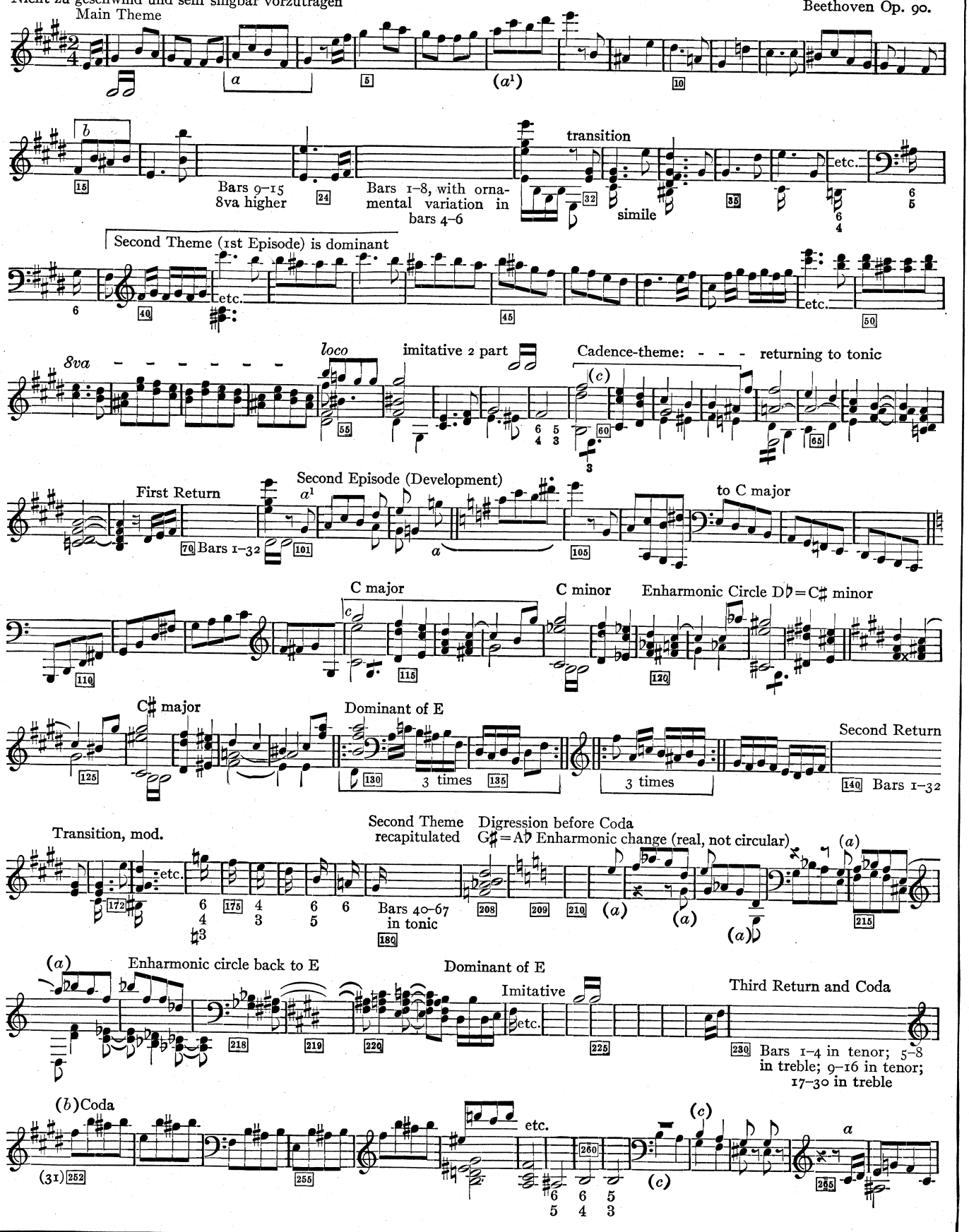
The population is composed largely of Indians and mestizos.

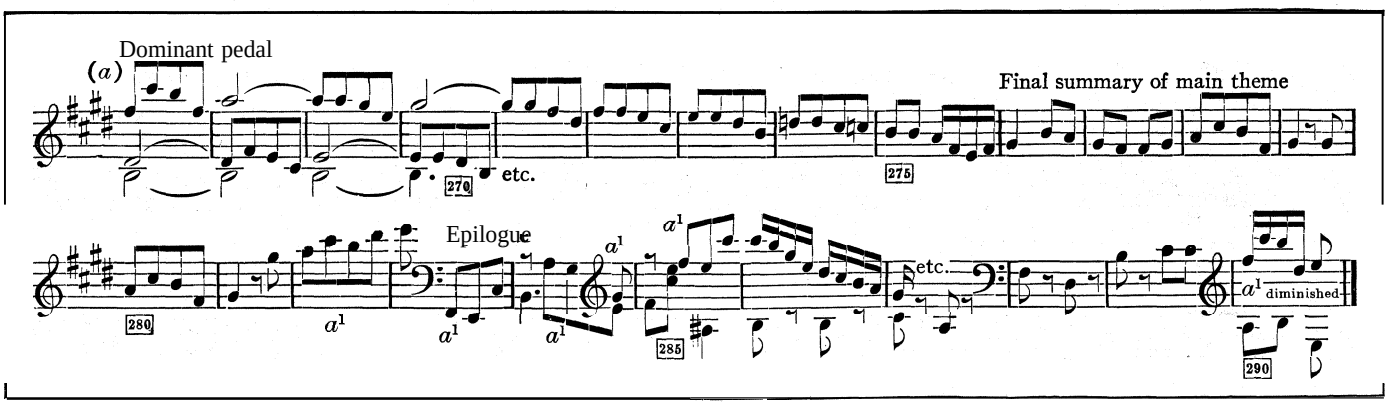
Pôrto Velho (1950 pop., 10,036) is the territorial capital, terminus of the Madeira-Mamoré railroad and entrepbt for the Bolivian trade.

River transportation on the Madeira, Mamoré, Guaporé (*qq.v.*) and their affluents is supplemented by air service from Pôrto Velho. Guajará and Principe da Beira. (J. L. TR.)

Ex. 2. Outline of Sonata form Rondo with developing middle episode.

and indicate prevalent movement of accompaniment. Blank bars indicate prevalence of the same chord.





RONSARD, PIERRE DE (*1524–1585*), French poet, chief of the Pléiade *(see* FRENCH LITERATURE), was born Sept. 11 (?), 1524, at the Chbteau de la Possonnikre (Loir-et-Cher). His father Louis de Ronsard, a member of the Vendômois nobility, held a court appointment. Ronsard spent his youth in his native province, which was often to inspire his poetry. In 1536 his father placed him as page first to the dauphin, later to Prince Charles. He accompanied Princess Madeleine to Scotland after her marriage to James V in 1537. Returning in 1538, he was sent to Flanders, again to Scotland (where his ship was wrecked in the very last stage of the voyage) and to England. Early in 1540 he resumed his education at the Écurie Royale and from May to August accompanied the diplomat Lazare de Baïf on a mission to Haguenau. In the autumn. a severe illness followed by a long convalescence at la Possonnière left Ronsard partially deaf and forced him to abandon all thought of a military or diplomatic career. In 1543 he received the tonsure, which enabled him to qualify for ecclesiastical benefices without being ordained priest.

Encouraged by Jacques Peletier, Ronsard then turned to poetry, which, he tells us, had always attracted him. His father died in 1544 and Ronsard went to Paris. He studied with Antoine de Bai'f, the diplomat's son, under the famous Hellenist Jean Daurat (Dorat). Daurat's brilliant lectures at the Collkge de Coqueret inspired Ronsard and Baïf with a passion for Greek poetry and a desire to revolutionize French poetry. They were joined at Coqueret by others, including Belleau and Du Bellay, who in 1549 published the manifesto of the new *brigade* of poets, the *Défense et illustration de la langue française,* preaching judicious imitation of the ancients and Italians and cultivation of their genres. Ronsard's contributions to this manifesto are erudite, full of mythological lore and arrogantly addressed to a learned élite. His *Odes* (1550, 4 books) are inspired by Pindar and Horace; his *Amours* (1552), decasyllabic sonnets of great lyrical intensity celebrating a young court beauty, Cassandre Salviati, imitate the manner of Petrarch. They were set to music by Pierre Certon, Claude Goudimel, Marc-Xntoine Muret and Clément Janequin.

The *Odes* brought Ronsard fame and provoked the raillery and enmity of Mellin de Saint-Gelais, then the favourite court poet. He was defended by Princess Marguerite, sister of Henry II, and her chancelor Michel de L'Hôpital. Ronsard expressed his triumph, his gratitude and his lofty conception of poetry in the Pindaric *Ode* a *Michel de L'Hôpital* (1552). Then he turned to less pretentious models—the Greek Anthology, the Anacreontea, Catullus—and wrote simpler poems. The *Folastries* (1553), *Bocage* (1554). *Mélanges* (1554, title page 1555), the sonnets and odes written for new editions of the *Amours* and *Odes,* all show a lighter mood. Next Ronsard, in love with Marie, a simple country girl, published the *Continuation des amours* (1555) and the *Nouvelle Continuation* (1556), sonnets and songs no longer chastely Petrarchan but playful and epicurean in tone, with a charming background of country sights and sounds. The lofty *Hymnes* in alexandrines, (1555–56) show a return to the erudite manner. Modeled on Callimachus. Theocritus and others, they contain fine epic descriptions and religious or philosophical meditations. Many of Ronsard's hymns and odes are of an official or laudatory character. He was in the favour of Henry II, who made him counselor and almoner (1559). His collected *Oeuvres* appeared in 1560.

With the deaths of Henry II in 1559 and Francis II in 1560 France entered the dangerous period of the religious wars. Ronsard, intensely loyal and patriotic, used his pen in the cause of the monarchy, the established religion and national unity. His *Institution pour l'adolescence du Roi Charles IX* (1562) shows him unafraid to preach duty and morality to the young king. His polemical *Discours des misères de ce temps, Remonstrance au peuple de France* (1562) and *Réponse aux injures et calomnies* (1563) show him aware of the political and religious problems and critical of abuses in the church. Patriotic indignation, vigorous satire and invective against the Protestants alternate with passages of imaginative poetry or sincere self-revelation. Ronsard appears here, as alnays. versatile and original. In 1565 the *Elegies, mascarades et bergerie* shoa Ronsard producing official poems and verses for court entertainments. He enjoyed the friendship of Charles IX, a passable poet. and exchanged poems with him. He went on experimenting, correcting, adding new poems for his editions of 1567, 1571, 1572–73, 1578 and 1584. Ronsard's most ambitious work, his epic *La Franciade* (1572), tracing in decasyllabic couplets the founding of the French nation by the Trojan hero Francus, had little success and only four books appeared.

Ronsard had been undisputed "prince of poets and poet of princes" for many years but a new poet, Desportes, became the favourite of Henry III. Ronsard, stung into competition, published many new poems in the 1578 edition: *Diverses amours,* the exquisite sonnets and elegies *Sur la mort de Marie* and the *Sonnets pour Hélène (H.* de Surgères), a learned and virtuous lady-in-naiting of 20. Some are erudite or precious in the Italianate style that was again fashionable; others, harmonious, intimate and sincere, shom, a new maturity.

The poet's last years were tormented by arthritis and recurrent fevers; he usually avoided the court and lived at his priories of Croixval (Vendômois) and Saint-Cosme (near Tours). He gave his time to his religious duties, gardening and the tireless revision of his poems. In Paris he often stayed with Jean Galland at the Collège de Boncourt. Ronsard remained a poet to the last. The moving sonnets which he dictated to a monk a few hours before his death (*Derniers vers,* 1586), show his splendid gifts still unimpaired. He died at Saint-Cosme, Dec. 27–28, 1585.

Claude Binet in his *Life of Ronsard* (1586) gives an attractive picture of the poet—tall, athletic, distinguished, soldierly; in conversation charming, frank and sincere. "His life and his writings bore an indefinable stamp of nobility and in all his actions shone forth the characteristics of a true French gentleman." Ronsard was the greatest poet of the French Renaissance. He had a European reputation; Elizabeth I and Mary Stuart sent him gifts; he was imitated in England. He deeply influenced his contemporaries, Du Bartas. A. d'Aubigné, R. Garnier.

Ronsard held a noble conception, deriving from Pindar and Plato, of the poet's mission as the recipient of divine inspiration and the interpreter of higher truths to mankind; he believed that the poet should be morally worthy of this divine gift of genius. He also believed that the poet should work unceasingly to attain perfection. Innumerable variants (no poet has left more) testify eloquently to his labours. He had made a meticulous study of the

poetic technique of the Ancients and of the problems of French verse, which he enriched with new lyrical forms. He developed the alexandrine, making it capable of the finest effects. Though deaf. Ronsard greatly loved music and harmony was for him an essential quality of poetry; his sense of rhythm is extremely subtle. His theories appear in *Abrégé de l'art poétique* (1565) and in the prefaces to the *Franciade* (1572; 2nd pref. 1586; title page 1587). Ronsard's work is immensely varied in subject, form and style. Only Victor Hugo can be compared with him for fertility of invention. He writes freely of his own emotions; his best lyrics have the quality of universality. His chief fault, in modern eyes, is an over-lavish adornment of his poems with the Greek mythology he loved. He has fine descriptive powers and, like the Elizabethans, uses magnificent imagery to express his feeling for the majesty of the universe, the power of the cosmic forces, the beauty of Nature and her impact on man's emotions. He meditated on man: his diversity. his greatness, his ambitions, his passions, his destiny of inevitable deieat by decay and death. Death is a subject on which Ronsard always writes well, whether in an epicurean mood or in a Christian spirit.

In the 17th century the development of a new poetic ideal demanding clarity, refinement and restraint put Ronsard's richly imaged poetry out of fashion. Malherbe and Boileau condemned his poetry and he was forgotten until the 19th century, when the appreciation of Sainte-Beuve and others reinstated him. In the 20th century a vast amount of research once more revealed his greatness and his reputation continues to grow. The general public, however, appreciates him most as a simple lyric poet, the poet of nature, love and fleeting time.

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RÖNTGEN (ROENTGEN), **WILHELM CONRAD** (1845–1923), German physicist, received the first Nobel prize for physics in 1901 for his discovery of X-rays. Born at Lennep on March 27, 1845, he received his early education in the Netherlands, and then went to study at Zurich. He then became assistant to August Kundt at Würzburg and afterward at Strasbourg, becoming *Privatdocent* (official but unpaid lecturer) at Strasbourg in 1874. He was next professor of mathematics and physics at Hohenheim (1875), extraordinary professor at Strasbourg (1876), ordinary professor of physics and director of the Physical institute at Giessen (1879) and professor at Wiirzburg (1885) and Munich (1900). It was at Wiirzburg in 1895 that he made the discovery for which his name is chiefly known, Rontgen or X-rays. While experimenting with a highly exhausted vacuum tube on the conduction of electricity through gases, he observed the fluorescence of a barium platinocyanide screen which happened to be lying near. Further investigation showed that this radiation had the power of passing through various substances which are opaque to ordinary light, and also of affecting a photographic plate. Its behaviour being curious in several respects, particularly in regard to reflection and refraction, he doubted whether it was to be looked upon as light or not, and put forward the hypothesis that it was due to longitudinal vibrations in the ether. not to transverse ones like ordinary light; in view of the uncertainty existing as to its nature, he called it X-rays. For this discovery he received the Rumford medal of the Royal society in 1896, jointly with Philip Lenard, who had already shown, as also had Heinrich Hertz, that a portion of the cathode rays could pass through a thin film of a metal such as aluminum. Rontgen also conducted researches in various other branches of physics, including elasticity, capillarity, the ratio of the specific heats of gases, the conduction of heat in crystals, the absorption of heat rays by different gases, piezoelectricity and the electromagnetic rotation of polarized light. He died at Munich on Feb. 10, 1923. *See* also X-RAYS.

See O. Glasser, *Dr.* W. C. *Rontgen* (1945).

ROOF is a cover or shelter of the uppermost part of a building. Its primary purpose is to protect against the rain. snow and other inclemencies of the weather. (This article deals primarily with the construction of roofs. The historical development of the design of residences will be found in HOUSE; the design of industrial structures is treated in INDUSTRIAL ARCHITECTURE. For the factors affecting the choice of a roof for a contemporary dwelling, *see* HOUSE DESIGN. *See* also ARCHITECTURE.)

The construction of the roof was one of man's earliest engineering accomplishments. With ingenuity and manual skill prehistoric peoples developed structural forms for shelter using crude tools and materials. The form and covering of roof structures continue to be important elements in the design of buildings. From the purely functional point of view the design of roofs includes many complex problems. The risk of fire must be considered in the choice of materials, as well as strength and weight. The manner in which the roof is supported may influence the use of the area that it covers. The quality of the material used for the roof system should be compatible with the standard of the building as a whole, the initial expense and the cost of maintenance. Standards of performance have become increasingly exacting. Comfort is no longer measured by degrees of temperature alone; it is affected by all of the factors that make up a climate within the structure. The roof, being the part of the house most exposed to the elements, is the main boundary between conflicting forces. Insulation against heat losses in the winter and heat gains in the summer should be provided. Insulation may be classified in two groups: those that resist the flow of heat, having low conductivity, and those that reflect radiant heat waves.

The presence of moisture in the air can result in condensation on the inner surface of the roof, or, if there is a difference in vapour pressures, the condensation can occur within the roof assembly. Both conditions can be corrected, but they should be prevented by giving consideration to possible effects of moisture in the choice of materials for the roof assembly.

The form of the roof is not influenced by problems of insulation or condensation, both of which may be present in all types. The form determines the selection of the nonstructural waterproof cover; horizontal or slightly inclined surfaces require a membrane type, and unit types of waterproof materials may be used on more inclined surfaces. The principal factors determining the form of the roof are structural or aesthetic. Roofs may have flat, pitched, vaulted, domical or warped surfaces. They may be supported on walls, columns, piers or they may extend directly to their foundations.

FORMS OF ROOFS

WOODEN ROOFS

The flat roof is the simplest. least distinguished of roof forms. It is a cover adaptable to rectilinear plan arrangements over large areas. When it is applied to dwellings a light frame construction is appropriate. This type of construction consists of beams, called joists, laid horizontally and supporting a structural cover of boarding on which a membrane type of roofing is applied. The joists have nominal widths of 2 in. and nominal depths ranging from 6 in. to 12 in, in multiples of 2 in. (Nominal dimensions refer to the sawn timber before being finished or sized.)

The joists span from wall to wall and are spaced 16 in. to 18 in. on centres. When the joists are used on long spans, 16 ft. to 18 ft., they require lateral support at intervals of 6 ft. to 8 ft. This lateral support in the form of X bracing is called bridging. Flat roofs of timber construction are found appropriate for industrial plants, but due to the risk of fire they are constructed by using heavy timber beams, spaced 6 ft. to 8 ft. on centres, supporting a plank roof cover. This type of roof is classified as a mill or slow burning construction. Although this type of framing introduces limitations in planning arrangements due to interior column supports (at intervals of 16 ft. to 18 ft.), it is found to be economical

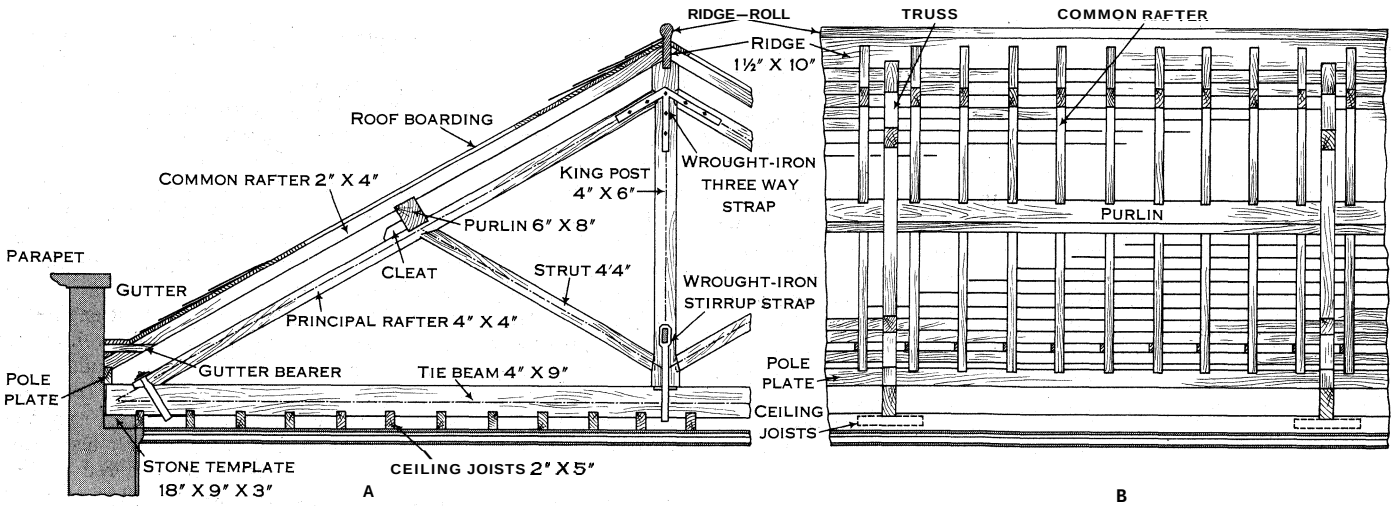

FIG. 1.—KING-POST ROOF TRUSS

and suitable for some industrial operations. Variations of the flat roof construction, in which the plane of the roof has a decided slope, are called lean-to and shed roofs. The supporting sloping beams are called rafters and have the same proportions and dimensions as the joists in the light frame construction. These roofs have the advantage of permitting the use of unit types of roof covering when the slope is sufficiently steep.

The widespread use of the double-sloped or gable (*q.v.*) roof is attributable to tradition, as well as a certain amount of standardization. The principal elements of this type of roof are pairs of rafters meeting at their highest points at a horizontal ridge beam (fig. 1 [A]) that acts as a tie and stiffener. The elements are resolved into a stable framework when the sloping surfaces are boarded in. The lower ends of the rafters rest on a plate which is securely attached to the supporting walls. The weight of the structure and its covering. in addition to the snow and wind forces, bring a considerable thrust to the walls. The magnitude of these thrusts varies with the slope of the rafters, becoming larger as the slopes are reduced. To avoid the thrusts on the walls, a horizontal tie may be introduced for each pair or each alternate pair of rafters. If the ceiling joists rest on the plate or are reasonably close to the elevation of the plate. they may be secured to the walls or rafters and act as ties. If it is impracticable for reasons of headroom (clear height) to place the ties at or near the elevation of the plate, it is possible to reduce the thrust by tying the rafters at an intermediate elevation above the plate with horizontal beams attached to pairs of rafters. These ties. known as collar beams, with pairs of rafters form A frames. This type of roof structure may be used for relatively large spans, ranging up to 26 ft.; without the need of intermediate supports for the rafters. When tie beams also serve as ceiling joists they may require intermediate supports on the longer spans. Support may be provided by means of a tie or hanger attached at mid-span of the rafter, or at the ridge. and secured to the ceiling joist.

When the roof span is very large (30 ft. or more), intermediate supports are required in order to avoid the necessity of excessively heavy rafters. These supports are provided by purlins which in turn are carried by roof trusses (see TRUSS). (See fig. 1 and 2.) The trusses are spaced at intervals of 10 ft. to 12 ft. and provide support for the purlins at the intersection of the axis lines of the struts and principal rafters. The vertical components of force in the struts are carried by the king post into the principal rafters at the intersection of the axis line at the peak. The resulting thrusts in the principal rafters are carried by the tie beam. The queen-post truss is similar in action to the king-post truss except at the connection of the straining beam and straining sill. Both of these early truss forms are assembled in a manner requiring skill in joinery (see fig. 3) and are inefficient even when done with great skill. A more acceptable truss form for long spans is the Fink type (fig. 7[D]) which may be built up of rafter stock and assembled with bolts. (See also CARPENTRY.)

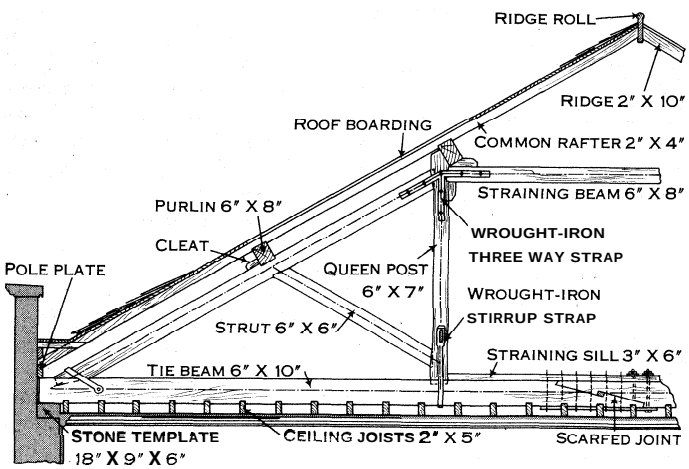

FIG. 2.— QUEEN-POST ROOF TRUSS

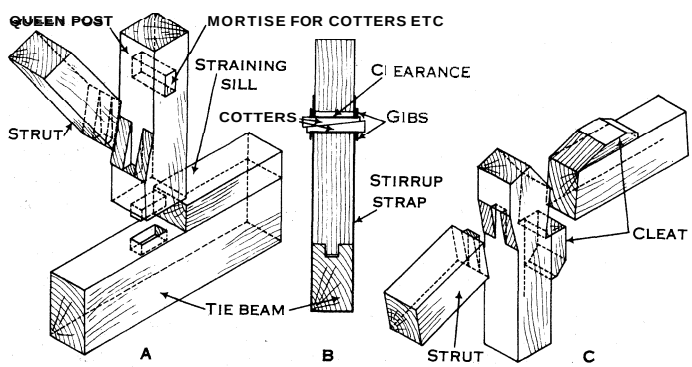

FIG. 3.— QUEEN-POST ASSEMBLY

(A) Detail of queen-post truss and (B) vertical section through queen post at base. (C) Detail of aueen-post truss at head. (Purlin and wrought-iron straps are omitted for clearness)

Open Timber Roofs.—When trusses or frames are exposed to view, a justification for less efficiency can be made in the interest of fine workmanship. The hammer-beam truss, which is essentially an A frame, was developed into a highly decorative element of roof construction displaying fine workmanship in joinery and carving by the builders of the middle ages. (See HAMMER-BEAM ROOF.)

The section and elevation (fig. 4) with the roof plan (fig. 5), show the construction of a hip roof in which the rafters slope upward from the plate to the high points along the hip rafter. The hip roof, having no gable ends, has the effect of making the building appear lower, and transmits the thrusts through the hip

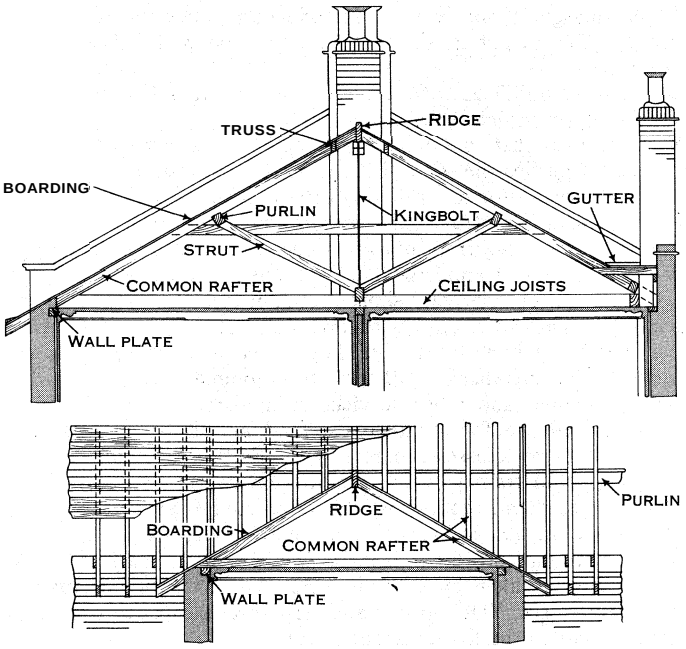

FIG. 4.— SECTION AND ELEVATION OF A ROOF FOR A DOMESTIC BUILDING

rafters to comers where the plates, acting as ties, can more readily resist outward forces.

The Mansard Roof.—The mansard roof (*q.v.*) (fig. 6), though rarely used in present-day construction, was once a common form in Europe and the U.S. Its form was primarily a device for providing additional usable area without the necessity of adding a full story. With the cornice line at the base of the upper floor, it gave the appearance of a lower building. Remnants of its influence in the U.S. survived in the practice of using shingles for the upper story of dwellings and clapboards for the lower story. The device of lowering the cornice line to the lower chord of deep trusses and introducing a strip of sloping roof at the exterior walls may well be due to the influence of the mansard roof. (See also GAMBREL **ROOF.**)

Long-Span Timber Roofs.—In the early years of the 20th century the use of timber trusses and frames was generally limited to spans of 50 ft. to 60 ft. This limitation was largely due to the difficulties in joining the various parts with any real assurance of developing the predicted strengths. together with uncertainties about the behaviour and strength of the timbers. The uncertainties of joining since have been reduced with the use of split ring connectors, which in effect have the advantages of larger diameter bolts without reducing the cross-sectional areas of the timbers appreciably.

By mid-20th century the elements of the trusses could be made up of narrow stock which permitted a more accurate selection. The elements are then assembled with ring connectors.

Long-span trusses of the bowstring type, using a laminated curve member, may be employed for spans up to 200 ft., while the Pratt, Howe, Warren and Fink trusses (fig. 7) are acceptable for spans of 100 ft. Frames can be assembled from laminations 1⅝ in. or less in thickness, which permits an accurate selection and arrangement of the laminates for high strengths. The improvements in glues have made the use of laminated arches and frames reliable for long-span structures. Arches and frames have been constructed for spans up to 100 ft.

Laminated frames have become increasingly acceptable for

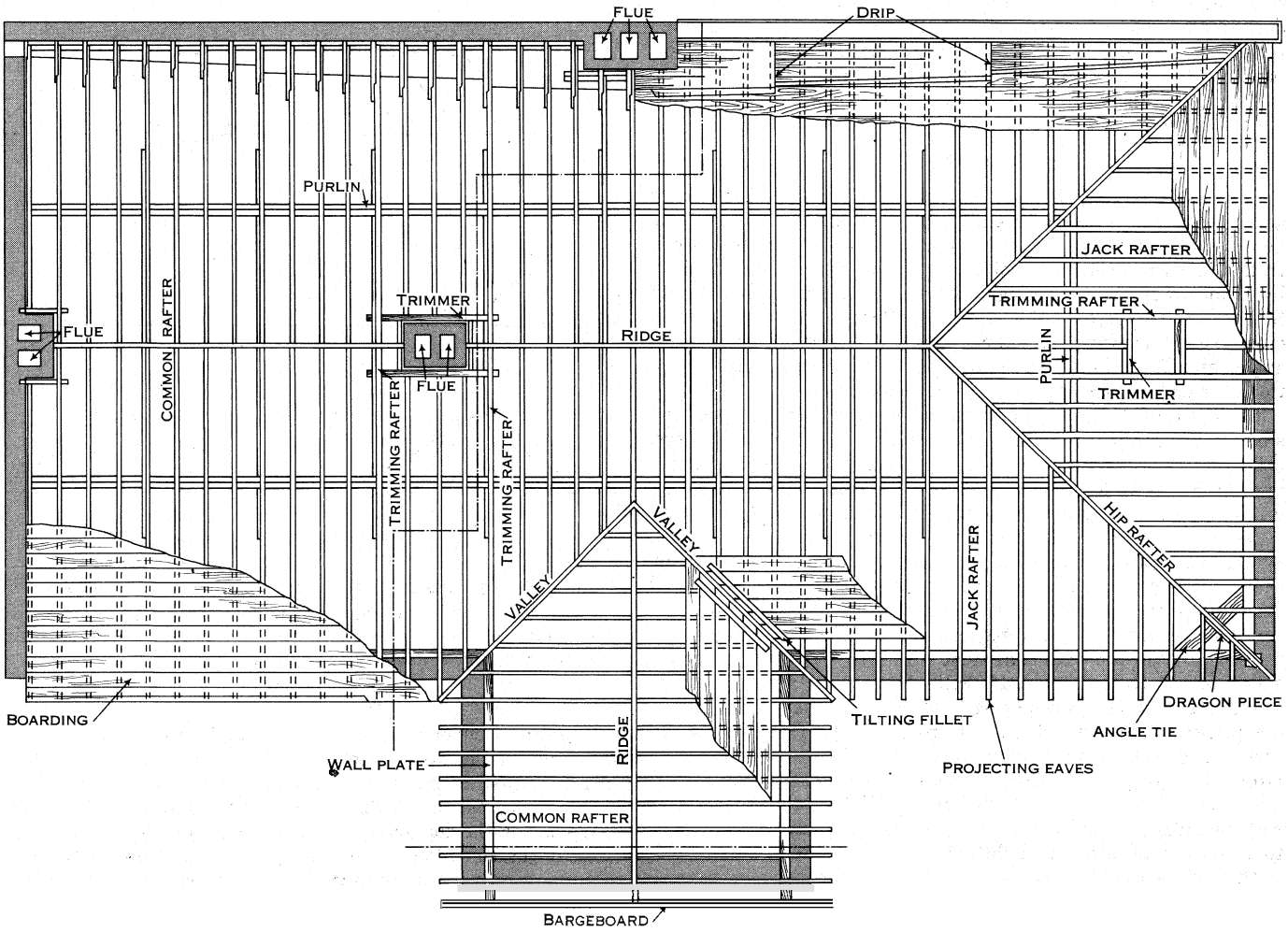

FIG. 5.— PLAN OF A ROOF SHOWING THE DETAILS OF CONSTRUCTION

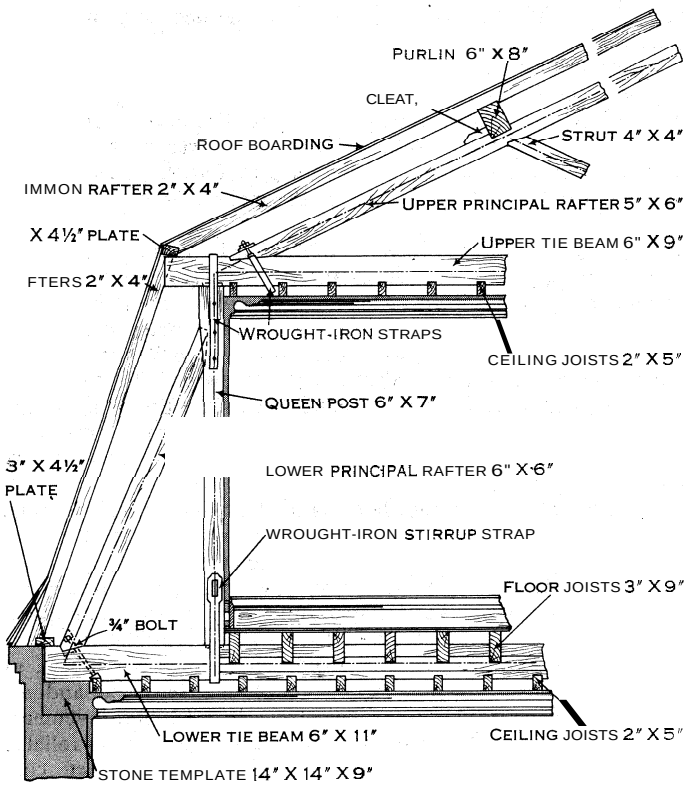

FIG. 6. — MANSARD ROOF TRUSS

spans of 40 to 60 ft. in buildings where it would be normally undesirable to expose the structure of the roof. Since the laminated frame is a continuous formed member. proportioned in its various parts to resist the forces to which it is subjected, without any visual indication of the joining, its appearance does not conflict with other interior finished surfaces.

STEEL ROOFS

Steel as a material for roof structures has many desirable characteristics. It is strong and stiff, it can be prefabricated in a shop and erected rapidly on the site. The manufacture of steel is controlled so as to produce a uniform quality. Steel permits joining by means of rivets or welding without appreciable loss in strength. Structural steel is available in straight lengths of many efficient cross-sectional forms, including plates, I beams, [channels, L angles and T sections. In addition to these there are lighter sections formed or assembled into joists and trusses.

For flat roofs requiring noncombustible materials the open-truss steel joist supporting a steel deck and protected by a plastered ceiling is appropriate. The steel joists are available in depths varying by multiples of 2 in. from 8 in. to 20 in. and may be spaced up to 3 ft. on centres on spans ranging from 16 ft. to 36 ft. Other types of structural roof covers or decks may include wood plank or various types of composite materials consisting of a cementing agent. usually portland cement, and a light aggregate having such desirable properties as insulation, resistance to fire, holding power for nails or fasteners and strength. The decking materials are usually precast into sizes consistent with their structural capacities and attached to their supports with clips or fasteners.

Industrial buildings requiring large areas of unobstructed space are usually built with steel roof trusses supporting purlins that carry the structural roof cover. For flat roofs the chord members (top and bottom) are parallel (see fig. 7) except for long spans where the top chord is sloped slightly from the mid-span to the ends in order to facilitate draining of the roof surface. The bottom chord may also be slightly higher at mid-span (cambered) so that the deflected truss does not have the appearance of sagging. The parallel chord trusses are usually designed with depths equal to $\frac{1}{10}$ to $\frac{1}{12}$ of their span and with lateral bracing for the top and bottom chords. For aesthetic as well as economic reasons a sloping margin of roof may be introduced at the outer walls, thus reducing the height of the wall and the apparent height of the building.

For some buildings with moderate spans pitched roofs may be desirable. In principle the structure of the roof using steel trusses is the same as that for timber construction. Thus with the introduction of purlins the span of the rafters or structural roof covering is reduced. For roofs of this type it is often desirable to use a noncombustible structural cover in the form of nailable precast slabs. spanning from purlin to purlin, to which the unit type of covering may be applied. The Fink truss is well adapted to the pitched roof for relatively short spans; it may be used economically for spans of about 40 ft. up to 100 ft. For long spans, a considerable volume of the building is taken by the trusses and their bracing members. Although this volume may be used for ducts, pipelines and other services in industrial plants, it has a more limited use for auditoriums, field houses or gymnasiums, where long-span trusses are required. For these buildings steel arches or rigid frames, which require less depth, are more desirable. Frames and arches may be fabricated from the available standard elements, in the form of plate angles and T sections. Both the frame and the arch introduce thrusts at the foundation which may be taken by tie rods concealed in the floor structure or by buttresses. The purlins and structural cover are similar in arrangement to the flat or pitched roof.

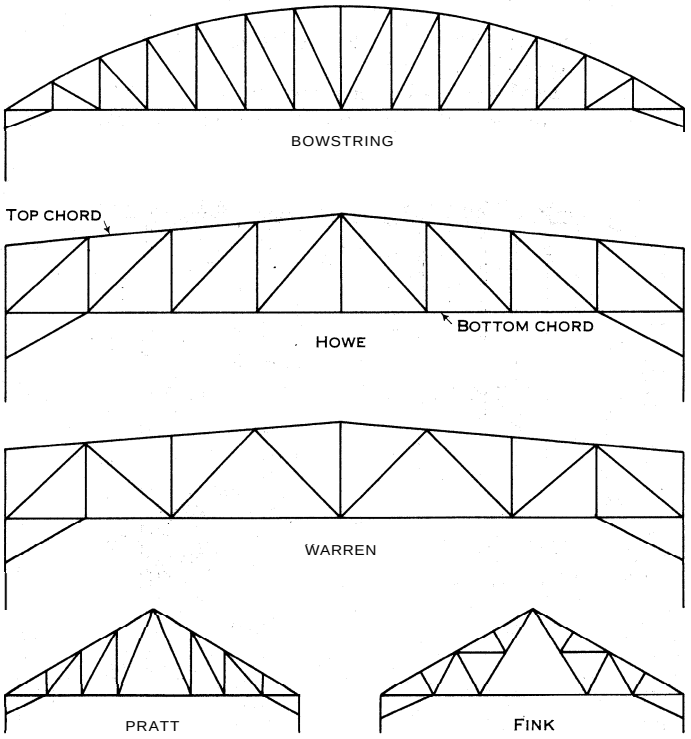

FIG. 7. — TYPES OF MODERN ROOF TRUSSES

Arches and frames are equally well adapted to short spans. Because of their greater strength and their ability to be incorporated with concrete, they are used for roof structures where the minimum of structural presence is desired.

CONCRETE ROOFS

The use of concrete as a structural material had its beginning in the era of the Roman empire. The cementing material was a mixture of hydrated lime and volcanic ash, known today as a slag or puzzolan cement. With this cementing material a mortar was made having the characteristics of portland cement mortar. The dome of the Pantheon (*q.v.*) in Rome, having a diameter of about 141 ft., was constructed during the 1st century using cement mortar and masonry. The masonry material was laid with large joints of cement mortar to the extent of approximating a concrete dome. True hydraulic cement, having the ability to set under

water, was made during the mid-18th century by an English engineer, during his researches in connection with the building of the third Eddystone lighthouse. The introduction of reinforcing steel and the advances in the technology of concrete since the mid-19th century have resulted in its increasing use as a structural material for roofs.

Concrete, being plastic, may be formed into various shapes having flat or curved surfaces. It has an inherent characteristic of continuity when reinforced with steel which eliminates most of the problems of joining and permits the construction of monolithic structures. At first reinforced concrete was used in forms that were modeled after masonry structures, but during the latter part of the 19th century the more familiar forms developed in wood and steel were followed. For roof structures, concrete is rarely used without reinforcing steel. An interesting example of concrete vaulting and domical roofing without metal reinforcement is the Roman Catholic cathedral at Westminster, London, a remarkable building designed by J. F. Bentley and constructed between 1895 and 1903.

Present-day practice tends toward the use of lighter roof structure using thin-shell forms reinforced with steel rods where tension may occur and relying on the capacities of the concrete to resist compression. Structures of thin-shell construction appeared in the 1930s in the form of semispherical domes having diameters up to 80 ft. with shell thicknesses of 3 in. The domes were supported on columns on their periphery.

In more recent years other forms have been built, including cylindrical or barrel shells, spanning in the direction of their long axis. They have cross sections in the form of segments of thin-walled cylinders with stiffening edge beams. Thus they are similar in appearance to vaults with edge beams at the springing line. When placed adjacent to one another and supported on columns along the edge beams, they can provide large areas of unobstructed space.

Unique roof structures using cables as the supports for the roof were constructed during the 1940s and 1950s. A stadium built in Montevideo. Urug., of this type is cylindrical with a diameter of 310 ft. The cables are arranged radially with outer ends attached to a circular ring at the top of the outer wall 85 ft. high; the inner ends are attached to a steel ring at the centre. The roof itself is of precast concrete slabs (2 in. thick) attached to the cables.

COVERING MATERIALS FOR ROOFS

Roof covers may be classified in two general groups depending upon the manner in which they seal off the entrance of water. One group consists of waterproof membrane, or built-up roofing; the other group of a unit type of waterproof material arranged in a manner so as to avoid direct passage of water through the joints. The membrane or built-up roofing is commonly applied to decks having slopes 2 in. or less per foot and single curved surfaces with varying slopes. The unit type is used on roofs having slopes of 6 in. or greater per foot.

For intermediate slopes, a wide selvage type of roll roofing may be used, or a built-up roof may be adapted. Built-up roofing is made up of several layers or plies of tarred felt, laid in coal-tar pitch so that one layer of felt is never in contact with another. Over the entire roof surface a uniform coating of pitch is poured and a covering of gravel or slag is sprinkled before the pitch has set. When the roof is to be used as a terrace or promenade, the built-up roofing is laid without gravel or slag, but with additional plies on which the tile or terrace flooring is set in a 1 in. mortar bed. Expansion joints filled with some elastic cement are usually installed in the tiled surface. Such roofs. either covered with tile, slag or gravel, are watertight, do not crack under extreme heat or cold and have become common for the better class of flat roof coverings. If adequately flashed at intersections with walls and parapets, they require a minimum of slope, sufficient only to drain the surface.

Corrugated Sheets. — Corrugated iron or steel is supplied either black, galvanized or with protective coatings. It is especially suited for the roofs of storage buildings and buildings of a temporary or semipermanent character. Being to a large extent self-supporting, it may have a specially designed roof framework of light construction. If, as is usually the case, the sheets are laid with the corrugations running with the slope of the roof, they can be fixed directly on purlins spaced at full or half lengths of the sheets according to the stiffness of the sheets. In pure air the zinc coating of the galvanized sheets is durable for many years, but in large cities and manufacturing towns its life is short unless protected by painting. In such districts it has been found that sheets manufactured with protective coatings applied on iron or steel are more serviceable. In such districts it has been found that plain sheets, well coated with paint, will last longer than those galvanized, for the latter are attacked by corrosive influences through minute flaws in the zinc coating developed in the process of corrugation, in transit or from some defect in the coating.

For roofing purposes the sheets are supplied in several thicknesses ranging from no. 16 to no. 22 standard wire gauge. No. 16 is for exceptionally strong work. No. 18 and no. 20 are used for standard work and no. 22 for temporary buildings. The sheets when laid should lap one full corrugation at their sides and from 3 in. to 6 in. at the ends. Riveting is the best method of connecting the sheets, although galvanized bolts, which are not as satisfactory, are frequently employed. The joints should be along the crowns of the corrugations to avoid leakage. Holes can be punched during the erection of the roof. For attachment to timber framework, galvanized screws or nails with domed washers are used. Fixing to a steel framework is effected by galvanized hook bolts which clip the purlins and pass through the sheet. Sheets formed with V crimps, spaced about 15 in. on centres with the portion between being flat, give a better effect in some positions than the $1\frac{1}{4}$ in. to $2\frac{1}{2}$ in. corrugated sheets.

Aluminum. — In addition to the surface-protected iron and steel corrugated sheets, there are available in many areas aluminum sheets and rolls. As a light material having insulation value this corrugated material is well adapted to general use. It should be applied to a structural roof cover in a manner similar to that used for laying corrugated iron and steel sheets, using aluminum nails with screw shanks.

Composition. — A widely accepted corrugated sheet manufactured under various trade names consists of a formed sheet using portland cement and asbestos fibre compressed under great pressure into a monolithic unlaminated sheet having good strength characteristic and durability. It resists corrosion, has a high resistance to acid fumes and to exposure to extreme weather conditions. It may be used as the structural cover for flat roofs and the complete cover for pitched roofs having slopes greater than 2 in. per foot. The distance between supports may be 54 in., and the method of fixing is similar to that used for metal corrugated sheets. The sheets are manufactured in 42 in. width, ranging in length from 3 ft. to 11 ft.

Zinc. — Zinc in sheets is a material largely used as a roof covering and. if care is taken to select metal of good quality, is strong and durable as well as light and relatively inexpensive. Zinc is stronger weight for weight than lead, slate, tile or glass, but weaker than copper, wrought iron or steel, although with the exception of the latter two it is not so durable under normal roofing conditions. It is not liable to easy breakages as are slates, tiles and glass. It is usually supplied in flat sheets, and may be had in corrugated form. When exposed to air a thin coating of oxide is formed on the surface which protects the metal beneath from further change and obviates the necessity of painting. In laying the sheets, the use of solder and nails should be avoided entirely except for fixing clips and tacks which do not interfere with the free expansion and contraction of the sheets. Zinc expands and contracts freely with changes in temperature, sheets laid with soldered seams or fixed with nails are liable to buckle, thus causing the zinc to become brittle and after repeated buckling to break away.

Zinc sheets are usually 7 ft. or 8 ft. long by 3 ft. wide, weighing from $11\frac{1}{2}$ oz. to 25 oz. per square foot. The thickness varies from 25 to 19 standard wire gauge. A dependable method of laying zinc on flat roofs is with the aid of wood rolls, about 2 in. by 2 in. in section, splayed at the sides, spaced 2 ft. 8 in. apart and fixed to

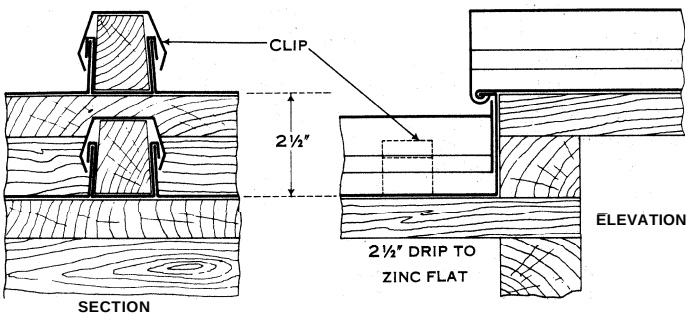

FIG. 8.—DETAILS OF ZINC FLATS

the roof boarding with zinc nails.

The sheets of zinc are laid between the rolls with sides bent up 1½ in. or 2 in. against them, and held firmly in position by clips of zinc attached to the rolls. A cap of the same metal is slipped over each roll; tacks about 3 in. long, which are soldered inside the cap, hook it under the same clips that anchor the sheet.

Drips of about 2½ in. are made in the slope at intervals of 6 ft. or 7 ft., *i.e.*, the length of the sheet, and care must be taken at these points to keep the work waterproof. The lower sheet is bent up to the face of the drip and under the projecting portion of the upper sheet, which is finished with a rolled edge to turn the water. The end of the roll has a specially folded cap which also finishes with a curved or beaded water check, and this, in conjunction with the saddle piece of the wood roll beneath, forms a weatherproof joint (fig. 8). The fall between the drips is usually about 1½ in. deep, but where necessary it may be less, the least permissible fall or slope being about 1 in 80. Felt laid beneath the zinc has the effect of lengthening the life of the roof and should always be used, as the edges of the boarding upon which it is laid are, when warped. apt to cut the sheets. It also forms a cushion protecting the zinc if there is traffic across the roof.

Lead.—Sheet lead forms a much heavier roof covering than other sheet metals, but it lasts a great deal longer and more easily withstands the attacks of impure air. Lead must be laid on a close boarding. for its great ductility prevents it from spanning even the smallest spaces without bending and giving away. This characteristic of the metal, however, conduces largely to its usefulness and enables it to be dressed and bossed into awkward corners without the necessity of jointing. The coefficient of expansion for lead is nearly as great as that for zinc and much higher than for iron; precautions to allow free expansion and contraction must be taken when laying the lead covering. The manner of laying is with rolls and drips as in the case of zinc, the details of the work differing somewhat to suit the character of the material (see fig. 9); the use of nails and solder should be avoided

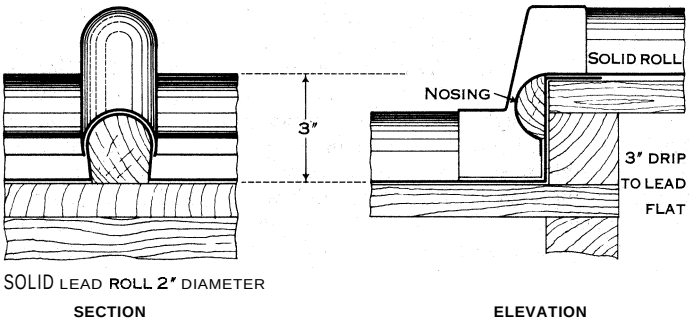

FIG. 9.—DETAILS OF LEAD FLATS

as far as possible. Contact with iron sets up corrosion in lead and when nails are necessary they should be copper; screws should be brass. Lead is supplied in rolls of 25 ft. to 35 ft. long and up to 7 ft. 6 in. wide. That in general use varies from $\frac{1}{14}$ in. to $\frac{1}{7}$ in. in thickness. The weights most suitable for employment in roofing are 7 or 8 lb. per square foot for flats and gutters, 6 lb. for ridges and hips and 5 lb. for flashings.

Copper.—As a roof cover, copper is lighter, stronger and more durable than either zinc or lead. It expands and contracts less than these metals, and although not so strong as wrought iron or steel it is much more durable. From a structural point of view these qualities enable it to be classed as the best available metal for roof covering, although its heat-conducting properties require it to be well insulated by layers of felt and other nonconducting materials placed beneath the metal. On exposure to the air, copper develops a feature of great beauty in the coating of green carbonate which forms upon its surface and protects it from further decomposition. Perhaps the chief disadvantage in the use of copper has been its first cost, but account must be taken of the almost imperishable nature of the metal and of the less substantial framework that its light weight requires for support. Copper roofing should be laid in a similar manner to zinc, with wood rolls at intervals of 2 ft. 4 in. It is, however, often laid with welted seams. The general stock sizes of sheets are from 4 ft. to 8 ft. long and 2 ft. to 3 ft. wide. The thickness almost invariably used is known as 24 standard wire gauge and weighs 16 oz. per square foot. Thinner material would suffice, but with the increased cost of rolling. little would be gained by adopting the thinner gauge.

Slate.—Slate is a strong and very impermeable material, it is easy to split into thin plates suitable to laying. and its cost is comparatively low: these qualities have made it the most generally used of all materials for roof covering for many years.

Slates are cut to many different sizes varying in length from 10 in. to 36 in, and in widths from 5 in. to 24 in. There are perhaps 30 or more recognized sizes, each distinguished by a different name. In common practice those generally used are "large ladies." 16 in. by 8 in.; "countesses," 20 in. by 10 in.; and "duchesses." 24 in. by 12 in. Generally speaking, the rule governing the use of the different sizes is that the steeper the pitch the smaller the slate, and vice versa. Buildings in very exposed positions naturally require steeply pitched roofs, if they are to be covered and rendered weathertight by small lapped units of covering. Slates may be fixed by nailing at the head or at about the middle. The latter method is the stronger. as the levering effect of the wind cannot attain so great a strength.

The nails used in slating are important and the durability of work depends on good selection. They should have large flat heads. The most satisfactory are those made of a composition of copper and zinc, but others of copper, zinc, galvanized iron and plain iron are used. Those of copper are most durable but are soft and expensive. Zinc nails are soft and not very durable; they will last for about 20 years. Iron nails even if galvanized are only employed in cheap and temporary work; they may be preserved by being heated and plunged in boiled linseed oil. The pitch of a roof intended for slating should not incline less than 25° from the horizontal; for smaller sizes 30° is a safer angle. Modern slate roofs are frequently laid with varying courses and varying thicknesses, usually with the heavier slate from ¾ in. to 1½ in. thick at the eaves. with thinner and smaller slate in the upper part of the roof. Marked variation of colour is often sought by combining green and purple slate, or fading and unfading slate.

Tile.—Tiles for roofing purposes are made from clay and baked in a kiln like bricks. The clay from which they are made is, however, of a specially tenacious nature and prepared with great care so as to obtain a strong and nonporous covering. Tiles are obtainable in many colours. some having beautiful effect when fixed and improve with age. They comprise tints from yellowish red, red and brown to dark blue. As with brick, the quality depends to a large extent upon the burning; underburned tiles are weak and porous and liable to early decay, while overburning, though improving durability, will cause warping and variations in colour. Variation in colour is now deliberately obtained, and artistic effects are secured by sand facing, artificial rustication and by burning to metallic surfaces. The usual shape is the "plain tile," but they are made in other shapes for lighter weight and ornamental effect. There are also several patented forms on the market for which the makers claim special advantages. The ordinary tiles are slightly curved in the direction of their length to enable them to lie closely at their lower edges. Some of them have small nibs at the head by which they are hung upon the battens without nails. Nail holes

are provided, and it is advisable to nail at least every fourth or fifth course. Others are made without the nibs, and are either fixed by nailing to the battens or boarding or are hung by means of oak kegs wedged in the holes to the battens, the kegs in the latter case acting in the same way as the mentioned nibs. Plain tiles are of rectangular form, the standard dimensions are 10½ in. long by 6½ in. wide. They are usually 3 in. thick and weigh about 25 lb. each. There are many forms of ornamental tiles, which are plain tiles having their tails cut to various shapes instead of molded square. Patented forms of tiles are also on the market, some of which possess considerable merit. "Pantiles" are suitable for temporary and inferior buildings, if laid dry and on flat slopes. but if laid upon board and felt and if bedded and pointed in mortar, pantiles may prove an excellent covering. They are laid on a different principle from plain tiles, merely overlapping each other at the edges. This necessitates bedding in mortar and pointing, inside and sometimes outside, with mortar or cement. This pointing plays an important part in keeping the interior of the building free from penetration of wind and water. Pantiles are generally made to measure 13½ in. long by 9½ in. wide and weighing from 5 lb. to 5½ lb. each. Molded on the head of each tile is a small projecting nib which serves to hang the tile to the batten or lath.

They are laid with a lap of 3½ in., 25 in. or 1½ in.. giving a gauge (and margin) of 10 in., 11 in. and 12 in., respectively. The side lap is generally 1½ in., leaving a width of 8 in. exposed face. There are many other forms based upon the shape of the pantile, some of which are patented and claim to have advantages that the original form does not possess. Among them are "corrugated tiles" of the ordinary shape or with angular flutes, the Italian pattern "double roll tiles" and "Foster's lock-wing tiles." Poole's bonding roll tiles are a development of the Italian pattern tile. French and Belgian tiles of the "Marseilles" pattern are economical and therefore popular for housing schemes and cheap building.

There are other forms of roof covers that were once in common use but no longer meet the requirements set up by regulations and ordinances of most communities. Because of the risk of fire. shingles of wood and other combustible materials have been replaced nith asphalt and asbestos cement units. These coverings are available in many colours and textures as individual units or strips and sheets. The quality of the materials has been improved and the techniques of applying them developed to such a point that they have practically replaced the older types of roof coverings. The colours and textures of the older roofing, such as wood, slate and tile have been reproduced with limited success in the newer materials, but for the most part their acceptance has been the result of their own inherent characteristics.

Insulation has become an integral part of the roof assembly of most buildings; it is available in types adapted to various conditions of the roof structures. For the purpose of reducing the conductivity of the roof assembly a low density material composed of vegetable fibres. cork, glass fibres or mineral wool are formed into "rigid" units, semirigid units (batts) or flexible strips. The insulation for flat roofs having precast units or concrete structural covers is usually in the form of a rigid insulation board on which the built-up roofing is applied. For other types of structural roof coverings, the insulation is usually a flexible type or it consists of batts applied below the structural roof cover. The reflective type of insulation in the form of a metallic foil mounted on strong paper backing is applied as an air space boundary below structural cover. The function of the vapour seal is to prevent the warm moist air of the interior from reaching the colder areas of the roof assembly and should therefore be located below the insulating material. The vapour seal is an asphalt membrane on sheathing paper or it may be an integral part of the paper surfaced with the reflective insulation.

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ROOK (*Corvus frugilegus*), throughout a great part of Europe, the commonest of the crow tribe. Besides its gregarious habits, which are distinctive, the rook is distinguished from the rest of the *Corvidae* by losing at an early age the feathers from its face, leaving a bare, scabrous and greyish-white skin visible at some distance. In the rare cases in which these feathers persist, the rook may be known from the crow (*q.v.*) by the rich purple gloss of its black plumage, especially on the head and neck, as well as by its voice. The sexes are very similar. It nests in colonies on large trees (occasionally on buildings), making a strong nest of twigs and earth and using it year after year. The three to five green eggs, marked with grey and brown, are laid in early April. In Britain the rook is resident and stationary, but in most of Europe it is either a summer or winter visitor. Its food is very varied, but includes a high percentage of noxious insects The bird is thus of great value to the farmer.

ROON, ALBRECHT THEODOR EMIL, COUNT VON (1803–1879), Prussian general field-marshal, was born at Pleushagen, near Colberg, in Pomerania, on April 30, 1803. He entered the corps of cadets at Kulm in 1816, proceeded to the military school at Berlin, and in Jan. 1821 joined the 14th (3rd Pomeranian) regiment. In 1826 he was appointed an instructor in the Berlin cadet school, and in 1832 published his *Grundzüge der Erd-, Volker- und Staaten-Kunde* (3 vols.), gaining a great reputation. This was followed by *Anfangsgründe der Erdkunde* (1834), *Militärische Länderbeschreibung von Europa* (1837) and *Die iberische Halbinsel* (1839).

In 1832, he rejoined his regiment, and became alive to the inefficient state of the army; in 1842 he was promoted to be major and attached to the staff of the VII Corps. In 1848 he was appointed chief of the staff of the VIII. Army Corps, and during the disturbances of that year served under the Crown Prince William (afterwards emperor), distinguishing himself in the suppression of the insurrection at Baden. At that time he broached the subject of his schemes of army reform. In 1850 came the revelation of defective organization; next year Roon was made a full colonel and began active work as reorganizer.

Prince William became regent in 1857, and in 1859 he appointed Roon (now lieutenant-general) a member of a commission to report on military reorganization. Supported by Manteuffel and Moltke, Roon was able to get his plans to create an armed nation, to extend Scharnhorst's system and to adapt it to Prussia's altered circumstances generally adopted. To attain this he proposed a universal three years' service, and a reserve (*Landwehr*) for the defense of the country when the army was actively engaged. During the Italian War he was charged with the mobilization of a division. At the end of 1859, though the junior lieutenant-general in the army, he succeeded von Bonin as war minister, and two years later the ministry of marine was also entrusted to him. His proposals of army reorganization met with the bitterest opposition, and it was not until after long fighting against a hostile majority in the chambers that, with Bismarck's aid, he carried the day. Even the Danish campaign of 1864 did not wholly convince the country of the necessity of his measures, and it required the war with Austria of 1866 (when he was promoted general of infantry) to convert obstinate opposition into enthusiastic support. After that von Roon became the most popular man in Prussia, and his reforms were ultimately copied throughout continental Europe. His system, adopted after 1866 by the whole North German Confederation, produced its inevitable result in the war with France 1870–71. He was created a count, and in Dec. 1871, succeeded Bismarck as president of the Prussian ministry. Ill-health compelled him to resign in the following year. He was promoted field-marshal on Jan. 1, 1873, and died at Berlin on Feb. 23, 1879.

After his death his son published the valuable *Denkwürdigkeiten aus dem Leben des Generalfeldmarschalls Kriegsministers Grafen Roon* (2 vols., Breslau, 1892), and *Kriegsminister von Roon als Redner politisch und militärisch erläutert* (Breslau, 1895). His correspondence with his friend Professor Cl. Perthes, 1864–67, was also published at Breslau in 1895.

ROORKEE, a municipal town and tehsil in the Saharanpur district of Uttar Pradesh. India. Pop. (1951) of town. 23,239; of cantonment. 9,853. The town contains the workshops of the Ganges canal and is the site of Koorkee university which was originally founded in 1848 as the Thomason Civil Engineering college. The university was inaugurated in 1949 to provide for the teaching of all branches of engineering.

ROORKEE TEHSIL (area 306 sq.mi.) had a population in 1951 of 410,787. The cantonment is the headquarters of the Bengal engineer group, corps of engineers.

ROOSEVELT, FRANKLIN DELANO (1882–1945),

thirty-second President of the United States, was born at Hyde Park, N. Y., Jan. 30, 1882. His father, James Roosevelt a wealthy landowner, vice-president of the Delaware & Hudson Railroad, and Democratic politician, held several minor diplomatic offices under President Cleveland; his mother, Sara Delano, had sprung from a family of New York merchants and shippers. The upper Hudson Valley community in which Franklin D. Roosevelt was reared was devoted to sports, and he early learned to hunt to hounds, shoot, play polo and tennis, and manage an ice-boat. In summers at Campobello on the New Brunswick coast he made long cruises by catboat and yacht. European travel began when the boy was three and he learned to speak German and French fluently. Passing through Groton School, he entered Harvard in 1900 and on graduation went to the Columbia University Law School in 1904. In March, 1905, he married Anna Eleanor Roosevelt of New York, a sixth cousin, the wedding being attended by President Theodore Roosevelt, who was uncle of the bride and fifth cousin of the groom. Thereafter the couple frequently saw President Roosevelt in Washington or at Oyster Bay. In 1907 Franklin D. Roosevelt completed his course at Columbia, was admitted to the bar, and began practice in New York City. His father had meanwhile died. and he combined his legal work with frequent visits to Hyde Park where he took an important position in business, philanthropic and social activities.

Contact with Theodore Roosevelt inspired the young man with an interest in politics; the Democratic leaders in Dutchess County saw in him a promising recruit. In 1910 they gave him the nomination for State Senator. Though only one Democrat had been elected to that post since 1856, by virtue of a pleasing personality, a strenuous automobile campaign, and a schism in the Republican party, he obtained a narrow majority. In his first year in Albany he attained prominence by leading a small band of Democratic legislators who refused to accept the Tammany Hall candidate for election to the U. S. Senate, William F. Sheehan. Declaring Sheehan unfit for the place by his character and close association with predatory traction corporations, Roosevelt held his fellow-insurgents firm against the party caucus till a better candidate was substituted. The reputation for progressivism and independence which he thus obtained was extended by his championship of reform legislation. In 1911 he was prominent in the New York movement for nominating Woodrow Wilson to the Presidency, and in June, 1912, led an unofficial delegation of 150 men to the Democratic Convention in Baltimore, where he did effective work. Reelected that fall to the State Senate, he introduced some notable bills for protecting the farmers against unfair commission merchants and stimulating rural co-operation. The incoming Wilson Administration offered him a choice of several minor posts; he accepted the Assistant Secretaryship of the Navy.

Spending the years 1913–1921 in the Navy Department, Mr. Roosevelt was the principal lieutenant of Secretary Josephus Daniels in administering naval affairs. During 1913–1916 he was an unwearying advocate of greater naval preparedness, producing many speeches and articles; he set about converting useless navy yards into industrial plants for making naval supplies; and he and Mr. Daniels broke up an alleged combination of armour plate manufacturers. Before war broke out he had built up a small Naval Reserve on the basis of systematic civilian training. During the conflict he gave much attention to the submarine problem. He was one of the earliest and most enthusiastic advocates of the mine barrage between Norway and the Orkneys, refusing to heed American and British experts who pronounced it impossible; and he was also largely responsible for the 110-foot submarine chasers, of which about 400 were built. In the summer of 1918 he had charge of the inspection of American naval forces in European waters and did much to promote co-operation with the British Admiralty. After the armistice he took charge of demobilization in Europe and helped dispose of naval supplies stored there. He returned to the United States on the same ship with Wilson (February, 1919) and began speaking for the League of Nations. The following year he received the Democratic nomination for Vice President, made approximately a thousand speeches, and after the Democratic defeat returned to New York to practise law.

In August, 1921, Mr. Roosevelt was stricken with infantile paralysis and emerged with the muscles of his legs and lower abdomen paralyzed. By careful exercises and winter treatments at Warm Springs, Ga., he gradually recovered. Meanwhile he continued legal work, establishing the firm of Roosevelt & O'Connor in 1924, and kept up much of his business and civic activity. As head of the Boy Scouts Foundation in New York City he raised large sums, and at Warm Springs he established an important hydrotherapeutic centre on a non-profitmaking basis. In 1924 he placed Alfred E. Smith in nomination at the Democratic National Convention. After the Democratic defeat of that year he made efforts to bring the Bryan-McAdoo and Smith-Raskob factions together on a progressive basis. These failed, but he succeeded in softening much of the Southern opposition to Smith. In 1927 he urged acceptance of Smith and in 1928 nominated him again at the Houston Convention. At Smith's insistence, though protesting that two more years of private life were necessary to his health, he allowed himself to be drafted as Democratic candidate for governor of New York. Carrying the State by about 25,000 votes while Smith lost it by more than 100,000, he was inaugurated in January, 1929. He furnished a conciliatory administration, and in 1930 was reelected by the unprecedented plurality of 725,000, economic depression and the quarrel over prohibition cutting down the Republican vote. His principal achievements in his two terms as governor were partial settlement of the hydroelectric question on the basis of public development of the St. Lawrence waterpower; a strengthening of the Public Service Commission; and passage of various pieces of social welfare legislation, including an old-age pension law.

With the approach of the election of 1932, it became evident that Mr. Roosevelt was in a happy position to unite the discordant Democratic elements. At the Chicago Convention in July the rival candidates proved unable to unite, and on the third ballot a change by the California and Texas delegations gave Mr. Roosevelt the nomination. He at once began a campaign which took him into every section, travelling 12,500 miles and delivering some 200 speeches. Making effective use of demands for tariff reduction, farm relief, and greater attention to the "forgotten man," he enlisted the support of many influential Progressive Republicans. The economic depression caused an enormous defection of Republican voters, and in h'ovember Roosevelt received 472 electoral votes against 59 for Hoover, carrying all but six states with a popular plurality of over seven million.

Mr. Roosevelt took office, March 4, 1933, amid the throes of a crisis unprecedented in time of peace. Between his election and inauguration he had realized its imminence and had prepared the broad outlines of a programme. Details of his plans, in a fast-changing situation, had to be worked out in the heat of the moment. His first task, as the nation seemingly stood on the brink of an abyss, was to restore its morale. An eloquent inaugural address caught the popular imagination. It was at once followed by a proclamation closing banks, embargoing gold, and proving the government's power to cope with the financial crisis. From that point he moved swiftly toward three objectives already outlined: restoration of prosperity "by re-establishing the purchasing power of half the people"; a better balance between farm, factory, and trade; and reshaping the American economic system to eliminate abuses and excesses.

The 99-day session of the 73rd Congress which began March g, 1933, witnessed the most daring Presidential leadership in American history. Congress, dazed and planless, found itself subjected to a carefully timed bombardment of bills. Mr. Roosevelt sent a rapid succession of presidential messages, sufficiently spaced to avoid confusion; followed each message by a bill to implement it; and thus dealt with the agricultural crisis, banking crisis, relief crisis, and a dozen other problems with amazing speed. The fact that Congress was passing laws to order was never concealed; never before had the American Government so closely a p proached the British system of Ministerial leadership. In his first month Mr. Roosevelt used this unprecedented authority (1) to reopen banks; (2) to restore Federal credit by temporarily

abolishing some of the worst forms of waste; (3) to relieve distress by Federal grants, creation of the Civilian Conservation Corps, and stoppage of foreclosures; (4) to reform the handling of investments and securities; and (5) to begin a system of public works. These emergency measures were at once followed by four steps of the most far-reaching character: (1) a farm relief law; (2) creation of the Tennessee Valley Authority to plan the development of a 640,000-sq. mi. region; (3) passage of the National Recovery Act; and (4) the decision to abandon the gold standard and move toward revaluation of the dollar. His programme had a scope never before approached in time of peace. When Congress adjourned June 16. after heeding all his principal recommendations, the nation had been placed squarely upon a new path.

Mr. Roosevelt's administration then entered upon a different phase. His primary task for the next three years was to administer the legislation already obtained. Since his genius was for originating rather than executing, his record was uneven. The Agricultural Adjustment Administration under Secretary Henry A Wallace proved highly efficient. Its crop restriction plans, together with two great droughts, relieved the farmer of the incubus of crop surpluses and restored prices. When the Supreme Court struck down the A A. A., Mr. Roosevelt and Mr. Wallace had a substitute scheme ready for immediate operation. Mr. Roosevelt was less fortunate when he placed the National Recovery Administration under General Hugh Johnson, whose attempt to carry the code system into all industries and to resort to moral coercion brought the law into discredit. When the Supreme Court held the Recovery Act unconstitutional (May 27, 1935), Mr. Roosevelt expressed bitter disappointment and indicated a temporary disposition to seek an amendment to the Constitution conferring enlarged power in social and economic spheres upon Congress. But public opinion was chilly and he abandoned the idea. He made excellent appointments for administering the Tennessee Valley Authority (Dr. Arthur Morgan) and the Securities Commission (Mr. Joseph P. Kennedy); his choice of Mr. Harry Hopkins as principal agent in charge of relief was also sound, though he was not able to prevent costly bickering between Mr. Hopkins and Secretary Harold L. Ickes. His administration at first moved too rapidly for the civil service merit system, but the attacks on its alleged subserviency to spoilsmen were grossly exaggerated.

While busy with administration Mr. Roosevelt continued to demand new measures of social and economic reconstruction. One of the most important was the Gold Reserve Act of January 1934, under which he devalued the dollar to 59.06 cents in terms of its former gold parity. A measure close to Mr. Roosevelt's heart, the Utilities Act, designed to end abuses in the organization of huge holding companies, became law Aug. 26, 1935. It was essentially an attack upon one of the most complicated and mischievous forms of quasi-monopoly in the postwar period. Still more important uas the Social Security Act, passed in August 1935. Setting up two great Federal-State systems for unemployment compensation and contributory old-age insurance, it obviously required amendment in the light of future experience, but held great social possibilities. Meanwhile Mr. Roosevelt on June 19, 1935, urged legislation to effect a wider distribution of wealth, calling for two sets of measures: one (inheritance taxes, high income surtaxes, abolition of tax-exempt securities) to halt the accumulation and transmission of great fortunes; the other (graduated corporation income taxes, holding-company taxes, and taxes on unwieldy corporate surpluses) to limit the concentration of power in big business. A highly controversial tax law shortly embodied some of these proposals.

Mr. Roosevelt's views on national policy were never left in doubt. He was an earnest advocate of national planning; but by this he meant not the regimentation of society, but only a constant use of foresight in dealing with national problems. He was hostile to great accumulations of wealth; suspicious of efforts by large-scale business to manipulate the government; eager to give better treatment to the farmer as against urban industry, and to labour as against capital; a believer in constant experimentation in government; certain that a more co-operative, less individualistic society must come into existence. In a time when conflict of opinion was violent, his way of zigzagging between "right" and "left" perhaps gave him a maximum of public support. His method of pushing reform, as the Securities and Exchange Act and other laws showed, was to ask for maximum remedies, then accept modifications as experience showed them necessary.

The Democratic national convention renominated Mr. Roosevelt by acclamation June 27, 1936, and the balloting on Nov. 3 resulted in what nas probably the most sweeping victory in all American elections, a popular plurality of 11,069,785 votes, and an electoral vote of 523 to 8 for Alfred M. Landon, governor of Kansas.

A political precedent as old as the republic was broken July 18, 1940, when Mr Roosevelt was nominated by the Democrats for a third term. He was elected the following November 5 by 27,244,160 votes to 22,305,198 for Wendell L. Willkie. In 1944 he was elected to a fourth term. defeating Gov. Thomas E. Dewey of New York. Although Roosevelt's plurality was only slightly more than 3,000,000 votes, he won 432 electoral votes to Dewey's 99. Franklin D. Roosevelt died on April 12, 1945, at Warm Springs. Ga. (For events of the second and third Roosevelt administrations, see UNITED STATES.) (A. N.; X.)

ROOSEVELT, THEODORE (1858–1919), 26th president of the United States, was born in New York city on Oct. 27, 1858. His father, Theodore Roosevelt, was of a Dutch family conspicuous for centuries in the affairs of the city of his birth; his mother, Martha Bulloch, was of Scotch-Irish and Huguenot origin. Young Roosevelt's ill-health necessitated tutors and withheld him from the rough-and-tumble companionship of boys his own age; but deliberately and with great persistence, he built up his frail body. He was graduated from Harvard in 1880 and the same year married Alice Hathaway Lee, of Boston. At the Columbia Law school, and in the office of his uncle, Robert B. Roosevelt, he prepared himself for the bar. But law did not attract him. Roosevelt joined a local political club, and his associates there guided him (1881) through his initial campaign for the State legislature. Roosevelt was in the New York assembly three years; and in 1884 became his party's candidate for speaker. He became the acknowledged leader of a small but potent group of young men who were willing to fight both in the legislature and within the Republican party to keep corrupting influences in check. As chairman of the New York delegation to the Republican convention in Chicago in 1884, Roosevelt supported the candidacy of Sen. George F. Edmunds, and vigorously opposed the nomination of James G. Blaine. When Blaine was chosen Roosevelt refused to desert the party, contending that Blaine, having been fairly nominated, had a right to the support of all loyal Republicans. For three years Roosevelt lived thereafter a ranchman's life in the Dakota territory, and wrote biographies of Thomas H. Benton and Gouverneur Morris. A call from the Republicans in New York city to be their candidate for mayor brought Roosevelt back into politics in 1886; Abram S. Hewitt, the Democratic nominee, was elected however, third.

Immediately after the election, Roosevelt, whose first wife had died in Feb. 1884 after the birth of their daughter, married Edith Kermit Carow, a friend of his childhood, and thereafter made his home at Sagamore Hill, near Oyster Bay, L.I. In 1889, President Harrison appointed him a member of the U.S. Civil Service commission in Washington, and for six years he directed the battle against defenders of the spoils system. He left the Civil Service commission in 1895 to become president of the police board of New York city. Roosevelt built up the morale of the force by substituting a system of appointment and promotion by merit and by enforcing the laws regardless of pressure. Politicians of both parties opposed him.

The election of William McKinley to the presidency brought Roosevelt back to Washington as assistant secretary of the navy. He reorganized the system of rank and promotion among naval officers, and he adjusted the differences between the "line" and the "engineers." When the United States battleship Maine was blown up in Havana harbour on Feb. 15, 1898, Roosevelt sharpened his efforts to strengthen the navy.

On the outbreak of hostilities with Spain in April, Roosevelt resigned from the Navy Department and joined with his friend, Leonard Wood, a young army surgeon, to organize the 1st U.S. Volunteer Cavalry. Roosevelt succeeded to the command of the regiment on the promotion of Wood after the first fight. In the battle of San Juan hill Roosevelt personally led the cavalry division in the assault of the Spanish outpost known as Kettle Hill and from that position, at the head of his brigade, charged across an intervening valley and up the slopes of the ridge which was the enemy's main line of defence. The advance of the Rough Riders, as they were popularly known, lacked military form and was called "the school-boy charge" by officers of the regular army who led the orderly advance of the regiments of regular infantry which captured the San Juan blockhouse. But the impetuous rush of Roosevelt and his men—joined by the 1st and 10th cavalry, all dismounted—had a reckless and exultant sweep which contributed notably to breaking the Spanish spirit.

Governor of New **York.**—The Rough Riders were mustered out of service on Sept. 15, 1898. Two weeks later, the Republican party of New York State nominated Roosevelt as its candidate for governor. Thomas C. Platt, the Republican boss, who distrusted Roosevelt as a radical of "altruistic" views, reluctantly agreed to his nomination. Roosevelt was elected by a scant majority, and remained governor for two years.

He was able to secure (1899) from Platt's own legislature, against his opposition and that of the conservative press, the important Ford Franchise Act, taxing corporation franchises. Roosevelt's administration as governor marks the beginning of an effort on his part to secure the subservience to government and law of great business combinations. Platt decided to resist Roosevelt's desire to succeed himself as governor by lifting him into the honorable seclusion of the vice-presidency. Roosevelt and his Eastern friends laboured hard to prevent his nomination, but his friends in the West, out of a real enthusiasm, played into the hands of the man who was plotting their hero's political demise. The combination proved irresistible, McKinley refused to intervene and Roosevelt was nominated. He spoke a little ruefully of having "taken the veil," and made plans to beguile the dreary boredom of the vice-presidency with the study of law.

ROOSEVELT AS PRESIDENT

President McKinley was shot in Buffalo on Sept. 6, 1901, and died Sept. 14. On the same day Theodore Roosevelt took the oath as president of the United States.

Campaign Against Financial **Interests.**—On Feb. 18, 1902, Roosevelt threw what was in effect a bomb into the financial world when he announced through his attorney general, Philander C. Knox, that he had brought suit in behalf of the United States for the dissolution of a holding corporation known as the Northern Securities Company. The announcement caused consternation among such financiers as J. P. Morgan, Edward H. Harriman and James J. Hill. The holding company was a device designed by shrewd legal minds to evade the restrictions of the Sherman anti-Trust act of 1890, and was generally regarded as impregnable. In the Knight case (1895) involving the American Sugar Refining Company, the Supreme Court had, in fact, held that Congress was without constitutional power to forbid it. On April 9, 1903, however, the U.S. circuit court, sitting at St. Louis, ordered the dissolution of the Northern Securities Company; and on March 14, 1904, the Supreme Court affirmed the decree.

The anthracite coal strike in 1902 brought the menace of popular unrest to the surface. The miners, under the leadership of John Mitchell, were insistent in their demands; the operators led by J. P. Morgan and George F. Baer, president of the Philadelphia and Reading Railway, were obdurate. Roosevelt for the first time asserted the right of the President to act as representative of the public in an industrial dispute. The miners agreed to arbitrate, but the operators were indignant at the President's "interference" in what they regarded as their private concern Roosevelt saw clearly what the operators failed to see, that the labour problem had entered upon a new phase; that the growth of industry necessitated a new approach to the questions affecting it; that the public was in no mood to suffer for the inability of the operators to recognize the parity of human rights with the rights of property, and that in a winter of coal famine lay the possible beginnings of irreparable discontent. After a long-drawn struggle he succeeded in impressing these views upon the operators.

The initiation of the Government's suit against the Northern Securities Company marked the beginning of a conflict between Roosevelt and the large financial interests which continued unabated throughout his administration and for years thereafter, until the outbreak of the World War (1914) brought a shift of issues and a truce. The business leaders were convinced that the President was a destroyer, and was shaking the foundations of the social structure and undermining the institution of private property. His objection, in regard to corporations, as he frequently pointed out, was not to size but to wrongdoing. In swift succession, the President ordered suits brought against the United States Steel Corporation, the Standard Oil Company, the American Sugar Refining Company and other powerful combinations. Meanwhile, he inspired important legislation involving the regulation of railroads. The Elkins law (Feb. 19, 1903) forbade rebates; the Hepburn rate bill (June 29, 1906) granted the interstate commerce commission the right to fix railroad rates. A Pure Food bill, forbidding the manufacture, sale or transportation of adulterated foods, drugs, medicines and liquors, became law on June 30, 1906; the fbllowing day another act, providing for the inspection of stockyards and packing-houses, was signed by the President. An Employers' Liability act was adopted. A department of commerce and labour, including a bureau of corporations, was established by congressional action on Feb. 14, 1903. President Roosevelt strengthened his position in reference to the excesses and transgressions of corporations by setting himself with equal firmness against the violence of labour agitation. He noted that the hunger for special privilege was not limited to the ranks of capital. He was by nature sympathetic to the labouring man and scrupulously fair to his interests, but struck at him fearlessly when he thought he was wrong, linking two advocates of violence in the ranks of labour on one occasion with a law-dodging railroad magnate, as "undesirable citizens."

Conservation.—Early in his administration, with the purpose of breaking the strangle-hold of a small minority on the sources of wealth which should be open to the honest endeavours of all the people, the President—under the guidance of Gifford Pinchot—embraced the policy of conservation. The established theory in regard to the national resources was that the general prosperity of the country could best be advanced by the development of these resources by private capital, and upon this theory land was either given away or sold for a trifle. Under this policy, over wide areas, the timber-lands had been stripped bare with reckless waste; the control of the nation's water power had to a dangerous extent passed into private hands; and the public grazing lands and the wealth in minerals and oil in the public domain were bringing enormous dividends to a few, but no returns whatsoever to the people as a whole to whom these natural resources belonged.

Under Roosevelt's administration the area of the national forests was increased from 43 to 194 million acres, the water power resources of those areas were put under government control to prevent speculation and monopoly, and cattle-raisers grazing their herds on the reserves were forced to pay for what they got. In March 1907 Roosevelt created the Inland Waterways commission, and in May 1908 held a conference of State governors at the White House in behalf of conservation. As a result of this conference he appointed a national conservation commission to prepare an inventory, the first ever made for any nation, of all the natural resources within the territory of the United States. A joint Conservation Congress held in Dec. 1908 was followed by a North American Conservation conference in Feb. 1909. The movement for the reclamation of land either excessively or insufficiently watered was essentially a part of the effort in behalf of conservation. It received congressional sanction in the Reclamation Act (June 17, 1902) and achieved its most noteworthy result in the building of the Roosevelt dam in

Arizona, which, by impounding the waters of the Salt river, turned a desert into one of the most fertile farming districts in the world. No policy of Roosevelt's administration excited deeper public interest or sharper opposition than his efforts in behalf of conservation. His official acts and the influence of his speeches and messages led to the adoption by both citizens and government of a new theory regarding natural resources. It is that the Government, acting for the people who are the real owners of public property, shall permanently retain the fee in public lands, leaving their products to be developed by private capital under leases which are limited in their duration and which give the Government complete power to regulate the industrial operations of the lessees.

Re-election.—The popularity which Roosevelt enjoyed at the end of his first term found emphatic expression in the election of 1904. By the largest majority which, up to that time, had been accorded any candidate, Roosevelt was chosen to succeed himself in the White House, receiving 7,623,486 popular votes and 336 electoral votes, against 5,177,971 popular votes and 140 electoral votes cast for Alton B. Parker, the Democratic nominee.

Foreign **Policy.**—Roosevelt's warfare with the forces popularly symbolized as "Wall Street" was punctuated at intervals during his administration by actions in the realm of international relations which greatly stimulated national pride. The President was brilliantly assisted in his conduct of foreign affairs, first by John Hay and then by Elihu Root, but he was in reality his own Secretary of State. His policy in regard to the army and navy was a highly important part of his foreign policy. He believed in the virtue of being ready as a preventive of war, pointing out the results of unpreparedness in the preface to his first book, ***The*** *Hzstory of the Naval War of 1812* (1882), and urging an effective army and navy in many of his later writings. He increased greatly the general efficiency of the army. His promotion of officers for merit in defiance of the rules of seniority and his order directing officers to demonstrate their ability to ride go m. in three successive days caused some criticism, especially in the more conservative element in the army. Roosevelt's services as Assistant Secretary of the Navy contributed vitally to the distinguished success of the American fleets during the Spanish War. As President he sought with great persistence to build up the navy's power and to make it as effective as possible, giving younger and more progressive officers the prestige of his support in their struggles within the service. When in 1907 he sent the battleship fleet around the world—against the advice of experts in naval construction—he did so partly to call the attention of the great powers, notably Japan, to the fighting strength of the United States, and partly to dramatize the navy and its needs to the American people. The voyage was brilliantly successful.

The attitude of Roosevelt in foreign affairs as in domestic was frank, clear-cut and firm. He knew the involutions of international politics in the Old World as no American president before him had known them, and he countered and checked his subtle opponents in diplomacy with skill and relish. He was bold—startlingly bold at times—but never reckless, calculating costs in advance, saying unambiguously what he had to say and taking account of the human equation. His handling of the German emperor in the matter of Venezuela in 1902 was so firm and so courteous that the emperor became his devoted admirer even though he recalled the ambassador who had failed to warn him that the President meant what ne said. His action in regard to an old dispute with Great Britain over the boundary of Alaska was equally friendly and effective.

Swift and vigorous was his action (1903) in sending a cruiser to Panama immediately following its secession from Colombia. He was one of the first Americans to apprehend the part which the Pacific was destined to play, both commercially and politically, in world history. The long delay, moreover, during the Spanish War, in bringing one of the navy's greatest battleships, the *Oregon,* from the Pacific coast of the United States to the Atlantic, had convinced Roosevelt of the urgent need, if only for strategic reasons in the event of war, of a canal across the Isthmus of Panama. When, therefore, after years of fruitless negotiations, the opportunity came to him to acquire for the United States the right to build the canal, he acted promptly, convinced that to do otherwise was to invite a new and dangerous succession of postponements.

The charge was made that President Roosevelt had encouraged or even fomented the revolution in Panama; but no evidence has been produced to give the accusation the slightest support. Roosevelt's boast (1911) "I took Panama," must, moreover. be considered in conjunction with a phrase he added at the semi-jocose request of a French engineer who himself claimed the credit and the responsibility for the insurrection—"when Bunau-Varilla handed it to me on a silver platter." Roosevelt's leadership in the actual construction of the canal was of vital significance. When private engineers failed in the task, he appointed an army engineer, Col. George W. Goethals, as head of the Canal commission with autocratic powers. He broke the precedent which was supposed to prevent an American president from leaving the territory of the United States during his term of office in order to inspect the work and encourage the workers.

Roosevelt approved and eloquently defended the policy of national expansion adopted by the Government under President McKinley. Aside from the acquisition of the Canal Zone, however, he made no move to acquire further territory for the United States. To the surprise of Europe, he carried out the provisions of the American pledge not to annex Cuba, and launched that long-oppressed people as an independent republic under the protection of the United States but not under its Government. By assuming supervision of the finances of San Domingo he put an end to controversies in that unstable republic which threatened to disturb the peace of Europe.

Roosevelt's action in bringing about peace between Japan and Russia in 1905 added greatly to his prestige at home and abroad. Portions of Roosevelt's papers, published since his death, reveal the extent to which international politics on the Continent were involved in a struggle which appeared to be localized in the Orient and indicate that it was Roosevelt's intervention which prevented in 1904 and again in 1906, during the Algeciras Conference, the outbreak of the World War which actually came in 1914. The Nobel Prize committee recognized his services in ending the Russo-Japanese War by conferring upon him in 1906 its award for the promotion of international peace. In accepting the honour in an address at Christiania in 1910, he suggested the possibility of a League of Nations for the prevention of war. He was the first to send an international controversy for settlement to the International Court of Arbitration at The Hague and was instrumental in having the Second Hague Conference called. He was opposed, however, to peace treaties which promised more than human nature could be counted upon to fulfil, and had no patience with any policy remotely resembling "peace at any price."

His administration had a profound effect on the national prestige of his country. He found the Government of the United States, when he took up the reins, in the position among world powers of a new boy in school; he left it firmly established in the first rank, admired and feared, its favour sought after, its citizenship respected in the remotest corners of the globe.

Home Affairs.—In domestic affairs his influence was even more far-reaching. His success in drawing the leaders on both sides of the social and economic struggle back from the danger zone where extremes meet in violent disturbance was possible only because he had to an unprecedented degree the support of the public, regardless of party. His vigour, his courage, his abounding vitality, his lack of presidential pomposity, his familiarity with all manner of men, even his loudness of action or utterance, and his undisguised delight in driving the "band wagon," all endeared him to "plain folks." He entered into men's lives, kindled fires in them, impelled them to scorn ease and safety and rejoice to do the fine, the difficult thing. His power to inspire his followers to take a pride in their country and her welfare brought to his side hundreds of young men of ability, who asked no greater privilege than to serve under him in an enterprise which in its details was prosaic enough but which he had somehow invested

with the spirit of high adventure. The President gave them work to do in the Federal departments and in the island possessions. Their high quality impelled the British ambassador, James Bryce, an acute observer of governments, to remark to Roosevelt that he had "never in any country seen a more eager, high-minded and efficient set of public servants, men more useful and creditable to their country, than the men then doing the work of the American Government in Washington and in the field." Roosevelt had, indeed, the gift of stimulating men to raise themselves for the moment above the ordinary level of their abilities and their desires.

SCIENTIFIC EXPEDITIONS AND TRAVELS

In March, 1909, Roosevelt retired from the Presidency. He adhered to a pledge which he had made after his election in 1904 not to accept the nomination for the Presidency in 1908, and gave his support to the candidacy of William H. Taft, his Secretary of War. Taft was nominated and elected. On April 23, 1909, Roosevelt, accompanied by his son Kermit, sailed for Africa on a scientific expedition under the auspices of the Smithsonian Institution in Washington.

Africa.—Roosevelt entered Africa at Mombasa, and for ten months, moving slowly northward, he hunted big game and collected specimens. He was a keen naturalist, accepted by scientists in his field as a trustworthy observer who had added substantially to the study of American fauna. He had a memory which all who came in contact with him agreed was astonishing in its tenacity and accuracy; and for one who had given only the off-hours of a busy life to scientific study, his knowledge was wide and thorough; but he recognized its limitations and humbly yielded to instruction.

Roosevelt emerged from the wilderness at Gondokoro at the end of Feb. 1910. Nothing showed better the fascination which he exercised over the imaginations of men the world over than the interest which his reappearance created. An address at Khartum on orderly government created a mild stir, but another address, delivered before the students of the University of Cairo, denouncing the assassination by nationalists of the pro-British premier, Boutros Pasha, brought him threats of assassination.

Europe.—Roosevelt's journey northward was in the nature of a triumphal procession. An official at the Vatican precipitated an unpleasant situation by stipulating certain conditions for an interview with the Pope, but Roosevelt's refusal to permit any limitation on his freedom of action was direct and emphatic. In Paris he made a public address at the Sorbonne on "Citizenship in a Republic," in Berlin he spoke at the University on "The World Movement," and, at the emperor's side, reviewed the Imperial Guard, the first civilian who had ever reviewed German troops.

Before he reached England, the king. Edward VII, died, and when Roosevelt arrived in London it was as President Taft's special ambassador to the funeral. His Romanes lecture at Oxford on "Biological Analogies in History" was widely praised, but a speech at the Guildhall in London in which he criticized what appeared to him as the timid ineptitude of the British Government in Egypt brought sharp rebukes from both sides of the Atlantic, but had the endorsement of the new king and of his Foreign Secretary. The address had certain momentous consequences in the appointment of Lord Kitchener as consul general to Egypt (in effect, governor) and the strengthening of a British position which, through its control of the Suez canal and the road to India, became of vital importance to the British Empire on the outbreak of the World War four years later. What remained to Englishmen, however, as the most striking memory of Roosevelt's stay in England, was the walk he took through the New Forest with Sir Edward Grey, when he proved that, though he had spent less than a month altogether in England since his boyhood, he could identify every bird which he saw or heard.

THE RETURN TO POLITICS

Roosevelt returned to the United States on June 18, 1910, disembarking at New York, and received a tumultuous welcome. He had already been put in touch with the political situation. The struggle between the conservative and the progressive elements in the Republican party, which under Roosevelt had remained under the surface, had, under President Taft, developed into what threatened to become a definite schism. A new tariff law, the dismissal of certain commissions which Roosevelt had appointed, the President's position in a bitter controversy regarding western lands, and the general mood of the Administration led Roosevelt to believe that Taft, instead of carrying forward the policies of the former administration, was definitely aligned with their opponents.

Security for Roosevelt and his fame lay in his retirement to his home acres as a kind of national sage; but at the request of the governor of New York, Charles Evans Hughes. he plunged into a factional fight within the Republican Party in the State (1910) and was sharply defeated. In numerous addresses in many parts of the country, however, and in the columns of the *Outlook*, a weekly periodical of which he was "contributing editor," Roosevelt carried forward his fight for what he called the new nationalism; a struggle for "social justice and popular rule," the control by the people of their political instruments and their government for the purpose of providing a condition approximating equality of opportunity. "The new nationalism" was denounced as revolutionary; it was, in fact, essentially conservative, seeking, as it did, merely a reinvigoration of established American institutions. Certain mildly radical expedients which it proposed were: the recall of elective officers by popular vote, the referendum, intended to make the legislatures more directly responsive to the popular will, and the direct primary. The recall of judicial decisions, advocated by Roosevelt as a check on the reactionary tendency of the judiciary in its function as the interpreter of the constitution, frightened the conservatives. As the struggle between the two factions in the Republican Party became increasingly bitter, pressure was brought to bear upon Roosevelt to declare himself a candidate for the presidency; and on Feb. 25, 1912, to use his own phrase, he "threw his hat in the ring."

It was not in Roosevelt's nature, once he had entered a struggle of any sort, to strike with cushioned gloves. The quarrel between Roosevelt and Taft, brought into the open by the contest for delegates, proved distressing alike to the friends of the protagonists and to the general public. In the 13 States where presidential primaries were held, the result, however, gave evidence that the majority of the Republican voters wanted him as their candidate; for of 362 delegates thus selected, 278 favoured Roosevelt and 48 Taft. The President's strength, in fact, came largely from States which cast a very small Republican vote and in which the control of the political machinery was in the hands of the office-holders. In many cases, the progressive voters named protesting delegations who appeared before the Republican National Committee in Chicago before the convention met (June 22, 1912) to claim the seats which they declared had been fraudulently assigned to their rivals. By a margin of 15 votes—which were offered to Roosevelt, but on terms which he felt he could not accept—the convention was organized by his opponents.

In the stirring events of the convention—though not in the hall itself—Roosevelt played the dominant part. He was ready to agree on a compromise candidate, but only on condition that the rolls of the convention be purged of those delegates who, he insisted, had been fraudulently seated. The convention nominated Taft, and the defeated elements, under the leadership of Roosevelt, formed the Progressive Party. Its first convention, held in Chicago early in August, proved unique in American political history in the fact that women were admitted as delegates. Roosevelt announced the principles of his party, demanding what he had fought for throughout his presidency—the control of the government and the resources of the United States by the people rather than by the professional politicians and financiers; asking, in effect, for a return to fundamental principles. On Aug. 7, the convention nominated Roosevelt for president and Hiram Johnson of California, for vice-president. The Democrats, meanwhile, meeting in Baltimore, had nominated Woodrow Wilson for president. During the campaign, both Wilson and Taft concentrated their artillery on Roosevelt. At the height of the campaign,

on Oct. **14,** Roosevelt was shot by a maniac in Milwaukee as he was getting into the automobile which was to take him to the hall where he was to speak; he insisted, however, on making his address and it was an hour and a half before he consented to be taken to a hospital. In the election, Wilson received 435 electoral votes, Roosevelt 88 and Taft 8 The popular vote was 6,293,097 for Wilson; 4,119,507 for Roosevelt; 3,484,956 for Taft, and 901,873 for the Socialist candidate, Eugene V. Debs.

RETIREMENT

Roosevelt had expected defeat and it brought no bitterness. He returned to his editorial work on the *Outlook,* wrote his ***Autobiography*** and only interrupted the life of a country gentleman to move upon a little town in Michigan with a score of "character witnesses" in May, 1913, to confound the editor of a magazine called *Iron Ore* who had rashly put in print a charge widely current, that the ex-president was occasionally or, in fact, frequently, drunk The defendant admitted that he had combed the country in vain for witnesses to substantiate his charge, acknowledged his error and paid the six cents in damages which was all Roosevelt would accept.

In the autumn of 1913, Roosevelt went to South America to address numerous learned bodies and to secure specimens in the jungles of Brazil for the American Museum of Natural History. His journey from capital to capital—a repetition of his triumphal progress through Europe—belied the theory that his action as President regarding Panama had angered the South American peoples. At the suggestion of the Brazilian government and accompanied by a gallant Brazilian explorer, Col. Candido Rondon, he set out to determine the course of a hitherto unknown river, vaguely indicated on existing maps as the River of Doubt. The journey of 900 m. through primeval wilderness was arduous and full of peril, with death by starvation awaiting the expedition if it went too slow; and death in the rapids waiting if it went too fast Canoes were crushed in the treacherous waters; supplies were lost; fever made sharp inroads. Finally Roosevelt himself was taken desperately ill, but he struggled forward, until at last, when disaster seemed inevitable, the party reached civilization at the confluence of the river they had charted with the Madeira, a tributary of the Amazon. In honour of the exploit the Brazilian government christened the stream the Rio Roosevelt.

The World War.—He returned to the United States in May 1914 Early August brought the catastrophe in Europe which, as President, he had foreseen and postponed. His sympathies were with France and England, for he distrusted the German emperor whose imperious and unstable mind had during his presidency caused him frequent irritation and anxiety; but he maintained for a few weeks a neutrality in utterance if not "in thought," which he later regretted. But before September was over, he was once more in the centre of public discussion and debate. He saw earlier than the leaders of the administration in power that America could not remain untouched by the gigantic struggle, since any disturbance of the existing balance of power would have a profound effect not only on the foreign relations of the United States but on the personal lives of the American people. America could afford to see England, France and their allies win, but she could not afford to see Germany win, for a German victory implied an aggressive neighbour in Canada and in the Caribbean and the adoption by the United States of the European condition of an "armed peace." He wanted America to enter the war on the side of the Allies because he was convinced that if she did not accept the gage of battle at that time, she would have to accept it later under less favourable conditions. He pleaded for preparedness, but he went beyond the immediate need to what he was convinced was the ultimate necessity—an international tribunal backed by force to execute its decrees. He attacked the divided allegiance—"fifty-fifty Americanism" was his phrase—which permitted certain Americans of German origin to praise all things German at the expense of the American institutions under which they lived; but at the same time he pleaded for justice for the German-American who kept his head and was loyal.

The destruction of the *Lusitania* by a German submarine brought from Roosevelt a scathing denunciation of German methods of warfare, and successive attacks on what seemed to him the timid and inept statesmanship of the Wilson administration. There was a kind of berserker fury in these attacks. Between himself and his opponents in power he kne no middle ground of compromise and party truce; the issues that divided him from them were to his mind not political but moral. It seemed to him that Wilson was deliberately lulling the public into **a** sense of false security, permitting it to dissipate its spiritual energies in an orgy of acquisition while their president set about with gestures and phrases to exorcise an opponent both aggressive and armed. Once more Roosevelt appealed to the public conscience, and stirred it as never before.

In this last struggle of a stormy life, he rose to what seemed to many of his countrymen new heights of devotion, as he pleaded for the defence of those institutions which he had as president himself revitalized. "Let us pay with our bodies for our souls' desire!" The shift of issues had brought to Roosevelt's support many of the men who had been his bitterest enemies, and early in 1916 he was put forward as a candidate for the Republican nomination for president. He warned the public that he must not be nominated unless the nation were in an "heroic mood." An effort was made by the Progressives to persuade the Republicans to join them in nominating Roosevelt, but the majority of the Republican delegates were not ready to forgive the schism of 1912, and his suggestion that Gen. Wood be named as a compromise candidate never reached the convention. Roosevelt refused the nomination of the Progressive Party, and gave the Republican nominee, Charles Evans Hughes. his support.

When the United States entered the war in April 1917, "the Colonel," as he was affectionately known, offered to raise a division of volunteers from among the ranks of the "outdoor men" of the country who would be almost immediately ready for service; 250,000 men recorded their desire to go under his leadership to France and Congress passed a bill authorizing the creation of two divisions of volunteers, but the President refused his consent. "This is a very exclusive war," Roosevelt remarked, "and I have been blackballed by the committee on admissions" His four sons all went to the front; two were wounded, one Quentin, the youngest, a lieutenant in the Air Service, was killed in combat over the German lines. Roosevelt, forbidden to fight in the field, grimly and in bitter disappointment flung himself into the work that lay at hand. Here and there over the country he spoke for the Liberty Loan campaign. for the Red Cross and other relief agencies, and in the pages of the Kansas City *Star* and the *Metropolitan Magazine* fought week after week for speed in military preparation, for an honest facing of facts and for whole-hearted and unreserved participation in the war by the side of the allies, greeting the Administration's satisfaction over the "happy confusion" of the war preparations with words of stinging realism.

The fever he had contracted in Brazil returned now and again. For weeks he travelled and made public addresses in spite of it. In Feb. 1918, however, he became dangerously ill; was operated upon, recovered, returned to his full activity and was again laid low. His illness scarcely abated his ceaseless activity and in nowise seemed to weaken the force of his fighting spirit. At no previous period in his career was his following so large or so devoted. It seemed as though, in the intensity and grief of the war-years, his countrymen turned to him with new understanding and affection. While scholars talked of this or that notable act of an administration which was already acquiring a kind of glamour in the perspective of a decade, the common man called him "the great American" and let others analyse why. He died in his sleep on Jan. 6, 1919.

Character and Influence.—It can be said of Washington that he founded the American nation, and of Lincoln that he preserved it; it can be said of Roosevelt that he revitalized it. Twice, at critical times, through his vision, his ardour, his effective anger, his faith in American institutions and his peculiar understanding of all sections of the American people, he cleansed the body of the nation of treacherous poisons, and set its soul to work on labours

higher than the acquisition of physical comforts. He dreamed nobly for his country and impelled millions of his countrymen to dream nobly. Roosevelt was one of the most versatile presidents of the United States. In addition to his talents as a politician, statesman and popular leader, he was eminent as naturalist, soldier, orator, historian; and was one of the most widely-read men of his time. *The Winning of the West* has faults of hasty composition inevitable in a book written in the off-hours of a crowded life, but it maintains its authority; his *Naval History of the War of* **1812** has not been supplanted as the leading work on the subject. He was an assiduous and occasionally a brilliant writer. His narratives are lucid and swift, his descriptions full of colour and significant detail, his literary criticism straightforward and free from the jargon of the craft. His letters have taken a high place in epistolary literature; his volume of *Letters to his Children* is already a classic. His political writings, moreover, are direct and clear, open to the most untutored intelligence, and flashing at intervals with arresting epithets. Under the stress of emotion, in some of the prefaces of his hunting books, in a descriptive passage here and there—in his appeal, for instance for imagination in the writing of history—his prose became transmuted into the gold of poetry.

"A man who could do so much could not do everything perfectly, though few have ever done so many things so well," wrote his friend Albert Bushnell Hart *(Encyclopedia Britannica,* 12th edition). "It was more true of him than of most men that his defects were inherent in his virtues. There were few half-tones in Roosevelt's moral perceptions and fewer in his vocabulary; he saw things as either black or white, and he forgot sometimes that he had not previously seen them as he saw them at the moment. . . . The very intensity of his convictions sometimes blinded him to the sincerity and even to the justice of other points of view. Nevertheless, this intensity, this moral fervour, gave his ideas a momentum and a success which they could never have acquired had they proceeded from a more judicial mind. He scorned 'weasel words,' and on occasion he did not hesitate to describe his enemies as thieves and liars. His remarkable energy reminded observers of some great elemental force which, like any natural phenomenon, is controlled by its own necessary laws."

Writings.—Theodore Roosevelt's published works, including books, pamphlets, addresses, campaign speeches, contributions to the books of others, translations and periodical articles, number between two and three thousand titles and date from 1877 to his death. During his life Theodore Roosevelt wrote not less than 150,000 letters, most of which were included with the Roosevelt papers in the Library of Congress in Washington, and there are a great number of published works dealing with his colourful life. There have been many collections of Roosevelt's works, including the Memorial edition, 24 vol. (1923–26); and the National edition, 20 vol. (1926).

Roosevelt's principal works are: *Naval War of* **1812** (1882); *Hunting Trips of a Ranchman* (1885); *Thomas Hart Benton* (1887); *Gouverneur Morris* (1888); *Ranch Life and the Hunting Trail* (1888); *Winning of the West,* 4 vol. (1889–96); *New York* (1891); *Wilderness Hunter* (1893); *Hero Tales from American History* (with Henry Cabot Lodge) (1895); *American Ideals* (1897); *Rough Riders* (1899); *Oliver Cromwell* (1900); *Outdoor Pastimes of an American Hunter* (1905); *African and European Addresses* (1910); *African Game Trails* (1910); *New Nationalism* (1910); *Realizable Ideals* (1912); *History as Literature* (1913); *Progressive Principles* (1913); *Autobiography* (1913); *Through the Brazilian Wilderness* (1914); *Life Histories of African Game Animals* (with Edmund Heller) 2 vol. (1914); *America and the World War* (1915); *Book-lover's Holidays in the Open* (1916); *Fear God and Take Your Own Part* (1916); *Foes of our Own Household* (1917); *Great Adventure* (1918); *Theodore Roosevelt's Letters to his Children* (1919); *Theodore Roosevelt and his Time Shown in his Own Letters,* Ed. by J. B. Bishop, 2 vol. (1920); *Roosevelt in the Kansas City Star* (1921); *Letters to Anna Roosevelt Cowles* (1924); *Selections from Correspondence of Theodore Roosevelt and Henry Cabot Lodge* (1925).

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ROOT, **ELIHU** (1845–1937), American lawyer and political leader, was born at Clinton (N.Y.), on Feb. 15, 1845. He graduated at Hamilton college where his father was a professor in 1864, taught at the Rome (N.Y.) academy in 1865, and graduated at the University Law school, New York city, in 1867. As a corporation lawyer he soon attained high rank and was counsel in many famous cases. Politically, he became identified with the reform element of the Republican Party. He was U.S. attorney for the Southern District of New York (1883–85), and a delegate to the State Constitutional Convention of 1894, acting as chairman of its judiciary committee. From Aug. 1899 until Feb. 1904 he was secretary of war in the cabinets of Presidents McKinley and Roosevelt, and in this position reorganized the army and created a general staff, and in general administered his department with great ability during a period marked by the Boxer uprising in China, whither troops were sent under Gen. A. R. Chaffee, the insurrection of the Filipinos, the withdrawal of U.S. troops from Cuba and the establishment of a government for the Philippines under a Philippine Commission, for which he drew up the "instructions," in reality comprising a constitution, a judicial code and a system of laws. In 1903 he was a member of the Alaskan Boundary Tribunal. In July 1905 he re-entered President Roosevelt's cabinet as secretary of State, where he considerably improved the consular service. In the summer of 1906, while attending the Pan-American Conference at Rio de Janeiro, he was elected its honorary president, and during a tour through the Latin-American republics, brought about a better understanding between the United States and these republics. In general he did much to further the cause of international peace, and he concluded treaties of arbitration with Japan, Great Britain, France, Italy, Spain, Portugal, Austria-Hungary, Switzerland, Norway, Sweden, Denmark, Holland and other countries. Upon his resignation from the cabinet he was elected, in Jan. 1909, as U.S. senator from New York. In 1910 he was chief counsel for the United States before The Hague Tribunal for the arbitration of the long-standing dispute concerning fisheries between his country and Great Britain. Upon his return, he was appointed by President Taft a member of the Permanent Court of Arbitration. In the same year he was elected president of the Carnegie Endowment for International Peace. Root thus took up again the work which he had initiated when secretary of State, and became the recognized leader of the peace movement in the United States. In 1912 he was awarded the Nobel Peace Prize. He strongly supported in the Senate the treaty of obligatory arbitration concluded between the United States and Great Britain in 1912, but failed to prevent amendments to the treaty being inserted by the Senate which prevented an exchange of ratifications.

He took a leading part in the passage of the Federal Reserve bill of 1913, providing for a Federal Bank under Federal control, in order to stabilize the finance of the country. In matters of foreign policy also his opinion had great weight. In 1915 a treaty negotiated by Secretary of State Bryan with Colombia provided for payment by the United States of $2 5,000,000 to Colombia in settlement of all outstanding claims between the two countries

arising out of the independence of Panama; Mr. Root opposed ratification, principally because a statement of regret on the part of the United States had been inserted in the preamble, though he also considered the sum too much. His opinion prevailed, and later on, in 1922, when the Senate finally ratified the treaty, the clause in question was omitted.

On March 4, 1915, his term as senator expired and he declined to be a candidate for re-election. That summer he was president of the New York State Constitutional Convention, and advocated, among other measures, the short ballot, means for remedying the law's delays, the reduction of costs involved in the administration of justice and measures which would facilitate the impeachment of unworthy public officials. After the declaration of war by the United States, on April 6, 1917, he gave his whole support to the Government. He was asked by President Wilson to head the mission which was sent to Russia shortly thereafter with a view to encouraging the Revolutionary Government under Kerensky to carry on the war with vigour. He accepted, but while in Russia the overthrow of the Moderates there by the Bolsheviks under Lenin frustrated the purposes of his mission.

At the conclusion of the war, though not a member of the U S. Mission to Paris to conclude peace, his advice was requested in the matter of the Covenant of the League of Nations and his views prevailed to a certain extent. To the Covenant as actually drafted, however, he was opposed. He was, nevertheless, of the opinion that the Covenant and the Treaty of Versailles should be accepted with reservations, to secure the interests of the United States, inasmuch as the President's re-election in 1916 and his presence as negotiator at Paris had led the other plenipotentiaries, however erroneously, to believe that he represented the opinion of his fellow countrymen. In Mr. Root's opinion it would be better to accept the Covenant with reservations, and by subsequent amendments to remove the obstacles which had originally stood in the way of its acceptance.

He accepted an invitation from the League of Nations to become a member of the Advisory Committee of Jurists which met at The Hague in 1920 for the purpose of devising a plan for a permanent court of international justice, in accordance with Art. 14 of the Covenant. His presence enabled the committee to frame a plan acceptable to all by which the judges were to be elected by the separate and concurrent action of the Council (in which the Great Powers had a preponderance) and the Assembly (in which the Small Powers were in a majority), each interest, real or alleged, having thus a veto upon the abuse of power by the other. The plan was accepted with modifications by the Council and Assembly on Dec. 14, 1920, and became the statute of the court. It functioned perfectly when the judges were elected in 1921.

Root was appointed by President Harding one of the U.S delegates to the International Conference on Armament Limitation, which met at Washington in Nov. 1921. There he secured the adoption of the convention subjecting submarines to the requirements of surface vessels and prohibiting the use of noxious gases in warfare. He devised the Pacific agreements which resulted in the cancellation of the Anglo-Japanese alliance, and drafted the Four Power Pacific Treaty, which took its place. In Jan.. 1929, he accepted an invitation to be a member of a committee of jurists meeting at Geneva to test and revise the original statutes of the Permanent Court of International Justice in the light of eight years' experience. He participated in every session held for this purpose and offered valuable suggestions. His main work, however, was the working out of a formula upon which the United States might see its way clear to become a member of the court. This Root protocol, as redrafted by Sir Cecil Hurst, was unanimously accepted by the committee of jurists, and was intended to replace the protocol of Sept. 23, 1926 drawn up in answer to the American Senate reservations The changes made were only in the article on advisory opinions and were held to be favourable to the United States. The hope was general that the Cnited States Senate would act favourably after the report of the committee had been formally accepted by the League Council, but the Senate rejected it. Mr. Root died Feb. 7, 1937.

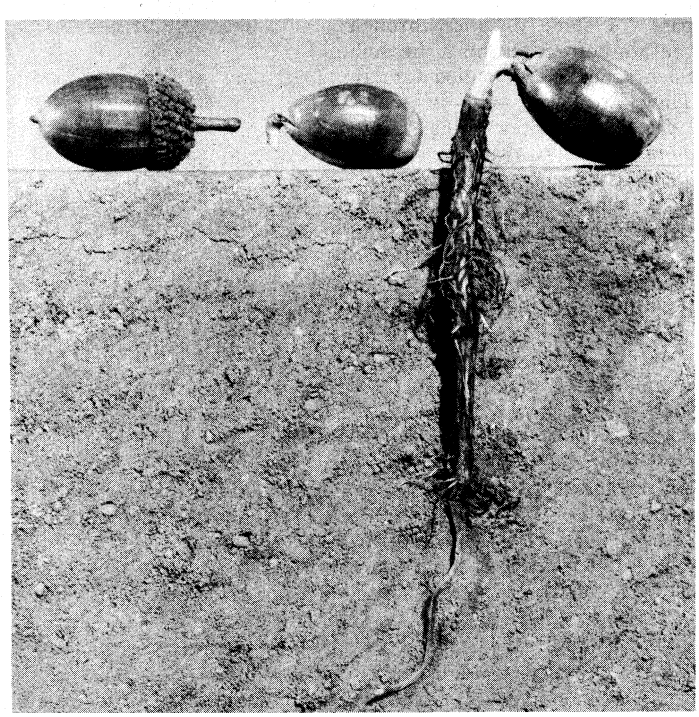
A collection of Root's public addresses has been edited by Robert Bacon and James Brown Scott in eight volumes. He also published *Experiments* in *Government and the Essentials of the Consztutzon* (Princeton Lectures, 1913) and *American Ideals During the Past Half Century* (International Conciliation, no. 210, 1925).

ROOT, in popular usage. the part of the plant which is normally below the surface of the earth. Botanically its application is more restricted, for many plants develop subterranean structures that are in reality specialized stems (rhizomes. tubers, corms) The root is distinguished from such underground stems by not bearing leaves and by having its apex enclosed by a cap (rootcap) which protects the actively dividing cells of the growing point or meristem. There are also structural differences which distinguish roots from stems. The most important of these is the manner in which lateral members or offshoots originate and the arrangement and development of the primary vascular or conducting tissues (xylem and phloem). (For internal structure see PLANTS AND PLANT SCIENCE: *Anatomy* of Plants.)

Not all plants have true roots; they are lacking in thallophytes (algae and fungi) and bryophytes (mosses and liverworts), although some of these lower plants develop organs (rhizoids) which perform some of the functions of roots. Phylogenetically the root is associated with the evolution of the sporophytic generation in the higher land plants. They occur in pteridophytes (ferns and their allies) and spermatophytes (seed plants).

The primary function of the root is absorption of water and inorganic salts in solution and the conduction of these to the stem, but it also affords anchorage and support and frequently serves for storage of reserve foods. In some instances it may function in vegetative (asexual) reproduction and in special cases (some aerial and aquatic roots) may carry on photosynthesis — a function usually carried out in the leaves. The root usually develops root hairs. slender unicellular outgrowths formed by the lateral extension of cells of the outer layer (epidermis). These serve to increase the absorbing surface of the root and bring it into intimate relationship with the soil particles. The older root hairs generally die — rarely some are persistent — so that the active zone of root hairs usually lies just back of the apex of the root.

When the seed germinates, the primary root or radicle is the first organ to appear. It grows downward through the soil, anchoring the seedling and establishing contact with the soil. Secondary roots, which often repeat the form and structure of the main root, are developed in regular succession from above downward (acro-



JOHN H GERARD

FIG. I.—ROOT DEVELOPMENT OF THE WHITE OAK (QUERCUS ALBA)

petal), and because they originate in a definite position in the interior of the root (generally opposite the xylem masses) they develop in longitudinal rows and must penetrate the overlying tissue of the parent root. True forking of the root (dichotomy) occurs in the Lycopodiaceae (club moss and fern allies) but not in higher plants.

In addition to the main root and its acropetal outgrowths are adventitious roots, which may arise on any part of a plant. They are especially numerous on underground stems, such as the underside of rhizomes, and also develop from stems under favourable conditions such as moisture and absence of light; a young shoot or a cutting placed in moist soil may quickly form adventitious roots. This ability of many plants to develop adventitious roots from stems is widely used in horticulture as a means of vegetative propagation to ensure the production of plants that resemble the parent stock. It is also a rapid method of propagation in the case of slow-growing woody plants. Adventitious roots may also arise from leaves under similar conditions—for instance: from begonia leaves planted in soil.

The form of a root depends on its shape and mode of branching. When the central axis goes deep into the ground in a tapering manner without dividing, a taproot is produced. This kind of root is sometimes short and becomes swollen by storage of foodstuffs, as in the conical root of carrot, the fusiform or spindle-shaped root of radish or the napiform root of turnip. In some forest trees the first root protruded continues to elongate and forms a long primary root axis from which secondary axes arise. In many plants, especially monocotyledons, the primary axis soon dies and the secondary axes take its place. When the descending axis is very short, and at once divides into thin. nearly equal fibrils, the root is called fibrous, as in many grasses; when the fibrils are thick and succulent, the root is fasciculated, as in the sweet potato. dahlia. *Ranunculus ficaria* and Oenanthe crocata. Some so-called roots are formed of a stem and root combined. as in *Orchis,* where the tuber consists of a fleshy, swollen root bearing at the apex a stem-bud. As in the stem, growth in length occurs only for a short distance behind the apex, but in long-lived roots increase in diameter occurs continually in a similar manner to growth in thickness in the stem.

Roots are not invariably underground. In some cases where they arise from the stem they pass for some distance through the air before reaching the soil. Such roots are called aerial. They are seen well in maize (Zea), the screw pine (Pandanus), the banyan (*Ficus indica*) and many other species of Ficus, where they eventually assist in supporting the stem and branches. In the mangrove they often form the entire support of the stem, which has decayed at its lower part. In tree ferns they form a dense coating around and completely conceal the stem; such is also the case in some Dracaena and palms. In epiphytes, or plants growing in the air, attached to the trunks of trees, such as orchids of warm climates, the aerial roots produced do not reach the soil; they continue aerial and greenish and they possess stomata. Delicate hairs are often seen on these epiphytic roots, as well as a peculiar spongy investment formed by the cells of the epidermis which have lost their succulent contents and are filled with air. This layer, the velamen, serves to absorb the moisture contained in the air, on which the plant is partially dependent for its water supply. Some leafless epiphytic orchids, such as species of Angraecum,

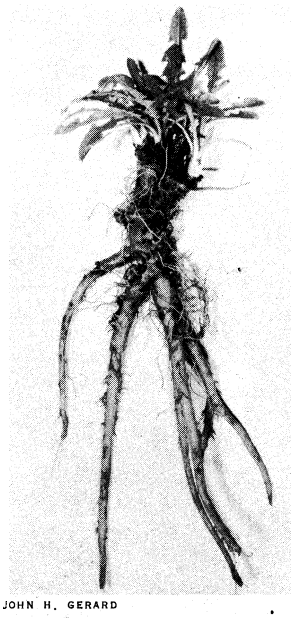


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FIG. 2.— ROOT OF THE DANDELION (TARAXACUM)

depend entirely upon their aerial roots for nourishment; these perform the functions of both leaves and roots. A respiratory or aerating function is performed by roots of certain mangroves growing in swampy soil or water and sending vertical roots up into the air which are provided with aerating passages.

Parasitic plants, as the mistletoe (*Viscum*), broomrape (*Orobanche*), dodder (Cuscuta) and *Rafflesia,* send rootlike processes into the body of the host plant. Leaf buds are sometimes formed on roots, as in plum, cherry and other fruit trees.

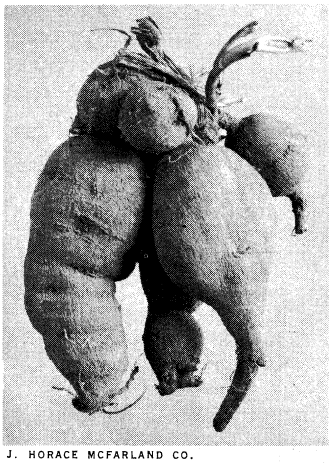

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FIG. 3.—FLESHY TUBERS AND ROOTS OF THE DAHLIA

In the coralroot orchid, *Corallorhiza,* a stem structure, the shortly branched underground rhizome, performs all the functions of a true root, which is absent. In some aquatic plants the root acts merely as an anchor. or it may be flattened and contain chloroplasts for the manufacture of food; in others it is altogether absent, as in *Salvinia* and *Utricularia.*

The well-known epiphyte *Tillandsia usneoides* (Spanish moss) is rootless.

See also PLANT PROPAGATION; STEM: Rhizomes, *Corms,* Tubers and *Bulbs.* (H. E. HD.; X.)

ROOT. Arab writers of the 9th century spoke of one of the equal factors of a number as a root, and their medieval translators used the Latin radix (root) for the same concept. The adjective is radical.

If a is a positive real number and n is a positive integer, there exists a unique positive real number x such that $x^n = a$. This number is called the (principal) nth root of a, and is written $\sqrt[n]{a}$. The integer n is called the index of the root. For $n = 2$, the root is called the square root and is written $\sqrt{a}$. The root $\sqrt[3]{a}$ is called the cube root of a. If a is negative and n is odd, the unique negative nth root of a is termed principal.

The practical determination of square and higher roots of positive numbers is discussed in the article on ARITHMETIC.

If a rational integer (whole number) has a rational nth root, *i.e.*, one which can be written as a common fraction, then this root must be an integer. Thus 5 has no rational square root since $2^2 < 5$ while $3^2 > 5$.

There are exactly n complex numbers which satisfy the equation $x^n = 1$, called the complex nth roots of unity. If a regular polygon of n sides is inscribed in a unit circle with centre at the origin so that one vertex lies on the positive half of the x-axis, the radii to the vertices are the vectors representing the n complex nth roots of unity. If the root whose vector makes the smallest positive angle with the positive direction of the x-axis is denoted by w, then $w, \omega^2, w^3, \ldots \omega^n = 1$ constitute all of the wth roots of unity. Thus $\omega = -\frac{1}{2} + \frac{1}{2}\sqrt{-3}$, $\omega^2 = -\frac{1}{2} - \frac{1}{2}\sqrt{-3}$, $\omega^3 = 1$ are the cube roots of unity.

Any root ϵ which has the property that $\epsilon, \epsilon^2, \ldots \epsilon^n = 1$ give all of the nth roots of unity is called primitive.

Evidently the problem of finding the nth roots of unity is equivalent to the problem of inscribing a regular polygon of n sides in a circle. For every integer n, the nth roots of unity can be determined in terms of the rational numbers by means of rational operations and radicals; but they can be constructed by ruler and compasses (*i.e.*, determined in terms of the rational operations and square roots) only if n is a product of distinct prime numbers of the form $2^h + 1$, or 2^k times such a product, or is of the form 2^k.

If a is a complex number not 0, the equation $x^n = a$ has exactly n roots. (*See* COMPLEX NUMBERS.) All of the nth roots of a are the products of any one of these roots by the nth roots of unity.

The term root has been carried over from the equation $x^n = a$

to all polynomial equations. Thus a solution of the equation

$$f(x)=a_0x^n+a_1x^{n-1}+\ \ldots\ +a_{n-1}x+a_n=0,\ a_0\neq 0$$

is called a root of the equation. If the coefficients lie in the complex field, an equation of the nth degree has exactly n not necessarily distinct complex roots. If the coefficients are real and n is odd, there is a real root. But an equation does not always have a root in its coefficient field. Thus $x^2-5=0$ has no rational root.

If $f(x)=0$ is an equation with coefficients in a field F, there exists a unique field F^* obtained by adjoining to F all of the roots of $f(x)=0$. This field is called the root field of $f(x)=0$. In F^* the polynomial $f(x)$ can be factored into linear factors. (See EQUATIONS, THEORY OF.)

A rigorous proof of the existence of the root field F^* can be made along the following lines. Let $f_1(x)$ be a factor of $f(x)$ which is irreducible in F. The set of all polynomials in x with coefficients in F, taken modulo $f_1(x)$, constitute a field F containing F in which $f_1(x)$ has a linear factor. A continuation of this process leads to the root field F^*. (C. C. M.)

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ROOT CROPS. Many kinds of roots are cultivated for human use, some of which are grown extensively on a commercial scale. Those most commonly produced for human consumption include the beet, carrot, onion, parsnip, potato, radish, sugar beet, sweet potato and turnip. Representative minor root crops are the chufa (*Cyperus esculentus*), cultivated in the southern U.S., and the so-called tule potato (tubers of Sagittaria *latifolia*), cultivated by the Chinese in central California. Many roots grown for other economic purposes assume local importance as crops; *e.g.*, the licorice grown in southern Europe.

The term root crop is sometimes restricted to those grown in rotation with other crops. See also ROOT; ROTATION OF CROPS; BEET; MANGEL; TURNIP, etc.

ROOZEBOOM, HENDRIK WILLEM BAKHUIS (1854–1907), Dutch physical chemist, best known for his introduction into chemistry of the phase rule, was born on Oct. 24, 1854; he was at first (1878) assistant in the Chemistry institute at Leyden, then lecturer (1890) and finally (1896) professor of inorganic and physical chemistry at Amsterdam. He died on Feb. 8. 1907. The phase rule had been deduced previously by J. Willard Gibbs on thermodynamical grounds. With his students he made a large number of investigations of melting points and solubilities in studying the equilibriums between solid and liquid phases in various systems. He started in 1904 to publish a compilation under the title of Dze heterogenen *Gleichgewichte* vom *Standpunkt* der Phasenlehre, which was completed in 1918, after his death, by his pupils.

ROPE AND ROPEMAKING. Rope is made of animal or vegetable fibres and of metallic wires. Fibre rope alone will be considered here. (See WIRE: Wire Rope.) "Cordage" is a term applied generally to yams, twines, ropes and cables but refers specifically to "rope" in the industry.

Fibre rope is cordage of "stranded" construction, *i.e.*, fibres or hairs laid parallel and twisted together making a yarn; two or more of these yarns twisted together "forming" the strand and three or more of these strands twisted together "laying" the rope. Three or more ropes laid together make a "cable-laid" rope, sometimes referred to colloquially as "hawser-laid." The smallest fibre ropes made are approximately $\frac{1}{2}$ in. in circumference or $\frac{3}{16}$ in. in diameter so that any similar products of less than these dimensions are not rope in the usual acceptation of the term.

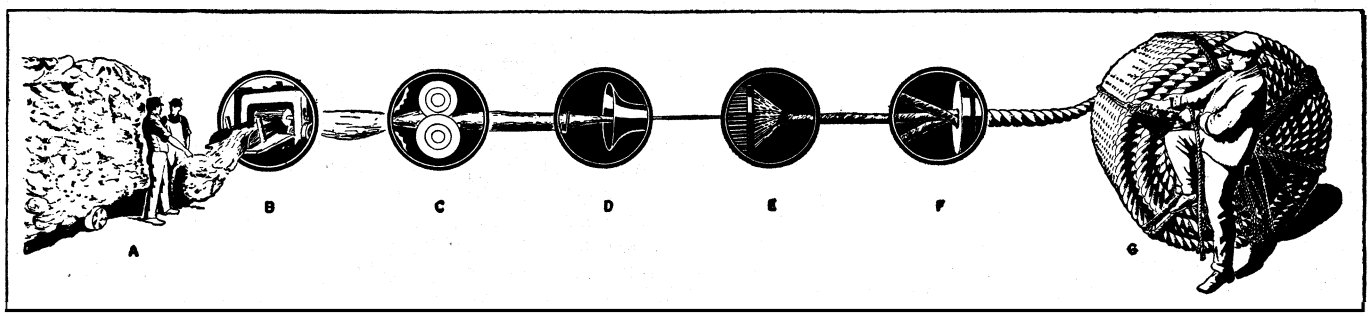
Two or more yams twisted together, either plain twisted or laid, are twine regardless of the form of put-up; laid twine is sometimes referred to as "corded." Single yarns are known as yarns except binder twine, which is a single yarn product. This group of products is known as "ply and yarn goods" in the hard fibre cordage industry and as yarns, twines or cords in the soft fibre industry. Braided construction of yarns, such as sash cords, is sometimes referred to as "rope." (X.)

Early History of **Ropemaking.**—Rope is already represented in use in southwest Asia (Elam) in the chalcolithic period (4th millennium B.C., *v.* Lasso), but this was probably made of plaited thongs, a type which has persisted down to modem times, especially in arrested cultures, *e.g.*, among the Rodiyas of Ceylon, a retarded, outcast group. But probably almost, if not quite, as ancient is that of bark fibre, represented in more evolved forms by the coir types of southeast Asia, where one kind is still made in the very primitive technique of rolling the fibres together with the palm of the hand on the bare thigh, *e.g.*, among the Nayadis of Malabar, the nucleus of whose culture remains epipalaeolithic in character. The thong-plaiting is the simplest and quite likely the first stage of plaiting out of which grew, before the end of the palaeolithic period, mat- and basketmaking, which in turn engendered, in the neolithic, true weaving. The primitive coir-ropemaking method, on the other hand, is the most rudimentary, and almost certainly the initial way of spinning, still used, *e.g.*, well down into historical times in Egypt. Thus ropemaking is the technical ancestor of both the two fundamental textile processes.

Cord (the primary element of rope, and incorporating its essential principle) must have been used very early, probably in the upper palaeolithic period at least, to attach tools to handles; and the same need for rope implies its common currency in the 4th millennium, when numerous bone handles are sometimes found with the blade or point missing (E. Schmidt, *Tepe Hissar*, Phil., 1937, p. 59). In the middle of the 3rd millennium B.C., patterns impressed with spun cords are the definitive feature of a south-eastern European pottery; and by the middle of the 2nd millennium heavy rope must have been a commonplace in the east Mediterranean, given the development there of shipping and hence ships, which even when propelled by oars require rope equipment. Moreover, at about this same time a number of terms for "rope" are found in Akkadian, *e.g.*, though they are not yet more specifically translatable, while actual examples of papyrus rope of about this period have been found in Egyptian tombs. Late in the millennium heavy cables are reproduced in bronze as handles of vessels in China, whither the technique had probably been conveyed by the bronze casters, most likely from the eastern Asia Minor-Adharbayjan region, and heavy cable mouldings appear about the same time on pottery from Luristan whose bronze art can be traced to the same source.

When Xerxes (480 B.C.) built the bridge of boats across the Hellespont "the Phoenicians constructed one line with cables of white flax, the Egyptians in the other used ropes made of papyrus (Herod., Hist., vii, 34). In India in the 4th century B.C., rope-making was so specialized that one class of experts made ropes just for horses, another for elephants (*Arthasastra*); and in China, in the Han period if not earlier, the emperor's carriage in time of mourning was equipped with silk ropes (Li *Ki*, Bk. iii, sect. iii). The craft was carried, along with various textile and other techniques such as pottery making and metallurgy, into the early American cultures. (P. AN.)

Ropemaking had been going on for centuries with little change up to the time of the introduction of machinery about the middle of the 19th century. In the early days all the yarn was spun by hand. The hemp was first hackled by combing it straight over a board studded with sharp steel teeth. A bunch or "head" of this hackled hemp was placed around the spinner's waist, who attached a few fibres to a hook on the spinning wheel and, as the hook was revolved by means of a large wheel turned by hand, walked backwards away from the wheel feeding the fibre from the supply around his waist, preserving the uniformity and proper size of the yarn. Several yarns were twisted together by use of a hand wheel and several hooks, forming the "strand" and three or more strands twisted together "laying" the rope. Horsepower was used in old times for forming and laying rope which was too large to be made by hand. The term "ropewalk" came from the long low buildings used and the walking back and forth of



BY COURTESY OF THE COLUMBIAN ROPE CO.

PROCESSES THROUGH WHICH FIBRE PASSES IN THE MANUFACTURE OF ROPE: (A) FIBRE FROM BALES WITH TANGLES SHAKEN OUT; (B) THE BREAKER WHERE THE FIBRE IS COMBED; (C) SLIVER (FIBRE AFTER IT IS COMBED) COMPRESSED INTO COMPACT FORM; (D) FIBRE TWISTED INTO YARN; (E) YARN DRAWN THROUGH A GUIDE AND TWISTED INTO A READY OR STRAND; (F) STRANDS LAID UP INTO ROPE; (G) FINISHED ROPE COILED AND READY FOR SHIPPING

the spinners and ropemakers. In the early days every community of any size had its ropewalk, there being 173 in the United States in the year 1810. These walks were often goo ft. or more in length. Many were in the open air.

The crude methods of ropemaking of centuries ago are still used in many parts of the world today. Improved ropewalk methods are used extensively today for making extra large ropes and all but the smaller sizes of tarred hemp ropes; it is also an economical and quick method of making ropes to special order for immediate delivery.

Raw **Materials.**—In the United States and European countries soft fibres, principally hemp (coming mostly from Russia, Italy and the United States) and flax were used for rope until the second quarter of the 19th century. Hemp is still used for tarred hemp rope and fittings for marine purposes. Abaca commonly referred to as Manila fibre, because it is grown almost exclusively in the Philippine Islands and exported principally from the port of Manila, has established itself as the best material for ropemaking where strength and durability are the prime requirements. Henequen, sometimes misnamed sisal, is next in importance as a rope fibre, and comes from Yucatan, Mexico and Cuba. Sisals are important rope fibres and come principally from Java, Africa and the Bahamas. Other fibres used are New Zealand, Mauritius, Maguey and Istle fibres. Jute and cotton are used to a limited extent in the manufacture of ropes of stranded construction. Cotton is used to a greater extent in the manufacture of braided cords.

Present Manufacturing Processes.—The primary object of twisting fibres together in a rope is that, by mutual friction, they may be held together when a strain is applied to the whole. Hard twisting has the further advantage of compacting the fibres and preventing, to some extent, the penetration of moisture when the ropes are exposed to water; but the yield of rope from a given length of yarn diminishes in proportion to the increase of twist.

The ropemaking process is essentially the same, no matter what kind of fibre is used. The process divides itself into five operations. First, selection of fibre; second, preparing the sliver; third, spinning the yarn; fourth, forming the strands; fifth, laying the strands into rope. With cable-laid ropes there is another operation, laying the strands of the cable, which are in fact completed ropes, into the finished cable.

At the start of the manufacturing process the bales of fibre are opened and heads of fibre shaken out. The fibre is put through several processes of combing and straightening. These operations are, in general, all of the same kind. The fibre is slowly carried along on a series of bars connected by endless chains, the bars being studded with sharp steel pins, like combs, that stand upright as the fibre passes along with them. A similar set of combs, moving very much faster, pulls the fibre rapidly away from the first set, combing it out at the same time. Fine jets of lubricant are sprayed on the fibre as it enters the first machine.

The fibre is delivered from the machine in a heavy, continuous stream or sliver which is coiled by hand or machine into a receptacle, or on the floor. Several of these slivers are then fed into a similar machine, and the kinks and unevenness further removed by a repetition of the same process. This preparation or combing is repeated from 8 to 12 times on five different machines, each operation combing the fibre and producing a smaller and more even sliver, until finally it comes out of the finisher in a continuous stream as water flows from a hose. The thoroughness with which these operations are carried out—the care taken in preparing the fibre—is largely responsible for the uniformity and excellence of the finished product.

In the preparation of the sliver, the object has been merely to eliminate all sorts of dirt and foreign matter and to lay these fine, threadlike strands parallel with one another so that they can be more easily spun together. As the sliver enters the spinning machine it is taken from the rollers by another series of fine combs. From the combs it passes through a funnel-shaped tube and is then wound about a little capstan. It is between the tube and the capstan that the yarn comes into being. The friction on the revolving capstans draws the yarn through the machine. From the capstans it is automatically wound on a large spool about 12 in. long, named a bobbin. The capstans and the bobbin whirl very fast, and the combination of this whirling motion and the drawing forward of the revolving capstans, spins the heretofore parallel fibres into what is known as a yam. For different sizes of yarn and for yarns designed for various purposes, a varying number of twists per foot are imparted to the yarn. This yarn is the first merchantable product of the cordage mill and may be sold in this original form or used as the basis of other cordage products.

A rope is usually formed of three or four strands, each strand composed of a number of yarns laid parallel and slightly twisted together. Making these strands is "forming." As the strand is tnisted it is wound on a large reel and appears as a smooth, round strand composed of a number of individual yarns. This is known as the "ready." The yarn has a tendency to untwist; to overcome this the twist of the ready or strand is made in the opposite direction. The result is that the tendency of the yarn to untwist in one direction, and the tendency of the ready to untwist in the other direction balance each other.

The ropemaking operation is "laying." In laying the rope, three or four of the reels containing the readies or strands are put on the laying machine, and the strands are led through a "block," wound around the capstan, and reeled on the finishing end of the laying machine. In laying there is a different twisting problem, for the ready is *neutral*—that is, it has no tendency to untwist—and if the readies were twisted together without altering this neutral condition the rope would continually untwist. So an extra twist is added to the ready as it is passed into the machine, this twist being computed so that it will he just sufficient to counteract the tendency of the three strands to untwist when they are formed into a rope. All good rope is absolutely neutral; if cut off in 5-ft. to 10-ft. lengths and laid on the ground, it will not untwist of its own accord.

Cable-laid rope consists of three completed ropes, nine of the simple strands which form an ordinary rope. The same method of balancing the twisting strands is used, an additional twist or foreturn being given to the three-strand ropes just before they are laid up, so that their tendency to untwist in one direction shall exactly counterbalance the tendency of the cable to untwist in the opposite direction.

Uses and Care of Rope.—The uses of rope are many and varied. The marine and fishing industries consume more than half of the rope produced. Cable-laid rope is also used extensively for the drilling of oil, water and gas wells. Ropes are used in the transmission of motive

power. (*See* POWER TRANSMISSION: *Mechanical.*) Small cotton ropes are used extensively in textile mills for small machine drives. Rope is used on the farms for hoisting, hauling, harness and many other uses. Rope is used in building and engineering projects construction. In the home also it has many applications.

The useful liie of rope depends on the quality of the rope, and on the care and treatment it receives. To give the best service, it must be made of high-grade raw material, selected with a thorough knowledge of what the rope is to do. It must be so made that every strand will be of even tension. It must be properly treated with a lubricant which will at once preserve and lubricate. There are three general sources of damage which mill shorten the life of rope: first, mechanical injury, such as bending over too sharp a pulley; second, damage from chemicals, such as acids; and third, damage from climatic or other conditions of storage, such as moisture or dry rot. It should be stored in a cool dry place with air circulation. (J. S. McD.)

In addition to the heavy rope there are many varieties of cord and twine made by means of the preparing, spinning and doubling machines. The fishing industry takes many different types for lines and nets, while the variety of cord and twine for other industrial and for household purposes is almost unlimited. All yarn from long vegetable fibre is more or less rough as it leaves the spinning frame, even after two or more threads have been twisted together. It is therefore necessary, for many uses, to impart a polish to the cord or twine. Special machines are used for this purpose. Bobbins of yarn, equal to the number required, and depending upon the capacity of the machine, are placed in a bank or creel, and the ends are collected and passed under a roller which is immersed in hot starch. The yarns become saturated with this starch, but, as they emerge from the starch-box. the superfluous starch is removed by passing the yarns between two rollers. The yarns now pass over a series of drying cylinders and polishing rollers, and are finally rewound by the same machine on to other bobbins. This machine is termed a bobbin-to-bobbin polishing machine. In some cases the hot drying cylinders are replaced by a system of hot-air drying. The finished yarns arc now made up by machinery into hanks, balls or cheeses, according to which happens to be the best state for future use and for transport.

Driving Ropes.—It has already been stated that cotton driving ropes are extensively applied in the transmission of motive power. Although the mechanical efficiency of transmission by ropes is less than that obtained by wheel gearing, rope driving has several compensating advantages:—

1. It is practically noiseless.
2. It occupies less space than belt driving, and the slip is not so great.
3. The turning movement is better; machines therefore run more steadily and production is increased.
4. Shaits may be run at higher speeds.
5. Greater range of drives; anything from 10 ft. to over 80 ft., and much greater distances when carrier pulleys are used.
6. The drive is usually obtained by a number of ropes; if one should break, the rope may be removed and the machinery run in most cases until stopping-time.

The number of ropes to be used depends upon the power to be transmitted; upon the sectional area of the ropes, and upon the surface speed of the driving pulley. The speed of the rope may vary from 2,000 ft. to 6,000 ft. or over per minute. In some few exceptional cases 60 ropes have been used on one pulley; the number usually varies between 15 and 40. (*See* POWER TRANSMISSION: *Mechanical.*)

The foregoing reiers exclusively to ropes made from fibrous yarns; metallic ropes appear under the heading WIRE: *Wire Rope.*

See T. Woodhouse and P. Rilgour, *Cordage and Cordage Hemp and Fibres* (1919); Robert Chapman, *A Treatise on Rope-making* (1868); H. R. Carter, *Modern Flax, Hemp and Jute Spinning and Twisting* (1925); P. J. Stopiord, *Cordage and Cables* (1925); "U.S. Government Master Specifications for Rope Cotton," *Bureau of Standards Cir.* 326, (1927).

ROPES, JOHN CODMAN (1836–1899), U.S. military historian and lawyer, was born at St. Petersburg (later Leningrad), Russia, on April 28. 1836. He graduated from Harvard Law school in 1861, and became a successful lawyer. He founded in 1876 the Military Historical Society of Massachusetts for the collection and discussion of evidence relating to the Civil War. To it he presented his military library and his collection of prints and medals.

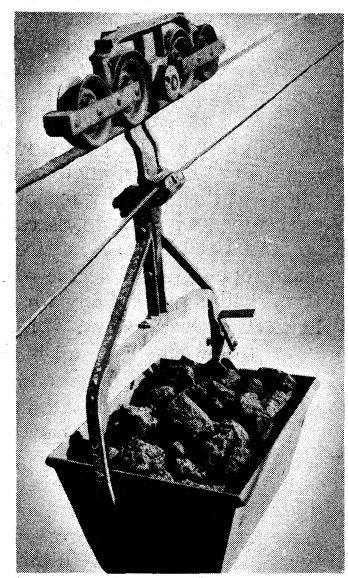
Ropes died at Boston, Mass., on Oct. 28, 1899.

His chief work is an unfinished *Story* of *the Civil War,* to which he devoted most of his later years; this covers the years 1861–62 (1894–98). It was completed in five volumes in 1913 by W. R. Livermore. *The Army under Pope* (in "Campaigns of the Civil War," vol. iv, 1881) is a detailed narration of the Virginia campaign of Aug.–Sept., 1862, which played a great part in reversing contemporary judgment on the events of those operaticns, notably the condemnation of Gen. Fitz John Porter's conduct. His *Campaign* of *Waterloo* (1892) is a standard work.

ROPEWAYS AND CABLEWAYS. An aerial ropeway is a special form of railway in which the traffic-carrying unit is a steel wire rope. Whereas in a railway the path for the traffic is formed by steel rails laid along the ground, a ropeway uses a tensioned wire rope supported above the ground. It can be used for the transport of both materials and passengers.

Until steel wire ropes came into use, ropeways were limited in scope by the relatively low strength of hemp or other natural fibres; and the popular impression of the origin of ropeways is based on a mid-17th-century print showing a crude form of installation in which such fibre ropes were used. It was the steel wire rope which made ropeways an important modern means of transport. They are particularly useful in regions where their facility in surmounting natural barriers gives them a great advantage over railways or roads, both of which m a need heavy civil engineering work to secure easy gradients. Quite apart from this, ropeways have other advantages. They are inexpensive to maintain; their power demand is modest; and they are not seriously affected by adverse climatic conditions.

There are two main types of ropeway systems: monocable and bicable, both are described below. The choice of a particular type depends upon the length and topography of the route, the type and intensity of the traffic, and in many cases the remoteness of the site and the class of labour available for operation.



BRITISH ROPEWAY ENGINEERING CO., LTD.

BICABLE CARRIAGE. BUCKET AND HANGER ON AERIAL ROPEWAY

Monocable **Ropewav.**—This comprises an endless loop of rope which is maintained in continuous circulation by a grooved driving wheel at one end of the route, and kept under tension by a counterweighted wheel at the other end. Tension is necessary both to keep the rope clear of the ground when it is carrying traffic and to prevent it from slipping on the driving wheel. Between the two ends of the route, the outward and return legs of the rope are supported on pulleys carried on towers; these are positioned so as to ease gradients and also maintain ground clearance where the profile is irregular.

The loads are usually carried in containers spaced at regular intervals along the moving rope. The containers are slung from carrier heads provided with clips which, when the rope gradient does not exceed about 23°, merely rest saddlewise on the rope or, for steeper gradients, are arranged to grip the rope mechanically. Small wheels are mounted on the carrier heads, to allow them to be detached in the terminal stations from the moving rope and to run on to a fixed rail where they can come to rest to be loaded or unloaded. The modern practice is to mechanize the propulsion and control of the carriers on the fixed rails by means of slow-speed haulage ropes or chains. This enables angle stations (see below) to work automatically.

Capacities of up to 120 tons per hour can be carried on the less steeply graded routes at a speed of about 2 yd. per second; but in favourable conditions both speed and capacity can be increased by as much as 50%. Steeper gradients are restricted to the smaller capacity installations of up to 50 tons per hour. The individual gross load on the rope seldom exceeds 1% of the hourly net capacity. For example, a monocable system with a net capacity of 100 tons per hour and a speed of 2 yd. per second would be designed with gross loads of 1 ton, the containers and carriers having a total tare weight of about $\frac{1}{4}$ ton.

Monocable ropeways with positive-acting, mechanically operated grips can work on rope gradients of up to 40°, and can run at speeds of 3 yd. per second or more. They are most com-

monly used for the transport of passengers, particularly in mountainous districts, since the carriers with two or four persons lend themselves to the fitting of special devices required by law to ensure safe transport of the passengers.

Bicable Ropeway. — In this system two stationary carrying ropes are employed, these being parallel to one another and held under tension above the ground. on towers suitably positioned. Spans of over 1,000 yd. can be used if conditions permit. The containers have carriers with wheels arranged to run on the t o fixed ropes; a separate endless moving rope is used to haul the carriers along these fixed ropes, the moving rope being driven and tensioned as in the case of the monocable system. The carriers are provided with mechanical grips which automatically attach and detach themselves from the moving rope when the carriers are leaving from or arriving at the terminal stations. Angle stations are automatic in action unless the carrier needs to be detached for other reasons.

The terminal stations have fixed rails on which the carriers can run. these rails being structural prolongations of the fixed ropes along the route, and usually arranged to provide a connecting loop between the incoming and outgoing ropes. The propulsion of the carriers along the station rails is usually mechanized by a prolongation of the haulage rope, or by a separate slow-speed rope if the containers have to be loaded.

Bicable ropeways are used where rope gradients are considerable—up to 40'—and where capacities are high—up to 500 tons per hour, at the generally accepted speed of about 3 yd. per second. Very heavy individual loads can be carried because the carrying ropes can be increased in size without materially affecting the haulage rope. Many bicable ropeways exist with individual loads of over 5 tons net, usually for carrying logs.

Length of Ropeways. — Many long ropeways have been built, on both the monocable and bicable systems, but they all consist of a series of short, interconnected ropeways. Each section is preferably routed in a straight line of 3–6 mi. length, but the junction of two sections can be set at an angle to secure any necessary diversion of the general route. The junction stations can be arranged as intermediate loading or unloading stations, with accommodation sidings or shunts.

Two examples of long ropeways are: Kristineberg to Boliden. in Sweden, a distance of 60 mi., with a bicable ropeway handling 500.000 tons of iron ore per year; and Mariquita to Manizales, in Colombia, a distance of 47 mi., with a monocable ropeway handling 25 tons of general merchandise per hour.

Aerial Cableways. — An aerial cableway is a special form of overhead crane in which the hoisting and cross-traveling carriage runs in a single span on one or more steel wire ropes instead of on a rigid horizontal girder. The use of a single rope span mith a traveling carriage goes back to Roman times, but one of the earliest recorded cableways with steel ropes was built in Scotland in 1873 for a load of 3 tons of granite. Lifting capacities grew steadily over the years: 8 tons in 1884; 10 tons in 1902; 20 tons in 1919 and 150 tons in 1932.

An aerial cableway can cover much larger areas than a rigid structure can, and installations are commonly built with spans of 1.500–3,000 ft. The carrying ropes terminate at each end of the span in structural steel towers. One of these, known as the head tower, incorporates the mechanism for tensioning the ropes. and also the driving machinery and controls both for moving the hoisting and cross-traverse carriage backward and forward over the spans, and for raising or lowering the load hook. The tail tower. at the other end of the span, provides termination and support for the ropes at the required elevation.

The cross-traverse motion is obtained by means of an endless loop of rope tensioned and driven by means similar to those applying to monocable ropeways, and spanning the gap between the towers just below the carrying ropes on which the carriage runs. The carriage is permanently attached to the cross-traverse rope and moves mith it. The hoisting motion is obtained by a separate rope passing from a winch mechanism out over the span, and reeved through the carriage down to the load hook. The carrying ropes are sufficiently tensioned to ensure that the ratio between sag and span is not more than about 1 to 20 when the fully-loaded carriage is at the middle of the span.

In the simplest case both head and tail towers are fixed, in which case the cableway provides service along the line only; but either one or both of them can be mobile, thus covering an area which is either triangular or rectangular in shape. Their ability to cover large service areas makes cableway installations particularly useful in the construction of dams. The head and tail towers are usually situated high up on the flanks of the valley in which the dam is to be built, and their available movements are arranged so as to command beneath the load hook the whole of the construction area. The cableway then serves to remove excavated material, to place the formwork and reinforcement for the concrete, and finally to carry the concrete itself from the mixing plant to the formwork.

The largest cableway built was for the U.S. reclamation bureau, Denver, Colo., for use on the Hoover (Boulder) dam. It had a capacity of 150 tons, a span of 1,256 ft. and used six supporting ropes for the carriage to run upon.

The rope techniques evolved for ropeways and cableways have been extended to new forms of conveying; instead of the intermittent containers mentioned above, continuous systems are carried by running ropes.

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ROPS, FÉLICIEN (1833–1898), Belgian painter and graphic artist. who ranks as a modern master in printmaking, was born at Namur, July 10, 1833. Rops spent his childhood in Namur, later going to Brussels. In 1856 he composed for friends at the university the *Almanach crocodilien,* his first work. He brought out two *Salons illustrés* and collaborated on the *Crocodile,* a students' magazine. This attracted the attention of publishers and he designed frontispieces for P. A. Poulet-Malassis and Gay. In 1859–60 he contributed some of his finest lithographs to the satirical journal, *Uylenspiegel.* About 1860 he went to Paris and worked in the studio of H. A. Jacquemart but returned to Brussels and founded the short-lived International Society of Etchers. In 1865 he produced his famous "Buveuse d'absinthe" (Absinthe drinker) and in 1871, "Dame au Pantin." After 1874 Rops resided in Paris, devoting himself principally to illustrating books. Among his notable book illustrations are *Le'gendes flamandes* by *C.* de Coster, *Jeune France* by Théophile Gautier, *Les Diaboliques* by Barbey d'Aurévilly, *Zadig* by Voltaire and the poems of Stéphane Mallarmé. Many have frontispieces which exhibit his fertile and powerful imagination. He published *Cent croquis pour réjouir les honnêtes gens* ("One hundred sketches to delight solid citizens"). Rops joined the Art Society of the "XX," formed at Brussels in 1884, as their revolutionary views were in harmony with the independence of his spirit. He died at Essonnes, Fr., on Aug. 22, 1898.

After Rops's death, the Libre Esthétique, which had succeeded the "XX," arranged a retrospective exhibition (1899) of his paintings and drawings. M. Exsteens, in his definitive catalogue of the prints of Rops, lists 1.193 subjects. It is unfortunate that these survive more for their so-called licentiousness and their free choice of subject than for any other reason, because his work as a printmaker is most important, both for its brilliance of technique and its originality of content. His handling of dry point marks him as one of the masters of the medium; he was one of the first modern etchers to revive the neglected medium of soft-ground etching and employ it to great effect. Although Rops was a friend of Charles Baudelaire, the poet, Rops's work has a spiritual counterpart in literature in the diabolical dandyism of Barbey d'Aurevilly more than in the *Fleurs du mal.*

See E. Ramiro, *Fe'licien Rops* (1905), the best monograph on the artist, and M. Exsteens, *L'Oeuvre grave' et lithographié de Félicien Rops,* 4 vol. (1928), a complete descriptive catalogue of all of Rops's prints with illustrations of each work. (H. Es.)

ROQUE: *see* CROQUET AND ROQUE.

RORIDULA, a genus of flowering undershrubs of the family Droseraceae, of which there are two species peculiar to the mountains of South Africa. In both species the leaves are armed with numerous stalked glands, superficially resembling the tentacles of Drosera (see SUNDEW) and secreting a sticky material which catches insects. These characters led to the belief that the plants are carnivorous. It was shown, however, that the secretion is not mucilaginous but resinous. which at once excludes the possibility of carnivory. since enzymes work in a watery medium. Moreover, the tentacular glands in Roridula are of entirely different structure from that in Drosera, having resin glands opening by ducts at the apex of the gland. (F. E. L.; X.)

RORQUAL, the common name for several species of large whales of the genus Balaenoptera. They are slender and elongate, with a small dorsal fin and longitudinal folds on the throat. The flippers are small, the head small and flat, the baleen or whalebone coarse and short and the tail much compressed. All rorquals feed on small crustaceans and fish, which they strain from the water through the baleen plates. Among the rorquals is Sibbald's rorqual or the blue whale, the largest of all living animals; the common rorqual or fin whale; Rudolphi's rorqual or Sei whale; and the lesser rorqual or piked whale. Most rorquals are cosmopolitan in distribution. ***See*** WHALE.

RORSCHACH, HERMANN (1884–1922), Swiss psychiatrist, who devised the ink-blot test known by his name and widely used in diagnosis of psychopathologic conditions, was born in Ziirich, Switz., Nov. 8, 1884. As a psychoanalyst, Rorschach was oriented toward exploring the personality in depth, not only tracing the intellectual activity but also reaching into the emotional forces and the unconscious. The test consists of ten symmetrical ink blots. Earlier investigators had used ink blots as free association stimuli but had generally limited themselves to studying the thematic content. Rorschach's advance was in systematically analyzing the patient's attention to wholes or details of the blot figures, colour and shading, apparent movement in human form percepts and other factors. Thus he penetrated to psychologic processes or "structure" of the personality and found differential patterns for the several clinical pictures. The test has been criticized by experimentalists because of the difficulty of maintaining its variables under strict laboratory control. As an aid toward diagnosis in psychopathology, however, it has proved itself very valuable and is used in many countries. Rorschach looked on his work as experiment in perception and emphasized an empirical statistical orientation. He died at Herisau, Switz., April 2, 1922. His best-known work is Psychodiagnostics (English translation by P. Lemkau and B. Kronenberg, 1942).

See Samuel J. Beck, *Rorschach's Test,* vol. iii *(1952).* (S. J. BK.)

ROSA, CARL AUGUST NICHOLAS (1842–1889), English musical impresario, was born at Hamburg, Ger., on March 22, 1842, his family name (which he subsequently changed) being Rose. He started as a solo violinist, studying at Leipzig and Paris. In 1867 he met and married the famous operatic soprano Madame Parepa (1836–74). In 187j he started the Carl Rosa Opera company. He died in Paris on April 30. 1889.

ROSA, SALVATOR (1615–1673), Italian painter of the Neapolitan school, best known for his wild landscapes and battle scenes, was born in Arenella, near Naples, on July 21, 1615, according to the writer G. B. Passeri. Rosa went to his uncle Paolo Greco to learn painting, then to his brother-in-la+ Francesco Fracanzano, a pupil of Giuseppe Ribera, and afterward to Ribera himself. He obtained some instruction under the battle-painter Aniello Falcone. Encouraged by the painter G. Lanfranco, he went to Rome in 1635 to study, but catching fever, he returned to Naples and Falcone. and for a while painted nothing but battle pieces.

Rosa went on to the landscape art peculiarly characteristic of him — savage scenes peopled with shepherds, seamen or. especially. soldiers. He then revisited Rome and was housed by Cardinal Brancaccio. In 1637 he took part in the insurrection of Masaniello against the Spaniards but on the approach of Don John of Austria he escaped to Rome. He was an actor, poet and musician as well as a painter. It was about this time that Rosa wrote his satire Babylon, under which name Rome was indicated.

Cardinal Giancarlo de' Medici invited the painter to Florence, where he remained for the better part of nine years, introducing there the new style of landscape; he had no pupils, but various imitators. Lorenzo Lippi the painter-poet, and other *beaux* esprits shared with Rosa the hospitalities of the cardinal, and they formed an academy named I Percossi ("the Stricken"). He was well acquainted also with Ugo and Giulio Maffei in Volterra, where he wrote four other satires—*Music,* Poetry, *Painting* and *War.* Finally he returned once more to Rome. To confute his detractors he wrote the last of the series, entitled Envy. Among the pictures of his closing years were the "Battlepiece" (Louvre, Paris); "Pythagoras and the Fishermen"; the "Conspiracy of Catiline," considered one of his best works (Pitti gallery, Florence); and "Saul and the Witch of Endor" (Louvre. Paris:).

His etchings reflect his sympathy with the rough and ready life of the soldier and peasant. He also produced a number of large mythological and historical plates. He died in Rome on March 1 j. 1673.

See E. W. Manwaring, *Italian Landscape in 18th Century England* (1925); Irene Cattaneo, *Salvatore Rosa* (1929).

ROSA, MONTE, the name of a great glacier-clad mountain mass (Aostan patois word roese, "a glacier") which rises southeast of Zermatt and on the frontier between Switzerland and Italy. Ten summits in this huge mass are distinguished by name; of which four (Nordend, 15,131 ft., Zumstcinspitze, 14.964 ft., Signalkuppe or Punta Gnifetti, 14,957 ft., and Parrotspitze. 14,-642 ft.) rise on the frontier. The five lower summits are on the Italian slope. but the highest of all. the Dufourspitze, 15,203 ft. (named by the Swiss government in honour of General Dufour. the head of the survey which first accurately fixed the position of these points), rises west of the frontier ridge, on a buttress, and being entirely in Switzerland, is its highest peak (not, as often stated, the Dom, 14,911 ft., in the Mischabel group). The summit of the Dufourspitze was first attained in 1855 by a large English party, including G. and C. Smyth and C. Hudson. The Zumsteinspitze was first climbed in 1820, the Signalkuppe (on top of which there is now a club hut) in 1842, the Nordend in 1861 and the Parrotspitze in 1863.

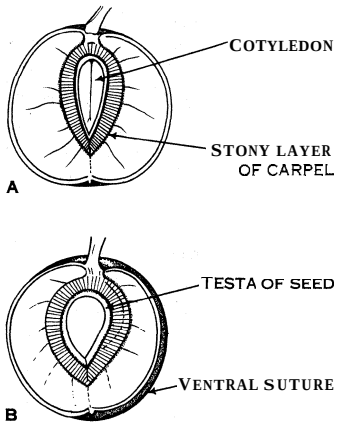
ROSACEAE, a large cosmopolitan family of seed-bearing dicotyledonous plants belonging to the order Rosales (see PLANTS AND PLANT SCIENCE: Dicotyledons) and containing about 100 genera with more than 2,000 species.

Habit of Growth. — The plants vary widely in habit of growth. Many are herbaceous, growing erect, as *Geum,* or with slender creeping stem, as in species of Potentilla, sometimes sending out long runners, as in strawberry; others are shrubby, as raspberry, often associated with a scrambling habit, as in the brambles and roses, while apple, cherry, pear. plum and other fruit trees represent the arborescent habit. Vegetative propagation takes place by means of runners, which root at the apex and form a new plant, as in strawberry; by suckers springing from the base of the shoot and rising to form new leafy shoots after running for some distance beneath the soil, as in raspberry; or by shoots produced from the roots. as in cherry or plum. The scrambling of the brambles and roses is effected by means of prickles on the branches and leafstalks.

Distribution. — In North America, Rosaceae are represented by about 40 genera, the largest being Crataegus (ha thorn) with about 70 or more species, *Rubus* (bramble) with 100 or more species. Potentilla (cinquefoil, five finger) with about 100 species, *Prunus* (plum, cherry, etc.) with 30 species, and Rosa with 90 species. Potentilla is the most generally distributed genus in the United States.

The family is characteristically typical of temperate and subtemperate regions, but some genera, such as *Rubus,* are of worldwide distribution. The strictly tropical groups are mostly trees and shrubs in such genera as *Chrysobalanus, Hirtella, Coupeia, Parinarium,* etc.

Leaf Arrangement. — The leaves, which are arranged alternately, are simple. as in apple. cherry. etc., but more often compound. with leaflets palmately arranged, as in stranberry and spe-



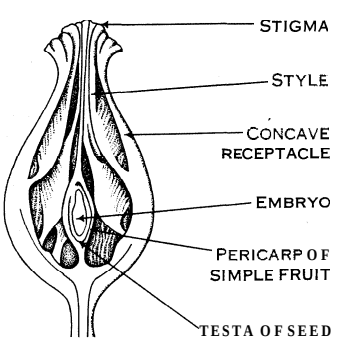
FROM GROOM, "ELEMENTARY BOTANY" (G. BELL & SONS)

FIG. 1.—CHERRY (PRUNUS CERASUS), SHOWING (A) VERTICAL SECTION OF THE DRUPE OF CHERRY, CUT VERTICALLY THROUGH THE VENTRAL AND DORSAL SUTURE: (B) FRUIT CUT VERTICALLY IN A PLANE AT RIGHT ANGLES TO PRECEDING ONE

cies of *Potentilla*, or pinnately arranged, as in the brambles, roses, mountain ash, etc. In warm climates the leaves are often leathery and evergreen. The leaves are stipulate, the stipules being sometimes small and short-lived, as in *Pyrus*, *Malus* and *Prunus* (cherry, plum. etc.), or more important structures adnate to the base of the leafstalk, as in roses, brambles, etc.

Flowers.— The flowers, which are regular, generally bisexual and often showy, are sometimes borne singly, as in some species of rose, or of the cloudberry (*Rubus chamaemorus*), or few or more together in a corymbose manner, as in some roses, hawthorn and others. The inflorescence in agrimony is a raceme, in *Poterium* a dense-flowered spike, in *Spiraea*, a number of cymes arranged in a corymb. The parts of the flowers are arranged on a pentamerous plan, with generally considerable increase in the number of stamens and carpels.

The shape of the thalamus or floral receptacle, and the relative position and number of the stamens and carpels and the character of the fruit, vary widely and form distinguishing features of the different subfamilies, six of which may be recognized.

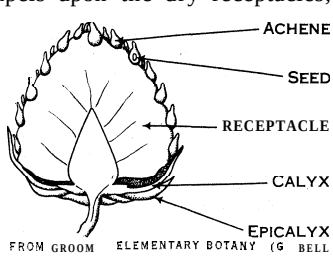


FROM GROOM, "ELEMENTARY BOTANY" (G. BELL & SONS)

FIG. 2.—DOG ROSE (ROSA CANINA), SHOWING VERTICAL SECTION OF COMPOUND FRUIT

Subfamilies.—*Subfamily I.*—Spiraeoideae is characterized by a flat or slightly concave receptacle on which the carpels, frequently two to five in number, form a central whorl; each ovary contains several ovules, and the fruit is a follicle except in *Holodiscus*. The plants are generally shrubs with simple or compound leaves and racemes or panicles of numerous small white, rose or purple flowers. This subfamily is nearly allied to Saxifragaceae, chiefly north temperate in distribution. The largest genus is *Spiraea*, with numerous species cultivated in gardens.

Subfamily II.—*Rosoideae*, the largest subfamily, with **40** genera and more than 1,000 species. is characterized by the receptacle being convex and swollen, as in strawberry, or cup-shaped, as in rose, and bearing numerous carpels, each of which contains one or two ovules, while the fruit is one-seeded and indehiscent. The genera are grouped in tribes according to the form of the receptacle and of the fruit. The Potentilleae bear the carpels on a large, rounded or convex outgrowth of the receptacle. In the large genus *Rubus* the ripe ovaries form drupels upon the dry receptacles; the genus is almost cosmopolitan, but the majority of species occur in the forest region of the north temperate zone and in the mountains of tropical America. *R. fruticosus* is blackberry, *R. idaeus*, raspberry and *R. chamaemorus*, cloudberry. In the flower of *Potentilla*, *Fragaria* (strawberry) and a few allied genera an epicalyx is formed by stipular structures arising at the base of the sepals.

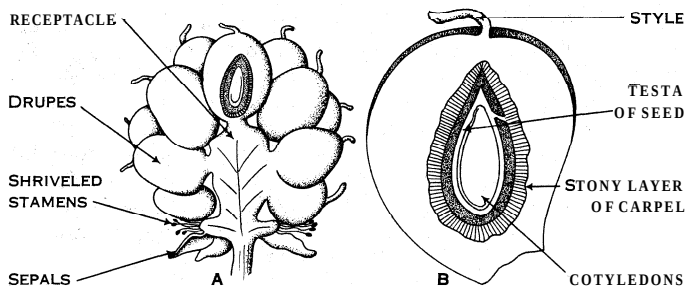


FROM GROOM ELEMENTARY BOTANY (G BELL & SONS)

FIG 3.—STRAWBERRY (FRAGARIA VESCA), SHOWING VERTICAL SECTION OF COMPOUND FRUIT

The fruits consist of numerous dry achenes, borne in *Fragaria* on the much-enlarged succulent torus, which in the other genera is dry. In *Geum* (avens) and in *Dryas* (an arctic and alpine genus) the style is persistent in the fruit, forming a feathery appendage (*Dryas*) or a barbed awn (avens), either of which is of service in distributing the fruit. The Potentilleae are chiefly north temperate, arctic and alpine plants.

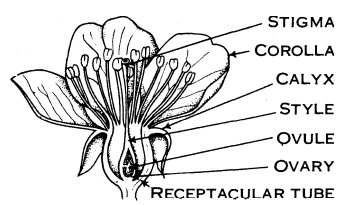
The Roseae comprise the large genus *Rosa* (with possibly 200 species) characterized by a more or less urn-shaped torus enclosing the numerous carpels which form dry one-seeded fruits enveloped in the bright-coloured fleshy torus. The plants are shrubs bearing prickles on the stems and leaves; many species have a scrambling habit resembling the brambles. The species of *Rosa*, like those of *Rubus*, are extremely variable, and a great number of subspecies, varieties and forms have been described. Petals are often wanting, as in *Alchemilla* (lady's mantle) and *Poterium*, and the flowers are often unisexual and frequently wind-pollinated, as in salad burnet (*Sanguisorba minor*), where the small flowers are crowded in heads, the upper pistillate, with protruding feathery stigmas, and the lower staminate (or bisexual), with exserted stamens. *Agrimonia* (agrimony) has a long spike of small honeyless flowers with yellow petals; in the fruit the torus becomes hard and crowned by hooked bristles, which ensure the distribution of the enclosed achenes.



FROM GROOM, "ELEMENTARY BOTANY" (G. BELL & SONS)

FIG. 4.— BLACKBERRY (RUBUS FRUTICOSUS), SHOWING (A) VERTICAL SECTION OF COMPOUND FRUIT. (B) VERTICAL SECTION OF SINGLE DRUPE (ENLARGED)

Subfamily III.—*Pomoideae* is characterized by a deep cup-shaped receptacle with the inner wall of which the two to five carpels are united; the carpels arc also united with each other, and each contains generally two ovules. The fruit is made up of the large fleshy receptacle surrounding the ripe ovaries, the endocarp of which is leathery or stony and contains one seed. The plants are shrubs or trees with simple or pinnately compound leaves and white or rose-coloured often showy flowers. The genera are distributed through the north temperate zone, extending southward in the new world to the Andes of Peru and Chile.

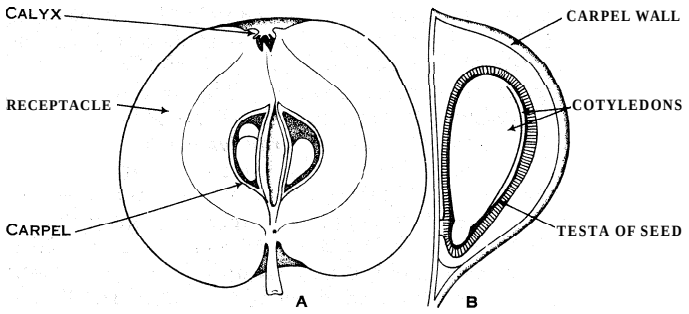


FROM GROOM, "ELEMENTARY BOTANY" (G. BELL & SONS)

FIG. 5.—VERTICAL SECTION OF FLOWER OF CHERRY

While some botanists still continue to include the pears and the apple and even the mountain ash in *Pyrus* as a collective genus, most now recognize three genera, *Malus* to take the apples, a genus of about 25 species, the common apple being *Malus pumila*, formerly known as *Pyrus malus; Pyrus* to take the pears, a genus of about 20 species, the common pear being *Pyrus communis;* and *Sorbus*, a genus of about **80** species to take the rowan or mountain ash (*S. aucuparia*), wild service (*S. torminalis*), American mountain ash (*S. americana*) and white beam (*S. aria*). *Mespilus* (medlar), with a single species, and *Cotoneaster*, with about **50** species, are also included. All these genera are confined to the north temperate zone.

Subfamily IV.—*Neuradoideae* contains only three genera of small annual herbs of African and Indian deserts. The flowers are yellow, and the five to ten carpels are united together and with the base of the cup-shaped torus, which enlarges to form a dry



FROM GROOM, "ELEMENTARY BOTANY (G BELL & SONS)

FIG. 6.— APPLE (MALUS PUMILA), SHOWING (A) VERTICAL SECTION OF FRUIT, (B) ONE OF THE PARCHMENTLIKE SEED CHAMBERS REMOVED FROM THE FRUIT

covering round the one-seeded fruits.

Subfamily V.—Prunoideae is characterized by a free solitary carpel with a terminal style and two pendulous ovules, and the fruit a one-seeded drupe. The torus forms a cup from the edge of which spring the other parts of the flower. The plants are deciduous or evergreen trees or shrubs with simple leaves, often with small caducous stipules, and racemes or umbels of generally showy. white or pink flowers. There are six genera. the chief of which is Prunus, to which belong the plum (Prunus communis), with several well-marked subspecies—sloe or blackthorn (P. *spinosa*). bullace (P. *insititia*), wild plum (P. *domestica*), the almond (P. amygdalus) with the nearly allied peach (P. *persica*), cherry (P. *cerasus*), birdcherry (P. *padus*) and cherry laurel (P. laurocerasus). The subfamily is distributed through the north temperate zone, passing into the tropics.

Subfamily VI.—Chrysobalanoideae resembles the last in having a single free carpel and the fruit a drupe, but differs in having the style basal, not terminal, and the ovules ascending, not pendulous; the flowers are frequently zygomorphic. The genera are tropical evergreen trees or shrubs, the great majority being South American. See also STRAWBERRY; APPLE; CHERRY; PLUM.

(G. N. J.)

ROSAMOND, known as "The Fair" (d. c. 1176), mistress of Henry II, king of England, is believed to have been the daughter of Walter de Clifford of the family of Fitz-Ponce. Rosamond is said to have been Henry's mistress secretly for several years. but was openly acknowledged by him only when he imprisoned his wife Eleanor of Acquitaine as a punishment for her encouragement of her sons in the rebellion of 1173–74. Rosamond died in 1176. and was buried in the nunnery church of Godstow before the high altar. The body was removed by order of St. Hugh, bishop of Lincoln, in 1191, and was, seemingly. reinterred in the chapter house. The story that she was poisoned by Queen Eleanor first appears in the French Chronicle of London in the 14th century. The romantic details of the labyrinth at Woodstock, and the clue which guided King Henry II to her bower, were the inventions of story writers of later times. There is no evidence for the belief that she mas the mother of Henry's natural son William Longsword, earl of Salisbury.

ROSARIO, a city and river port of Argentina, in the province of Santa FC, on the west bank of the Paraná, 186 mi. N.W. of Buenos Aires by rail. Pop. (1960) 671,852. It ranks next to Buenos Aires in size and in trade. It is accessible to ocean-going steamers of 26 ft. draught. The city stands on the eastern margin of the great pampean plain, 65 to 75 ft. above the wide riverbed washed out by the Paraná. It extends back a considerable distance from the river. The city is laid out with chessboard regularity, with wide streets and spacious parks. The Boulevard El Santafecino is an attractive residential street with double driveways separated by a strip of garden and bordered by fine shade trees. The chief edifices of an official character are the custom-house, post office, municipal hall and law courts. Industries include sugar refining, flour milling, brening, printing and the manufacture of bricks. leather, furniture and various kinds of food. The city is chiefly commercial, being the shipping port for a large part of northern Argentina. Among its exports are wheat, flour, baled hay, linseed, Indian corn, sugar, rum, cattle, hides, meats, wool and quebracho extract.

ROSARY, a popular devotion of the Roman Catholic Church, consisting of 15 Pater Nosters and Glorias and 150 Aves. The word also denotes the chaplet of beads for counting the prayers. It is divided into three parts, each containing five decades, a decade comprising one Pater, ten Aves and a Gloria, in addition to a subject for meditation selected from the "mysteries" of the life of Christ and of the Blessed Virgin. The Christian practice of repeating prayers is traceable to early times: Sozomen mentions the hermit Paul of the 4th century who threw away a pebble as he recited each of his 300 daily prayers. It is not known precisely when the mechanical device of the rosary was first used. William of Malmesbury says that Godiva, who founded a religious house at Coventry in 1043, left a string of jewels, on which she had told her prayers, that it might be hung on the statue of the Blessed Virgin. Thomas of Cantimpré, who wrote about the middle of the 13th century, first mentions the word "rosary," using it in a mystical sense as Mary's rose garden. Jacob Sprenger, a Dominican, founded the first confraternity of the Rosary at Cologne in 1474. The feast of the Rosary of the Blessed Virgin Mary was ordered to be observed on the first Sunday in October in such churches as maintained an altar in honour of the Rosary. Clement XI, by bull of Oct. 3, 1716, directed the observance of the feast by all Christendom.

ROSAS, JUAN MANUEL DE (1793–1877), tyrant of Buenos Aires and noted political figure in Argentine history, mas born March 30, 1793, in Buenos Aires. His parents were Léon Ortiz de Rozas and Agustina Lopez de Osornio, both of noble Spanish descent, and together they held perhaps the greatest family wealth in Buenos Aires province, consisting mainly of *estancias* (cattle ranches). Rosas received a primary education in the city of Buenos Aires, but as a young man preferred to spend his time on the family ranches where he became a complete *gaucho* (cowboy). He himself gradually acquired land south of the Salado river in Buenos Aires province, stocked it with cattle, and organized about him a force of *gauchos* trained with an iron discipline to which he was the first to subject himself..

On March 16, 1813, he married Encarnación Ezcurra y Arguibel. Then, after turning back to his parents all the properties he had administered for them. he established the large *estancia* of Los Cerrillos and a meat-salting plant in partnership with a friend.

His fame as a trainer of men brought him in 1815 the title of ojicial de *milicias* and in 1820 he was made a colonel of cavalry. Col. Manuel Dorrego, Federalist leader and governor of the province of Buenos Aires, later made Rosas *comandante* de la *campaña*, and when Dorrego was overthrown and executed in 1828 by Juan Lavalle, Rosas took over the Federalist party command, defeated Lavalle, the leader of the *unitarios* (Centralists), and in Dec. 1829 had himself elected governor of Buenos Aires. During his three-year term Rosas gave the province the first peace it had known in many years using bribery, political maneuvers and force to bring malcontents into line. A servile legislature made him brigadier-general and gave him the title of "Restorer of the Laws." He refused to be re-elected in 1832 and instead went south to fight the Indians, freeing white captives and capturing much-desired lands for himself and his followers.

Renewed political agitation, instigated and abetted by his followers (including his wife), brought disorder and confusion again to the province and an urgent demand for Rosas' return to power. But this time he refused to serve as governor unless granted complete dictatorial power, which the legislature gratefully gave him. In March 1835 he became dictator of Buenos Aires, a position he held until 1852. Other provincial governments permitted him to run their military and foreign affairs and usually did his bidding. Rosas refused to call a constitutional convention. His Argentine confederation (as he called it) continued under his domination as leader of the Federalist party, while the *unitarios* were pursued until captured or harried out of the land.

He quashed several revolutions that broke out against his tyranny. Killings of Rosas' opponents by his henchmen became the

order of the day. By 1840 few dared oppose him.

Rosas' policies embroiled him also in foreign conflicts, including wars with neighbouring countries and with England and France. Finally a coalition of Brazilians, Uruguayans, French troops and native Argentines under the leadership of Justo José de Urquiza overthrew him in the battle of Caseros (Feb. 3, 1852). Rosas fled to England and retired to a farm near Southhampton, where he died on March 14, 1877.

Much has been written on the Rosas regime, including some comparisons with the later Péron regime. Rosas has his modern admirers in Argentina, but in general Argentine historians have been critical of his rule, pointing out at the same time that he was perhaps indispensable in his day to bring law and order to an Argentina sunk in political anarchy following the winning of independence from Spain. (F. L. HN.)

ROSCELIN (*c.* 1050–*c.* 1125), in Latin called ROSCELLINUS COMPENDIENSIS, French philosopher and theologian, famous as an extreme nominalist, was born at Compiègne (Compendium). Having studied at Soissons and at Reims, he taught at Compiègne, at Loches (where he had Abelard as his pupil), at Besançon and at Tours. His only extant work seems to be a violent and vulgar letter to Abelard on the Trinity; the little that is known of his doctrines is otherwise derived from St. Anselm's and from Abelard's works and from the anonymous *De generibus* et *speciebus*. According to Roscelin, universals are nothing more than verbal expressions (in Anselm's words, *flatus vocis)*; Roscelin was, therefore, considered as the originator of extreme nominalism (*q.v.*). Again, no one thing can be divided into parts; every "part" is a whole in itself, and the division of "wholes" into "parts" is possible only in words, not in reality. Not even a syllogism is a unity; each proposition in it has a value in its own right without forming a whole with the others. Roscelin's doctrine of the Trinity, as consisting of three essences or substances—a doctrine inappropriately called "tritheism"—is partly based on the accepted Boethian definition of *persona* as *substuntie rationalis;* if God were one substance, all three persons would have been incarnated. It is not clear how this doctrine is connected with Roscelin's nominalism, nor how and whether he retracted it after his condemnation at the council of Soissons (1092).

BIBLIOGRAPHY.—Roscelin's letter to Abelard was first edited by J. A. Schmeller in the *Abhandlungen* of the Royal Bavarian academy, vol. iii (1849–50); for a later edition *see* F. Picavet, *Roscelin philosophe et théologien,* 2nd ed. (1911), the best documented work on Roscelin. (L. M.-Po.)

ROSCIUS (GALLUS), QUINTUS (c. 126–62 B.C.), a Roman actor, so famous that the name "Roscius" became used to designate a successful actor. was born at Solonium, near Lanuvium. He studied the delivery and gestures of the most distinguished advocates in the Forum, especially Q. Hortensius, and won universal praise for his grace and elegance on the stage. He especially excelled in comedy. Cicero took lessons from him. The two often engaged in friendly rivalry to try whether the orator or the actor could express a thought or emotion with the greater effect, and Roscius wrote a treatise in which he compared acting and oratory. Q. Lutatius Catulus composed a quatrain in his honour, and the dictator Sulla presented him with a gold ring, the badge of the equestrian order, a remarkable distinction for an actor in Rome, where the profession.was held in contempt. Like his contemporary Aesopus, Roscius amassed a large fortune, and he appears to have retired from the stage some time before his death. In 76 B.C. he was sued by C. Fannius Chaerea for 50,000 sesterces and was defended by Cicero in a famous speech.

ROSCOMMON, WENTWORTH DILLON, 4TH EARL OF (*c.* 1633–1685) English poet and critic. described by Pope as the only moral writer of Charles II's time. was born in Ireland about 1633, son of Sir James Dillon, 3rd earl of Roscommon, and nephew of the earl of Strafford, then lord deputy of Ireland. He was educated privately at Strafford's house in Yorkshire and, after his uncle's impeachment (1641), at the Protestant university of Caen in Normandy: he then toured Europe. Succeeding to the earldom in 1639, he returned to England in 1660. had his estates restored to him and soon won favour at Charles II's court. It is said that he became an immoderate gambler. After passing some time in Ireland he returned to London in 1662. He planned; together with Dryden and others, to form an academy on the continental model, which was to fix and refine the language and translate classical works into English. The design came to nothing, but Roscommon translated *Ars Poetica* into English blank verse in 1680. In his *Essay on Translated Verse* (1684) he n-as the first critic to praise *Paradise Lost* publicly. Dryden spoke highly of the *Essay*, though Johnson thought it unimportant, and considered Roscommon "elegant but not great." His writings, though they have merit, might not have been so highly commended as they were in his own time had he been of inferior rank. Both Oxford and Cambridge conferred doctorates on him. He died in Westminster, Jan. 17, 1685.

ROSCOMMON, a county of Ireland in the province of Connaught, bounded northeast by Leitrim, northwest by Sligo, west by Mayo, west and south by Galway, east by Longford and east and south by Westmeath and Offaly counties. The land area is 608,540 ac. or 950.8 sq.mi. Pop. (1956) 63,710 Most of the county belongs to the great limestone plain of central Ireland. The land is generally poor and used for grazing, with oats as the principal crop; there are a few small market towns and villages. In the northeast, on the Leitrim border, the Bralieve mountains, consisting of flat-topped ridges, attain an elevation in Cashel mountain of 1,377 ft.; and in the northwest the Curlew hills, of similar formation, between Roscommon and Sligo, rise abruptly to a height of more than 800 ft. In the east the Slieve Bawn range, formed of sandstone, has a similar elevation. The Shannon forms nearly the whole eastern boundary of the county, and on the west the Suck from Mayo forms for more than 50 mi. the boundary with Galway until it unites with the Shannon at Shannon Bridge. The other tributaries of the Shannon within the county are the Arigna, the Feorish and the Boyle. The lakes formed by expansions of the Shannon are Loughs Allen, Boderg, Boffin, Forbes and Ree. Other lakes are Lough Key in the north and Lough Gara (mostly in County Sligo) in the northwest. The county town, Roscommon, has a population of (1961) 1,697.

The district was granted by Henry III to Richard de Burgh, but remained almost wholly in the possession of the native septs. Until the time of Elizabeth I Connaught was included in the two districts of Roscommon and Clare and when these were subdivided, Roscommon was assigned its present limits. All the old proprietors were dispossessed at the Cromwellian settlement: except the O'Connor family headed by the O'Connor Don. Within the county are the ruins of Croghan, the palace of the kings of Connaught. The principal ancient castles are the stronghold of the M'Dermotts on Castle Island, Lough Key, the dismantled castle of the M'Donoughs at Ballinafad and the extensive fortress at Roscommon rebuilt by John d'Ufford, justiciary of Ireland in 1268. The abbey of Boyle, which is in good preservation, has Norman arches. The Irish bard Carolan, who died in 1738, is buried by the ruined church of Kilronan. The Protestant bishopric of Elphin was united with Kilmore and Ardagh in 1833. The Roman Catholic diocese of Xchonry has its seat at Ballaghaderreen, but some parts of the county are included in the dioceses of Clonfert and Elphin.

The administrative county of Roscommon returns four members to *dail eireann.*

ROSE, any of numerous species of wild or cultivated flowering shrubs of the genus *Rosa*. The rose has been closely associated with the culture of many civilizations. Not only is it a favourite flower but it serves as a symbol of perfection, elegance, romance and love. The Greek poetess Sappho in her "Ode to the Rose" first called it "the queen of flowers." No other flower is so universally known and even the name is easily recognized in most languages of Latin or Germanic origin. It is prominent in painting, architecture, music and literature and figures in legends, customs, heraldry and religion. Roses have been used in medicines and during World War II rose hips or fruits were a source of vitamin C. Rose petals can be used in cookery, particularly for confections, and extracts containing the essential oil which gives the fragrance are used for flavouring desserts or for scent in cosmetics and perfume. From the horticultural point of view roses are important plants. Large acreages are devoted to their production for

garden and greenhouse culture in the leading countries of t world. O the subcontinent oi India, in Iran, the Balkans nnd France large quantities oi blooms are grown ior tl production of the perfume attar of roses (*q.v.*). The great variation in habit oi growth makes them useful in almost any landscape situation.

As a garden flower they possess many admirable qualities. The colour ranges from white through various tones f yellow, pink and dark crimson and maon Many varieties with beautl blends of colour including apricot and salmon tones exist. The form of the rose bloom varies from the delicate primitive charm of the species roses to the fully double, high-centred, beautifully sculptured blooms of the modern hybrid. Size ranges from the tiny miniatures not more than one-half inch in diameter to exhibition flowers seven inches or more across. Few persons fail to enjoy the delightful fragrance of most roses. which varies according to the variety and climatic conditions. While the typical rose odour is that produced by the damask and similar roses known as attar of roses, the scent of other kinds may suggest spices. fruits, hay, other flowers or. as in the case of the tea rose. fresh green tea leaves. Many species and varieties have brilliantly coloured hips which are ornamental during the fall and winter. Because of the history and romance associated with them and the scientific challenge of their culture, rose study is an absorbing hobby. There are national amateur and professional rose organizations in several countries.

PHOTOGRAPHS: L. W. BROWNELL (LEFT), J. C. ALLEN & SON (RIGHT)

COMMON WILD ROSE (ROSA HUMILIS) AND DOMESTIC GARDEN ROSE

The rose gives its name to the botanical family Rosaceae, of which it may be considered the type. Most botanists agree that the genus consists of from 100 to 200 species, although thousands of botanical names have been applied. Roses. even from widely separated regions, hybridize readily, giving rise to types which overlap the parental forms and thus make it difficult to determine basic species. Rose species are distributed primarily in the temperate part of the northern hemisphere, but some are found above the Arctic circle and a few at the higher elevations in the tropics.

Roses are erect, climbing or trailing shrubs, never trees (except in grafted sorts) or herbs. generally more or less copiously armed with prickles of various shapes and sizes popularly called thorns. The leaves are invariably alternate. provided with stipules which are often aromatic glandular. and unequally pinnate. the leaflets varying in number from 1 to 11 or more, the odd leaflet always being at the apex. the others in pairs. The flowers are solitary or in loose corymbs or panicles produced at the ends of the shoots. The flower stalk expands into a fleshy vase- or urn-shaped hypanthium, called the receptacle or receptacular tube or hip which ultimately contains the numerous achenes (seeds).

From the edge of the hypanthium proceed five sepals, often more or less compound like the leaves and overlapping in the bud. Within the sepals are five petals. generally broad or roundish in outline. with a very short stalk or none at all. and of various shades of white. yellow or red. The numerous stamens originate slightly above the sepals and petals; each has a slender filament and a small two-celled anther. The carpels are numerous, covered with hairs. Each is provided with a long style and buttonlike stigma. The carpels are concealed within the hypanthium and only the stigmas as a rule protrude from its mouth. Each carpel contains one ovule.

The hips are usually brightly coloured as an attraction to birds, which devour them and thus bring about the dispersion of the seed. The stamens are in whorls and, according to J. B. Payer, originate in pairs, one on each side of the base of each petal so that there are ten in each row; a second row of ten alternates with the first, a third with the second. and so on. By repeated radial and tangential branching a vast number of stamens are ultimately produced. These stamens may become petaloid, giving rise to double flowers so much admired by gardeners. Under natural circumstances rose flowers do not secrete nectar, the attraction for insects being provided by the colour and perfume and the abundance of pollen for food. The stigmas and anthers come to maturity at the same time; consequently, while cross-pollination by insects is common. self-fertilization is not prevented.

Species.—The numerous roses native to North America belong to about 35 species. The smooth rose (R. *blanda*), usually lacking prickles. with flowers about three inches broad, occurs abundantly from Newfoundland to Saskatchewan and southward to New Jersey and Missouri. The prickly rose (R. *acicularis*). with spiny stems, leaves composed of from five to nine leaflets and solitary flowers two and one-half inches broad, ranges from Quebec to Alaska and south to Colorado. The pasture rose (R. *virginiana*), from one-half to six feet high, with few or solitary flowers two to three inches across. sometimes double, occurs from Newfoundland to Wisconsin and south to Georgia. This is the most common wild rose of the eastern states and Canada. The prairie rose (R. *setigera*). a large shrub with a tendency to climb. the leaves usually with three leaflets, bears rose-pink flowers which turn white with age. This handsome rose. which grows wild from Ontario to Wisconsin and south to Florida and Texas, has become naturalized eastward to New England. The California rose (*R. californica*). a sparsely prickly shrub three to nine feet high, flowering nearly the year round. sometimes forms thickets along streams.

The large number of roses described as European may be included under about 12 generally accepted species. R. *spinosissima*, the Scotch rose, is a low bush densely provided with slender prickles and producing white, pale pink or yellowish flowers one and one-half to two inches across. *R. eglanteria*, the eglantine or sweetbrier, is a stiff, erect, branching bush with pink blooms and sweet-smelling foliage. The dog rose, R. *canina*, including numerous subspecies and varieties, is common along the lanes and hedgerows of England and bears white or pinkish single flowers one to two inches across. The large-fruited apple rose, R. *pomifera*, is prized because of its large scarlet hips which may be one inch or more in diameter. R. *arvensis*, the parent of the Ayrshire rose, is a very thorny shrub with more or less decumbent or creeping branches. The French rose, R. *gallica*, a small shrub three to four feet high, is a variable old and familiar garden rose.

The damask rose, *R. damascena,* possibly of hybrid origin, is similar to *R. gallica* but larger. The cabbage rose, *R. centifolia,* has been cultivated since ancient times for its double fragrant flowers. The moss rose, which has a "mossy" pedicel and calyx, is a variant of this species. *R. rubrifolia* is an unusual shrub because of its reddish glaucous stems and foliage. The cinnamon rose, *R. cinnamomea,* is a hardy old garden species common along fences and roadsides and has double fragrant blooms in shades of red, two inches or more across.

Many species important as cultivated plants and for the hybrids produced with North American and European species are of Asiatic origin. The tea rose *(R. odorata)* from western China is nearly evergreen, has five to seven leaflets and blooms more or less continuously through the year. The fragrant tea-scented flowers are one to three inches across, white, light pink or salmon yellow. The China or Bengal rose *(R. chinensis)* is similar to *R. odorata* but the plants are smaller and the flowers odourless. The Austrian briar *(R. foetida)* is a three- to five-foot shrub with deep yellow flowers two to three inches in diameter, usually solitary. *R. multiflora* is an attractive shrub with long, arching branches. The flowers are one-half to three-fourths inches across and borne 25 to roo in dense panicles. The memorial rose *(R. Wichuraiana)* produces long prostrate stems and fine glossy foliage; the slightly fragrant white flowers are one inch across, borne in clusters. *R. rugosa* is a remarkable species because of its bold rugose foliage, its large red, pink or white flowers and its conspicuous fruits. R. *Moyesii* is an attractive ten-foot shrub with two and one-half inch deep red flowers. R. *Hugonis* is a handsome, hardy shrub producing an abundance of light yellow flowers in early spring. The Macartney rose *(R. bracteata),* introduced into England from China, is a stout evergreen shrub producing lopping shoots 10 to 20 ft. long. The Cherokee rose *(R. laevigata)* is a rampant plant climbing over fences and trees. It is widely planted in southern United States, where it has run wild and appears to be indigenous; in fact, the species was first described botanically from American plants. The Lady Banks rose *(R. Banksiae)* is a high-climbing evergreen with few or no prickles and smooth slender twigs. The flowers are about one inch across, single or double, white or yellow, somewhat fragrant and borne in umbellike clusters.

Roses have been cultivated for so many centuries and have been hybridized so extensively that it is difficult to refer the cultivated forms to wild prototypes. It is generally agreed. however, that the present-day garden varieties of bush roses have been evolved through the repeated intercrossing of *R. gallica, R. damascena, R. centifolia, R. chinensis, R. odorata* and *R. foetida.* Certain traits such as continuous blooming and certain fragrances characteristic of modern roses are traceable to the influence of R. *chinensis* and *R. odorata.* The influence of *R. foetida* is shown through the strong yellow hues of many garden hybrids. Vigour, hardiness and other growth, flower and odour characteristics are apparently derived from *R. gallica, R. damascena* and *R. centifolia.* Many climbing roses resulted from crosses between hybrids of bush types with *R. Wichuraiana, R. multiflora* or other species.

The number of cultivated clones is very large and about 100 are introduced into commerce each year. To facilitate grouping varieties (clones) with similar characteristics, a horticultural classification has evolved which is complicated and often inconsistent. In some cases it is based upon origin from mild species, in others upon habit of growth or manner of flowering. There is considerable overlapping and mergence of classes as the result of relentless interbreeding. Among bush roses the main classes include hybrid perpetuals. teas, hybrid teas, polyanthas, floribundas or hybrid polyanthas and grandifloras. Climbing roses are classed as ramblers, large-flowered climbers, everblooming hardy climbers, climbing forms of hybrid teas, floribundas and other bush types and trailing varieties. A comprehensive list is given in J. H. McFarland's *Modern Roses* IV (1952), which includes 6,150 names. Of these *300* are classed as species or botanical varieties; 3,264 as hybrid teas; 215, hybrid perpetuals; 617, polyanthas and floribundas; 32j, climbing hybrid teas; 249, ramblers; and 173, large-floaered climbers. The list. however, represents only a small proportion of the roses hybridized and named during the preceding 250 years.

Propagation. — Roses are propagated by seeds, cutting, layering, grafting and budding. Most rose seed requires a stratification treatment to hasten germination. Commercially, rose plants are produced largely by budding the desired clone onto an understock. In Europe forms of *R. canina* are used extensively while in the U S. forms of *R. multiflora* are commonly used although in some areas Ragged Robbin, Dr. Huey and forms of *R. odorata* are employed. Tree or standard roses are budded from two to six feet above ground level on a tall, straight cane of the understock. For this purpose forms of *R. canina,* R. *multiflora* and R. *rugosa* are commonly used. Plants for greenhouse culture are usually budded on Manetti *(R. Noisettiana* var. *Manetti).*

Cultivation. — It is important to select a proper location for the rose planting or garden. In moderate or cool climates, full sun is desirable. Where summers are hot, shade during part of the day, particularly in the afternoon, is desirable. Good drainage is essential and, if the site has a tendency to become waterlogged, a tile drainage system should be installed or the beds raised well above ground level. Roses should be planted away from trees or shrubs ahose roots may invade the bed and compete for water and nutrients. Protection from strong winds should be provided. Soil that will grow good vegetables is usually satisfactory. Incorporating organic material such as well-rotted stable manure, leaf mould, compost, peat moss or similar substances improves unsatisfactory soil. The optimum soil reaction range is from *p*H 5.5 to 6.5. Lime should be applied to acid or sour soil and alkaline or sweet soil may be acidified with the use of ferrous sulphate, powdered sulphur or other chemicals.

Most roses are set out as dormant bare-root plants in the spring or fall depending upon the climate. Mounding soil around the base of the plants after planting helps to protect the canes from drying out until root action occurs. Bushes for planting at other seasons are available in pots, tin cans or other containers.

Roses respond to the use of fertilizers and the organic types are preferred, although inorganic mixed fertilizers are satisfactory when properly used. Top-dressing with rotted manure or using liquid manure is advantageous. Watering the beds immediately after fertilizer is applied is recommended.

Watering during dry periods is important for successful rose culture. A great deal of water is given off by the leaves and experiments have shown that an average-sized hybrid tea bush may transpire as much as *30* gal. of water during a single growing season. Thorough watering is essential; this means soaking the soil to a depth of from six to eight inches.

Cultivating the beds to eliminate weeds and keeping the surface loose and well aerated is recommended but it should not be so deep as to destroy roots. Mulching with grass clippings, peat moss, buckwheat hulls, ground corncobs, rice hulls, etc., conserves moisture, keeps down soil temperature and eliminates weeds.

Pruning is practised to keep the plants in vigorous condition and to improve their appearance and productivity. The different classes and even different varieties in the same class may respond to different pruning treatment, but in general the practice for bush roses involves cutting out all dead or injured wood in the spring, removing weak, twiggy growth and cutting back the strong canes to a moderate height to give a well-balanced appearance.

The climbers that bloom only once during the season are best pruned immediately after flowering. Withered blooms should be removed promptly from everblooming climbers so that new flowering shoots will be produced.

In cold climates where the temperature normally goes below 5° F., protection during the winter is necessary. This is accomplished by mounding soil around the base of the plants just before the surface freezes and later covering with evergreen boughs, marsh hay, straw or other coarse material. Where climbing roses are likely to freeze they may be removed from their supports, laid on the ground and covered with soil. In the spring the canes are again tied back on the supports.

Diseases. — Roses are infected by a number of diseases, most of them caused by fungi. Powdery mildew is widespread wherever roses are grown and is observed as a grayish-white moldlike growth

on the surface of young leaves, stems and buds. Copper and sulfur fungicides are effective for control when applied either as a spray or dust.

Black spot may occur in humid climates if precautions are not taken. Conspicuous black spots appear on the leaves, which soon drop, defoliating the plants. Spores are formed in the spots on the leaves and are washed from one plant to another by rain or overhead sprinkling. If the surface of the leaf remains wet for a period of about six hours, the spores can germinate and cause infection unless the surface of the leaf is protected by a thin film of fungicide. Fixed or insoluble copper fungicides, finely powdered, or wettable sulfur are standard control materials. There are also a number of organic fungicides such as Ferbam and Captan that are highly effective if applications are timely and thorough. Removing infected leaves as soon as a spot is detected and keeping all fallen leaves removed from the surface of the bed is recommended.

Rust appears on both cultivated and wild roses in the spring, bursting through the bark in the form of masses of orange powder consisting of the spores of the fungus. In summer the spores infect the leaves and produce on them small orange dots and later groups of spores that are able to live through the winter. It is important that all affected leaves should be destroyed in the autumn and the bush sprayed with a copper, sulfur or Ferbam fungicide in the spring to prevent infection of leaves by spores brought from a distance.

Other diseases that are sometimes troublesome are canker, crown or root gall and anthracnose.

There are a number of insects which may prove troublesome. Aphids are common but are easily controlled by nicotine spray or dust and many other insecticides. Various caterpillars, sawfly larvae and similar insects feed on the leaves and young shoots. These are easily controlled, however. by stomach poisons such as arsenate of lead. DDT and other materials. Red spider mites which multiply in great numbers, largely on the undersides of the leaves, are serious pests because they are difficult to see and may cause damage before being discovered. Materials such as Malathion, Aramite and Ovatran are available for their control. Other insects are thrips, earwigs, midge and scale insects.

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ROSEBERY, ARCHIBALD PHILIP PRIMROSE, 5TH EARL OF (1847–1929), British statesman, born in London on May 7, 1847, was the son of Archibald, Lord Dalmeny (1809–1851) and Catherine, daughter of the 4th earl Stanhope. Lady Dalmeny married, after her husband's death, the duke of Cleveland. Young Dalmeny was educated at Brighton and at Eton, where he had as slightly junior contemporaries A. J. Balfour and Randolph Churchill. In 1866 he matriculated at Christ Church, Oxford, but went down in 1868, by the request of the dean, rather than abandon the possession of a small racing stud. In the same year he succeeded his grandfather, the 4th earl, in the earldom and the family estates. After some time spent in travel he acquired an English country house called The Durdans, Epsom, which he largely rebuilt and adorned with some of the finest turf portraits of George Stubbs. He had a famous stable, and, later, won the Derby three times, in 1894, 1895 and 1905. In 1878 he married Hannah, only child of Baron Meyer Amschel de Rothschild.

Though impeded in his political career by his exclusion from the House of Commons, Lord Rosebery's reputation as a social reformer and orator was steadily growing. In 1878 he was elected Lord Rector of Aberdeen and in 1880 of Edinburgh University, where he gave an eloquent address upon Patriotism. In 1880 he entertained Gladstone at Dalmeny, and during the "Mid Lothian campaign" he arranged the demonstrations. In August 1881 he became under-secretary at the home office, his immediate chief being William Harcourt. His work was practically confined to the direction of the Scottish department of the office, and he resigned in 1883. He resumed office (1884) as first commissioner of works with a seat in the cabinet.

In the brief Gladstonian government of 1886 Lord Rosebery threw in his lot with the old leader, and was foreign secretary. His views on foreign policy differed materially from those of Granville and Gladstone. His mind was dwelling constantly upon the political legacy of the two Pitts; he was a reader of John Seeley; he had himseif visited the colonies; had predicted that a war would not, as was commonly said, disintegrate the empire, but rather the reverse; had magnified the importance of taking colonial opinion, and had always been a convinced advocate of some form of Imperial Federation. He was already taunted with being an Imperialist, but his independent attitude won public approval. In January 1889 he was elected a member of the first county council of London, and on Feb. 12, chairman of that body by 104 votes to 17. With a view to the impending political campaign he found it necessary to resign the chairmanship of the county council in June. In November of this year. however, Lady Rosebery died, and he withdrew for a period from public business. In January 1892 he again for a few months became chairman of the county council. In October he received the Garter.

In August 1892, upon the return of Gladstone to power, he was induced with some difficulty (for he was suffering at the time from insomnia) to resume his position as foreign minister. He strongly opposed the evacuation of Egypt; he insisted upon the exclusive control by Great Britain of the Upper Nile Valley, and also upon the retention of Uganda. In 1893 the question of Siam came near to causing serious trouble with France, but the crisis was averted, and the lines were laid down for preserving Siam, if possible, as a buffer state between the English and French frontiers in Indo-China. In the spring of 1895 he was clear-sighted enough to refuse to join the anti-Japanese league of Russia, France and Germany at the end of the China-Japan War.

Lord Rosebery's personal popularity had been increased at home by his successful intervention in the coal strike of December 1893, and when in March 1894 the resignation of Gladstone was announced, his selection by Queen Victoria for the premiership was generally welcomed. but the malcontents in his own party, who considered that William Harcourt should have been the prime minister, or who were perpetually intriguing against a leader who did not satisfy their idea of radicalism, made Lord Rosebery's personal position no easy one. The support of the Irish Nationalists was endangered by his insistence that the goodwill of England, the "predominant partner," was essential to the success of Home Rule. On June 24, 1895, the government fell.

For the state of disorganization and discontent in the Liberal Party during the next ten years of opposition see LIBERAL PARTY. The breach between William Harcourt and Rosebery had never been healed, and Rosebery found himself also, to his great grief, at variance with Gladstone. He declined to support Gladstone's demand for intervention on behalf of the Armenians at the risk of a European war, and on Oct. 8, 1896, he announced to the Liberal whip, Thomas Ellis, his resignation of the Liberal leadership. For some time he held aloof from party politics, "ploughing his furrow alone," as he afterwards phrased it.

In 1898, on the death of Gladstone, he paid a noble and eloquent tribute in the House of Lords to the life and public services of his old leader. He gave a general support to the policy of the Salisbury government on the South African War. But the war had brought to the front a section antagonistic to the war and known in the jargon of the day as pro-Boers. These had won the qualified support of Campbell-Bannerman, the leader in the House of Commons. Lord Rosebery maintained for the most part a sphinx-like seclusion, but in July 1901 he at last came forward strongly as the champion of the Liberal Imperialist section of the party, which included Asquith, Grey and Haldane. At a meeting at Chesterfield (Dec. 1901), he spoke of "cleaning the slate" of the old party cries, and eventually spoke of his separation from the "tabernacle" of Campbell-Bannerman. But the main body of the

party stood by Campbell-Bannerman, and a partial reconciliation was effected. Chamberlain's tariff reform campaign helped to bring the Liberal Imperialists nearer to the rest of the party. Rosebery's own pronouncements on the tariff issue were hesitating, and to some extent contradictory. But though he eventually came into line with his colleagues on tariff reform, he finally broke with Campbell-Bannerman on the question of Home Rule for Ireland. On the fall of the Conservative government in Dec. 1905, Campbell-Bannerman was invited to form a cabinet, and Rosebery retired from party politics, though he encouraged his immediate associates to join the new government.

Rosebery continued eloquent and witty addresses on miscellaneous subjects. No public man of his time was more fitted to act as unofficial national orator; none more happy in the touches with which he could adorn a social or literary topic and charm a non-political audience; and on occasion he wrote as well as he spoke, His *Pitt* (1891) was already a classic; his *Appreciations and Addresses* and his *Peel* (containing a remarkable comment on the position of an English prime minister) were published in 1899; his *Napoleon: the Last Phase—an* ingenious, if paradoxical attempt to justify Napoleon's conduct in exile at St. Helena—in 1900; his *Cromwell* in the same year.

Lord Rosebery took an active part in the constitutional crisis in 1910 and 1911. He treated the Parliament Bill as a revolutionary measure. which in effect constituted single-chamber government, and did his utmost to arouse the nation to its danger. In 1914, as lord-lieutenant of Midlothian and Linlithgowshire he promoted recruiting and other war-like activities among his own people. He was chancellor of Glasgow university in 1908, as he had long been chancellor of London university, and he was chosen lord rector of St. Andrew's university for the year of its quincentenary celebration in 1911.

Lord Rosebery's eldest son, Lord Dalmeny (b. Jan. 1882), entered parliament in 1906 but retired in 1910. The younger son, Neil Primrose (1882–1917) was undersecretary for the Foreign Office in 1915 and parliamentary secretary for munitions in 1916. He died in Palestine on Nov 18. 1917.

ROSECRANS, WILLIAM STARKE (1819–1898). Union officer during American Civil War, was born in Kingston. O., Sept 6, 1815, and graduated from West Point in 1842. After 12 years as a regular army officer he resigned to enter business in Ohio until the Civil War brought him back to military service. He served under Gen George B. McClellan and Gen. John Pope and succeeded each when they moved east to larger commands. During 1862 he led the Union forces to victory in the battles of Iuka and Corinth. after which he moved on to Nashville to the command of the Army of the Cumberland. He fought the bloody and indecisive battle of Stone (or Stones) River (Murfreesboro) Dec. 31, 1862–Jan 3, 1863. His aggressive spirit had pleased his Washington superiors, nho mere looking always for a fighting general, but now he began to show other qualities: an excess of caution and hesitancy, a disposition to worry and to argue with his superiors. Finally. on June 23, 1863. after six months of delay in the face of official pressure to take the offensive, he pushed Gen. Braxton Bragg into Chattanooga, then maneuvered him out of the city without a battle. Here his customary caution deserted him and he followed Bragg who turned upon him at Chickamauga (*q.v.*), Sept. 19–20. An ill-advised move opened a gap in his lines and allowed the Confederates to pour through and drive him and a part of his army back into Chattanooga (*q.v.*). Only the stand of Gen. George Thomas on the Union left averted complete disaster. Gen. U. S. Grant, now charged with the defense of Chattanooga, removed Rosecrans, ending any important role for him in the war.

Rosecrans resigned his army commission in 1867. He served for tno years as minister to Mexico (1868–69) and later engaged in mining operations in Mexico and California. He served in congress, 1881–85, from California, and afterward became register of the treasury. He retired to California in 1893 and died there on March 11, 1898. (C. W. TE)

ROSEGGER, PETER (1843–1918), Austrian poet and novelist, known down to 1894 under the pseudonym *Petri Kettenfeier*, was born at Alpl near Krieglach in Upper Styria, on July 31, 1843, the son of a peasant. His work includes novels, poems, religious writings and autobiographical volumes, notably *Waldheimat* (1873) and *Mein Weltleben* (1898).

ROSELLE and **ROSELLE PARK,** boroughs in Union county, N.J., U.S., adjoining Elizabeth on the west, are suburban residential communities of the New York metropolitan area and also have factories whose products include rugs, toys, restaurant equipment, surgical supplies and leather goods. Roselle, incorporated in 1894, is the site of the birthplace of Abraham Clark. one of the Kew Jersey signers of the Declaration of Independence. Thomas A. Edison's experiments there made Roselle the first community to be completely lighted by electricity.

Roselle Park, once named North Roselle, was incorporated in 1901. Guglielmo Marconi. inventor of the wireless, established a plant there in 1913 which during World War I was a leader in the manufacture of communications equipment. KDY, a pioneer commercial radiobroadcasting station, was located there in 1921.

For comparative population figures *see* table in NEW JERSEY: *Population.* (E. R. D.)

ROSEMARY, botanically *Rosmarinus officinalis,* a plant of the mint family (Labiatae), the only representative of the genus and a native of the Mediterranean region. It is a low shrub with linear leaves, dark green above, white beneath, and with margins rolled back on to the under face. The flowers are in small axillary clusters. Each has a two-lipped calyx, from which projects a bluish two-lipped corolla enclosing two stamens. The fruit consists of four smooth nutlets. Rosemary was highly esteemed by the ancients for its aromatic quality and medicinal uses. In modern times it is valued mainly for its perfume; the oil is obtained by distillation. Rosemary plays an important part in literature and folk-lore, being an emblem of remembrance.

ROSENBACH, ABRAHAM SIMON WOLF (1876–1952), U.S. book and manuscript collector and dealer, who combined solid scholarship and exceptional business acumen, was born in Philadelphia, Pa, on July 22, 1876. He attended the University of Pennsylvania (B.S. 1898; Ph.D. 1901) where as a freshman he bought for $3.60 a first edition of Dr. Johnson's prologue at the reopening of Drury Lane theatre in 1747 for which he later refused $5,000. From 1895 to 1901 he was a teaching fellow in the English department, and before 1903 he joined his brother Philip, a book dealer, in launching the Rosenbach company. Upon the death in 1903 of their uncle, Moses Polock, whose bookshop Rosenbach had haunted since his childhood, the brothers acquired a substantial collection of his books and were soon in a position to buy entire libraries, expanding their business into what may well have been the most lucrative book concern in the world. Among his clients were Henry E. Huntington, founder of the library bearing his name at San Marino, Calif., and J. Pierpont Morgan, founder of the library bearing his name in New York city. In 1947, Rosenbach bought a copy of *The Bay Psalm Book* for $151,000, then a record price. A shrewd bibliophile, Rosenbach came to be the most formidable bidder of his time at auctions in the US. and Europe. The total of his purchases was estimated as exceeding $75,000,000. In addition to a wealth of English literature and Americana, Rosenbach acquired a magnificent collection of children's books that he later presented to the Philadelphia Free library; he bought eight Gutenberg Bibles and more than thirty Shakespeare first folios. He published a great many bibliographical and literary articles; his checklist *Early American Children's Books* (1933) is a standard reference. In 1930 he established the Rosenbach fellowship in bibliography at the University of Pennsylvania, and upon his death in Philadelphia on July 1, 1952, willed his estate to the Rosenbach foundation. established in 1950 to foster interest in books. paintings, and *objets d'art.*

His other works include *Books and Bidders* (1927), *The Unpublished Memoirs* (1917) and *A Book Hunter's Holiday* (1936).

See *E* Wolf and J. F. Fleming, Rosenbach (1960).

ROSENHEIM, German town and watering place in Upper Bavaria, at the confluence of the Mangfall and the Inn, 40 mi. S.E. of Munich by rail. Pop. (1950) 29,937. Rosenheim is frequented for its saline and sulfur baths, and there are saltworks.

ROSENKRANZ, KARL (1805–1879), German philosopher of the Hegelian school, was born at Magdeburg on April 23, 1805. He was professor of philosophy at Konigsberg from 1833 until his death on July 14, 1879. Rosenkranz was a loyal Hegelian. In the great division of the school, he, in company with Michelet and others, formed the "centre," midway between Erdmann and Gabler on the one hand, and the "extreme left" of Strauss, Feuerbach and Bruno Bauer. With F. W. Schubert he edited Kant's *Sämtliche Werke* (Leipzig, 12 vols., 1838–42), the last vol. of which contains his *Geschichte der kantischen Philosophie.*

ROSENWALD, JULIUS (1862–1932), U.S. merchant and philanthropist, was born in Springfield, Ill., on August 12, 1862, the son of Samuel Rosenwald and Augusta (Hammerslough) Rosenwald. His father came to the United States about 1854 from Germany and finally established himself as one of the leading clothing merchants of Springfield, Ill. Julius Rosenwald was educated in the public schools of Springfield. At the age of 16 he went to New York city to learn the clothing business. In 1885, together with his brother, Morris S. Rosenwald, and his cousin, Julius Weil, he established the clothing business of Rosenwald & Weil in Chicago. In 1897 he became active as vice-president of Sears, Roebuck & Company. In 1909 Richard W. Sears retired as president of Sears, Roebuck & Company, and Julius Rosenwald succeeded him in that office and held the position until 1924, when he became chairman of the board. In 1916 Rosenwald, aith Albert H. Loeb, treasurer of the company, was instrumental in establishing an employees' savings and profit-sharing pension fund.

In Dec. 1916, at the request of President Wilson, Julius Rosenwald began his service as a member of the advisory commission of the council of national defense, and he served as chairman of the committee on supplies of that body until the summer of 1918. During the period of America's participation in the war he made huge purchases of equipment and materials for the army and navy and for the Allies of the United States.

As soon as he began to acquire a large personal fortune, Rosenwald started to engage in charitable and philanthropic activities on a great scale. He was active in Jewish charities in Chicago and became actively interested in the welfare of the Negro in 1911. The Julius Rosenwald fund was established in 1917 and dedicated to "the well-being of mankind." Rosenwald was firmly opposed to perpetual endowments, and his propaganda against them exercised a creative influence on philanthropy throughout the world.

The chief effort at first of the Julius Rosenwald fund was to better the condition of Negroes through education. It was always one of Rosenwald's principles of public giving to inspire others to give by the example of his own gifts, and frequently he made his offers, large and small, in such form that they had to be matched by other gifts before they were gained.

In addition to his work for Negro education through the Julius Rosenwald fund, Rosenwald served as a trustee of Tuskegee institute. founded by Booker T. Washington in 1881. from 1912 until the time of his death.

During the war Julius Rosenwald donated $1,000,000 to the Jewish War Relief fund. After the war, he pledged $6,000,000 for the effort of the Joint Distribution committee to settle the Jews of Russia in agricultural colonies in that country. He contributed $100,000 in 1920 for the relief of German children.

Rosenwald made gifts of more than $4,000,000 to The University of Chicago, and he gave approximately $6,600,000 for a Museum of Science and Industry in Chicago. He also founded dental infirmaries in the Chicago public schools. He was a large contributor to the work of the Y.M.C.A. in Chicago and elsewhere, and he contributed $25,000 toward the cost of erecting each Y.M.C.A. building for Negroes in 21 cities of the United States. Rosenwald's gifts during his lifetime exceeded $22,000,000 exclusive of the Rosenwald fund, which had assets worth $40,000,000 in 1928.

Rosenwald took an active interest in the civic affairs of Chicago for many years, and he was deeply interested in the improvement of municipal and national government. He was a trustee of The University of Chicago, of the Rockefeller foundation, of the Baron de Hirsch fund and of other organizations. Julius Rosenwald died in Chicago on Jan. 6, 1932. (M. R. W.; X.)

ROSES, WARS OF THE, a name given to a series of civil wars in England during the reigns of Henry VI., Edward IV, and Richard III. Their importance in the general history of England is dealt with elsewhere, and their significance in the history of the art and practice of war is small. They were marked by a ferocity and brutality practically unknown in the history of English wars before and since. The honest yeoman of Edward III.'s time had evolved into a professional soldier of fortune, and had been demoralized by the prolonged and dismal Hundred Years' War, at the close of which many thousands of ruffians, whose occupation had gone, had been let loose in England. At the same time the power of feudalism had become concentrated in the hands of a few great lords, who were wealthy enough and powerful enough to become king-makers. The disbanded mercenaries enlisted indifferently on either side, corrupting the ordinary feudal tenantry with the evil habits of the French wars, and pillaged the countryside, with accompaniments of murder and violence, wherever they went. It is true that the sympathies of the people at large were to some extent enlisted: London and, generally, the trading towns being Yorkist, the country people Lancastrian—a division of factions which roughly corresponded to that of the early part of the Great Rebellion, two centuries later, and similarly in a measure indicative of the opposition of hereditary loyalty and desire for sound and effective government. But there was this difference, that in the 15th century the feeling of loyalty was to a great extent focussed upon the great lords.

It is from the Wars of the Roses that there originated the deep-rooted dislike of the professional soldier which was for nearly four centuries a conspicuous feature of the English social and governmental system, and it is therefore in their results rather than their incidents that they have affected the evolution of war. They withdrew the English army system from European battlefields precisely at the moment of transition when the regimental and technical organization of armies was becoming a science and seeking models, and the all-powerful English longbow at the moment when the early, scarcely effective firearms were, so to speak, struggling for recognition as army weapons. On the other hand, they destroyed the British military organization, which remained for 150 years an aggregation of county levies armed with bills and bows.

The first campaign, or rather episode, of these wars[1] began with an armed demand of the Yorkist lords for the dismissal of the Lancastrian element in the king's council, Henry VI. himself being incapable of governing. The Lancastrians, and the king with them, marched out of London to meet them, and the two small armies (3,000 Yorkists, 2,000 Lancastrians) met at St. Albans (May 22, 1455). The encounter ended with the dispersion of the weaker force, and the king fell into the hands of the Yorkists. Four years passed before the next important battle, Blore Heath, was fought (Sept. 23, 1459). In this the earl of Salisbury trapped a Lancastrian army in unfavourable ground near Market Drayton, and destroyed it; but new political combinations rendered the Yorkist victory useless and sent the leaders of the party into exile. They made a fresh attempt in 1460, and, thanks partly to treason in the Lancastrian camp, partly to the generalship of Warwick, won an important success and for the second time seized the king at Northampton (July 10, 1460). Shortly afterwards, after a period of negotiation and threats, there was a fresh conflict. Richard duke of York went north to fight the hostile army which gathered at York and consisted of Lancashire and Midland Royalists, while his son Edward, earl of March, went into the west. The father was ambushed and killed at Wakefield (Dec. 30, 1460), and the Lancastrians, inspired as always by Queen Margaret of Anjou, moved south on London, defeated Warwick at St. Albans (Feb. 17, 1461), and regained

[1]The name, as is well known, comes from the "white rose of York" and the "red rose of Lancaster"; but these badges, though more or less recognized as party distinctions, by no means superseded the private devices of the various great lords, such as the "falcon and fetterlock" of Richard duke of York, the "rose in sun" of Edward IV., the "crowned swan" of Margaret, the Vere star, and even the **revived** "white hart" of Richard II.

possession of the king's person. But the young earl of March, now duke of York, having raised an army in the west, defeated the earl of Pembroke (Feb. 2, 1461) at Mortimer's Cross (jm. west of Leominster). This was the first battle of the war which was characterized by the massacre of the common folk and beheading of the captive gentlemen — invariable accompaniments of Edward's victories, and notably absent in Warwick's. Edward then pressed on, joined Warwick, and entered London, the army of Margaret retreating before them. The excesses of the northern Lancastrians in their advance produced bitter fruit on the retreat, for men flocked to Edward's standard. Marching north in pursuit, the Yorkists brought their enemy to bay at Towton (see TOWTON, BATTLE OF), 3m. south of Tadcaster, and utterly destroyed them (March 29, 1461). For three years after Towton the war consisted merely of desultory local struggles of small bodies of Lancastrians against the inevitable. The duke of York had become King Edward IV. But in 1464, in the far north of England, the Red Rose was again in the field. Edward acted with his usual decision. His lieutenant Montagu (Warwick's brother) defeated and slew Sir Ralph Percy at Hedgley Moor, near Wooler (April 25, 1464), and immediately afterwards destroyed another Lancastrian army, with which were both Henry VI. and Queen Margaret, at Hexham (May 1 j. 1464). The massacres and executions which followed effectively crushed the revolt. For some years thereafter Edward reigned peacefully, but Warwick the king-maker and all the Neville following having turned against him (1470), he was driven into exile. But at a favourable moment he sailed from Flushing with 1,500 retainers and Burgundian mercenaries, and eluding the Lancastrian fleet and the coast defence troops, landed at Ravenspur (Spurn Head) in Yorkshire in March 1471. His force was hardly more than a bodyguard; the gates of the towns were shut against him, and the country people fled. But by his personal charm, diplomacy, fair promises and an oath of allegiance to King Henry VI., sworn solemnly at York, he disarmed hostility and, eluding Montagu's army, reached his own estates in the Wakefield district, where many of his oid retainers joined him. As he advanced south, a few Yorkist nobles with their following rallied to him, but it was far more the disunion of the Warwick and the real Lancastrian parties than his own strength which enabled him to meet Warwick's forces in a pitched battle. At Barnet, on Easter Eve, April 14, 1471, the decisive engagement was fought. But in the midst of the battle reinforcements coming up under the earl of Oxford to join Warwick came into conflict with their own party, the badge of the Vere star being mistaken for Edward's Rose-en-soleil. From that point all the mutually distrustful elements of Warwick's army fell apart, and Warwick himself, with his brother Montagu, was slain. For the last time the unhappy Henry VI. fell into the hands of his enemies. He was relegated to the Tower, and Edward, disbanding his army, reoccupied the throne. But Margaret of Anjou, his untiring opponent, who had been in France while her cause and Warwick's was being lost, had landed in the west shortly after Barnet, and Edward had to take the field at once. Assembling a fresh army at Windsor, whence he could march to interpose between Margaret and her north Welsh allies, or directly bar her road to London, he marched into the west on April 24. On the 29th he was at Cirencester, and Margaret, engaged in recruiting an army, was near Bath. Edward hurried on, but Margaret eluded him and marched for Gloucester. At that place the governor refused the Lancastrians admittance, and seeking to cross the Severn out of reach of the Yorkists, they pushed on by forced marches to Tewkesbury. But Edward too knew how to march, and caught them up. The battle of Tewkesbury (May 3, 1471) ended with the destruction of Margaret's force, the captivity of Margaret, the death of her son Edward (who. it is sometimes said, was stabbed by Edward IV. himself after the battle) and the execution of 16 of the principal Lancastrians.

This was Edward's last battle. The rest of his eventful reign was similar in many ways to that of his contemporary Louis XI., being devoted to the consolidation of his power, by fair means and foul, at the expense of the great feudatories. But the Wars of the Roses were not yet at an end. For 14 years, except for local outbreaks, the land had peace, and then Richard III.'s crown, struck from his head on Bosworth Field (Aug. 22, 1485), was presented to Henry earl of Richmond, who, as Henry VII., established the kingship on a secure foundation. A last feeble attempt to renew the war, made by an army gathered to uphold the pretender Lambert Simnel, was crushed by Henry VII. at Stoke Field (4m. south-west of Newark) on June 16, 1487.

ROSETTA STONE, the ancient Egyptian stone bearing inscriptions, the deciphering of which led to the understanding of hieroglyphics. It is an irregularly shaped stone of black basalt, 3 ft. 9 in. long and 2 ft. 4½ in. wide, broken in antiquity, which is now in the British museum, London. It was found near the town of Rosetta, or Rashid, on the left bank of a branch of the Nile in the western delta, about 30 mi. from Alexandria.

The modern town was founded by the Arab conquerors of Egypt in the 9th century A.D., when Alexandria was suffering a commercial eclipse, but after the discovery of the sea route to India it gradually declined in importance. The inhabitants of Rosetta include many Greeks as well as Egyptians. Pop. (1947) 23,996.

The Rosetta stone was found in Aug. 1799 by a Frenchman, whose name is given variously as Bouchard or Boussard, during the execution of repairs to the fort of St. Julien, and passed into British hands with the French surrender of Egypt (1801). The inscription records the commemoration of the accession of Ptolemy V Epiphanes to the throne of Egypt in the year 196–197 B.C., in the ninth year of his reign. The decree summarizes the benefactions conferred by Ptolemy upon the priesthood and appears to have been written by the priests of Memphis after a general assembly of religious leaders. The inscription is in two languages and three scripts (hieroglyphics, demotic and Greek) and gave the key to the translation of Egyptian hieroglyphics hitherto undeciphered.

The decipherment of the hieroglyphic inscription was largely the work of Thomas Young and Jean François Champollion (*qq.v.*). Young discovered that the royal names were written within ovals known as cartouches, and he worked out that foreign names, those of Ptolemy and Cleopatra, would probably be written in phonetic values which could be compared to the original group. Out of the total of 13 signs in this name he attributed the correct value to six and partially right value to three. He also discovered in 1814 the way in which the hieroglyphic signs were to be read, by examining the direction in which the birds and animals in this pictorial script faced. His main contribution to Egyptian philology was published in the supplement to the *Encyclopædia Britannica* of 1819.

In 1821–22 Champollion, starting where Young had left off, published memoirs on the decipherment of hieratic and hieroglyphics and went on to establish a whole list of signs with their Greek equivalents. He was the first Egyptologist to realize that some of the signs were alphabetic, some syllabic and some determinative~standing for the whole idea or object previously expressed. He also established that the hieroglyphic text was the translation of the Greek, not the reverse as had been thought. The work of these two men established the basis for the translation of all future hieroglyphic texts. (M. V. S.-W.)

ROSETTE, an ornament, usually circular, oval or polygonal, formed by a series of petals or leaves radiating from the centre and symmetrically placed. The form undoubtedly originated as an attempt to represent, systematically. the corolla of an open flower. Egyptian rosettes were thus, probably, representations of the open lotus. In Assyrian ornament and in the Persian work based upon it rosettes are one of the commonest ornaments and are used, by continuous repetition, to form decorative bands. Although common in archaic pottery of the Greek islands, they were little used in the developed art of Greece itself. The Romans, on the other hand, used the form lavishly and gave it great richness by employing the complex acanthus leaf as the basic radiating form. It was used not only at the centre of each face of the Corinthian capital, but also to decorate the little panels between the modillions or the scrolled brackets of the Corinthian order and as a decoration for the centre of the coffers or sunk panels of

a coffered vault or ceiling. The rosette almost went out of use in the medieval period except as it sometimes occurred as an individual flower in Gothic naturalistic ornament. In the Perpendicular period in England, the popularity of the heraldic Tudor rose gave a new importance to the rosette idea. and rosettes were frequently employed, repeated at regular intervals, to decorate hollow moldings.

Renaissance rosettes in design are based upon those of Rome, but were used even more lavishly, because of the immense development of wooden coffered and paneled ceilings.

In metalwork the idea of the rosette was probably developed independently. because of the ease with which little drops of metal could be soldered or fastened in a circle! to a basic utensil. Such rosettes, formed either of a simple circle of nearly hemispherical shape, or of one large hemisphere surrounded by several smaller ones, are favourite late Bronze and early Iron age decorations in the metalwork of the Celts, Scandinavians and the people of northern Europe generally. (T. F. H.)

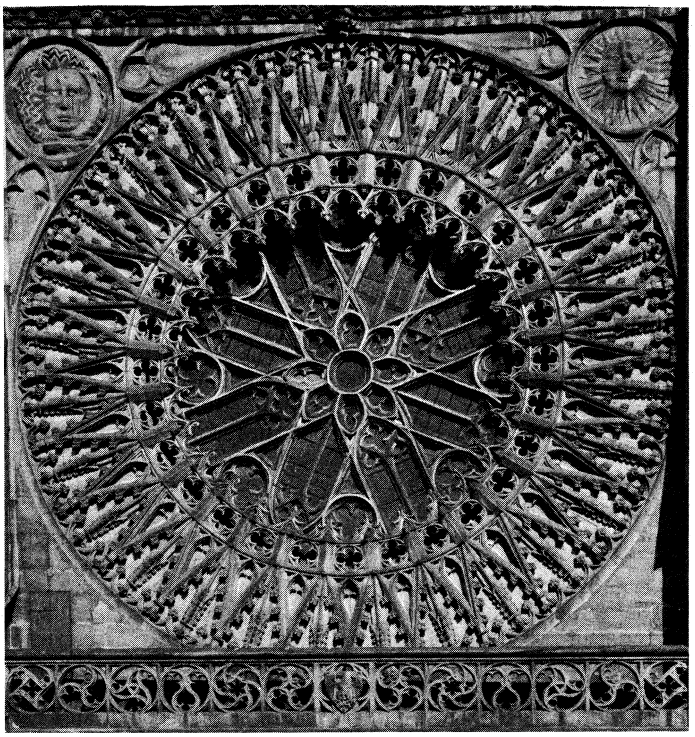
ROSE WINDOW (WHEEL WINDOW), in architecture, is a term applied to any decorated circular window. Cndecorated circular windows are found in certain imperial Roman structures, used especially in the upper portions of rooms or pierced through vaults. as in the tomb of the time of Hadrian known as the Casale dei Pazzi, near Rome, but structural decoration of such forms was apparently not attempted until the Byzantine and Romanesque periods.

One of the earliest decorated circular windows extant is that of the Italian Romanesque church of S. Maria in Pomposa, possibly as early as the 10th century, in which the decoration consists of a pierced marble slab of great richness, with a design of interlaces and birds purely Byzantine. In French Romanesque work circular windows also appear, but in the earlier work. such as the late 11th-century apse of S. Sernin at Toulouse, they are undecorated, like those of the Roman empire. Meanwhile: in Mohammedan work, the cusped circle had been a common form, usually. however, not as a window, but as the outer boundary of a sunk hemisphere, as in the mosque of Ibn Touloun at Cairo. Egy. (876–878).

The crusaders probably saw many examples of'such forms; in any case it is only after the earlier crusades and especially toward the middle of the 12th century that the idea of making a rich decorative motive out of a round window appeared. From then on the simple rose window became more and more common. and was, in fact, a distinguishing characteristic of many transitional and early Gothic cathedrals. It was particularly used at the west end of the nave and the ends of the transepts. An exceptional early use is the round window which lighted the triforium roof space from the nave in the original form of Notre Dame at Paris (before 1177). In the west front of Laon cathedral (completed prior to 1200) there is an enormous rose window with 12 semicircles around the edge and the central foiled and cusped circle separated from the apexes of these semicircles by a considerable distance, the connection between being made by little radiating colonnettes like spokes. This window is remarkably advanced for its date. as the filling, like that of the Paris triforium: is essentially bar tracery. The rose window of the west front of Chartres cathedral (1194–1212) consists, on the other hand. of plate tracery: the circle being filled with a thin plate of stone, through which are pierced many small foiled or cusped holes.

A similar form of plate tracery within a circle is used to cap the twin windows of the clerestory bays.

The introduction of developed bar tracery gave a compelling impetus to rose window design. The general scheme consisted of a series of radiating forms. each of which was tipped by a pointed arch at the outside of the circle. The bars between these forms were joined at the centre by a pierced circle of stone and the forms themselves frequently treated like little traceried windows with subsidiary. subdividing bars, archs and foiled circles The most beautiful examples of this type are those of the west front of Reims cathedral (end of the 13th century) and the transepts of Reims. Amiens and Notre Dame at Paris (all of the last half of the 13th century). The introduction of the navy lines of Flamboyant tracery completely changed the character of French rose windows, but they continued basically radiating in design. The radiating elements consisted of an intricate network of wavy, double curved bars. creating all sorts of interesting circles and flame shapes and, incidentally. furnishing a diagonal bracing to the whole composition which added materially to its structural strength. The rose at the end of the transept at Beauvais (early 16th century) is characteristic.



AUTHENTICATED NEWS

THE ROSE WINDOW (1350), 30 FT. IN DIAMETER, ABOVE THE WEST PORTAL OF ST. LORENZKIRCHE. NÜRNBERG, GERMANY

The influence of the French rose windows was widespread from an early period. Variations of the form appear in a multitude of late Italian Romanesque churches, as in the widely varying type in the late 12th century west front of S. Pietro in Toscanella. and the more normal example in S. Zeno at Verona (late 12th century). In England the rose window has never been so popular as in France. Those in the transepts of Westminster abbey are more characteristically French than English. The most typically English examples are in the transepts of Lincoln cathedral; that on the north from the Early English period is a remarkably delicate example of plate tracery; that on the south from the Curvilinear period of the early 14th century is striking because it is not radiating in design, and therefore completely at odds with the French prototypes.

See TRACERY. (T. F. H.)

ROSEWOOD, the name given to several distinct kinds of ornamental timber, products of various tropical trees native to Brazil. Honduras. Jamaica. Africa and India. The most important commercially are the Brazilian rosenood, principally *Dalbergia nigra,* a leguminous tree of large dimensions, called *cabiúna* and jacaranda by the Brazilians — and the Honduras rosewood. D. *stevensoni* The term jacaranda is also applied to several species of *Machaerium,* also trees of the family Leguminosae; some of the rosenood of commerce is drawn from these sources.

Rosewood earlier was exported in large quantities from Rio de Janeiro, Bahia. Jamaica and Honduras. The heartwood attains large dimensions, but as it begins to decay before the tree arrives at maturity it is always faulty and hollow in the centre; therefore, squared logs or planks of rosewood are never seen. the wood being imported in half-round flitches 10 to 20 ft. in length and from 5 to 12 in in their thickest part. Rosewood, a deep ruddy-brown to purplish-brown in colour, richly streaked and grained

with black resinous layers, takes a fine polish, but because of its resinous nature is somewhat difficult to work. The wood, once much in demand by cabinetmakers and piano makers, is still used to fashion xylophone bars, but waning supplies now restrict its use in the U.S. to the making of carpenters' spirit levels, plane handles and brush backs. (N. TR.)

ROSICRUCIANISM. There are Rosicrucian societies, fraternities, orders, fellowships or lodges in most countries of the modern world. Some of them are very active; others are obscure and highly secret; some seem to be primarily religious in their emphasis, and some categorically deny that Rosicrucianism is a religion, holding rather that it is a philosophy, making use of the most modern scientific methods and techniques, as well as the methods of the occultist, the mystic and the seer, in the quest for truth.

But, while Rosicrucianism is sectarian in character and the various branches are sometimes bitterly critical of each other, they do have common features, the central one being the purported possession of certain secret wisdom handed down from ancient times, through a secret brotherhood, an esoteric wisdom that can only be imparted to the initiated.

Their teachings so far as known seem to combine something of Egyptian Hermetism, Christian Gnosticism, Jewish cabalism, alchemy and a variety of other occult beliefs and practices. While alchemy seems to have been prominent in the movement, modern Rosicrucians affirm that their language must be taken symbolically rather than literally and that they have no interest in such things as the transmutation of metals.

Whether all Rosicrucian organizations can trace their origins back to the main historic stream of Rosicrucianism is a matter of grave doubt. But after all, what is the true Rosicrucianism?

The earliest extant writing which unequivocally mentions a Rosicrucian order appeared in the early 17th century. But even here the actual existence of such an order cannot be affirmed absolutely. Indeed, not a few scholars believe rather that the order had its rise from the publication of this document and that it was written with this definite purpose in mind.

The document was the famous *Fama Fraternitatis,* first published in 1614 but probably circulated in manuscript form somewhat earlier than this. Seven editions appeared during the years 1614–17. It recounts the journey of the reputed founder of the movement, Christian Rosenkreuz, to Damascus, Damcar in Arabia, Egypt and Fez, where he was well received and came into possession of much secret wisdom. He returned finally to Germany, where he chose three others to whom he imparted this wisdom and thus founded the order. Later the number was increased to eight who separated, each going to a separate country.

One of the six articles of agreement they adopted was that the fraternity should remain secret for 100 years. At the end of 120 years the secret burial place and the perfectly preserved body of the founder were discovered by one of the then members of the order, along with certain documents and symbols held in very high esteem by Rosicrucians. The sacred vault was re-covered, the members of the order dispersed, and no one knows its location. The *Fama* ends with an invitation to "some few" to join the fraternity.

According to the *Confessio,* which is bound up with the *Fama* in some of the editions, Christian Rosenkreuz was born in 1378 and lived 106 years, or until 1484. His tomb was then hidden for 120 years, making its discovery fall in 1604. If this is a true account of the founding of the order, it must have come into being sometime in the 15th century.

Some regard the story as a statement of fact and hold Christian Rosenkreuz to have been the founder of the order. More generally it is held to be a mythical explanation of the order and Christian Rosenkreuz not a real person at all, but a symbolic character. R. Swinburne Clymer saw in the travels of Christian Rosenkreuz in the *Fama* an obvious parallel to the travels of Paracelsus, whom he regarded as the real founder of the movement.

H. Spencer Lewis held that it marks only a revival of the order which began in remote antiquity in Egypt, where the great Ikhnaton made significant contributions to it. We listed numerous persons of antiquity, including Solomon, Jesus, Plato, Philo, Plotinus and others, as well as movements such as the Essenes of Jesus' day, the young Christian movement itself and later movements such as Jewish cabalism, as related to the ancient order. These he identified as truly Rosicrucian because he was able to find among their reported teachings ideas which he regarded as Rosicrucian. His conclusions do not seem convincing to objective students. There can be no doubt that there were in ancient times persons whose outlook and thought were similar to that of the Rosicrucians. That there was a continuing order in existence previous to the 15th century or even the 17th is impossible to prove beyond question, on the basis of any sources available to non-Rosicrucian research.

With the publication of the *Fama,* international interest in the order was aroused and it was not long before there were Rosicrucian orders in several European countries. Michael Maier, a learned alchemist, became its chief exponent in Germany. Robert Fludd is thought to have introduced it into England. Thomas Vaughan translated the *Fama* into English in 1652, and though he knew of no existing order in England at that time he remarked that he was not unacquainted with Rosicrucian doctrine and had no doubt concerning the existence of the order.

That it is not always possible to prove the existence of the order in a given country at any particular moment does not disturb the Rosicrucians, for it seems to be recognized that there occur periods when the order is deliberately "in sleep." H. Spencer Lewis reduced these periods to a definite rhythm of 108 years of activity followed by 108 years of silence, in a given country. It was in accordance with this cyclic theory, he said, that he was led at the proper time to seek out the leaders of the order in France in the early years of the 20th century and under their authority to inaugurate a new cycle of activity in the United States in 1915, under the name Ancient Mystical Order Rosae Crucis, usually abbreviated to A.M.O.R.C. It became affiliated with the Fédération Universelle des Ordres et Sociétés Initiatiques, established in Europe in 1934.

R. Swinburne Clymer, head of a rival U.S. order with headquarters at Quakertown, Pa., who as early as 1902 published *The Rosicrucians: Their Teachings,* spoke of the periods of silence, but these were determined by specific conditions rather than by the passage of time. His organization, traced through a definite line of Rosicrucian adepts in the U.S. from revolutionary times, with Paschal Beverly Randolph and Freeman B. Dowd as his more immediate predecessors, is known as the Fraternitas Rosae Crucis. Its foreign affiliation was with La Fédération Universelle des Ordres, Sociétés et Fraternités des Initiés.

Rosicrucianism and Freemasonry have not a little in common. Indeed, there is a degree in masonry known as the Rose Croix degree. Likewise, the *Societas Rosicruciam in Anglia* and its affiliates are held to be more masonic than Rosicrucian.

The symbol of Rosicrucianism is a combination of the cross and the rose, from which the order takes its name. The origin of the symbol is variously given, but there seems to be no one explanation which is completely satisfactory.

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(C. S. B.)

ROSIN (COLOPHONY), the resinous constituent of the oleoresin exuded by various species of pine, known in commerce as crude turpentine. The separation of the oleoresin into the essential oil spirit of turpentine and common rosin is effected by distillation in large stills. Rosin (a later variant of "resin," *q.v.*), varies in colour, according to the age of the tree from which the turpentine is drawn and the amount of heat applied in distillation, from an opaque almost pitchy black substance through grades of brown and yellow to an almost perfectly transparent colourless

glassy mass. The commercial grades are numerous, ranging by letters from A, the darkest, to N, extra pale, and X. most pale, W (window glass) and WW (water white) varieties. the latter having about three times the value of the common qualities.

Rosin is a brittle and friable resin. with a faint pinelike odour; the melting point varies with different specimens, some being semifluid at the temperature of boiling water, while others do not melt till 220° F. or 250° F. It is soluble in alcohol. ether, benzene and chloroform. In addition to its extensive use in soapmaking. rosin is largely employed in making inferior varnishes, sealing wax, various cements and as a sizing agent in the manufacture of paper. It is also used for preparing shoemakers' wax, as a flux for soldering metals, for pitching lager beer casks, for rosining the bows of musical instruments, etc. In pharmacy it forms an ingredient in several plasters and ointments.

The chief region of rosin production is the south Atlantic and eastern gulf states of the United States. American rosin is obtained from the turpentine of the swamp pine, *Pinus palustris,* and of the loblolly pine, *P. taeda.* The main source of supply in Europe is the "landes" of the *départements* of Gironde and Landes in France, where the cluster pine, *P. pinaster,* is extensively cultivated.

In the north of Europe rosin is obtained from the Scotch fir, *P. sylvestris,* and throughout European countries local supplies are obtained from other species of pine.

See also TURPENTINE.

ROSKILDE, or ROESKILDE, **a** town of Denmark in the *amt* (county) of Kjøbenhavn (Copenhagen), 20 mi. by rail W. of Copenhagen, on the great lagoonlike inlet named Roskilde fiord. Pop (1960) 31.928.

Roskilde's chief interest is historical. It was the capital of the kingdom until 1443, and the residence of the bishops of Zealand until the Reformation.

The cathedral was consecrated in 1084, but of this early building only foundation walls remain; the present structure of brick was begun in 1215, and enlarged and restored at various later dates. It contains the tombs of most of the Danish kings from Harold I (987).

ROSMEAD, HERCULES GEORGE ROBERT ROBINSON, 1ST BARON (1824–1897), British colonial administrator, was born on Dec. 19, 1824. He was of Irish descent on both sides; his father was Admiral Hercules Robinson, his mother a Miss Wood of Rosmead, County Westmeath, from which he afterward took his title. Passing from Sandhurst into the 87th Foot, he attained the rank of captain; but in 1846, through the influence of Lord Naas, he obtained a post in the board of public works in Ireland, and subsequently became chief commissioner of fairs and markets. His energy in these positions, notably during the famine of 1848, and the clearness and vigour of his reports, secured for him at the age of 30 the office of president of the island of Montserrat. He was governor of St. Christopher from 1855 to 1859, when he was knighted in recognition of his services in introducing coolie labour into the island. Subsequently he was governor of Hong Kong, of Ceylon (K.C.M.G. in 1869), and, in 1872, of New South Wales. It fell to his lot to annex the Fiji Islands to the British empire, and his services were rewarded in 1875 by promotion to G.C.M.G. In 1879 he was transferred to New Zealand, and in 1880 he succeeded Sir Bartle Frere as high commissioner of South Africa. He arrived in South Africa shortly before the disaster of Majuba, and was one of the commissioners for negotiating a peace which was personally distasteful to him. It left him with the task of conciliating on the one hand a Dutch party elated with victory, and on the other hand a British party almost ready to despair of the British connection. He was called home in 1883 to advise the government on the terms of the new convention concluded with the Transvaal Boers in Feb. 1884. On his return to South Africa he found that a critical situation had arisen in Bechuanaland, where Boer commandoes had seized large tracts of territory and proclaimed the "republics" of Stella and Goshen *(see* KRUGER, STEPHANUS JOHANNES PAULUS). They refused to retire within the limits of the Transvaal as defined by the new convention, and Robinson. alive to the necessity of preserving this country—the main road to the north—for Great Britain, took action which led to the expedition of Sir Charles Warren and the annexation of Bechuanaland early in 188;. Robinson won Kruger's confidence by his fair-mindedness, while he seconded Rhodes's efforts to unite the British and Dutch parties in Cape Colony. His mind, however, was that of the administrator as distinguished from the statesman, and he was content to settle difficulties as they arose. In 1887 Robinson was induced by Rhodes to give his consent to the conclusion of a treaty with Lobengula which secured British rights in Matabele and Mashona lands. In May 1889 Robinson retired. and he was made a baronet in 1891.

Early in 1895, when he was 71 and not in robust health, he yielded to Lord Rosebery's entreaties, and went out again to South Africa, in succession to Sir H Loch. L. S. Jameson's *(q* v.) raid into the Transvaal produced a permanent estrangement between Robinson and Cecil Rhodes, and he was out of sympathy with the new colonial secretary, Joseph Chamberlain, who had criticized his appointment, and now desired Robinson to take this opportunity of settling the whole question of the position of the Uitlanders in the Transvaal. Robinson answered that the moment was inopportune, and that he must be left to choose his own time. Alarmed at the imminent danger of war, he confined his efforts to inducing the Johannesburgers to lay down their arms on condition that the raiders' lives were spared, not knowing that these terms had already been granted to Jameson. He went home to confer with the government. and was raised to the peerage as Baron Rosmead. He returned to South Africa later in the year, but was compelled by ill-health, in April 1897, to quit his post, and died in London on Oct. 28, 1897.

ROSMINI-SERBATI, ANTONIO (1797–1855), Italian priest and philosopher, the founder of the Institute of Charity, was born at Rovereto on March 24, 1797. He studied theology at the University of Padua and was ordained priest in 1821. Through his friendship with Niccolo Tommasseo and Alessandro Manzoni and a lifelong concern to reconcile his deep Catholic faith with modern political and scientific thought. Rosmini exerted a considerable influence on the Italian Risorgimento. His dissatisfaction with the spiritual and educational state of the church of his time led him. in 1828. to found the Institute of Charity at Monte Calvario, Domodossola, which was approved by Pope Gregory XVI in 1839 Modeled on the Jesuit rule. it aims at the perfection of its members through the exercise of charity in any torm or field, combined with absolute devotion to the church and to one's superiors in the society.

Rosmini's *Nuovo saggio sull' origine delle idee* (Eng. trans., *New Essay on the Origin of Ideas,* 3 vol., 1883) and *Massime di perfezione* (Eng. trans, *Maxims of Christian Perfection,* 1889, 1949), which contain the essence of his philosophical and religious thought. were published in Rome in 1830, later norks mere *Teodicea* (1845; Eng. trans., *Theodicy,* 3 vol., 1912) and *Psicologia* (1850; Eng. trans.. *Psychology,* 3 vol.. 1884–88). The centre of his philosophical system, which he developed also in education and in law, is ideal being, which is not an idea like other ideas but a reflection of God in man, appertaining in eternal truth, the indispensable means of acquiring, through the senses, all other knowledge. Ideal being is the supreme criterion of truth and certainty in logic and the basis of the concept of the dignity of the human person in law and politics. The synthetic character of Rosmini's system of human knowledge has made its assimilation difficult and led, falsely, to charges of "ontologism" and "pantheism."

Rosmini welcomed the Italian national movement, but was strongly critical of its anticlerical and anti-Catholic tendencies. Looking to the papacy for spiritual and political leadership, he published, in 1848, *Delle cinque piaghe della santa Chiesa* (Eng. trans., *Of the Five Wounds of the Holy Church,* 1883) and *La Costituzione secondo la giustizia sociale.* Both works were placed on the Index in 1849. As the Piedmontese government's special envoy in 1848–49, Rosmini was commissioned to negotiate a concordat with Pope Pius IX *(see* his narrative *Della missione* a *Roma . . . negli anni* 1848–49, 1881); and when the Roman revo-

lution broke out and Pius had to escape to Gaeta, Rosmini, whose counsels he wished to reward with the cardinal's hat, accompanied him into exile. But Rosmini's influence declined under the impact of the Austrian victories in Italy and the pope's rejection of liberal reforms. Compelled by polemics and attacks on Rosmini's doctrines, Pius ordered an examination of all his works. Rosmini at once declared his submission and retired to Stresa where he died, broken in health, on July 1, 1855.

Before his death Rosmini learned that his works had been proclaimed free from censure by the Congregation of the Index (decree *Dimittantur*, 1854); Leo XIII's decree *Post obitum* in 1887 declared 40 propositions from his books to be "not seemingly consonant with Catholic truth"; but this mild form of censure was later regarded as not having theological significance *(see* U. Honan, *II Decreto Post Obitum,* Domodossola, 1949).

The Institute of Charity was established in England by Father Luigi Gentili in 1835 and contributed through its missionary activities to the Catholic revival there. By the middle of the 20th century there were Rosminian foundations in Europe, the British Isles, the U.S. and Africa.

BIBLIOGRAPHY.—*Edizione Nazionale* of Rosmini's works (1934–) was planned to comprise 100 vol. *See* also his *Letters chiefly on Religious Subjects,* Eng. trans. (1901); G. B. Pagani, *The Life oj Antonio Rosmini-Serbati,* Eng. trans. (1907); C. R. Leetham, *Rosmini, Priest, Philosopher, Patriot* (1957); and the periodical *Rivista Rosminiana* (Domodossola). (R. J. H.)

ROSNY, JOSEPH HENRY, a pseudonym covering the collaboration of the French novelists, Joseph Henri Honoré Boex (1856–1940), and his brother Séraphin Justin François Boex (1859–1948). The novels of J. H. Rosny are full of scientific knowledge, of astronomy, anthropology, zoology and, above all, sociology. The stories are approached from the point of view of society rather than of the individual, but the characters, strongly individualized and intensely real, are only incidentally typical. The elder Rosny was the sole author of the earlier novels, and began novel writing as an avowed disciple of E. Zola. Among these earlier works may be mentioned *Le Bilate'ral* (1886), and the "prehistoric" novel, *Vamireh* (1891), a masterpiece of its kind. They were among the writers who in 1887 entered a formal protest in the *Figaro* against Zola's *La Terre,* and were designated by Edmond de Goncourt as original members of his academy. Among their other novels the more famous are *Daniel Valgraive* (1891); *L'Indomptée* (1895), the history of a girl medical student in Paris; Le *Serment* (1896, dramatized 1897); *Les Anzes perdues* (1899), an anarchist novel; *La Charpente* (1900); *Thérèse Degaudy* (1902); *Le Crime du docteur* (1903); *Le Docteur Harambur* (1904); *Le Millionaire* (1905); *Sous le jardeau* (1906); *La Guerre de feu* (1911) and *La Carapace* (1914).

ROSS, BETSY (1752–1836), heroine of one of the most picturesque legends which has grown up around the origin of the American flag, was born at Philadelphia, Pa., on Jan. 1, 1752. She married John Ross, whose uncle. George Ross, was one of the signers of the Declaration of Independence.

The versions of the flag story as told by her descendants, agree in the following main points: Washington, accompanied by Robert Morris and Gen. George Ross, called at the little upholstery shop in Arch street. where she was carrying on the business in which she and her husband had been engaged, and asked if she could make a flag. She said she never had made one, but that she could try. They thereupon produced a design, rather roughly drawn. She examined it and, noticing that the stars were six-pointed, suggested that they should be made with five points. The gentlemen agreed with her that five points would look better, but that the six-pointed stars would be easier to make. She then showed them how a five-pointed star could be made with a single clip of the scissors. Washington then and there changed the sketch and the three gentlemen left. Soon after a new design was sent to her, coloured by William Barrett, a painter of some note. She thereupon set to work to make the famous flag, which was soon completed and approved.

This story was first presented by William J. Canby, grandson of Betsy Ross, in a paper read in 1870 before the Historical Society of Pennsylvania, and it was verified by other descendants of the family who remembered the story as frequently told to them. No contemporary documentary evidence has ever been found to support the story, nor has any, on the other hand, been found which gives the honour to anyone else. All that has been verified is that there was a Mrs. Ross living in Philadelphia at the time of the flag's adoption, and that she was an upholsterer and flagmaker by trade. She died at Philadelphia on Jan. 30, 1836.

BIBLIOGRAPHY.—Canby's claims are ably presented by L. Balderston in *The Evolution of the American Flag* (1909); P. D. Harrison, *The Stars and Stripes* (1914); G. H. Preble, *Origin and History oj the American Flag* (new *ed.,* 1917); S. Abbott, *Dramatic Story of Old Glory* (1919).

ROSS, EDWARD ALSWORTH (1866–1951), U.S. sociologist. one of the early U.S. writers on social psychology, was born Dec. 12, 1866, in Virden. Ill. After studying at Coe college, Cedar Rapids, Ia.. the University of Berlin and Johns Hopkins university. Baltimore, Md. (Ph.D., 1891), he taught economics for brief periods at Indiana, Cornell and Stanford universities. At the last-named institution, beginning in 1895, he centred his attention on sociology. Resigning from Stanford in 1900 in a dispute concerning academic freedom, he spent a few years at the University of Nebraska, Lincoln. before joining the faculty of the University of Wisconsin, Madison, where he taught sociology. for 30 years.

Ross died on July 22, 1951, in Madison.

He was an early major systematizer of sociology; one of his principal contributions lay in creating a comprehensive body of theory. He was a prolific writer with a flair for popular presentation that did much to stimulate interest in problems of social research. His best-known work, *Social Control* (1901), was long regarded as a classic. and his *Social Psychology* (1908) was one of the first American works written specifically on that discipline.

Among his other works are *Foundations of Sociology* (1905); *Sin and Society* (1907); *Russia in Upheaval* (1918); *World Drift* (1928); *New Age Sociology* (1940).

See also SOCIOLOGY: *Nineteenth-Century Influences.*

(P. B. G.)

ROSS, HAROLD WALLACE (1892–1951), a revolutionary figure in U.S. journalism, founder and first editor of *The New Yorker,* was born in Aspen, Colo., Nov. 6, 1892. He quit high school to become a reporter, and in World War I edited *Stars and Stripes,* the serviceman's newspaper, in France. When he launched *The New Yorker* in 1925 he quickly toppled many conventional literary forms in his quest for ways to capture the contemporary scene in the magazine's pages.

Young new writers and artists, attracted by the rich odour of innovation, were drawn to the magazine. Under Ross's guidance. satire and parody flourished, reporting became lighthearted and searching, humour was allowed to infect everything, biography achieved bold strokes in the "Profiles." the short story enjoyed a reprieve from the heavy burden of plot, and social cartooning became less diagrammatic and more vigorous. In *The New Yorker,* the unknown writer was on equal footing with the established one; the editor sought good writing, not great names. Restless, noisy, consumed by curiosity, driven by a passion for clarity and perfection, Ross spent himself recklessly on each succeeding issue, and with unabating discontent.

Ross died in Boston on Dec. 6, 1951, having to a notable extent changed the face of journalism in his time. (E. B. W.)

ROSS, SIR JAMES CLARK (1800–1862), British rear admiral and polar explorer, who carried out important arctic and antarctic magnetic surveys, was born in London on April 15, 1800. He entered the Royal Navy in 1812, accompanying his uncle, Capt. (later Sir) John Ross (*q.v.*), on his first arctic voyage in 1818. Between 1819 and 1827 he accompanied Sir W. E. Parry on his four arctic expeditions, and from 1829 to 1833 again accompanied his uncle reaching the north magnetic pole in 1831. From 1835-38 he worked on the magnetic survey of Great Britain. except from Dec. 1835 to Aug. 1836 when he searched for some missing arctic whaling ships *(see* "Polar Record," no. 40, 1950). He commanded H.M.S. "Erebus" and "Terror" during the antarctic expedition of 1839–43, sailing to

Hobart and thence to the antarctic. The ships penetrated the pack ice from Jan. 5 to 10, 1841, in long. 174° E., reaching open water and discovering the Ross sea. The expedition's main object was to conduct magnetic observations in the antarctic and to reach the south magnetic pole. The ships sailed south toward the position assigned by K. F. Gauss to the pole, meanwhile discovering Victoria Land. Progress further south was barred by the Ross ice shelf, along which the ships coasted to long. 167° W. Unable to find suitable winter quarters, Ross returned to Hobart. In Nov. 1841 he sailed south to the barrier from New Zealand, reaching lat. 70° 10' S. in 161° 27' W., probably also sighting Edward VII peninsula. The ships wintered in the Falkland Islands and returned south to chart part of Graham coast. They sailed east along the edge of the Weddell sea ice and south to lat. 71" 30' S., long. 14° 51' W. On the way home Ross tried unsuccessfully to rediscover Bouvetøya (lat. 54° 26' S., long. 3° 24' E.). His *Voyage of discovery . . . in the Southern and Antarctic Regions* appeared in 1847. He was elected a fellow of the Royal society in 1848. From 1848 to 1849 he searched for Sir John Franklin in H.M.S. "Enterprise" and "Investigator."

He died at Aylesbury on April 3, 1862.

See also ANTARCTIC REGIONS; ARCTIC, THE. (A. M. Ss.)

ROSS, JANET ANNE (1842–1927), English writer, daughter of Sir Alexander Cornewall Duff Gordon, was born in London on Feb. 24, 1842. She is the original of Rose Jocelyn in George Meredith's *Evan Harrington*. She married in 1860 Henry Ross, a banker in Egypt and a great traveler, and her life in Egypt, where she spent six years, is described vividly in her *Fourth Generation: Reminiscences* (1912). From 1863 to 1867 she was a correspondent of *The Times*. In 1867 she and her husband settled in Italy, where her house was a centre for the lovers of Italian culture. Mrs. Ross died in Florence on Aug. 23, 1927.

Her publications include *Three Generations of English Women* (2 vol., 1888); *The Land of Manfred* (1889); *Old Florence and Modern Tuscany* (1904); *Lives of the Early Medici* (1910); *Letters of Principal J. M. Lindsay to Janet Ross* (1922).

ROSS, SIR JOHN (1777–1856), Scottish rear admiral and arctic explorer, whose second arctic expedition in search of a northwest passage made important contributions to oceanography, was born on June 24, 1777, at Balsarroch near Stranraer, Wigtownshire, Scot. He entered the Royal Navy in 1786 and fought in the French Revolutionary and Napoleonic wars, during which he captained the Swedish fleet. In 1818 he made his first arctic expedition on which he failed to discover much that was new; but in 1829–33 he made a second, surveying Boothia peninsula, King William Land and the Gulf of Boothia, and achieved important results. In 1850 he undertook a third voyage in unsuccessful search of Sir John Franklin and in 1851 he became a rear admiral. Ross died in London on Aug. 30, 1856.

His publications include *A Voyage of Discovery . . . for the Purpose of Exploring Baffin's Bay . . .* (1819); *Narrative of a Second Voyage in Search of a North-West Passage* (1835); *Memoirs and Correspondence of Admiral Lord de Saumerez* (1838).

ROSS, JOHN (Indian name KOOWESKOOWE or COOWEESCOOWE) (1790–1866), famed chief of the Cherokee Indians in the U.S., was born near Lookout mountain, Tenn., on Oct. 3, 1790. Ross's blue eyes and brown hair indicated that his Cherokee strain was small. His father, a Scottish trader, employed a tutor and later sent Ross to an academy at Kingston, Tenn. In 1813 he married a full-blooded Cherokee woman named Quatie. Some years after her death he married Mary Bryan Stapler, a white woman of Quaker faith.

During the early part of the 19th century there developed considerable pressure to open the Indian lands in Georgia to white settlement *(see* GEORGIA: *History)* and Ross became leader of the Cherokees opposed to westward removal. From 1819 to 1826 he served as president of the national council of the Cherokees. His leadership was strengthened when, in 1823, he exposed machinations of federal commissioners who attempted to bribe him into approving Cherokee land sales. In 1828 he became head chief of the eastern Cherokees under a new constitution he had helped write. His valorous defense of Cherokee freedom and property from land-hungry Georgians utilized every means short of war and included several appeals to the federal government. After all efforts had failed, in 1838–39 Ross led his people to their new home in what is now Oklahoma. There he helped write the constitution of 1839, uniting the eastern and western Cherokees under one government, and was chosen chief of the united tribe. He held this office until his death on Aug. 1, 1866, in Washington, D.C., where he had gone to assist in making the Cherokee treaty of 1866. Ross had his trenchant critics as well as devoted supporters, but he was the ablest leader of his people for almost 40 crucial years.

See Chapman J. Milling, *Red Carolinians* (1940), which includes an authoritative account of the Cherokee removal and Ross's leadership; with bibliography. (W. R. J.)

ROSS, SIR RONALD (1857–1932), British bacteriologist and Nobel laureate, noted for his investigations of malaria, was born at Almora, India, on May 13, 1857. He studied medicine at St. Bartholomew's hospital, London, and in 1881 entered the Indian medical service. In 1892 he began a series of investigations on the subject of malaria (*q.v.*), in 1895 undertook to verify experimentally the theory that the microorganisms of this disease are spread by mosquitoes and in 1897–98 investigated the life history of the parasites. In 1899 he retired from the Indian medical service, and, after a journey to west Africa in 1899 for the study of malaria-bearing mosquitoes, devoted himself to research and teaching, joining the Liverpool school of tropical medicine as lecturer and subsequently becoming professor of tropical medicine at the University of Liverpool. In 1913 he became physician for tropical diseases at King's college hospital, London, and later director in chief of the Ross Institute and Hospital for Tropical Diseases. During World War I Ross was war office consultant in malaria and after the war acted as consultant in malaria for the ministry of pensions. In 1902 he received the Nobel prize for medicine; in 1911 he was created knight commander of the Bath; and in 1918 a knight commander of St. Michael and St. George. He received the royal medal of the Royal society, of which he was a fellow, in 1901.

He was editor of *Science Progress*, and his other publications include *The Prevention of Malaria* (1910); *Philosophies* (1910); *Psychologies* (1919); *The Revels of Orsera*, a romance (1920); and *Memoirs* (1923), as well as mathematical and medical works.

Ross died Sept. 16, 1932.

See *British Medical Journal*, 2:609 *(1932)*.

ROSS AND CROMARTY, a northern county of Scotland. The mainland portion is bounded north by Sutherland and Dornoch firth, east by the North sea and Moray firth, south by Beauly firth and Inverness-shire and west by the strait of the Minch. The land area of the mainland and islands is 3,089.5 sq.mi. with a population (1951) of 60,508. The island portion (for details *see* HEBRIDES, THE) consists of the northernmost part of the Outer Hebrides, called Lewis, and many smaller islands almost all uninhabited and scattered principally off the west coasts of Lewis and the mainland. The only inhabited island off Lewis is Great Bernera, now linked to Lewis by a road bridge. There is a lighthouse on the Flannan Islands, 7 mi. out in the Atlantic. On the east coast, where there is a comparatively fertile strip of land, the chief indentations are Beauly firth and Inverness firth, marking off the Black Isle (actually a peninsula) from Inverness-shire; Cromarty firth, bounding the districts of Easter Ross and the Black Isle; Moray firth, separating Easter Ross from Nairnshire; and Dornoch firth, dividing northeast Ross from Sutherlandshire. On the Atlantic coast the principal sea lochs and bays, from south to north, are Loch Duich, Loch Alsh, Loch Carron, Loch Kishorn, Loch Torridon, Loch Shieldaig, Upper Loch Torridon, Gair Loch, Loch Ewe, Gruinard bay, Little Loch Broom, Loch Broom and Enard bay. Almost all the southern boundary with Inverness-shire is guarded by a rampart of peaks, ranging from 3,400 to nearly 3,900 ft. To the north of Glen Torridon rise the masses of the Liathach, with summits of 3,456 and 3,358 ft. On the northeastern shore of Loch Maree rises Ben Slioch (3,217), while the Fannich group contains at least six peaks of more than 3,000 ft. The isolated mass of Ben Wyvis (3,429) is the most noteworthy feature

in the northeast, and the Teallach group in the northwest with peaks of 3,483 and 3.474 ft. are equally conspicuous, though less solitary. Only a small fraction of western and southern Ross is under 1,000 ft. in height. Easter Ross and the peninsula of the Black Isle are comparatively level. The longest river is the Orrin, which rises in An Sithean and flows mainly east by north to its confluence with the Conon after a run of about 26 mi. during a small part of which it forms the boundary with Inverness-shire. At Aultgowrie the stream forms the Falls of Orrin in a narrow gorge. From its source in the mountains in Strathvaich the Blackwater flows southeast for 19 mi. until it joins the Conon, forming soon after it leaves Loch Garve the picturesque Falls of Rogie. Within a short distance of its exit from Loch Luichart the Conon pours over a series of graceful cascades and rapids and then pursues a winding course of 12 mi.. mainly eastward to the head of Cromarty firth. The Falls of Glomach, in the southwest! are the deepest in Britain (370 ft. sheer). Twelve miles south by east of Ullapool are the three falls of Measach, close to the gorge of Corriehalloch. The Oykell, throughout its course. forms the boundary with Sutherland, to which it properly belongs. The largest and most beautiful of the many fresh-water lakes is Loch Maree (see MAREE, LOCH). Of the straths or valleys the more important run from the centre eastward, such as Strathconon (12 mi.), Strathbran (10 mi.), Strathgarve (8 mi.), Strathpeffer (6 mi.) and Strathcarron (14 mi.). Excepting Glen Orrin (13 mi.), in the east central district. the longer glens lie in the south and toward the west. In the extreme south Glen Shiel (9 mi.) runs between fine mountains to its mouth on Loch Duich. General George Wade's road passes down the glen. Farther north are Glen Elchaig (9 mi.), Glen Carron (12 mi.), through which runs the Dingwall and Skye railway, and Glen Torridon (6 mi.). A large area southwest of Loch Maree forms the Beinn Eighe Nature reserve.

Geology.— The central portion of the county is occupied by the younger highland schists or Dalradian series. On the eastern side of the county the Dalradian schists are covered unconformably by the Old Red sandstone. The western boundary of the younger schist is formed by the great pre-Cambrian dislocation line which traverses the county from Elphin on the north by Ullapool to Glen Carron. Most of the area west of the line of disturbance is covered by Torridonian sandstone, mainly dark reddish sandstones, grits and shales, resting unconformably on the ancient Lewisian gneiss. Within the Torridonian tract the gneiss occupies large areas north of Coigach, on the east of Enard bay, between Gruinard bay and Loch Maree. The Lewisian gneiss is penetrated everywhere by basic dikes, generally with a northwest to southeast direction; some of these are of great breadth. The Torridonian rocks are succeeded unconformably by a series of Cambrian strata which is confined to a narrow belt west of the line of main thrusting. Glacial striations are found upon the mountains up to heights of 3,000 ft., and much boulder clay is found in the valleys and spread over large areas in the eastern districts. Ancient shorelines occur at 100, 50 and 25 ft. above the present sea level; they are easily seen in Loch Carron.

History and Antiquities.— During the first five centuries, and for long afterward, the land was occupied by Gaelic Picts, who, in the 6th and 7th centuries, were converted to Christianity by followers of St. Columba. Throughout the next three centuries the natives were continually harassed by Norse pirates, of whose presence tokens have survived in several place names such as Dingwall and Tain. At that time the county formed part of the great province of Moray. When the rule of the Celtic *mormaors* or earls ceased in the 12th century. consequent on the plantation of the district with settlers from other parts (including a body of Flemings) by order of David I, who was anxious to break the power of the Celts, the bounds of Moravia were contracted and the earldom of Ross arose. At first Ross proper included only the territory adjoining Moray and Dornoch firths. The first earl was Malcolm MacHeth, who received the title from Malcolm IV. After his rebellion in 1179 chronic insurrection ensued, which was quelled by Alexander II, who bestowed the earldom on Farquhar Macintaggart, then abbot of Applecross, and in that capacity lord of the western district. William, 4th earl, was present with his clan at the battle of Bannockburn (1314), and almost a century later (1412) the castle of Dingwall, the chief seat on the mainland of Donald, lord of the Isles. was captured after the disastrous fight at Harlaw in Aberdeenshire. which Donald had provoked when his claim to the earldom was rejected. The earldom reverted to the crown in 1424, but James I soon afterward restored it to the heiress of the line. the mother of Alexander MacDonald, 3rd lord of the Isles, who then became 11th earl. In consequence, however, of, the treason of John MacDonald, 4th and last lord of the Isles and 12th earl of Ross, the earldom was again vested in the crown (1476). Five years later James III bestowed it on his second son, James Stewart. whom he also created duke of Ross in 1488. By the 16th century the whole area of the county was occupied by different clans! the Rosses, Munroes, Macleods, Macdonalds and Mackenzies. The county of Ross was constituted in 1661, and Cromarty in 1685 and 1698. both being consolidated into the present county in 1889. Apart from occasional conflicts between rival clans, the only battles in the shire were those of Invercarron (1650), when Montrose was crushed by Col. Archibald Strachan, and Glenshiel (1719), when the Jacobites, under the earl of Seaforth, aided by Spaniards, were defeated near Bridge of Shiel by Gen. Joseph Wightman.

Stone circles, cairns and forts are found in the eastern district. A vitrified fort crowns the hill of Knockfarrel and there is a circular dun near the village of Lochcarron. Some examples of sculptured stones occur, the finest being at Shandwick. Among old castles are those of Lochslin, in the parish of Fearn. said to date from the 13th century, which, though ruinous, possesses two square towers in good preservation; Balone, in the parish of Tarbat, once a stronghold of the earls of Ross; the remains of Dingwall castle, their original seat; and Eilean Donan in Loch Alsh, which was blown up by English warships during the abortive Jacobite rising in 1719 but restored in 1932.

Population and Administration.— The population at the 1951 census was 60,508; Ross and Cromarty, though the third largest county in size: being the 1 jth in population. There were 1,123 people who spoke Gaelic only and 26,401 speaking Gaelic and English. Of the six small burghs, the chief are Stornoway (pop., 1951, 4,954), Dingwall (3,367). Invergordon (1,514) and Tain (1,600). Gllapool is a fishing port near the mouth of Loch Broom. There are 12 county districts and the county with Inverness-shire returns three members to parliament, for Inverness, Ross and Cromarty, and the Western Isles. Dingwall. Tain and Fortrose are royal burghs, and Dingwall is the county town. Ross and Cromarty with Inverness, Moray and Nairn forms a sheriffdom, and there are resident sheriffs-substitute at Dingwall and Stornoway, the former also sitting at Tain.

There are academies at Dingwall, Fortrose, Tain and Invergordon.

Agriculture and Industries.— Ross-shire embraces wider extremes of farming types than any other county in Scotland. On the fertile soils of Easter Ross there are large and productive holdings given over to rotational cropping and the rearing and fattening of livestock. Heavy yields of cereals and potatoes are obtained, and the cattle and sheep are of outstanding quality. At the other extreme are the crofts of Lewis, where the climate, the type of soil and the size of units are factors unfavourable to progressive agriculture. Between these extremes are the less intensive arable and stock-raising farms on the poorer and higher land bordering the hills. On the hills themselves, which in area comprise the greater part of the county, large-scale sheep farming is practised. Poultry and pig-keeping are mainly sidelines on mixed arable farms; there are relatively few dairy holdings. Dingwall is the principal agricultural market. Because of the unfavourable nature of most of the surface—which offers no opportunity for other than patchwork tillage—the number of small holdings (5 ac. and less) is enormous and the average size is about 18 ac. More than 800,000 ac. of poor and rough grazing land, much of it over 2,000-ft. above sea level, are devoted to deer forests, a greater area than in any other county in Scotland. The natural woodland has largely disappeared, but large-scale afforestation has been undertaken by the forestry commission. Apart from agriculture and forestry, the salmon fisheries in the bays and river mouths, and the herring, cod and ling fisheries are the only considerable industry. There are distilleries near Dingwall, Tain and Invergordon. Considerable employment of a temporary nature was provided

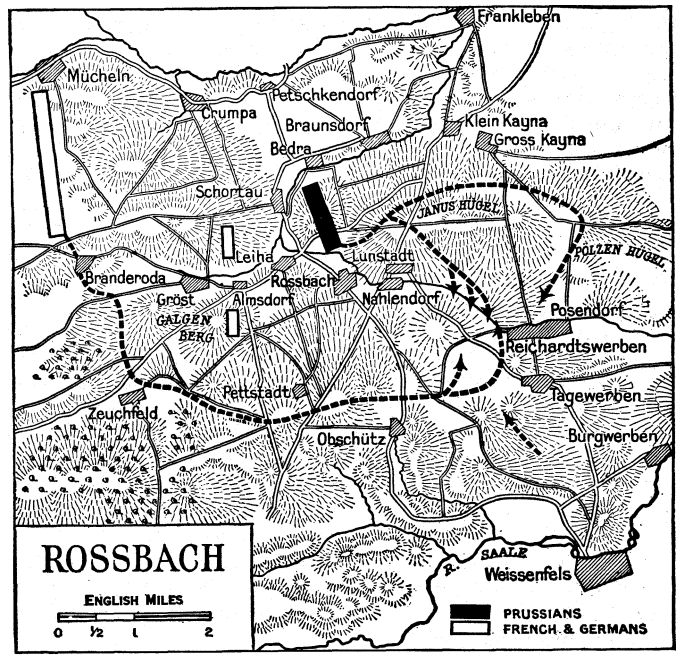
after World War II by the projects of the North of Scotland Hydro-Electric board.

ROSSANO, a city of Calabria. Italy, in the province of Cosenza, 24 mi. N.N.E. from that town direct. with a station 4 mi. distant on the line from Metaponto to Reggio. Pop. (1951) 11,739. It is on a spur of Sila mountain, overlooking the Gulf of Taranto, the highest part of the town being 975 ft. above sea level. Rossano is the seat of an archbishop, and in the cathedral is preserved the *Codex Rossanensis,* an uncial ms. of the Gospels of Matthew and Mark in silver characters on purple vellum. with twelve miniatures, of great interest in the history of Byzantine art. belonging to the 6th century A.D. Rossano *(Roscianum)* was an important fortress of Calabria. Totila took it in 548. In the 14th century it was made a principality for the family of De Baux. Passing to the Sforza. and thus to Sigismund of Poland. it was united in 1558 to the crown of Naples by Philip II. of Spain. During World War II it was bombed by the Allies.

ROSSBACH, a village in the Land of Saxony, Germany, in the district of Merseburg, 8 mi. S.W. of that place and N.W. of Weissenfels, famous as the scene of Frederick the Great's victory over the allied French and the army of the Empire on Nov. 5, 1757. For the preceding events *see* SEVEN YEARS' WAR. The Prussian camp on the morning of the 5th lay between Rossbach (left) and Bedra (right), facing the Allies, who, commanded by the French general, Charles de Rohan, prince de Soubise, and Joseph Frederick William, duke of Saxe-Hildburghausen. General Feldzeugmeister of the Empire, had manoeuvred in the preceding days without giving Frederick an opportunity to bring them to action, and now lay to the westward, with their right near Branderoda and their left at Miicheln *(see* sketch). The advanced posts of the Prussians were in the villages immediately west of their camp, those of the Allies on the Schortau hill and the Galgenberg.

The Allies possessed a numerical superiority of two to one in the battle itself, irrespective of detachments,[1] and their advanced post overlooked all parts of Frederick's camp. They had had the best of it in the manoeuvres of the previous days, and Hildburghausen determined to take the offensive. He had some difficulty, however, in inducing Soubise to risk a battle, and the Allies did not begin to move off their camping-ground until after eleven on the 5th, Soubise's intention being probably to engage as late in the day as possible, with the idea of gaining what advantages he could in a partial action. The plan was to march the Allied army by Zeuchfeld, round Frederick's left (which was covered by no serious natural obstacle), and to deploy in battle array, facing north, between Reichardtswerben (right) and Pettstadt (left). The duke's proposed battle and the more limited aim of Soubise were equally likely to be attained by taking this position, which threatened to cut off Frederick from the towns on the Saale. This position, equally, could only be gained by marching round the Prussian flank, *i.e.,* by a flank march before the enemy. The obvious risk of interference on the exposed flank was provided against by a considerable flank guard, and in fact it was not in the execution of their original design but in hastily modifying it to suit unfounded assumptions that the Allies met with disaster.

Frederick spent the morning watching them from a house-top in Rossbach. The initial stages of their movement convinced him that the Allies were retreating southward towards their magazines, and about noon he went to dinner, leaving Captain von Gaudi on the watch. This officer formed a different impression of the Allies' intentions, for the columns which from time to time became visible in the undulations of the ground were seen to turn eastwards from Zeuchfeld. Gaudi's excited report at first served only to confirm Frederick in his error. But when the king saw for himself that hostile cavalry and infantry were already near Pettstädt, he realized the enemy's intentions. The battle for which he had manoeuvred in vain was offered to him, and he took it without hesitation. Leaving a handful of light troops to oppose the French advanced post (or flank guard) on the Schortau hill, the Prussian army broke camp and moved—half an hour after the king gave the order—to attack the enemy. The latter were marching in the normal order in two main columns, the first line on the left, the second line on the right; farther to the right was a column consisting of the reserve of foot, and between the first and second lines



PLAN OF THE BATTLE OF ROSSBACH, NOV. 5, 1757

was the reserve artillery on the road. The right-wing cavalry was of course at the head, the left-wing cavalry at the tail of the two main columns. At first the regulation distances were preserved, but when wheeling eastward at Zeuchfeld there was much confusion, part of the reserve infantry getting in between the two main columns and hampering the movements of the reserve artillery, and the rest, on the outer flank of the wheel, being unable to keep up with the over-rapid movement of the wheeling pivot. A weak flank guard was thrown out towards Rossbach. When it was seen that the Prussians were moving, as far as could be judged, eastward, it was presumed that they were about to retreat in order to avoid being taken in flank and rear; and the Allied generals thereupon hurried the march, sending the cavalry on ahead.

Frederick had no intention either of forming up parallel to the enemy or of retreating. As his army could move as a unit twice as fast as the enemy's, he intended to make a détour, screened by the Janus Hiigel and the Polzen Hiigel, and to fall upon them suddenly from the east. If at the moment of contact the Allies had already formed their line of battle facing north, the attack would strike their right flank; if they were still on the move in column eastwards or north-eastwards, the heads of their columns would be crushed before the rest could deploy in the new direction—deployment in those days being a lengthy affair. To this end General von Seydlitz, with every available squadron, hurried eastward from Rossbach, behind the Janus Hiigel, to the Polzen Hiigel; Colonel von Moller, with eighteen heavy guns, came into action on the Janus Hiigel at 3.15 against the advancing columns of the Allied cavalry; and the infantry followed as fast as possible. When they came under the fire of Moller's guns, the Allied squadrons, which were now north of Reichardtswerben and well ahead of their own infantry, suffered somewhat heavily; but it was usual to employ heavy guns to protect a retreat, and they contented themselves with bringing some field-guns into action. They were, however, amazed when Seydlitz's thirty-eight squadrons suddenly rode down upon the head and right flank of their columns from the Polzen Hiigel *"avec une incroyable vitesse."* Gallantly as the leading German regiments deployed to meet him,

[1] V. der Goltz (*Rossbach bis Jena,* 1906 edition) gives 41,000 Allies and 21,600 Prussians as the combatant strengths. Berndt's statistical work, *Zahl im Kriege,* gives the respective forces engaged as Allies 43,000, Prussians 21,000. Other accounts give the Allies' total strength as 64,000 and the Prussians' as 24,000.

the result was scarcely in doubt for a moment. Seydlitz threw in his last squadron, and then himself fought like a trooper, receiving a severe wound. The mêlée drifted rapidly southward, past the Allied infantry, and Seydlitz finally rallied his horsemen in a hollow near Tagewerben, ready for fresh service. This first episode was over in half an hour, and by that time the Prussian infantry, in échelon from the left, was descending the Janus Hügel to meet the already confused and disheartened infantry of the Allies. The latter, as their cavalry had done, managed to deploy some regiments on the head of the column, and the French in particular formed one or two columns of attack—then peculiar to the French army—and rushed forward with the bayonet. But Moller's guns, which had advanced with the infantry, tore gaps in the close masses, and, when it arrived within effective musketry range, the attack died out before the rapid and methodical volleys of the Prussian line. Meanwhile the Allies were trying in vain to form a line of battle. The two main columns had got too close together in the advance from Pettstadt, part of the reserve which had become entangled between the main columns was extricating itself by degrees and endeavouring to catch up with the rest of the reserve column away to the right, and the reserve artillery was useless in the middle of the infantry. The Prussian infantry was still in échelon from the left, and the leftmost battalions that had repulsed the French columns were quickly within musket-shot of this helpless mass. A few volleys directed against the head and left flank of the column sufficed to create disorder, and then from the Tagewerben hollow Seydlitz's rallied squadrons charged, wholly unexpectedly, upon its right flank. The Allied infantry thereupon broke and fled. Soubise and the duke, who was wounded, succeeded in keeping one or two regiments together, but the rest scattered over the countryside. The battle had lasted less than an hour and a half, and the last episode of the infantry fight no more than fifteen minutes. (C. F. A.)

ROSSBY, CARL GUSTAF ARVID (1898–1957), Swedish-American meteorologist, whose studies, particularly in atmospheric circulation, had much to do with the rapid growth of the science during his time. Born on Dec. 28, 1898, in Stockholm and educated there, his principal published works appeared after he moved to the United States in 1925. Working first in Washington, D.C., and later as professor and head of the country's first department of meteorology at the Massachusetts Institute of Technology, Cambridge. he made important contributions to thermodynamics of air masses and atmospheric turbulence, including ocean-air boundary problems.

In the late 1930s Rossby turned his attention to the general circulation of the atmosphere, continuing this work after becoming professor and chairman of the department of meteorology at The University of Chicago. He identified the long waves in the upper westerlies, now often called "Rossby waves," and developed the theory for their movement. He is credited with having identified the so-called "jet stream" and with having developed the principal theories for its behaviour. He also worked on models for numerical weather prediction.

After 1948 Rossby was mainly identified with the Institute of Meteorology which he founded in connection with the university in Stockholm. From 1954 until his death on Aug. 19, 1957, in Stockholm, he introduced and led world-wide studies of atmospheric chemistry and radioactivity.

Rossby distinguished himself as a leader of men as well as a scientist. Wherever he worked he had a large and devoted following and generated much enthusiasm for meteorology.

(H. R. B.)

ROSSE, WILLIAM PARSONS, 3RD EARL OF (1800–1867), Irish astronomer and telescope constructor, was born at York on June 17, 1800, a son of the 2nd earl, Lawrence. Until his father's death he was known as Lord Oxmantown. Entered at Trinity college, Dublin, in 1818, he proceeded to Magdalen college, Oxford, in 1821, and in the same year he was returned as M.P. for King's county, a seat which he resigned in 1834. He was Irish representative peer from 1845, president of the British association in 1843, president of the Royal society from 1849 to 1854, being awarded the royal medal in 1851, and chancellor of the University of Dublin from 1862. He died at Monkstown on Oct. 31, 1867.

The first constructor of reflecting telescopes on a large scale, William Herschel, never published anything about his methods of casting and polishing specula, and Lord Rosse had no help toward his brilliant results. His speculum metal is composed of four atoms of copper (126.4 parts) and one of tin (58.9 parts), a brilliant alloy. Chiefly because of the brittleness of this material, Lord Rosse's first larger specula were composed of a number of thin plates of speculum metal (16 for a 3-ft. mirror) soldered on the back of a strong but light framework made of brass (2.75 of copper to 1 of zinc), which has the same expansion as his speculum metal. In Brewster's Edinburgh Journal of Science (1828) he described his machine for polishing the speculum. which in all essential points remained unaltered afterward. In Sept. 1839 a three-foot speculum was finished and mounted, but, though the definition of the images was good, its skeleton form allowed the speculum to follow atmospheric changes of temperature quickly, so Lord Rosse decided to cast a solid three-foot speculum. Hitherto a great difficulty in casting specula was the fact that they generally cracked while cooling. Rosse experimented, ingeniously overcame this difficulty, and successfully cast a solid three-foot speculum in 1840. In 1842 he began a speculum of six feet in diameter, and in 1845 this great reflector was mounted and ready for work.

From 1848 to 1878 it was but with few interruptions employed for observations of nebulae (see NEBULA); and many previously unknown features in these objects were revealed by it, especially the similarity of "annular" and "planetary" nebulae, and the remarkable "spiral" configuration in many of the nebulae. A special study was made of the nebula of Orion, and the resulting large drawing gives an extremely good representation of this complicated object. See TELESCOPE.

See Ball, *Great* **Astronomers (1895).**

ROSSELLINO (ROSSELLINI), the name of a family of stonecutters from Settignano, near Florence, of whom two of five brothers, BERNARDO, an architect and sculptor, and ANTONIO, a sculptor, are the most important.

BERNARDO ROSSELLINO (1409–64), notable early Renaissance architect and sculptor, was born at Settignano in 1409. His earliest recorded work, the upper part of the façade of the Misericordia at Arezzo (1433–35), in which a lunette with the Madonna of Mercy is set between elegant pilasters, reveals the strong influence of Filippo Brunelleschi, as does his masterpiece, the historian Leonardo Bruni's tomb (1445–50) in Sta. Croce in Florence. The Bruni monument has the form of a triumphal arch set against the wall, with the effigy resting on a classical sarcophagus and a relief of the Virgin and Child and two figures of angels above. It inaugurated a new type of sepulchral monument, which assumed great popularity and was imitated by Desiderio da Settignano and other artists. Notable alike for its architectural and sculptural qualities, this tomb ranks with the greatest achievements of Renaissance sculpture. In a tabernacle carved by Bernardo Rossellino in S. Egidio in Florence (1449–50), for which the bronze door was cast by Lorenzo Ghiberti, the influence of Brunelleschi is also dominant. His work as a figure sculptor can also be studied in two figures of the Annunciatory Angel and Virgin Annunciate in the museum at Empoli (1444–47) and the tomb of the Beata Villana delle Botte in Sta. Maria Novella in Florence (after 1451). Much of the effect of the Bruni monument is due to the extraordinarily skillful carving of the decorative ornament. Other examples of Bernardo's use of decorative carving occur in a doorway in the Palazzo Pubblico at Siena (1447) and the tomb of Orlando de' Medici in SS. Annunziata in Florence (1456). Throughout his life Bernardo Rossellino also practised as an architect, executing the Palazzo Ruccellai in Florence and the cathedral and episcopal palace at Pienza (after 1461). Between 1451 and 1453 he was employed in Rome by Pope Nicholas V on the building of St. Peter's, the restoration of S. Stefano Rotondo and other works. Bernardo became superintending architect of the duomo in Florence in 1461, and died in Florence on Sept. 23, 1464.

ANTONIO ROSSELLINO (1427–79), sculptor, the youngest brother,

born in 1427 at Settignano. His earliest authenticated work is a signed bust of the doctor Giovanni Chellini (1456; Victoria and Albert museum, London). This and a considerably later bust of the historian Matteo Palmieri (1468; Museo Nazionale, Florence) show him to have been a portrait sculptor of unusual incisiveness. About 1456 he executed a marble statue of St. Sebastian in the museum at Empoli, in which the style (like that of the portrait busts) is strongly influenced by the antique. Antonio Rossellino's most important and extended work is the chapel of the cardinal prince of Portugal in S. Miniato al Monte outside Florence for which he assumed responsibility after the death of its architect Antonio Manetti (1460), designing the pavement and episcopal throne and the tomb of the cardinal. The effigy of the cardinal rests on a reproduction of a Roman porphyry sarcophagus and is accompanied by two seated children, two kneeling angels and a circular relief of the Virgin and Child, which are some of the most distinguished marble sculptures of their time. A variant of this tomb commissioned for Mary of Aragon, duchess of Amalfi. in Sta. Anna dei Lombardi, Naples, was unfinished at Antonio's death in 1479 and was completed by Benedetto da Maiano. Also for the Piccolomini chapel in the same church he executed an altarpiece of the "Adoration of the Shepherds," in which an attempt is made to invest marble relief with the properties of a painted altarpiece. A circular relief of the "Nativity," carved in the same style, is in the Museo Nazionale, Florence. In this and in Antonio Rossellino's last work, the Nori Madonna in Sta. Croce (before 1478), some deterioration from the high standard of the tomb of the cardinal of Portugal is evident. Antonio's marble reliefs of the Virgin and Child with angels, of which the finest is in the Metropolitan museum in New York, show him at his most felicitous, and enjoyed great popularity in the 15th century.

See L. Planiscig, *Bernardo und Antonio Rossellino* (1942); L. Heydenreich, "Pius II als Bauherr von Pienza" in *Zeitschrift fur Kunstgeschichte,* vi, pp. 105–146 (1937). (J. W. P.-H.)

ROSSETTI, CHRISTINA GEORGINA (1830–1894), English poet, was the youngest of the four children of Gabriele Rossetti. *(See* article on her brother DANTE GABRIEL ROSSETTI.) She was born at 38 Charlotte Street, Portland Place, London, on Dec. 5, 1830. She enjoyed the advantages and disadvantages of the strange society of Italian exiles and English eccentrics which her father gathered about him, and she shared the studies of her gifted elder brother and sister. As early as 1847 her grandfather, Gaetano Polidori, printed privately a volume of her *Verses,* in which the richness of her vision was already faintly prefigured. In 1850 she contributed to *The Germ* seven pieces, including some of the finest of her lyrics. In her girlhood she had a grave, religious beauty of feature, and sat as a model not only to her brother Gabriel, but to Holman Hunt, to Madox Brown and to Millais. In 1853–54 Christina Rossetti for nearly a year helped her mother to keep a day-school at Frome-Selwood, in Somerset. Early in 1854 the Rossettis returned to London, and the father died.

In poverty, in ill-health, in extreme quietness, she was now performing her life-work. She was twice sought in marriage, but each time, from religious scruples (she was a strong high-church Anglican), she refused her suitor; on the former of these occasions she sorrowed greatly, and her suffering is reflected in much of her early song. In 1861 she saw foreign countries for the first time, paying a six weeks' visit to Normandy and Paris. In 1862 she published what was practically her earliest book, *Goblin Market,* and took her place at once among the poets of her age. In this volume, indeed, is still to be found a majority of her finest writings. *The Prince's Progress* followed in 1866. In 1867 she, with her family, moved to 56 Euston Square, which became their home for many years. Christina's prose work *Commonplace* appeared in *1870.* In April 1871 her whole life was changed by a terrible affliction, known as "Graves's disease"; for two years her life was in constant danger. She had already composed her book of children's poems, entitled *Sing-Song,* which appeared in 1872.

After a long convalescence, she published in 1874 two works of minor importance, *Annus Domini* and *Speaking Likenesses.* The former is the earliest of a series of theological works in prose, of which the second was *Seek and Find* in 1879. In 1881 she published a third collection of poems, *A Pageant,* in which there was evidence of slackening lyrical power. She now gave herself almost entirely to religious disquisition. The most interesting and personal of her prose publications (but it contained verse also) was *Time Flies* (1885)—a sort of symbolic diary or collection of brief homilies. In 1890 the S.P.C.K. published a volume of her religious verse. She collected her poetical writings in 1891. In 1892 she was led to publish a very bulky commentary on the Apocalypse, entitled *The Face of the Deep.* After this she wrote little. Her last years were spent in retirement at 30 Torrington Square, Bloomsbury, which was her home from 1876 to her death. In 1892 her health broke down finally, and she had to endure terrible suffering. From this she was released on Dec. 29, 1894. Her *New Poem* were published posthumously in 1896.

In spite of her manifest limitations of sympathy and experience, Christina Rossetti takes rank among the foremost poets of her time. In the purity and solidity of her finest lyrics, the glow and music in which she robes her moods of melancholy reverie, her extraordinary mixture of austerity with sweetness and of sanctity of tone with sensuousness of colour, Christina Rossetti, in her best pieces, may challenge comparison with the most admirable of our poets. The union of fixed religious faith with a hold upon physical beauty and the richer parts of nature has been pointed to as the most original feature of her poetry. Hers was a cloistered spirit, timid, nun-like, bowed down by suffering and humility; her character was so retiring as to be almost invisible. All that we really need to know about her, save that she was a great saint, was that she was a great poet. (E. G.)

See the *Poetical Works* of *C.G.R.,* with Memoir by W. M. Rossetti (1903); Edmund Gosse, *Critical Kit-Kats* (1896); an article by Ford Madox Hueffer in the *Fortnightly Review* (March, 1904); and another in *The Christian Society* (Oct. 1904). The *Family Letters of Christina Rossetti* were edited by W. M. Rossetti in 1908; *Selected Poems* of *Christina G. Rossetti,* edited by C. B. Burke (1913); T. Watts-Dunton, *Old Familiar Faces* (1916); Marjorie A. Bald, *Women Writers* of *the Nineteenth Century* (1923).

ROSSETTI, DANTE GABRIEL (1828–1882), English poet and painter, was born on May 12, 1828, at 38 Charlotte Street, London. He was the second of the four children of Gabriele Rossetti (1783–1854), Italian poet and liberal, a political refugee from Naples, who came to England about 1824, and married in 1826 Frances Mary (d. 1886), sister of Byron's physician, Dr. John Polidori. The elder Rossetti became professor of Italian at King's College. London, and was a subtle and original, if eccentric, commentator on Dante. His other children were Maria Francesca (1827–76), who eventually entered an Anglican sisterhood, and is known to scholars by her valuable *Shadow of Dante;* William Michael (*q.v.*); and Christina (*q.v.*) the poet.

Dante Gabriel Rossetti was educated at King's College School, London. On leaving school he went (1843) to Cary's Art academy (known as Sass's), near Bedford Square, and theh (about 1846) to the Royal Academy Antique school. He did not find the instruction he desired in the Royal Academy schools, and asked Ford Madox Brown to take him as a pupil. Brown remained his friend even after Rossetti had transferred his admiration to Holman Hunt.

Pre-Raphaelite Brotherhood.— The point of Pre-Raphaelite crystallization which had so'great though brief an influence upon Rossetti's life and art was found at a chance meeting, in 1848, between Rossetti, Millais and Holman Hunt in Millais's house in Gower Street, where certain prints from early Italian frescoes were studied. Rossetti proposed the formation of a "Brotherhood" with lofty aims, and they were joined by J. Collinson, F. G. Stephens, T. Woolner and W. M. Rossetti. Brown, though invited, declined to become a **P-R.B.** Rossetti's first effort was "The Girlhood of Mary, Virgin," which in March 1849 was exhibited at the "Free Exhibition," at Hyde Park Corner. The style of this famous picture was jejune, its handling was timid, while its coloration and tonality were dry, not to say thin. Its technique owed something to Brown, but its mysticism was Rossetti's own. Such was his advent in art under the Pre-Raphaelite banner. "Ecce Ancilla Domini!" the smaller picture which is now in the Tate Gallery,

London, was his one perfect expression of the original motive of the "Brotherhood." He chose virginal white and its harmonies as its aptest coloration, and the intense light of morning sufficed for its tonality. There is real grace and sweetness in the figure of the Virgin, for which his sister Christina was the model. This picture was exhibited at the Portland Gallery in 1850 and was violently attacked by the critics at the time.

In December 1850 appeared the first of the four numbers of *The Germ*, the organ of the "Brotherhood," in which Rossetti had a leading place in verse and prose. He contributed to it some of his most famous poems — The *Blessed Damozel*, six sonnets and four lyrics.

The attack on the Pre-Raphaelites by the critics prejudiced their sales, and Rossetti turned to water-colours. His first considerable effort in this medium, which proved well-suited to his talent, was the illustration to Browning's poem "The Laboratory," depicting a lady's visit to an old poison-monger to obtain a fatal potion for her rival in love. This wonderful gem of colour marked the opening of the artist's second period, and his departure from that phase of Pre-Raphaelitism of which "Ecce Ancilla Domini!" was the crowning achievement. Other water-colours followed including the original (pen and ink) of "Hesterna Rosa," a gambling scene (1852), and "Dante drawing the Angel" (1852). "Found" was begun in 1853; but this piece of pictorial moralizing (the analogue of the poet's *Jenny*), vigorous and intensely pathetic as it is, was never really finished.

Marriage to Elizabeth **Siddal.**—Rossetti had now become acquainted with the beautiful Elizabeth Siddal, whose sumptuous and individual type moved Hunt, Millais and Rossetti to paint her. Rossetti painted her innumerable times, and they became engaged to be married about 1851. The friends called her "Lizzy" and "Guggums," though the names ill suited her tragic temperament and ominous beauty. By 1854 the Brotherhood, championed by John Ruskin, was respectable, but at the moment of success the group was broken up. Ruskin became Rossetti's patron and friend; it was rather a onesided friendship, for Rossetti was not prepared to accept Ruskin's pretensions. In May 1860 Rossetti and Elizabeth Siddal were married, but the two years of their marriage were painful years, for she was dying of tuberculosis. She gave birth to a still-born child, and on Feb. 11, 1862, she died of an overdose of laudanum, which she took from time to time to allay her sufierings. In the meantime Rossetti had met William Morris and Burne-Jones, both of them his enthusiastic disciples. To these new friendships are due Rossetti's part in the luckless decorations of the Oxford Union (1857–8). To the exhibition of the Pre-Raphaelites in 1857 he sent many works, including the "Wedding of St. George and Princess Sabra" and "Arthur's Tomb" (both in the Tate Gallery, London). "Bocca Baciata," the portrait (in oils) of a woman, a work of wonderful fire, and the pictures on the pulpit at Llandaff Cathedral, marked the close of the second epoch in Rossetti's art and the beginning of the third, last and most powerful of all the phases of his career. The picture "Dr. Johnson at the Mitre" (Tate Gallery), when the "pretty fools" consulted the lexicographer on Methodism, is a good example of his humour. In 1861 Rossetti published the exquisite translations in *The Early Italian Poets*, later revised as *Dante and his Circle* (1874).

Achievements in Painting.—With Morris he began to take a keen interest in decorative art. He produced several fine designs for stained glass, and had a large share in the revival of stained-glass painting as an art. The practice of designing on a large scale, and employing masses of splendid deep-toned colours, was probably largely responsible for the development of his powers in painting at this period (1862–63). He produced at this time a striking and highly imaginative triptych (Tate Gallery), representing three events in the careers of Paolo and Francesca. The composition of the group of figures with the circular window behind them, is as fine as it was comparatively novel in Rossetti's practice. Other outstanding works are "Beata Beatrix" (Elizabeth Siddal as the blessed Beatrice contemplating the eternal) (1865), now in the Tate Gallery; "Proserpina in Hades" (1874), perhaps the most original, if not the most poetical and powerful of all his output; "Sibylla Palmifera" (1870); "Venus Verticordia," "Lilith," the better of the two versions is now referred to (1873); "Monna Vanna," in the Tate Gallery (1866); "Aurea Catena" (Janey Morris) (c. 1869); "La Ghirlandata" (1878); "Pandora," another study of Mrs. Morris (1871); "The Blessed Damozel" (1877); and the famous "Dante's Dream," now in the Walker Art Gallery at Liverpool. Nearly all Rossetti's last work was exhibited by the Royal Academy and at the Burlington Fine Art Club in 1883, after his death.

Development **As** a Poet.—The literary side of Rossetti developed *pari passu* with his achievements as a painter. After his wife's death he moved from Blackfriars to 16, Cheyne Walk, (The Queen's House), Chelsea, where for a short time A. C. Sninburne, W. M. Rossetti and Theodore Watts-Dunton lived with him. Rossetti had felt his wife's death — and perhaps his own remorse for having so frequently betrayed her — so acutely that in the first paroxysm of his grief he insisted upon his poems (then in manuscript) being burled in her coffin. But in 1869 they were disinterred and published in 1870. The volume contained the poems printed in *The Germ*, the sonnet-sequence *The House* of *Life*, very much enlarged at a later date. From this time to his death he continued to write poems and produce pictures — in the latter relying more and more upon his manipulative skill and less and less upon his inventive faculty. He depended also to some extent on the assistance of an artist whose name was Treffry Dunn.

In 1871 Robert Buchanan, in an unsigned article in the *Contemporary Review* on "The Fleshly School of Poetry," made a fierce attack on Rossetti's poems from a moral point of view, to which he answered by one on the "Stealthy School of Criticism." The attack was deeply felt by him, and his tendency towards gloomy brooding was further increased about 1868, by persistent insomnia. The result of this malady was a nervous shrinking from personal contact with any save a few intimate friends, which aas aggravated by the use of narcotics, and at one time he saw scarcely anyone save his own family and Theodore Watts-Dunton. Fears were felt for his sanity, and in 1872 Re was under medical care. He was frequently away with William Morris at Kelmscott, in Oxfordshire; indeed he was for some time (1872–74) a co-tenant of Kelmscott. This friendship was broken by the disputes arising out of the reorganization of the Morris firm, but Mrs. Morris was still an occasional visitor at Cheyne Walk.

While his *Ballads and Sonnets* was being printed (1881) his health began to give way and he died on April 9, 1882. His *Ballads* and *Sonnets* contained much of his best work, including the completed *House of Life*, and the fine ballads, *Rose Mary*, *The White Ship*, and *The King's Tragedy*.

BIBLIOGRAPHY.—*See* W. M. Rossetti—*Dante Gabriel Rossetti as Designer and Writer* (1889); *Ruskin, Rossetti, Pre-Raphaelitism* (1899); *Some Reminiscences* (1906) *and Rossetti, Classified Lists of his Writings with the Dates* (1906). Memoir by W. M. Rossetti *prefixed to the Collected Works* (1886, *Revised edition* 1911). *Lady Burne-Jones's Memorials of Edward Burne-Jones* (1904) is *full of* interesting *sidelights. See* also F. G. *Stephens, D. G. Rossetti; "Portfolio" monograph* (1894); *H. C. Marillier, D. G. Rossetti* (1899 *and* 1901); W. Sharp, *Dante Gabriel Rossetti: A Record and a Study* (1882); T. *Hall* Caine, *Recollections of Dante Gabriel Rossetti* (1882, *revised and enlarged edition*, 1928); *W. Allingham, Letters of Dante Gabriel Rossetti to William Allingham, 1854–70 (1807)*; *A. C. Benson, Rossetti*, in the "English Men of *Letters*" series (1904); *E.* Waugh, *Rossetti, his Life and Works* (1928); *R.* L. Mégroz, *Dante Gabriel Rossetti* (1929).

ROSSETTI, WILLIAM MICHAEL (1829–1919), English author and critic, born in London, second son of Gabriele and Frances Rossetti. In 1845, owing to pressure of family circumstances, he entered the Excise office, afterward the Inland Revenue office, where he remained till 1894, retiring with the rank of under-secretary. He was a founder of the Pre-Raphaelite Brotherhood, and edited its organ *The Germ*, to which he contributed several papers of criticism and some verse. From 1850 onward, he wrote on matters of art and literature for *The Spectator* and other papers, defending the Pre-Raphaelite cause.

W. M. Rossetti is best remembered for his work in connection with Shelley (1869), Blake and Walt Whitman. His edition and

memoir of Shelley (1869). with a carefully emended text and a dispassionate study of the poet's life, was invaluable at the time of its publication.

In 1874 he married Lucy (1843–1894), daughter of Ford Madox Brown, by whom he had five children.

He died at London on Feb j 1919

Rossetti's most important works are blank verse translation of Dante's *Inferno* (186j); *Fine Art, Chiefly Contemporary* (1867); *Aldine Edition of Blake's Poems* (1874); *Lives of Famous Poets* (1878); *Collected Works of D. G. Rossetti* (1886–1904); *Life of Keats* (1887); *D. G. Rossetti: His Family Letters With Memoir* (189j); Memoir of D. G. Rossetti prefixed to *New Poems* (1896); *Ruskin, Rossetti, Pre-Raphaelitism* (1899), the first of a series of family records; *Gabriele Rossetti—a Versified Autobiography* translated and supplemented (1901); *Some Reminiscences* (1906); *Democratic Sonnets* (1907).

ROSSI, PELLEGRINO LUIGI EDOARDO, COUNT (1787–1848), Italian economist, and statesman, was born at Carrara on July 13, 1787. He was educated at Pavia and Bologna. In 181j he supported Joachim Murat, and on his fall left the country and went to Geneva, where he lectured on Roman law. He was made a citizen of Geneva, and as member of the extraordinary diet of 1832, was employed to draw up a revised Constitution, the *Pacte Rossi.* This was rejected, and Rossi went to France, where he was professor of political economy in the College de France, and in 1834 professor of constitutional law at Paris university. In 1839 he was given a peerage and in 1845 sent to Rome, where he became French ambassador. After the revolution of 1848 he stayed in Rome, and became minister of the interior under Pius IX. He was assassinated on the steps of the House of Assembly on Nov. 15, 1848.

As a statesman, Rossi was a man of signal ability and intrepid character, but it is as an economist that his name will be best remembered. His *Cours d'kconomze politique* (1838–54) gave in classic form an exposition of the doctrines of Say, Malthus and Ricardo. His other works were *Traité de droit pénal* (1829); *Cours de droit constitutionnet* (1866–67); and *Me'langes d'économie politique, d'histoire et de philosophie* (2 vols., 1857).

See le Comte Fleury d'Ideville, *Le Comte Pellegrino Rossi, sa vie, ses oeuvres, sa mort* (1887).

ROSSINI, GIOACHINO ANTONIO (1792–1868), Italian operatic composer, was born at Pesaro on Feb. 29, 1792. His father was town trumpeter and inspector of slaughter-houses, his mother a baker's daughter. The elder Rossini was imprisoned by the Austrians in 1796, and the mother took Gioachino to Bologna, earning her living as a *prima donna buffa* at various theatres of the Romagna, where she was ultimately rejoined by her husband. Gioachino remained at Bologna in the care of a pork butcher, while his father played the horn in the bands of the theatres at which his mother sang. The boy learned singing and the pianoforte, and at thirteen appeared at the theatre of the Commune in Paër's *Camilla—his* only appearance as a public singer (1805). He was also able to play the horn. In 1807 he was admitted to the Conservatorio of Bologna, but his insight into orchestral resources was gained rather by scoring the quartets and symphonies of Haydn and Mozart, than from his teachers. At Bologna he was known as "il Tedeschino" on account of his devotion to Mozart. His first opera, *La Cambzale di Matrimonio,* was produced at Venice when he was eighteen. Two years before he had received the prize at the Conservatorio of Bologna for his cantata *Il pianto d'armonia per la morte d'Orfeo.* Between 1810 and 1813, at Bologna, Rome, -Venice and Milan, Rossini produced operas of which the successes were varying. *Tancredi,* produced at the Fenice, Venice (1813) made him famous. The libretto was an arrangement of Voltaire's tragedy by J. A. Rossi. Traces of Paer and Paisiello mere undeniably present in fragments of the music. But the sweetness and clarity of such melodies as "Mi rivedrai, ti rivèdrò" and "Di tanti palpiti," conquered Venice. Italians would sing "Mi rivedrai" in the law courts until called upon by the judge to desist. Rossini continued to write operas for Venice and Milan during the next few years, but without repeating the success of *Tancredi.*

In 1815 he retired to Bologna, where Barbaja, the impresario of the Naples theatre, engaged him as musical director of the Teatro San Carlo and the Teatro Del Fondo at Naples, on the understanding that he compose for each of them one opera a year. His payment was to be 200 ducats (about £35 or $175) per month; he was also to receive a share in the gaming-tables, also owned by Barbaja, amounting to about 1.000 ducats (£175 or $875) per annum. General enthusiasm greeted the court performance of his *Elisabetta regina* d' *Inghilterra,* in which Isabella Colbran, whom Rossini afterward married, took a leading part. The opera was the first in which Rossini wrote the ornaments of the airs instead of leaving them to the fancy of the singers, and also the first in which the *recitatieo secco* was replaced by a recitative accompanied by a quartet of strings. In *Almaviva* (Rome. 1816) the libretto, a version of Beaumarchais' *Barbier de Séville* by Sterbini. was the same as that already used by Paisiello in his *Barbiere,* an opera which had enjoyed European popularity for more than a quarter of a century. But Rossini had created such a masterpiece of musical comedy that the title of *Il Barbiere* di *Siviglia* ("The Barber of Seville") passed inevitably to his opera.

Between 1815 and 1823 Rossini produced 20 operas. Of these *Otello* formed the climax. contrasting interestingly with the treatment of the same subject at a similar point of artistic development by G. Verdi. In deference to the taste of the day the story was made to end happily! *Mose in Egitto* ("Moses in Egypt") was produced at Naples in 1818. In 1821. Rossini married Isabella Colbran. In 1822 he directed his comic opera based on the Cinderella story. *Cenerentola* (1817). in Vienna, where *Zelmira* was also performed. After this he returned to Bologna; but an invitation from Prince Metternich brought him to Verona at the opening of the Congress on Oct. 20, 1822.

In 1824 he became musical director of the Théâtre Italien in Paris at a salary of £800 per annum. and when the agreement came to an end he was appointed chief composer to the king and inspector-general of singing in France. The production of *Guillaume Tell* ("William Tell") in 1829 brought his career as a writer of opera to a close. The libretto was by Étienne Jouy and Hippolyte Bis, but their version was revised by Armand Marrast. The music is free from the conventions discovered and utilized by Rossini in his earlier works, and marks a transitional stage in the history of opera. In 1829 he returned to Bologna on family business. His return to Paris was delayed by the July Revolution of 1830 until Nov. 1830. Six movements of his *Stabat Mater* were written in 1832 and the rest in 1839, the year of his father's death, and the success of the work bears comparison with his achievements in opera; but his comparative silence during the period from 1832 to 1868 makes his biography appear almost like the narrative of two lives—the life of swift triumph, and the long life of seclusion, of which the biographers give us pictures in stories of the composer's cynical wit, his speculations in fish culture, his mask of humility and indifference. His first wife died in 1845, and political disturbances in the Romagna compelled him to leave Bologna in 1847, the year of his second marriage with Olympe Pelissier, who had sat to Vernet for his picture of "Judith and Holofernes." After living for a time in Florence he settled in Paris in 1855, where his house was a centre of artistic society. He 'died at Passy on Nov. 13, 1868.

See Stendhal. *Vie de Rossini* (1823, Eng. trans., London, 1869; mod. ed., Paris. 1922); Lord Derwent, *Rossini* (London. 1934).

ROSSLYN, ALEXANDER WEDDERBURN, 1ST EARL OF (1733–1805), Lord Chancellor of Great Britain, was the eldest son of Peter Wedderburn (a lord of session as Lord Chesterhall). and was born in East Lothian on Feb. 13. 1733. He was educated at Edinburgh university and entered the Inner Temple in 1753. It was alaays his intention to practise at the English bar, but in deference to his father's wishes he qualified as an advocate in Edinburgh in 1754, and practised there for three years. In 1757, following a quarrel with Lockhart, then dean of faculty, he left the Scottish bar. and was called at the Inner Temple. He engaged Thomas Sheridan and Macklin to teach him oratory and to eliminate his native accent. His countrymen, Lords Bute and Mansfield. were also useful to him. and it was he who suggested to Bute

a pension for Samuel Johnson. Bute's influence got him into parliament in 1761, and he took silk in 1763. In 1767 he married an heiress. His political career after this is complicated in the extreme. In 1768 he was a Tory, but the next year he resigned his seat over the government's action against the reformer John Wilkes (*q.v.*), thereby winning enormous popularity in the country, and getting a pocket-borough from Lord Clive in 1770. His new associates, however, distrusted him, and aith reason; in Jan. 1771 he deserted to the North ministry and was made solicitor-general. Throughout the American Revolution he savagely attacked the colonies, and in 1778 he was made attorney general. In 1780 he became chief justice of the common pleas with the title of Baron Loughborough. During North and Fox's coalition he was a commissioner of the great seal, and appears as leader of the Whigs in the lords, with full expectations of the woolsack. The king's recovery, however, blighted their hopes, and in 1792 Loughborough seceded from Fox, and became lord chancellor in Pitt's Tory cabinet. In 1801, Pitt's resignation was the end of him; Addington had no room for him, but he received the earldom of Rosslyn and retired. He died at his country house near Windsor on Jan. 2, 1805, and was buried in St. Paul's.

At the bar Wedderburn was an eloquent speaker. noted for his skill in marshaling facts, but not for his knowledge of the principles and precedents of law. On the bench his judgments were remarkable for their perspicuity, particularly in the appeal cases to the house of lords, and his readiness in debate in parliament was widely acknowledged. In social life, however, he had the reputation of being dull.

ROSS-ON-WYE, a market town and urban district in the Hereford parliamentary division of Herefordshire, Eng , $14\frac{1}{2}$ mi. S.S.E. of Hereford by road. Pop. (1951) 5.399. Area 1.6 sq.mi. The market house (1670) is a restored sandstone building, supported on columns; the upper part is used as a public library. The town owes much to the philanthropist John Kyrle (1637–1724), the "Man of Ross," eulogized by Alexander Pope (*Moral Essay III,* Of *The Use of Riches,* 1732). Ross is an ancient borough and was granted to the see of Hereford by Edmund Ironside, but became crown property in 1559. It is the centre of a highly productive agricultural district. Its industries include the manufacture of agricultural machinery, timber, brewing and milling.

ROSTAND, EDMOND (1869–1918), French dramatist, was born on April 1, 1869, the son of a prominent Marseilles journalist and economist. His first play, a burlesque, Les *romanesques,* was produced on the 21st of May 1894 at the Théâtre Français. He took the motive of his second piece, *La Princesse lointaine* (Théâtre de la Renaissance, 5th April 1895), from the story of the troubadour Rudel and the Lady of Tripoli. The part of Mélisande was created by Sarah Bernhardt, who also was the original Photine of La *Samaritaine* (Théâtre de la Renaissance, 14th April 1897), a Biblical drama in three scenes taken from the gospel story of the woman of Samaria. The production of his "heroic comedy" of *Cyrano de Bergerac* (28th December 1897, Théâtre de la Porte Saint-Martin), with Coquelin in the title rôle, was a triumph. No such enthusiasm for a drama in verse had been known since the days of Hugo's *Hernani.* The play was quickly translated into English, German, Russian and other European languages. For his hero he had drawn on French 17th-century history; in *L'Aiglon* he chose for his theme the unhappy life of the duke of Reichstadt, son of Napoleon I. and Marie Louise, under the surveillance of Metternich at the palace of Schonbrunn. *L'Aiglon,* in six acts and in verse, was produced (March 15, 1900) by Sarah Bernhardt at her own theatre, she herself playing the part of the duke of Reichstadt, one of her most famous later roles. In 1902 Rostand was elected to the French academy. *Chantecler,* produced in February 1910, had Lucien Guitry in the title role. During World War I he wrote chiefly patriotic verse. He died in Paris on Dec. 2, 1918.

His son, MAURICE ROSTAND, author of plays, made a sensation in 1928 by the production of *Napoléon IV,* in which it was sought to ascribe responsibility for the death of the prince imperial to Queen Victoria.

The following works by Edmond Rostand were published posthumously: *La dernière nuit de Don Juan* (1921); *Le cantique de l'aile* (1922); Le *Vol de la Marseillaise* (1922). *See G.* Haraszti, *Edmond Rostand* (1913); J. Suiberville, *Le Théâtre d'Edmond Rostand* (1919).

ROSTOCK, a town of Germany, situated in the district of the same name, one of the most important commercial cities on the Baltic. It is situated on the estuary of the U'arnow, 8 mi. from the port of Warnemiinde on the Baltic, 177 mi. N.W. of Berlin by rail, 80 mi. E.N.E. of Liibeck and 106 mi. S. of Copenhagen. Pop. (1950) 133,109. It is probable that the site was occupied by a village from very early times but the first definite mention of the settlement occurs in the 12th century. The town received its municipal charter in 1218. The earliest signs of commercial prosperity date from about 1260. In the 14th century it joined the Hanseatic league, and was one of the original members of the powerful Wendish Hansa, in which it exercised an influence second only to that of Liibeck. The most prosperous epoch of its commercial history began in the latter half of the 15th century. Rostock never entirely lost the independence which it enjoyed as a Hanse town. In the suburbs was located, after Hitler came to power, the Heinkel aircraft factory, one of the largest in Germany. As a result, the population of Rostock increased by 35,000 between 1933 and 1939. On April 28, 1942, a large British bombing squadron blasted Rostock and the Heinkel works with terrific results. Three more raids followed within a week. The aircraft factory was badly damaged, two large areas of Rostock were laid in ruins, and thousands of frightened citizens fled to the open country.

Rostock had five old churches: St. Mary's dating from 1398 to 1472, one of the most imposing Gothic buildings in Mecklenburg, with two Romanesque towers and containing a magnificent bronze font and a curious clock; St. Nicholas', begun about 1250 and restored in 1450 and again in 1890–94; St. Peter's, with a lofty tower built in 1400, which serves as a landmark to ships at sea; St. James's, completed in 1588; and the church of the Holy Rood, begun in 1270. St. Mary's church contains a monument marking the original tomb of Hugo Grotius, who died in Rostock in 1645, though his remains were afterward removed to Delft. Among other buildings are the curious 14th-century Gothic town hall, the façade of which is concealed by a Renaissance addition; the former palace of the grand dukes, built in 1702; and the university buildings, erected in 1867–70. The University of Rostock was founded in 1419. From 1437 till 1443 it had its seat at Greifswald in consequence of commotions at Rostock, and in 1760 it was again removed, on this occasion to Biitzow. The professors appointed by the city, however, still taught at Rostock, so that there were practically two universities in the duchy until 1789 when they were reunited at the original seat.

Rostock has a considerable trade, being the chief commercial town of the district, and vessels drawing 19 ft. of water are able to get up to the wharves. By far the most important export is grain, but bricks, sugar and salt are also shipped. The chief imports are ordinarily coal, herrings, timber, wine and colonial goods. A train-ferry service to Denmark runs from Warnemiinde, the outpost of Rostock.

ROSTOPTSCHIN, COUNT FEODOR VASSILIEVICH (1763–1826), Russian general, was born on March 23, 1763, in the government of Orel. The tsar Paul made him in 1796 adjutant general, grand marshal of the court, then minister of the interior. He was disgraced in 1801 for his opposition to the French alliance, but was restored to favour in 1810, and was appointed military governor of Moscow. He was charged with its defense against Napoleon. He is alleged to have instigated the burning of Moscow the day after the French had made their entry; it is certain that the prisons were opened by his order, and that he took no means to stop the outbreak. He defended himself against the charge of incendiarism in a pamphlet printed in Paris in 1823, *La Vérité sur l'incendie de Moscou,* but he subsequently made grave admissions. Shortly after the Congress of Vienna, to which he had accompanied the tsar Alexander, he was disgraced. He returned to Russia in 1825, and died at Moscow on Feb. 12, 1826. His *Mémoires écrits en dix minutes* were

posthumously published at St. Petersburg in 1853, his *Oeuvres inédites* in Paris in 1894.

ROSTOV-ON-DON, a seaport of the R.S.F.S.R., U.S.S.R., in the North Caucasian area, in 47° 15′ N., 39° 40′ E., on the Sea of Azov, 25 mi. from the point where the Don river reaches that sea by a number of mouths, only two of which are used, one for shipping and one for rafts. A channel through the former has been dredged with a minimum depth of 14 ft. The river is frost-bound for 100 days per annum on an average. Trade consists of transit from rail or river vessels to lighters or local steamers on which cargoes are carried to Taganrog roads, there to be loaded for foreign voyages. Few vessels from foreign ports reach Rostov itself. Imports and exports are thus practically the same as those of Taganrog (*q.v.*). Rostov is an industrial centre with shipbuilding yards, a dyeing industry, zinc, tobacco, boot and shoe factories and other enterprises. There is a fishing industry. It is linked by rail with the north and west, with the Volga river and with the Caspian sea. Pop. (1959) 597,000. much swollen in summer by seasonal hands coming in for the grain shipping.

During World War II Rostov-on-Don played a considerable role in the Russo-German campaign, being one of the main centres of the Ukrainian front. It changed hands many times and was definitely liberated only after the German retreat of 1943.

ROSTOV VELIKI, a town of the Russian Soviet Federated Socialist Republic, U.S.S.R., in the Yaroslavl *oblast* in 57° 14′ N., 39° 15′ E., near Lake Rostov or Nero. Rostov was founded by the Slavs about 862, and played a great part in early Russian history as the centre of the Rostov principality. Its pink washed Kreml (or citadel) walls have iron doors with quaint legends and paintings in each square; *e.g.,* a crow on a branch with the legend, "I sing only to relieve my sorrow." Its ancient cathedral, with the famous peal of bells, its numerous church domes: its 12th-century shrines and relics, the alleys and closes of its market, give a wonderful picture of medieval Russian life. After the Mongol invasion of 1239–42 it rapidly declined and in 1474 was purchased by Ivan III and annexed to Moscow. It was repeatedly plundered by Tatars, Lithuanians and Poles in the 15th, 16th and 17th centuries. The population (23,305) is mainly employed in the drying of vegetables and medicinal herbs, in coffee and chicory preparation and in flour milling. The district was once famous for its enameled icons.

ROSTRA (beaks), in Roman antiquities, the orators' platform which stood in Rome between the Comitium and the Forum, opposite the Curia. In 338 B.C. it was decorated by Gaius Maenius with the prows of ships captured from the people of Antium. From that time it was called *Rostra,* having previously been known as *templum* (literally consecrated place), since it had been consecrated by the augurs. Here were exhibited the statues of famous Romans, and state documents and memorials (the laws of the Twelve Tables, etc.). Caesar had it pulled down, intending that it should be rebuilt on the west side of the Forum, but it was left for Augustus to carry out his plan. The use of the term *Rostra Vetera* by classical authors makes it doubtful whether the old platform mas entirely demolished, unless the name was simply transferred to the new rostra of Augustus to distinguish it from the *Rostra Iulia.* This consisted of a rectangular platform, 78 ft. long, 11 ft. above the level of the Forum, reached by steps from the back; in front there was a marble balustrade with an opening in the centre where the speaker stood. In the existing remains, the holes in which the beaks of the ships were fastened are visible. *See* ROME: *The Forum.*

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ROSWELL, a city of southeastern New Mexico, U.S., about 170 mi. S.E. of Albuquerque is the hub for a trade area on a radius of approximately 100 mi. Nourished by an artesian basin, the city with its thousands of trees gives the appearance of an oasis in the semi-arid ranching plains. It lies at an altitude of 3,570 ft. The Pecos river flows 12 mi. to the east.

Roswell began as a trading post founded in 1871 by Van C. Smith. It was incorporated in 1891. Initially a cattle town, Roswell developed agricultural production first in orchards' and alfalfa, later in cotton. Its subsequent growth can be attributed to the establishment of Walker Air Force base in 1941, and to the location of district offices by major oil companies during the decade of the 1950s. Roswell is the seat of Chaves county and the home of the New Mexico Military institute. The Roswell Museum and Art centre has been called a model for museums in small cities. Its major exhibits include a collection of the paintings of Peter Hurd, who was born in Roswell in 1904; the Witter Bynner collection of Chinese art; and the Robert H. Goddard rocket exhibit, commemorating and illustrating Goddard's pioneer work (much of it carried out at Roswell, 1930–41).

For comparative population figures *see* table in NEW MEXICO: *Population.* (PL. HN.)

ROSYTH, a town and naval base of Fife, Scot., on the north shore of the Firth of Forth, 2½ mi. S.E. of Dunfermline (with which it was incorporated in 1911). Plans for the establishment of a large naval base there were drawn up in 1903; 285 ac. of foreshore and 1,184 ac. of land behind were purchased and work was begun in 1909. The scheme included a high-level main basin covering an area of 55 ac., a dry dock. a submarine tidal basin and an entrance channel. A great sea mall was built to form the southern boundary of the three docks. During World War I Rosyth was used as a secondary base to Scapa Flow, particularly for battle cruisers. In 1925 the dockyard was reduced to the basis of a care and maintenance establishment, but on the outbreak of World War II it recovered its former importance. After the end of that war, it continued to function as one of the main dockyards of the United Kingdom and to provide employment for about 7,000 people.

Rosyth has been built as a "garden city" and the number of its inhabitants in 1955 was estimated to be 13,000.

ROTA, COURT OF, one of the departments of the mediaeval papal organization in the Vatican. The Rota was the supreme court of appeal of Christendom. It declined in importance when a special court of appeal for Italy was set above it, and more so as the geographical jurisdiction of the pope was gradually lessened.

After the Council of Trent the old arrangements were replaced by the congregations, permanent committees of cardinals which deal with definite branches of business. The Rota, however, was restored to its functions as supreme court of appeal by Pope Pius X in 1908.

See CURIA ROMANA; and art. "Rota" in *The Catholic Encyclopedia.*

ROTARY CLUB, an organization of business and professional men founded for the purpose of furthering the object of service to others in all relationships. The first Rotary club was founded in Chicago. Ill., on Feb. 23, 1905, by a lawyer. Paul P. Harris. The members met in rotation at the offices or places of business of the various members. This method suggested the name, Rotary club. Similar clubs were organized in other cities of the U.S. and in Aug. 1910, at Chicago, the 16 clubs then in existence formed the National Association of Rotary clubs. In 1912, after the formation of clubs in Winnipeg, Can.; Dublin, Ire.; and London. Eng., the organization became the International Association of Rotary clubs. In 1922 the name was changed to Rotary International.

The object of Rotary is: to encourage and foster the ideal of service as a basis of worthy enterprise and, in particular, to encourage and foster (1) the development of acquaintance as an opportunity for service; (2) high ethical standards in business and professions; the recognition of the worthiness of all useful occupations and the dignifying by each Rotarian of his occupation as an opportunity to serve society; (3) the application of the ideal of service by every Rotarian to his personal, business and community life; and (4) the advancement of international understanding, good will and peace through a world fellowship of business and professional men united in the ideal of service.

The program of Rotary based on this object brings together in an atmosphere of personal friendship men of diverse occupations without reference to religion or politics. Some clubs (such as those in

Cairo, Egy.; Singapore; Hong Kong; Jerusalem) have a membership composed of many different nationalities and races.

Membership in a Rotary club is based upon activity in a business, profession or institution. Basically. there may be one representative of each classification of business, professional or institutional activity in a community. An additional active member from the same concern or establishment as an active member may be elected to membership in the same classification. Men who distinguish themselves by meritorious service in the furtherance of Rotary ideals may be elected to honorary membership. The affairs of each club are administered by a board of directors assisted by various standing committees. The officers (president. vice-president. secretary and treasurer) are elected annually. Clubs hold weekly luncheon or dinner meetings. Membership in the club is forfeited if the required standards of attendance are not maintained. Clubs are grouped in districts for administrative purposes. The club presidents and secretaries in each district meet together each year. Delegates and members of the clubs of each district meet in annual district conferences. , The administrative officer of Rotary International in a district is a district governor. nominated by the clubs in the district and elected by delegates of all Rotary clubs at the annual international convention. The annual international convention elects a president and members of the board of directors, who form the administrative body of Rotary International. The Rotary constitution provides that of the fourteen directors, at least seven must be from countries other than the United States.

A permanent secretariat, consisting of the secretary and his staff, is maintained with offices at Evanston, Ill.; and Zurich. Switz. An office in London serves Rotary clubs in Great Britain and Ireland. The official publications are The Rotarian (English) and *Revista Rotaria* (Spanish), published at Evanston. Other Rotary magazines are published in various languages by districts or groups of districts. In the mid-1950s there were about 8,700 Rotary clubs with a membership of 414,000 business and professional executives in 92 countries and regions.

The Rotary movement in Great Britain and Ireland was started in 1911 with the organization of a Rotary club in Dublin by an Irishman who, while in the U.S., had been a member of the San Francisco Rotary club. About the same time a club was organized in London by Rotarians from Chicago and Boston who had business connections in London. The club in Manchester was formed by London Rotarians and subsequently clubs were formed in Belfast, Glasgow, Edinburgh, Liverpool and Birmingham. In 1914 the clubs in Great Britain and Ireland organized into an association called Rotary International in Great Britain and Ireland. The association is administered by a general council. consisting of a president, immediate past president, vice-president, treasurer, secretary and the Rotary International representatives in the several districts. In the mid-1950s there were almost 800 clubs in Great Britain and Ireland with a membership of 35,000. Each year one member of the board of directors of Rotary International comes from this region. Rotary International in Great Britain and Ireland has a secretariat at London, a number of committees. an annual conference of delegates and members from all clubs in the region, and issues a monthly publication (Rotary Service). The Rotary movement in Great Britain and Ireland differs in no essential way from the movement in other parts of the world. Clubs meet weekly for luncheon or dinner and have a speaker on a topic of general interest, preferably one reflecting in a general way the Rotary ideal of service to others. (G. R. M.; C. R. P.)

ROTARY ENGINE. A type of engine in which the use of reciprocating parts is avoided with the object of saving the energy wasted in converting reciprocal or to-and-fro movement into rotary movement. The rotary principle never had any practical success in competing with the smaller reciprocating engines, but steam turbines (which are really a class of rotary engine) furnished the first solution of the problem for moderate and large size installations. Many rotary mechanisms have been tried. Some have comprised a flap piston rotating within a cylinder, the pressure of the steam causing rotation. Sometimes the flap has a sliding action within the piston, the shaft of the latter being mounted eccentrically in relation to the bore. More or less complicated arrangements of levers and of gears were also patented, with multiple pistons. James Watt's famous attempt was really a semirotary engine, with a radial piston which swung to and fro and actuated a pinion and rack device for working the rods of pit pumps.

In the earlier periods of airplane construction rotary engines were much employed. notably the Gnôme and the Le Rhône. but the radial engine later formed the equivalent of these types. Weaknesses of the rotary aero engine, in use during World War I. were the fact that it could be lubricated with only castor oil and the objectionable gyroscopic action produced by its rotating mass. Yet the rotary principle found great success in certain other directions, such as pumps, blowers and gas-exhausters. The latter are in principle blowers reversed. In a well-known type the piston or drum is set with its axis eccentrically in the cylinder, and radial blades slide in its slots, making a gas-tight fit against the bore. The drum rotates and pumps the gas from the inlet which is at one side of the cylinder to the outlet at the other side.

After World War II there was a continuous development of the gas turbine. In a gas turbine an atomized oil-air mixture burns and produces an expanding gas that serves the same function as steam. Great difficulties were overcome in developing materials that operate under the extremely high temperatures of the gas turbine. Gas turbines are used for stationary power installations particularly where there is a shortage of water for operating a steam plant. See AIRCRAFT PROPULSION; TURBINE: STEAM.

ROTATION OF CROPS refers to the repeated growing of different crops in a specified order. on the same fields. in contrast to a one-crop system or to haphazard crop successions. R'ell-planned cropping practices provide the basis for a smooth-running and effective farm organization. Long before the Christian era crop growers were aware of the influences of crops on each other and of the usefulness of cropping associations. Wherever food crops are produced some kind of rotation cropping appears to be practised. In central Africa the natives use a 36-year rotation. After cutting and burning a 35-year growth of woody shrubs and trees, one crop of finger millet is produced. In the food-producing regions of the world various rotations of much shorter length are widely used. Some of them are designed for the highest immediate returns without much regard for the continuing usefulness of the basic resources. Others are planned for high continuing returns with protected resources. The underlying principles for planning effective cropping systems began to emerge in the mid-years of the 19th century. The subject remains a fruitful field in agronomic research.

The oldest American rotation experiment (begun in Illinois in 1876) reveals a yield decline of 60% by mid-20th century for corn in continucus culture, When corn and oats were alternated the yield of corn declined but at a slower rate. When corn was alternated with oats and clover the yield of corn remained constant. If all crops are accounted for, as in corn-equivalent yields, the yield for a 12-year period at mid-20th century was 20.8 bu. an acre for continuous corn. When corn and oats, a low-profit crop, shared an acre equally the total yield was 22.9 bu. Where corn, oats and; clover shared an acre equally, the total yield for corn and oats on two-thirds of the acre was 29.j bu. and that for all three crops on the acre was 35.5 bu Competing crops provided each other with advantages, and when a complementary crop was added and removed from the land the benefits were greater. If the clover crop had functioned as a rest crop rather than a hay crop its complementary effects would, no doubt, have been much greater, as other experiments have indicated.

Rotation Ratios. — Early experiments, such as those at the Rothamsted Experimental station (*q.v.*), in England. pointed to the usefulness of selecting rotation crops from three classifications: cultivated row. close-growing grains and sod-forming or rest crops. Such a classification provides a ratio basis for balancing crops in the interest of continuing soil protection and production economy. It is sufficiently flexible for adjusting crops to many situations, for making changes when needed and for including go-between crops as cover and green manures. A simple rotation

would be one crop from each group with a 1:1:1 ratio. The first number in a rotation ratio refers to cultivated row crops, the second to close-growing grains and the third to sod-forming or rest crops. Such a ratio signifies the need for three fields and years to produce each crop annually. This requirement would be satisfied with a rotation of corn, oats and clover or of potatoes, wheat and clover-timothy. If green manure or cover crops were desired, three crops could be produced in a 2:1":0 rotation of corn, soybeans and oats (sweet clover). The mark " following a number means that, after a small-grain crop is harvested, a cover crop is on the land for the remainder of the year and until the following spring. Thus a green-manure crop can be grown in rotation without taking the land out of production for a year. Such a rotation could affect soil protection and production economy in a different manner than the 1:1:1 types of rotations. Rotations for any number of fields and crop relationships can be described in this manner. In general most rotations are confined to time limits of eight years or less.

Effects on Production and Soil.—In the interest of high crop incomes some farmers use a 3:0:0 type of rotation such as corn, corn and soybeans that requires annual plowing, seedbed preparation and cultivation. If continued too long such a rotation will bring about unfavourable changes in the soil as sizable reductions in organic matter and nitrogen, development of less desirable physical conditions, accelerated loss of soil and water by surface runoff and lowered nutrient-supplying powers. These changes are often accompanied with greater damage to crops from insects, diseases and weeds. The end results are declining yields, loss of crop quality and reduced incomes. Since World War II rotations of this type have been supplemented with the heavy use of fertilizer with the idea of offsetting the unfavourable effects of such rotations. Whether such a program can be continued satisfactorily will need to be judged in the light of sufficient experience.

In the interest of maximum soil protection with effective production economy. other farmers use 2:1:1 types of rotations as corn, soybeans, wheat and alfalfa for use on four fields. Additional advantages can be provided by doubling this rotation to 2(2:1":1) for use on four fields over an eight-year period as (1) corn, (2) soybeans, (3) wheat or oats (sweet clover), (4) corn, (5) soybeans, (6) wheat or oats. (7) alfalfa and (8) alfalfa, with a moderate use of fertilizer as needed. Such rotations are increasingly effective over long-time periods but may not produce as much cash income in the beginning years as the 3:0:0 type of cropping.

Rotation planning consists essentially in fitting soils and crops together in such ways as to be suitable and desirable for livestock, grain, truck-garden and other types of farming. The acreage devoted to sod-forming and rest crops should be expanded at the expense of row crops on soils of increasing slopes and declining fertility. This mill provide better vegetative covering to protect sloping land from excessive erosion and supply organic matter for improving soil productivity on both sloping and level lands. With lessening slope and increasing fertility the row crops may be expanded, but this should not be done with too much reduction in the sod-forming and rest crops. The differing effects of crops on soils and on each other and in reactions to insect pests, diseases and weeds require carefully planned sequences. Competitive and complementary relations can produce advantageous interactions.

Use of Legumes.—Rotation planning should also include a consideration of crop-handling practices. Sufficient legume residues should be returned to the soil either directly or indirectly in animal manure to supply all or much of the nitrogen required by the rotation. The nonlegume residues (stover straws) should be associated with the legume residues to obtain the greatest benefits from the legumes. Experiments show that association increases the yields of succeeding crops more than the combined yields of the two types of residues when used separately. These benefits cannot be secured if these residues are destroyed or removed from the land.

Broadly speaking, cropping systems should be planned around the use of deep-rooting legumes. If too little use is made of them, productivity will decline; if too much land is devoted to them, wastes may occur and other useful crops displaced. Rotations depending wholly on green-manure legumes should be confined to the more level and fertile lands. It mill be desirable to include legumes alone or in mixtures with nonlegume sod-forming crops as a regular crop in many field rotations. In general this should occur about once in each four-year period. Short rotations are not likely to provide the best crop balances and long rotations on a larger number of fields may introduce complications. With a moderate number of fields, additional flexibility can be provided by split cropping on some fields.

Regional Differences.—The usefulness of individual field crops is affected by regional differences in climate and soil. A major crop in one region may have little or no value in another. In each region, however, there are usually row, grain and sod or rest crops that can be brought together into effective cropping systems. The individual crops may vary much from region to region, but the rotation ratios will be somewhat similar among the regions. Some of the rotation ratios used in practice in differing regions, though not always the most useful or effective, are: 2:0:0; 0:2:0; 0:0:1; 2:1":0; 1:1:1; 1:1:2; 1:2":1; 2:1:1; 2(2:1":1); 2:2:1; 2:1:2; and 1:1:3 or 4.

In addition to the many beneficial effects on soils and crops, well-planned crop rotations also provide the business aspects of farming with advantages. Labour, power and equipment can be handled with more efficiency; weather and market risks can be reduced; livestock requirements can be met more easily; and the farm can be a more effective year-round enterprise.

See also SOIL: Soil Productivity. (F. C. BR.)

ROTH, WALTER RUDOLF VON (1821–1895) German philologist, a noted Sanskrit scholar, was born at Stuttgart on April 3. 1821. He was a student and later a professor at Tdbingen university. His profound studies of the Vedas brought about and clarified western understanding of these difficult religious texts. In 1846 he published *Zur* Literatur und Geschichte *des Weda*, a pioneer work based on manuscript materials. He edited the Atharva-Veda (1856) in collaboration with his American pupil, William Dwight Whitney. In the great Sanskrit lexicon published in St. Petersburg from 1852 to 187j by Otto von Böhtlingk and Roth, the Vedic portion is his. He died at Tdbingen on June 23, 1895. (M. B. E.)

ROTHAMSTED EXPERIMENTAL STATION, at Harpenden in Hertfordshire, Eng., founded in 1843. is the oldest agricultural research station in the world. John Bennet Lawes (*q.v.;* 1814- goo), the founder, started to experiment soon after he inherited the Rothamsted estate in 1834. By 1842 he had discovered and patented a process for making a soluble phosphatic fertilizer (superphosphate) and initiated the fertilizer industry by opening a factory to produce it commercially. He considered 1843 to date the station's foundation because he then invited Joseph Henry Gilbert (1817–1901), a chemist, to mork with him and started the long collaboration that lasted until Lawes's death; also, that year was the first year of the Broadbalk experiment on manuring of wheat. which still continues. It was one of a series designed to find the nutritional requirements of important crops, in which the same crop was grown year after year on the same land, with different plots getting different treatments but each plot getting the same one each year.

Other experiments conformed more to agricultural practice, with different crops grown in rotation. The crops. soils, manures and drainage water were analyzed and balance sheets produced to show the fate of what was added to the soil: whether it remained there, was removed in the crop or was lost. The general pattern of treatments was similar in most experiments: no manure; minerals only (minerals was the term used for the constituents of plant ash); nitrogen only; nitrogen and minerals; farmyard manure. The pattern was partly set by a controversy with the German chemist J. von Liebig, who thought plants could get all the nitrogen they need from the air. The Rothamsted experiments soon showed that Liebig was wrong and firmly established that nitrogenous manures greatly increase yields. The old experiments now provide soils unique in the information they carry about how plant nutrients increase and decrease with different treatments.

Lawes and Gilbert are known most for their work on the manuring of crops, but they studied such problems as the purification of sewage. the advantages and disadvantages of ensiling compared with haymaking and animal nutrition. The last established the value of different components in fodder, showed how the composition of animals changes during growth and fattening and destroyed the belief that animal fat came only from vegetable fat.

A converted barn served as the first laboratory. but the practical value of the work was soon recognized and grateful farmers subscribed to a Lawes Testimonial fund, which was used to build a laboratory in 1855. This served until the numbers of staff began to increase early in the 20th century. Until then the only new appointment was a second chemist. R. Warington, who started the study of soil microorganisms and showed that ammonia is converted to nitrate in soil by their activities. Until 1904, when the Society for Extending the Rothamsted Experiments was instituted, the work was paid for wholly by Lawes, at first directly and after 1889 by the income from the fund with which he endowed the Lawes Agricultural trust, the committee of which forms the governing body of the station. Public money was first provided in 1911, after which government grants were made annually and the work is now mostly financed by grants from the Agricultural Research council. The range of problems studied steadily increased and extended to all those affecting soil fertility and the growth of healthy crops. Rothamsted is the headquarters for the soil survey of England and Wales; it also houses the Commonwealth Bureau of Soils.

In 1934 money raised by public subscription allowed the Lawes Agricultural trust to buy the Manor house (now a residential hostel for workers at Rothamsted), the home farm and other parts of the estate. Of the 600 ac.. about half are suitable for experiments and carry approximately 3.000 plots each year.

Many experiments are also made at the Woburn Experimental station in Bedfordshire. started by the Royal Agricultural Society of England in 1876, and joined to Rothamsted in 1926; the different soil there allows experiments on crops for which Rothamsted farm is unsuitable. Workers at the Dunholme field station. Lincolnshire, study the manuring and the pests and diseases of sugar beet. (F. C. BN.)

ROTHE, RICHARD (1799–1867), Lutheran theologian, was born at Posen on Jan. 28, 1799. He studied theology in the universities of Heidelberg and Berlin (1817–20) under Karl Daub (1765–1836), Schleiermacher and Neander. In the autumn of 1823 he was appointed chaplain to the Prussian embassy in Rome, of which Baron Bunsen was the head. This post he exchanged in 1828 for a professorship in the Wittenberg theological seminary, of which in 1832 he became also second director and *ephorus*. In 1837 he became professor and director of a new clerical seminary at Heidelberg; in 1849 he was professor and university preacher at Bonn. but in 1854 he returned to Heidelberg as professor of theology, and afterward became member of the Oberkirchenrath. a position he held until his death on Xug. 20. 1867. His removal to Heidelberg and the publication of his *Die Anfänge der christlichen Kirche und ihrer Verfassung* (1837). coincide with the attainment of the principal theological positions with which his name is associated. Rothe's most important work is his *Theologische Ethik* (3 vol., 1845–1848; 2nd ed.. 5 vol. 1867–71).

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ROTHENBURG-OB-DER-TAUBER, a Bavarian town of Germany. in Middle Franconia. 49 mi. W. by rail of Nürnberg. Pop. (1910) 11,214. Rothenburg-ob-der-Tauber, mentioned in the chronicles in 804 as Rotinbure, first appears as a town in 942 and in 1108 passed to the family of Hohenstaufen. In 1172 it became a free imperial city and it attained the zenith of its prosperity under the famous burgomaster Heinrich Toppler (1350–1408). It is probably the finest surviving example of a medieval town, flanked by medieval walls, towers and gates. Perhaps the most interesting building is the town hall. one part of which dates from 1240 and the other from 1572. The latter is a beautiful Renaissance structure and contains a grand hall in which every Whit Monday a play. *Der Meistertrunk*, which commemorates the capture of the town by Tilly in 1631, is performed. It has manufactures of toys, soap and agricultural machinery. and breweries. linen weaving establishments, sandstone and limestone quarries.

ROTHENSTEIN, SIR WILLIAM (1872–1945), English artist whose portraits are notable for fine draftsmanship and sense of character. was born at Bradford. Yorkshire, on Jan. 29. 1872. He studied at the Slade school, in London, under Alphonse Legros and in Paris at the Académie Julian. In Paris he was encouraged by Degas and Whistler. He began exhibiting in 1891. He was principal from 1920 to 1935 of the Royal College of Art and served as an official British war artist in World Wars I and II. His paintings include the "Coster Girls" (1894; Graves gallery, Sheffield); "The Browning Readers" (1900; Bradford Art gallery); "The Dolls' House" (1899) and "Cliffs at Yaucottes" (1909, both in Tate gallery, London); "Morning at Benares" (1911); and "Bourlon Church" (1919). His portraits include those of Walter Pater (1894), Xlgernon Swinburne (1895), Auguste Rodin (1897), Henry James (1898) and Joseph Conrad (1905), in the National Portrait gallery. London; G. K. Chesterton (1922), Bernard Berenson (1910), Sir Rabindranath Tagore (1912) and a self-portrait (1900), in the Metropolitan Museum of Art. New York city. He painted one of the historical panels in St. Stephen's hall, Westminster. Knighted in 1931, Rothenstein died on Feb. 14, 1945. A memorial exhibition of his work was held at the Tate gallery in 1950.

His published works include *Oxford Characters* (1893); *English Portraits* (1897); *The French Set, and Portraits of Verlaine* (1898); *Manchester Portraits* (1899); *Liber Juniorum* (1899); a *Life of Goya* (1900); *Plea for a Wider Use of Artists and Craftsmen* (1918); *Twenty-Four Portraits* (1st series, 1920; and series, 1923); *Ancient India* (1925); *Men and Memories* (3 vol., 1931–39).

His son. Sir John Rothenstein, the author of a number of books on painting. was appointed director of the Tate gallery in 1938. Another son. Michael Rothenstein, became a painter.

ROTHERHAM, a county and parliamentary borough in the West Riding of Yorkshire. Eng., 6 mi. N.E. of Sheffield. Pop. (1951) 82.341. Area 14.3 sq.mi. It lies at the confluence of the Don and the Rother, which affords a notable north-south route on the east side of the Pennine upland. Rotherham is connected by the Don canal with Goole and the Humber and is a railway and road junction. There are Bronze and Iron Age barrows, and remains of a Roman fort and settlement in the vicinity. Rotherham was taken by the royalists in 1643. but after the battle of Marston moor it was surrendered to a detachment of parliamentary forces. Its industrial prosperity may be said to have begun when ironworks were established at Masborough on the opposite bank of the Don in 1746. It was incorporated in 1871 and became a county borough in 1902. A museum and art gallery was opened in 1893 and a technical college, art school and a central public library in 1931. On Old Rotherham bridge is a 15th-century chapel. The parish church of All Saints is 13th-century Perpendicular. In the mid-1950s there were four large parks and other open spaces covering about 500 ac. The principal industries are steel, iron. brass, glass. coal and its by-products, general engineering, brewing and corn milling. A cattle market is held on Mondays and retail markets twice weekly.

Wentworth Woodhouse, 4 mi. N.W., is an 18th-century mansion partly inhabited by Earl Fitzwilliam and partly used as a training college for teachers.

ROTHERMERE, HAROLD SIDNEY HARMSWORTH, 1ST VISCOUNT (1868–1940), British newspaper-owner, brother of Lord Northcliffe (*q.v.*), and the commercial brain behind the development of his publishing empire. He was born at Hampstead, April 26. 1868. the second son of Alfred Harmsworth. Largely under his mother's influence. he left the civil service in 1888 to become financial manager of his brother's magazine, *Answers*, which he saved from collapse. Thereafter he was the business genius in all of his brother's enterprises, balancing North-

cliffe's enthusiastic creative exuberance with hardheaded financial realism sometimes bordering on cheeseparing, which, although it infuriated Korthcliffe, ensured the stability essential to success.

Whereas Northcliffe was interested in newspapers for themselves, Rothermere was interested in them as a means of making money. To this end he brought ruthlessness and shrewd judgment. He quickly saw how much newspapers would benefit from controlling their own newsprint supplies, and founded the huge Anglo-Newfoundland Development corporation in 1906. He was created a baronet in 1910, and raised to the peerage in 1914. After a brief period as air minister in World War I, he received a viscountcy in 1919. Although he failed to secure control of the *Times* on Northcliffe's death (1922), he acquired his brother's majority interest in the other Northcliffe papers on favourable terms and began a series of operations which first gave him control of Sir Edward Hulton's Manchester newspaper properties (most of which he later resold at a profit) and then involved him in a bitter conflict, over the acquisition of a chain of provincial evening newspapers, with the Berry brothers (later Lord Camrose and Lord Kemsley) to whom, however, he sold the Northcliffe periodical interests, Amalgamated Press, for £8,000,000.

His journalistic judgment was less shrewd than his business sense. Under him the *Daily* Mail lost its lead and he nearly ruined the *Daily Mirror* before he sold it in 1931. His support for the British Union of Fascists and his attacks on all forms of public expenditure alienated readers and advertisers, and his attempt in 1929 to dictate terms to Stanley Baldnin (including the right to approve ministerial appointments before they were made) in return for his newspapers' support, brought a crushing rejoinder. His attempt to force Baldwin's hand by means of the United Empire party campaign, at first in conjunction with Lord Beaverbrook and then on his own, failed completely. Only abroad did he achieve the political acclaim he felt he deserved, uhen in 1927 his advocacy of a review of the treaty of Trianon brought an offer of the crown of Hungary. This he had the good sense not to accept.

Although ruthless in business and without his brother's personal magnetism, he was generous and both his personal and public benefactions were considerable. At the outbreak of World War II he accepted a mission to Canada, uhere his interests gave him great influence. But his health broke and he died, Nov. 26. 1940, at Hamilton, Bermuda. (F. Ws.)

ROTHES, EARLS OF. The first earl of Rothes was George Leslie, son of Norman Leslie of Rothes in Moray and of Ballinbreich in Fife. In 1445 he was created Baron Leslie of Leven, and about 1458 earl of Rothes in the peerage of Scotland His grandson GEORGE, the 4th earl (d. 1558), whose father, William, the 3rd earl, was killed at Flodden. was accused, but acquitted in 1546, of complicity in the murder of Cardinal Beaton, in which his brother and his two sons were undoubtedly implicated; he was one of the Scottish commissioners who witnessed the marriage of Mary Queen of Scots with Francis, the dauphin of France.

His son ANDREW, 5th earl of Rothes (d. 1611), took an active part with the lords of the congregation, first against the queen-mother, Mary of Guise, when regent of Scotland, and afternard against Mary Queen of Scots in opposing her marriage nith Darnley, and in devising the murder of David Rizzio. He was, however, one of the peers nho acquitted Bothwell of Darnley's murder; and going over to the side of the queen, he fought for her at Langside. He continued to occupy a position of some prominence in Scottish affairs until his death in 1611.

His great-grandson, JOHN, 7th earl of Rothes (1630–1681), held a command in the Royalist army at the battle of Worcester in 1651, and accompanied Charles II to England at the Restoration, when he became lord president of the council in Scotland. He was lord treasurer of Scotland from 1663 to 1667, when he was made lord chancellor of Scotland for life. His estates having been sequestrated by the parliament in 1651, he received a re-grant in 1663 of the earldom of Rothes.

See Sir *R* Douglas, *The Peerage* of *Scotland,* ed. Sir *J.* B. Paul; and *G E. C , Complete Peerage.*

ROTHESAY, a royal burgh and the chief town of the county and island of Bute, Scot. Pop. (1951) 10,141. Lying on Rothesay bay, on the eastern coast, it is a holiday town and conference centre. with a promenade 4 mi. long and a pavilion (1938). It is linked to the mainland by passenger and car ferries to Wemyss bay (Renfrewshire) and Colintraive (Argyllshire). The sheltered bay affords excellent anchorage and is the headquarters of a submarine squadron. In the centre of the town are the ruins of a castle. originally erected *c.* 1098 either by Magnus Barefoot, king of Korway, or by the Scots as a defense against the Norwegians. It is said to have been demolished by Robert Bruce, and the ruins today appear to be of 14th-century date. The village which grew up round the castle was made a royal burgh by Robert III, who in 1398 created his eldest son David duke of Rothesay, a title that became the highest Scottish title of the heir apparent to the throne of the United Kingdom. During the Commonwealth, Rothesay castle was garrisoned by the parliamentarians. It was burned by the followers of Argyll in 1685 and remained neglected until the rubbish was cleared away by the second marquess of Bute in 1816. It was repaired by the third marquess and is now maintained by the Scottish National Trust. Although agriculture is the chief industry, the manufacture of fine tweed cloth is becoming increasingly important. There are cruises from Rothesay to the Kyles of Bute, around Arran and to Campbeltown and Inverary. The town is under the jurisdiction of a provost and council.

ROTHSCHILD, the name of a great European Jewish banking family, the name being derived from a red *(rot)* shield on the house in which the family lived in the ghetto of Frankfurt-on-Main, Germany, during the early part of its history.

MAYER ANSELM ROTHSCHILD (1743–1812), the founder of the house, was born Feb. 23, 1743. He established moneylending branches in Europe and England, with his sons acting as branch managers. ANSELM MAYER ROTHSCHILD (1773–1855), his eldest son, born June 12, 1773, remained nith his father and took over the Frankfurt house. SOLOMON ROTHSCHILD (1774–1855), the second son, born Sept. 9, 1774. settled in Vienna; NATHAN MAYER ROTHSCHILD (1777–1836) settled in London; KARL ROTHSCHILD (1788–1855) in Naples and JACOB or JAMES ROTHSCHILD (1792–1868), born May 15, 1792, in Paris. The founder laid down two maxims for the conduct of the banking operations of his family: conduct all operations in common, and set definite limits to each operation and never aim at exorbitant profits.

The Naples house was discontinued after the annexation of Naples by Italy in 1860.

Nathan Mayer, in London, came to be regarded as the financial genius of the family. The political events of the Napoleonic wars gave the house of Rothschild its historic eminence. During that period, the Rothschilds raised £100,000,000 for the European governments. Anselm Mayer, the eldest brother, became a member of the Prussian privy council of commerce. and in 1820 Bavarian consul and court banker; Solomon, who settled in Vienna, was on terms of intimacy with Metternich; and Jacob, of Paris, negotiated large loans for the Bourbons. All of Mayer's sons received the right to use "von" before their names and mere made Austrian barons in 1812. The Rothschilds controlled European finance for many years.

The important London house, after Nathan Mayer's death in 1836, nas managed by his son LIONEL ROTHSCHILD (1808–79), born Nov. 22, 1808, who became the first Jewish member of parliament. in nhich he served from 1858 to 1874. His son NATHAN MAYER ROTHSCHILD (1840–1915) was born Nov. 8, 1840, inherited a baronetcy from his uncle ANTHONY DE ROTHSCHILD (1810–i6) and was made a peer in 1885, the first Jew to be raised to the British peerage. Nathan's son LIONEL WALTER ROTHSCHILD (1868–1937) succeeded to the title: he was born Feb. 8, 1868. and was famous as a naturalist. His collection of some 280,000 bird skins is now in the American Museum of Natural History in New York city.

The head of the London family has been considered the lay head of British Jewry. The Balfour declaration of Nov. 2, 1917, stating that the British government viewed with favour "the establishment of a national home for the Jewish people" in Palestine. was addressed to Lionel Walter Rothschild. EDMUND JAMES ROTH-

SCHILD (1845–1934), of the French branch of the family, invested more than 70,000,000 gold francs in helping to establish Jewish communities in Palestine.

Three of the Rothschilds have entered politics. LIONEL NATHAN ROTHSCHILD (1882–1942) was a member of the house of commons. 1910–23. JAMES ARMAND ROTIISCHILD (1878–) entered the house of commons in 1929. MAURICE ROTHSCHILD (1881–) was a member of the French senate.

Other eminent members of the French branch of the family have been EDOUARD ROTHSCHILD (1868–1949), who was president of the Chemins de Fer du Nord, and HENRI ROTHSCHILD (1872–1947). physician and playwright.

Two great-great grandsons of Mayer Anselm continued the British house of N. M. Rothschild and Sons: LIONEL DE ROTHSCI-IILD. (1882–), born Jan. 25, 1882, and ANTHONY GCSTAV DE ROTHSCHILD (1887–1961).

It is said that no authentic record of the Rothschild family exists, but the following may be consulted: E. C. Corti, *The Rise of the House of Rothschild* (1928); C. Roth, *The Magnificent Rothschilds* (1939). (J. R. LT.)

ROTHSCHILD, LIONEL WALTER ROTHSCHILD, 2ND BARON (1868–1937), British zoologist who founded the Tring museum of natural history, eldest son of Nathaniel Mayer, 1st Baron Rothschild, was born on Feb. 8. 1868, in London. He was educated at home, at Bonn university and at Magdalene college, Cambridge. He was a trustee of the British museum (1899–1937), a member of parliament (1899–1910), a fellow of the Royal society (1911) and president of the zoological section of the British association (1932'). He is notable as the founder of the Tring museum (subsequently presented as a gift to the British museum), the largest and most valuable collection of natural historical specimens ever assembled by one man, containing the largest collection of butterflies and moths in the world (more than 2,000,000 specimens and many thousands of types), and also a unique library of over 30.000 volumes. He published alone or in collaboration with his museum staff over 800 papers and monographs dealing with zoological and botanical subjects, principally birds, butterflies and moths.

Baron Rothschild died on Aug. 27, 1937. at Tring.

See *Novitates Zoologicae*, vol. xli, pp. 1–41 (1938–39), which includes a list of Lord Rothschild's works. (M. L. RD.)

ROTHWELL, an urban district in the Normanton parliamentary division of the West Riding of Yorkshire, Eng., about 4 mi. S.E. of Leeds. Pop. (1961) 25.360. Area 16.7 sq.mi. Soon after the Conquest. Rothwell was a dependency of the castle of Pontefract. and a baronial residence. of which there are slight remains, was erected there. Coal, stone. sand, clay and gravel are obtained and the town has copper tube. rope. chemical and engineering factories. Forced rhubarb is produced on a large scale. Methley urban and Hunslet rural districts were added to Rothwell in 1937.

Rothwell in Northamptonshire is a small manufacturing town 4 mi. N.W. of Kettering.

ROTIFERA (ROTATORIA), well-defined group of aquatic animals of microscopic size, noteworthy for the diversity of their forms. the vivacity and variety of their movements and the complexity of their structural development. They are often called wheel animalcules because in some species the ciliated bands on the head beat in a manner suggestive of the rotation of a wheel or wheels (see *Corona,* below). In length they range from .05 to 2 mm., but most are between 0.1 and 0.4 mm. In general rotifers are symmetrical in structure, although some are highly asymmetrical.

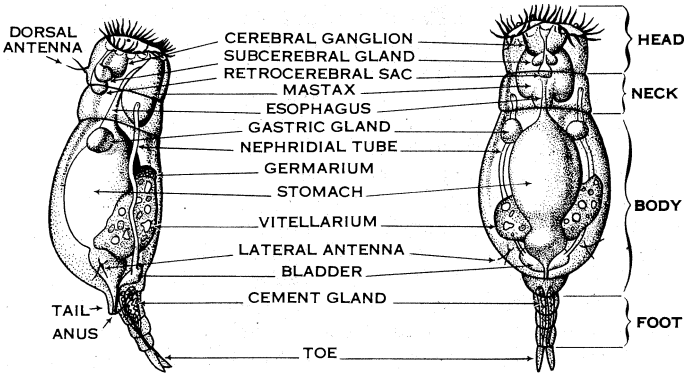
General Features. — The body. which is covered with a thin, flexible cuticle overlying a syncytial epidermis. is, in many species, weakly differentiated into several regions: head. neck, trunk and foot. These regions are separated from each other by folds (often a separate neck is not presentj. The foot may be divided into sections by folds. The sections, often called segments or joints. do not. however; reflect true metamerism.

The foot. an extension of the body posterior or ventral to the anus, bears at its end two conical toes, and contains within two pedal or cement glands which secrete a sticky material through ducts that open at the tips or near the base of the toes. The tail is the fold or prolongation dorsal or anterior to the anus.

At the head end is a flattened ciliated area, the corona, with a mouth near the ventral or posterior edge.

Corona. — Food is collected and swimming is brought about by the action of numerous cilia on an area close to or encircling the mouth, or on fringing lobes protrusible from the mouth. The whole area, including the mouth itself. as seen when the cilia are active. is called the corona. There are many varieties of this organ, differing widely in the arrangement of the cilia and in the presence of accessory structures.

The basic corona type can be regarded as a ciliated band around the head. The corona. prolonged posteriorly on the ventral side, encloses a bare apical area. Some rotifers have tufts of elongated cilia at the sides of the mouth or buccal area. Other species have lateral ciliated ridges, auricles, projecting from the head, the ciliation either being continuous with the buccal area, or limited to the edges, Auricles may be introvertable, in which case they are extended only when the animal is swimming.



FROM WARD AND WHIPPLE, FRESH-WATER BIOLOGY" (1959); REPRODUCED BY PERMISSION OF JOHN WILEY & SONS, INC.

FIG. I. — ANATOMYOF A REPRESENTATIVE ROTIFER SHOWING (LEFT) LATERAL AND (RIGHT) DORSAL VIEWS. GREATLY ENLARGED

Other coronal variations involve reduction of the ciliated band to a very narrow strip and reduction of the ciliation posterior to the mouth. Many actively swimming rotifers have the corona reduced to a thin strip of cilia surrounding the head and enclosing a large apical area. A snoutlike projection or rostrum may be developed from the apical area.

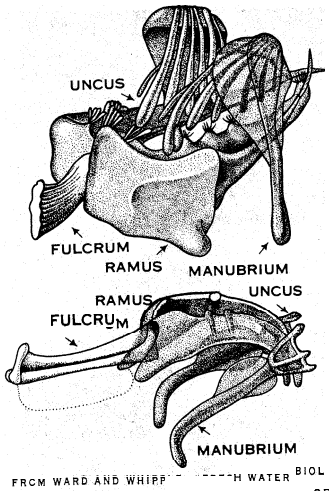
In many species the cilia on the anterior and posterior margins of the ciliated areas are elongated. The anterior line of larger cilia is the trochus, the posterior line is the cingulum. The edges of the corona may be elaborated into lobes. The bdelloids (order Bdelloida), the extreme development of this type, have the dorsal margin so deeply indented toward the ventral side that it has cut through. breaking the trochus into two circles; these are the "rotating wheels" seen in many bdelloids.

The corona of members of the family Collothecidae represents a great modification. The anterior part of the body is drawn out into a wide bowl, the margin of which is usually lobed and covered with very long generally nonvibratile bristles (setae). Within the bowl is a ventral shelflike membrane, usually ciliated. There may be vibratile cilia inside the bowl and, in some species, on the margin as well; however, most do not have coronal cilia. Some adult collothecids lack coronal cilia, except for a small area at the bottom of the bowl.

Foot. — The foot may be highly developed, rudimentary or even absent as in many open-water (planktonic) species. There is often only one toe, representing a fusion of two. The toes of some rotifers are long. unequal, slender filaments. with the cement glands opening at the base. Other species lack these filaments and have a ciliated cup at the end of the foot. In the sessile species the foot usually ends in a stalk attachment or peduncle. The foot, in some species. may be withdrawn into the body.

Body Wall. — In many rotifers the cuticle is thin and pliable; in others it may be thickened in places, forming relatively stiff

plates which together form the lorica. Often the anterior and posterior margins of a lorica have prominent spines. and a few rotifers have spines on the dorsal surface, Some animals have fairly flexible plates, difficult to differentiate from the connecting areas of cuticle. In some rotifers the lorica is simple and consists merely of a general thickening of the cuticle of the body, forming a boxlike structure devoid of obvious differentiation aithin the different regions. More commonly, honever. the lorica consists of an arched dorsal plate and a flat ventral plate fused together at their edges. In such cases the anterior part of the flat plate may be connected nith the arched plate by a pliable cuticular membrane which stretches to accommodate the head when it is retracted. Some have the dorsal and ventral plates joined together by lateral strips of thin cuticle folded inward. forming deep grooves along the sides; others have a dorsal groove



FROM WARD AND WHIPP[illegible]H WATER BIOLOGY" (1959); REPRODUCED BY PERMISSION OF JOHN WILEY & SONS INC

FIG 2 — MAJOR PARTS OF TWO TYPES OF ROTIFER TROPHI

Other modifications of the body wall are movable bristles and paddles, quite different from the spiny extensions of the lorica. They may be long slender filaments, flat paddles or hollow outgrowths of the body furnished with spines and powered by large muscles.

Digestive Tract. — From the mouth a ciliated gullet leads to the mastax. The cuticular lining of the pharynx is thickened, forming the trophi or jaws. Following posteriorly from the mastax, the rest of the digestive tract consists of an esophagus, a thick-walled cellular stomach and a relatively thin-nailed. syncytial intestine, the posterior portion of which is differentiated as a cloaca.

The anus opens on the dorsal surface; however, in genera in which the foot projects from the ventral surface. the anus opens posterior to the foot.

Trophi.—The trophi are very characteristic features of the rotifers. and are found in no other group of animals. There are several major variations of trophi structure associated with food and feeding methods. Some types serve a simple grinding function. Others may be thrust from the mouth to grasp prey. Still others are used for sucking out the contents of organisms

Usually, rotifer trophi consist of seven separate pieces arranged in three sections. An unpaired median ventral fulcrum is attached to a pair of rami (sing. ramus) which move in opposition to each other like a pair of pliers. Altogether these three sections are the incus. The rami are pulled away from each other by muscles attached to the fulcrum and to the outer part of the bases of the rami. Lying adjacent to each ramus is a structure. the malleus. nhich consists of two pieces, a toothed uncus and a manubrium; these tno pieces. hinged together. move in a plane at right angles to the rami.

In addition to these standard parts, there may be others: subunci. rods connecting each ramus to its corresponding uncus: an epipharynx, one or more rods in the wall of the gullet and serving to support the mouth. Other supporting members may be developed elsewhere.

Muscular System. — The muscular system is composed of a group of longitudinal and circular bands in the body wall, a network of muscle in the viscera, and a few muscles betneen the viscera and body wall In some rotifers some of the more powerful muscles are conspicuously cross striped or striated.

Nervous System and Sense Organs. — The chief part of the nervous system consists of a large cerebral ganglion and smaller ganglia associated with the mastax and foot. Numerous nerves lead to muscles and sense organs.

There are three conspicuous touch (tactile) sense organs on the body. two lateral antennae located toward the posterior end and a dorsal antenna on the midline of the head. The dorsal antenna represents the fusion of two antennae and receives two nerves; a few rotifers actually possess two dorsal antennae lying close together. The corona may support stiff cirri (apparently derived from cilia), which are said to serve a tactile function. The foot sometimes has a tactile bristle on the dorsal surface just anterior to the toes.

Excretion. — The excretory system consists of a pair of convoluted tubes (protonephridia) which begin with special end cells called flame bulbs. Most commonly the tubes lead to a bladder from which a duct leads directly to the distensible cloaca; but in some species the protonephridia empty into the cloaca.

Secretion. — In most rotifers the gastric glands are attached to the anterior part of the stomach. In addition, there may be accessory glands elsewhere along the digestive tract.

The adhesive secretion of the cement glands in the foot is used for attachment. for leechlike creeping (alternate attachment of sticky foot and head end) and in the construction of tubes in some sessile forms In sessile species there may be no distinct cement glands, the secretion being produced by swellings of the epidermis.

In the head are located prominent glands of unknown function: an unpaired glandular retrocerebral sac having a long forked duct opening on the apical region of the corona; and a pair of subcerebral glands lying beside the duct of the retrocerebral sac and the ducts leading to the apical area. The sac and glands together compose the retrocerebral organ. Rotifers may have either sac or glands; both, or neither. In some species the ducts are degenerate.

Reproduction. — The reproductive system is of taxonomic importance, the division of the group into classes is made on the basis of the number of ovaries and the development of males. Most rotifers have one ovary, but the bdelloids and seisonids have tno In the former the female reproductive system lies ventral to the digestive tract. The ovary (vitellogermarium) consists of a small germarium that supplies nuclei to eggs, and a massive yolk-gland (vitellarium). An oviduct leads from the ovary to the cloaca

The rotifers ordinarily found are amictic females; *i e*, they reproduce parthenogenetically by diploid eggs (see PARTHENOGENESIS). The eggs may be released free in the nater may be laid on plants or other surfaces ; in most planktonic species the eggs may be attached to the lorica of the mother and carried till they hatch.

Some rotifers bear living young. the mother carrying one or more developing embryos nithin the greatly enlarged oviduct Under adverse environmental conditions special females. (mictic) may lay haploid eggs nhich then become males. When such haploid eggs are fertilized, honever. they are called resting eggs and give rise to females. Resting eggs, having a thicker shell than the parthenogenetic ones, are resistant to drying, and generally take a longer time to hatch. There are reports of resting eggs being produced parthenogenetically, however. Mictic and amictic females usually look alike; they can be distinguished only by the eggs they produce. In a fen species. though, there are observable differences betneen them.

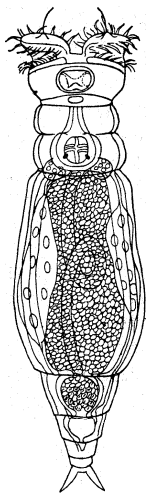
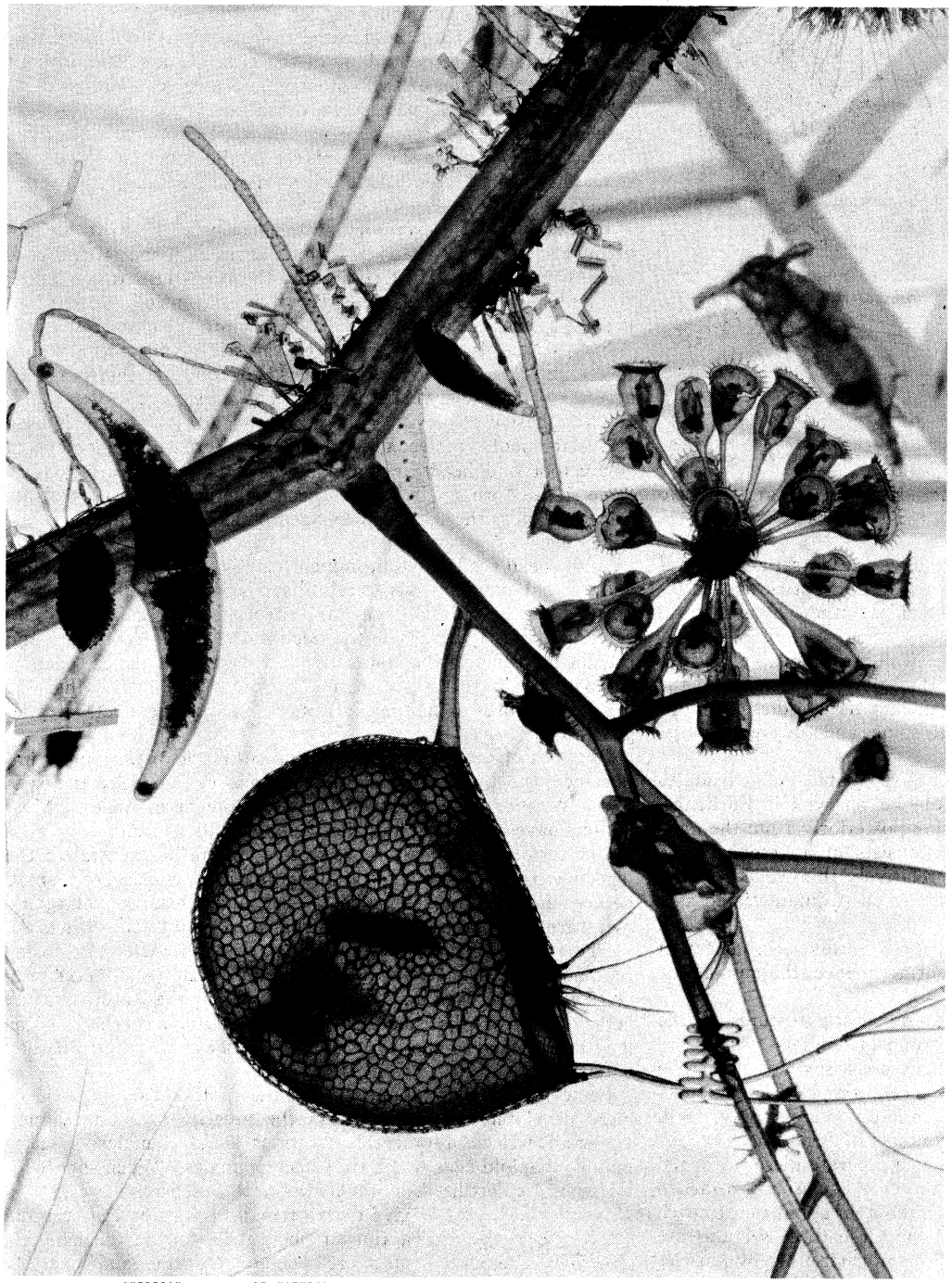


FIG 3 —A BDELLOID ROT"" (PHILODINA ACUTICORNIS)

Rlales, undescribed for most species. have been found in many species of the order Monogononta. In the order Digononta, males are apparently absent among the bdelloids, but the seisonids regularly produce them. In a fen genera the males look like miniatures of the females except for the reproductive system. In most genera however. there is great morphological difference betneen the sexes (sexual dimorphism) ; e g , the males lack a digestive system and bear no resemblance to the



BY COURTESY OF AMERICAN MUSEUM OF NATURAL HISTORY

DETAIL OF ROTIFERA GROUP IN ½ IN. OF POND-BOTTOM WATER

At upper left is main stem of a bladderwort (*Utricularia vulgaris*), a water plant, showing at centre bottom bladder (utricle) about size of a pin head in the living plant. At bladder's lower right margin is trap door, with remains of captured rotifers visible inside. Stem is covered with tiny algae. At centre right is a spherical colony of rotifers (*Conochilus hippocrepis*). Above it is *Notommata copeus* With auricles extended. At left centre is crescent-shaped desmid (*Closterium*), an alga

features of that locality, not by its geographical location. Nevertheless, some species show a distinctly limited range. a few, some very common, are found only in North America; others have been reported only from Europe; a number of species are restricted to warmer climates or at least tropical and subtropical locations, while others are not found in the tropics. In general, the fauna of high altitudes and high latitudes is composed of relatively few species of wide distribution.

Rotifers are plentiful in most bodies of freshwater, especially ponds and bogs. Some are restricted to sea water or saline or alkaline lakes, and are tolerant of wide variations in salinity. A few bdelloids live only in places intermittently wet. such as among the parts of land-growing mosses and liverworts. Most species live along the shore (littoral zone) swimming much of the time in close contact with plants and other surfaces. The planktonic species occur in greatest numbers in open water. Some live within the cells of water plants. A few are commensal. living in the gill-chambers of fresh-water crabs and crayfish or attached to the outside of certain aquatic worms (Oligochaetes). The adults of sessile species live attached to the leaves and stems of water plants; their larvae are free-swimming.

While they live mostly in waters of moderate temperature (10° to 20° C). some have been found in hot springs, and others are restricted to arctic and antarctic waters. Some are capable of withstanding freezing or drying for extended periods.

The duration of their individual lives has been little studied; however. some species are known to live a few days only, while others survive more than a month.

Systematic Affinities.—Much uncertainty and dissension has been expressed about the relationships of rotifers. In some works they are regarded as one of a group of related minor phyla, but in a widely used classification (that of Libbie H. Hyman) they are a class of the phylum Aschelminthes. which includes also the following groups: Gastrotricha, Kinorhyncha (Echinodera), Priapulida, Nematoda and Nematomorpha (Gordioidea).

The following is a working classification:

females. The occurrence of males, where they are known, is restricted to short periods. though they may become very abundant while they are present. The male reproductive system of members of the class Monogononta usually consists of a testis and a ciliated sperm duct with glands. The tip of the duct is capable of being turned outward (eversible) and may be lined with thickened cuticle, forming a penis.

Ecology and **Distribution.**—Rotifers have a distribution that is usually regarded as potentially cosmopolitan. Many species. since they are so easily dispersed, are, in fact, nearly world-wide in their distribution. The occurrence of most species in a given locality seems to be mostly the result of specific environmental

CLASS **ROTIFERA**

Order **1.** Seisonaceae (Seisonidea).—Slender with long necks, living on the marine crustacean Nebalia; sexes of equal size and like form; tuo ovaries. Example. *Seison.*

Order **2. Bdelloidea.**—Bottom-dwelling (Benthonic) rotifers

with jointed cuticle; both ends retractile into the trunk; corona of two trochal discs, set on pedicels; two ovaries; mastax ramate; males lacking. Examples; *Philodina, Rotaria, Habrotvocha.*

Order 3. Monogononta.—Sessile or free-swimming rotifers; one ovary, males more or less reduced in size and structure.

Suborder 1. Ploima.—Free-swimming rotifers. with undivided terminal or ventral corona, not consisting of trochal and cingular circlets; foot with usually two toes; one ovary; mastax various. Examples, *Notommata, Proales, Synchaeta, Trichocerca, Euchlanis, Brachionus, Lecane, Asplanchna.*

Suborder 2. Floscullariaceae.—Sessile or swimming rotifers with more or less lobed corona of trochal and cingular circlets; toes lacking; mastax malleoramate; one ovary. Examples, *Floscularia, Conochilus, Limnias, Hexarthra, Filinia, Trochosphaera.*

Suborder 3. Collothecacea.—Mostly sessile rotifers with large funnel-like corona, often lobed, lacking a ciliary border in most forms; mastax uncinate; toes lacking. Examples, *Collotheca, Stephanoceros, Cupelopagis.* (W. T. E.)

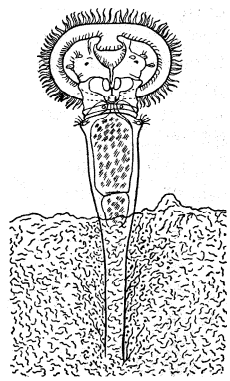


FIG. 4.—A SESSILE ROTIFER (PTYGURA STYGIS)

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ROTOGRAVURE: *see* GRAVURE.

ROTOR *SHIP,* a vessel utilizing revolving cylinders, called rotors, for auxiliary power. Anton Flettner, the German engineer who invented the rotor ship, originally intended to construct ships with metal sails. In 1922, however, experiments at the University of Gattingen, Ger., with revolving cylinders indicated that the pressure exerted upon a cylinder revolving in an air current was considerably greater than had been supposed. When disks of larger diameter than the cylinders mere provided at the ends. moreover, it was found possible to increase the wind effect to nine or ten times the amount of effect in normal sail. To achieve this effect the revolving speed of the cylinders had to be about 3 to $4\frac{1}{2}$ times as great as the speed of the wind.

Though an ordinary sailing vessel is required to take down all canvas in a hurricane, it was claimed that the rotor ship could continue sailing.

Tests were made with a three-masted schooner, the "Buckau." which had a displacement of 960 tons and was fitted with an auxiliary motor of about 200 h.p. The canvas rig of the vessel was dismantled, and in place of the fore and third masts two very strong masts were erected. The new masts were shorter, being 42 ft. in height. They were provided with bearings at the upper and lower ends to allow for the free rotation of the cylinders, which were placed over the masts. The cylinders were fitted at either end with disks of greater diameter than the cylinders that were built as part of them. The cylinders were rotated by means of motors, which could drive the towers at a speed of 125 r.p.m.

Circumferential speed was approximately 60 ft. per second, and the power required to rotate the towers about 9 h.p. By altering the circumferential speed of one or another of the cylinders, it was said, the pressure exerted by the wind could be correspondingly changed and so alter the vessel's course.

Sea tests were claimed to be successful, but little was heard of the subject thereafter. (F. J. D.; X.)

ROTORUA, a town of Rotorua county, North Island, New Zealand. It lies in the midst of a remarkable volcanic district, the Hot Spring district, which covers an area of 660 sq.mi. and extends 160 mi. from northeast to southwest from White Island, an active volcanic cone in the Bay of Plenty, to the mountains of Tongariro. Ngaruhoe and Ruapehu in the interior of the island, southwest of Lake Taupo.

Rotorua attracts many visitors because of the beauty and scientific interest of the locality and the bathing in its various medicinal springs. It is a scattered township lying on the southwestern shore of Lake Rotorua, amid hills reaching 2,600 ft. in the immediate neighbourhood, with a rich growth of forest. Pop. (1956) 12,302.

The springs are principally alkaline, alkaline and siliceous, acidic, or acidic and hepatic (sulfurous). The township includes the Maori village of Ohinemutu, an interesting collection of native dwellings. In the vicinity, on the lake shore, is the government sanatorium. One mile south of the Rotorua is another native village, Whakarewarewa, where there are geysers as well as hot springs.

Four miles from Rotorua, near the centre of the lake. the island of Mokoia rises to 1,518 ft. A short channel connects Lake Rotorua with Lake Rotoiti to the northeast. Both this lake and the smaller ones to the east, Rotoehu and Rotoma, have deeply indented shores and are set in exquisite scenery. The waters of Rotoma are of a particularly vivid blue.

South of Rotoiti is Tikitere, a sombre valley abounding in mud volcanoes, springs and other active volcanic phenomena. Mt. Tarawera (16 mi. S.E of Rotorua) is noted for the eruption of June 1886. which changed the outline of several lakes and destroyed the famous Pink and White terraces on the adjoining Lake Rotomahana

ROTROU, JEAN DE (1609–1650) French dramatist, called by Voltaire the founder of French drama, was born at Dreux in June 1609. More is known of his family than of his own life. He was educated in Paris, arote his first extant play (*L'Hypocondriaque,* publ. 1628) before he was 20. and a few years later emerged as protected by Richelieu and earning an assured income as writer for the chief established theatre of the capital. the Hôtel de Bourgogne.

Rotrou returned to Dreux at the age of 30, married, served for a time as a magistrate, and died, courageously. of the plague (June 28. 1650). He seems to have been a man of retiring disposition, conciliatory and unselfish.

His 35 extant plays shoa the evolution of public taste in drama and the increasing attraction of the theatre for the rising middle class. Nearly half are tragi-comedies, by which was meant a serious play involving peril but not death; the title was in one or two later altered to *"tragédie."* For Rotrou. with Corneille. nhom he admired, and one or two more, invented French classical tragedy. He saw that this new form of social pleasure. both spectacular and declamatory, might achieve emotional effects more powerful and delicate than rough prose drama. With a generous admixture of incident and reversal of fortune he allied discussion of moral issues and portrayal of character under strain. He did much to refine the instrument he had invented, by concentration, omitting extraneous incident and intensifying psychological motivation. His characters are faced with choices: the king's son in *Cosroès* (1648) between power and loyalty; the king in *Venceslas* first condemns his son to execution, and then abdicates in his favour. Racine gratefully borrowed from his study of *Antigone* (1638) and the starkest scene in *Britannicus* is re-worked from Rotrou's *Belissaire* (1644). His sense for comedy was no less keen: in *Les Sosies* (1636 or 1637) he discovered the delicious comic situation which Molière was to perfect in *Amphitryon*

Rotrou is a writer of power. He uses the alexandrine with great effect for resonant expression of stress and violence. He has the

rhetoric, the concentration, the formal structure of the classical manner, together with a baroque sense of surprise, contrast, tension and illusion. The last is most powerfully shown in Le *Veritable Saint-Genest* (1647), showing an actor whose professional martyr's role turns into personal conviction.

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ROTTERDAM, the second largest city of the Netherlands, is situated in the province of South Holland, about 15 mi, from the North sea, on both sides of the Maas river (the mouth of the Rhine). It is the largest European port and one of the largest in the world, and is connected with the North sea by a wide canal called New Waterway. The land area of the city totaled about 57.6 sq.mi. in 1956. The population was about 5,000 in 1514; 72,294 in 1830; 309,307 in 1899; 605,733 in 1938; 643,712 in 1947; 722.718 (mun. estimate) in 1957.

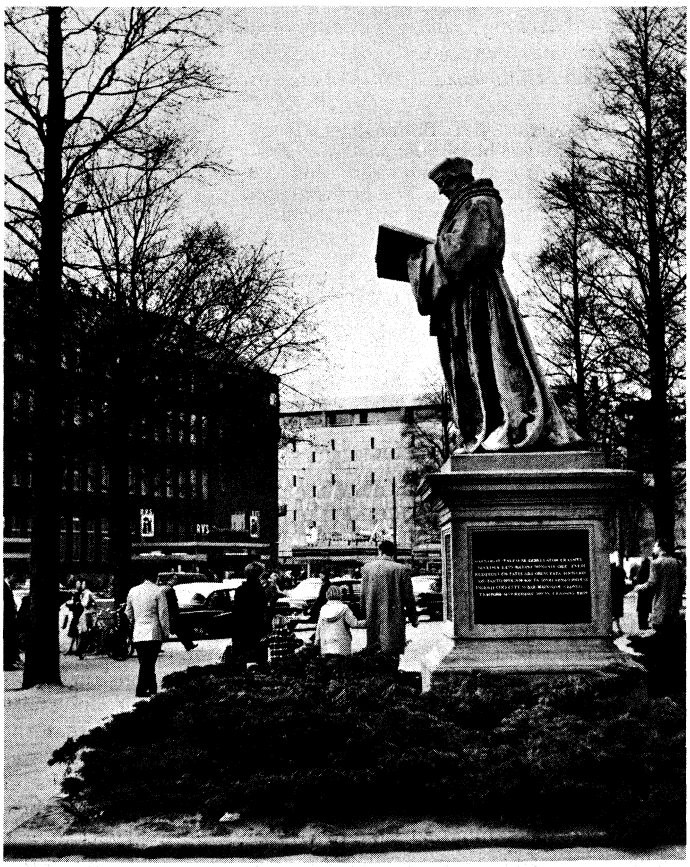
Rotterdam takes its name from the Rotte river which in former times flowed through the marshland of South Holland into the Maas river. A strong dike was built on the north bank of the Maas in about 1250, with the result that the Rotte was shut off from the Maas by a system of locks. A small colony that settled on this dam was granted certain charters in 1299 and 1328. In 1340 Count William IV of Holland bestowed city rights on Rotterdam and at the same time gave the citizens the concession to dig an open canal to the Schie, another right-hand tributary of the Maas. This was an important privilege as it gave Rotterdam a communication with Delft and Leyden, whereas the Rotte only provided a link with the still sparsely populated marshland. Its unusually favourable position between the great market town of Dordrecht and the other Dutch towns was a reason for the city's rise to prosperity. Its thriving growth, however, came to a temporary halt when Jonker Frans van Brederode, leader of the nobles who were in revolt against the sovereign, Maximilian of Austria, gained possession of Rotterdam and used it as a base from which he conducted his military campaigns and pillaged the surrounding countryside.

In 1563 a large part of the town was destroyed by fire and it scarcely had time to recover from this disaster before it was occupied and plundered by Spanish troops in April 1572. The Spaniards withdrew, however, after a few months, and Rotterdam ranged itself on the side of the prince of Orange. It was spared further hostilities and before long it was enjoying a period of great prosperity. From the southern Netherlands, where Philip II's authority had been restored, a great many people fled north, for reasons of faith, and a number of merchants and artisans, mainly from Antwerp, settled in Rotterdam. At this time the city council of Rotterdam was very much under the influence of Jan van Oldenbarneveldt, who was later to play an important part in the government of his country and whose life was to end on the scaffold. Under his auspices, in the last quarter of the 16th century, an ambitious plan emerged for the enlargement of the town. Harbours were dug out of the mud flats and the scale of this plan was so immense that for the next two and a half centuries the city was provided with sufficient possibilities of expansion.

In the 17th and 18th centuries the town on the Maas increased steadily in importance. Trade was principally centred on France and England, but there was also shipping to Indonesia and America. The Court of the Fellowship of the Merchant Adventurers had been at Rotterdam since 1635; it was transferred to Dordrecht in 1656, but this circumstance had no detrimental effect on trade relations with England. After the revocation of the Edict of Nantes (1685) many French Protestants came to Rotterdam, where they contributed largely to the city's prosperity. The years of French domination (1795–1813) were lean years for Rotterdam, and it was only long after 1813 that prosperity returned.

Furthermore, trade had shifted; in the 19th century it was the transit trade that grew more and more important, and it took some time before conditions could be adapted to the new situation. After 1850 Rotterdam grew rapidly, chiefly as a result of the German unification in 1870 and the industrialization of the Rhineland in general and of the Ruhr area in particular. With the expansion of the town, a vast network of harbours was made, stretching along the New Waterway (planned by Pieter Caland) and in open communication with the sea, and this made Rotterdam one of the best equipped ports in the world. World War I and the economic depression of the 1930s were severely felt in Rotterdam.

In World War II the city and port suffered tremendously. On May 14, 1940, the German *Luftwaffe* destroyed practically the entire city centre and an extensive part of the east district. About 900 people were killed and approximately 78,000 were rendered homeless. Of public buildings, only the city hall (1920), the main post office (1923), the stock exchange, the famous Boymans museum and some minor buildings escaped destruction. The Boymans museum, rehoused in 1935, contains masterpieces of Flemish and Dutch art, sculpture, glass and Delft porcelain. More than 8,500 yd., or over one-third, of the total length of quayside for seagoing



WIES MEERTENS

BRONZE STATUE OF DESIDERIUS ERASMUS. BY HENDRIK DE KEYSER. 1622. RE-ERECTED FOLLOWING WORLD WAR II ON THE VAN HOGENDORPSPLEIN. ROTTERDAM

vessels and about 40% of the port's equipment were destroyed in the autumn of 1944.

Apart from some 18th-century houses, Rotterdam possesses only two buildings of historical interest, namely, the 15th-century St. Laurens church and the Schielandshuis. The former was very badly damaged but it was in the process of restoration in the late 1950s, and the tombs of the famous admirals Cortenaer, Witte de With and Van Brakel were to be reinstated in the church. The Schielandshuis, built in 1662–65 by Jacob Lois, was the meeting place for the *dijkgraaf* and *hoogheemraden* of Schieland, where they deliberated upon everything concerning the dikes of that part of Holland. It now houses the Historical museum. Of historical interest is also Hendrik de Keyser's beautiful statue of Erasmus, the great Rotterdam humanist, which was placed on the Grote Markt in 1622. It was spared by the fire of May 1940 and removed to a place of safety. After the war it was erected again on the

van Hogendorpsplein in the neighbourhood of the Schielandshuis.

Immediately after the bombing of the city centre, the debris was cleared away and the ruins and foundations of bombed buildings were removed Only four days later the city architect, W G Witteveen, was instructed by the municipality to prepare a plan for the reconstruction of the city centre. Meanwhile in order to make central replanning possible, the entire devastated area was expropriated. Witteveen's plan, fragments of nhich were carried out during the occupation. was superseded by a far more radical plan. drawn up under the leadership of C. van Traa, director of town planning and reconstruction, which was accepted in 1946. Without hampering the expansion of the city effected by the construction of new housing estates, the reconstruction of the city centre progressed to such an extent that on Jan. 1. 1957, the undamaged buildings, the new edifices completed and the new buildings then under construction occupied 65.2% of the available building sites. Particularly noteworthy of the new buildings are the Central railway station (1957); the Wholesalers building (1952), which accommodates the offices, stores and showrooms of more than 200 wholesalers and which is said to be the biggest modern business edifice in Europe: the Building centre (1948–55), an international research and information centre for building and interior decoration; the Lijnbaan shopping promenade (1953), which consists of 7j shops and nhich is open only to pedestrians, the Bijenkorf department store (1957); the Dijkzigt City hospital (to be completed in 1960); and some fine housing achievements in the rebuilt city centre and in the new housing estates in the suburbs and around the city proper. A controversial memorial monument of the May 1940 bombing (by Ossip Zadkine) was inaugurated in 1953 and. four years later, a monument to the memory of the fallen (by Mari Andriessen) nas unveiled

The restoration of the port facilities was completed in 1949. Thereafter the port facilities were steadily extended, and gradually maritime traffic returned. After 1946 it rose steadily, to such an extent that in 1957 previous records were broken for the fourth successive year. In 1957 Rotterdam had 22,309 yd of quayside for seagoing vessels and 14.600 yd. of quayside for inland craft The total area of its harbour basins was 1,508 ac.

In May 1940 Waalhaven airport, the first civil aerodrome in Europe. was destroyed. In 1953 the heliport of the city centre (daily connections with Antwerp, Brussels and Paris) was opened. The new Rotterdam airport. north of the city, was opened in 1956. After World War II Rotterdam aimed even more than before at broadening, and thus strengthening, its economic basis by nurturing new business propositions. Its industries comprise the largest oil refineries in Europe, several shipbuilding yards, engineering works, automobile-assembling plants the manufacture of coffee, tea, cocoa, tobacco, margarine, clothes, paper, railway material and all kinds of chemical products. In addition, there are breweries and distilleries. (W. A. H. C.; H RT)

See J Schraver (ed), *Rotterdam, the Gateway to Europe (1948)*; Hans Reinhardt, *The Story of Rotterdam* (1955)

ROUAULT, GEORGES (1871–1958), French painter and engraver, perhaps the greatest religious painter since Rembrandt. was born in Paris on May 27. 1871. the son of a cabinetmaker in working-class surroundings. He was taught to appreciate art by his grandfather Champdavoine, an admirer of Daumier whose work was to influence Rouault decisively. Apprenticed to a glazier from 1885 to 1890, Rouault worked on the restoration of the stained-glass windows of Chartres cathedral; and these awakened his feeling for decorative and architectural values and for the monumental use of colour and line Gustave Moreau, under whom he studied at the Ecole des Beaux-Arts in 1892, introduced Rouault to the work of Leonardo da Vinci and of Rembrandt. but during 1898–1902, influenced by Toulouse-Lautrec and Cézanne. Rouault developed a new style, producing water colours of sober tints (blues predominating) with strong tones and emphatic forms. Hideous prostitutes, terrifying judges. repulsive millionaires. pitiful poor people and tragic clowns (these as the symbol of the anguish of mankind) portray "the dereliction of man without God" Rouault was converted to Roman Catholicism (*c* 1895) and later became the friend of J K Huqsmans and Léon Bloy.

From 1906 to 1910 Rouault took an interest in pottery; and from 1917 onward he practised engraving (some of his later masterpieces were to be in this medium). In oils he began to build up colour. solidity and tension in his compositions of the story of the Passion of Christ. From 1914 to about 1935 he pursued this hieratic style. From 1935 to about 1948, Rouault's painting became more serene and was characterized by the appearance of graceful feminine figures. He now produced small canvases on which the paint was applied thickly and with the glowing lustre of enamel. Tranquillity gave place in 1948 to an impulse of joy. Using greens and yellows (both new to his palette) so thickly as to give the appearance almost of relief, Rouault infused his works, particularly his landscapes, with universal significance and religious grandeur. Such a reawakening in an artist approaching 80 was exceptional. After this swan song he painted little more. but uaited quietly for his death in Paris on Feb. 13, 1958.

Rouault stood apart from his contemporaries. Evoking form by a new use of colour and outline whose very flatness becomes monumental, he drew inspiration from French medieval masters, uniting religious and popular traditions, divorced since the Renaissance. To secular art he brought back craftsmanship and the sense of congruity bet een the sublime and the grotesque. To religious art he restored its concern with both human life and the transcendental. *See* also PAINTING: *20th century: Fauvism.*

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ROUBAIX, a manufacturing town in the Nord *département* of France. 6½ mi. N.E. of Lille. lies on the Roubaix canal which links the lower Deule with the Scheldt by way of the Marcq and the Espierre. Pop. (1954) 109.480. Area 5 sq.mi. It unites with Tourcoing (*q.v.*) to form a large industrial centre. The town's more important buildings and institutions include Saint-Martin church, dating from 1471 and restored in 1849; Notre Dame church (1816); the Hotel de Ville (1911) containing a collection of paintings by J. J. Weerts; the Chamber of Commerce (opened 1908); the National Higher School of the Textile Arts and Industries with attached museum containing paintings, sculptures and fabrics; the attractive Barbieux public park: the municipal sports centre and open-air school for boys and girls; and the swimming baths.

Roubaix has been called the Manchester of France. and has a universal reputation and market for its textiles. More than 200 establishments are engaged in the production of woolen, cotton and other fabrics, including spinning. wool combing. dyeing and weaving. There are also rubber and plastic factories. The tonn has a lively trade and is the centre of a network of road services

The prosperity of Roubaix had its origin in the charter granted in 1469 by Charles the Bold, duke of Burgundy, to Peter, lord of Roubaix and a descendant of the royal house of England. This charter permitted the citizens to dress all in wool. In the 18th century the town suffered from the jealousy of Lille. of nhich it was a dependency, and it nas not until the 19th century that its industries acquired importance. During World War I it was occupied by the Germans. and manufacture came to a standstill As the cotton spinning plants were mostly spared. its industry was restarted in 1919 with government aid and bank credits. It was again occupied by the Germans in 1940. After World War II the employers' and workers' associations formed co-operative organizations for professional guidance, health measures and housing. A bold housing policy assisted the construction after 1949 of more than 12.000 dwellings.

ROUBILLAC (ROUBILIAC), **LOUIS FRANÇOIS** (1705?–1762), probably the greatest sculptor at work in England during the 18th century, was born of French parentage at Lyons, probably in 1705. He was apprenticed to B. Permoser and later became assistant to Nicolas Coustou. He came to London about 1732 and was employed by Thomas Carter the elder. His first independent commission was the statue of Handel for Vauxhall gardens in 1737, and a year later he set up for himself in St. Martin's lane. In 1746 he carved the monument of the duke of Argyll in Westminster abbey, one of his greatest works, though

his more dramatic monument of Lady Elizabeth Nightingale in the same building is better known. Other works by him in the abbey include the monuments of Field-Marshal Wade, Admiral Warren and Handel. Outside London his most important monuments are those of Miss Myddleton at Wrexham, Denbighshire, Viscount Shannon at Walton-on-Thames, Surrey, and the duchess of Montagu at Warkton, Northamptonshire.

Roubillac's busts are unsurpassed, for he had the seeing eye as well as the skilled hand, and examples can be seen at Windsor castle, Wilton house, Wiltshire, Trinity college, Cambridge, and the National Portrait gallery, London. Statues by Roubillac include Sir Thomas Molyneux in Armagh cathedral, Lord President Forbes in the Advocates library, Edinburgh, and Sir Isaac h'ewton at Trinity college, Cambridge. G. Vertue, who knew Roubillac well, rightly described his works as "curious and excellent, with great skill and variety, picturesque, so light and easy, as painting." Roubillac died on Jan. 11, 1762, and was buried in the graveyard at St. Martin-in-the-Fields, London.

See K. A. Esdaile, The Life and Works of Louis *François* Roubiliac (1929); Rupert Gunnis (comp.), Dictionary of British *Sculptors 1660–1851* (1953). (R. Gs.)

ROUBLE. The rouble is the monetary unit of the U.S.S.R. It is divided into 100 kopecks. The par of exchange with sterling before World War I was: R.10 = *21s. 2d.* The main currency in circulation between 1863 and 1921 was credit notes issued by the state bank. Toward the end of the 19th century, these depreciated sharply in relation to gold. A law of 1897 stabilized the paper rouble at 66⅔ kopecks in gold. The credit note was maintained at this ratio until World War I.

Under the influence of war and revolution, followed by economic chaos, inflation developed at a terrific pace, and the value of the paper rouble fell catastrophically. In 1921, the Soviet government introduced the "new economic policy," one of the most important achievements of which was the creation of a stable monetary system and the restoration of the state bank. The monetary reform was accomplished in two stages. On Oct. 11, 1922, the state bank created a new currency—the *chervonetz*. The chervonetz was equal to ten prewar roubles, and its fine gold content was established at 7.74234 grams. The obligatory cover was established at 25% gold, platinum or stable foreign currency, and 75% in easily realizable commodities, short-term bills and other short-term bonds. Simultaneously, the old paper currency was maintained in circulation. As compared with the chervonetz, its value fell steadily. On March 10, 1924, the rate of redemption was defined at 50,000,000,000 roubles of the old denomination in one rouble in gold, *i.e.*, one chervonetz rouble. The depreciation of the old rouble created instability in the budget and in the entire economy. Between February and June 1924, a series of decrees was passed constituting the second phase of the monetary reform. The old Soviet rouble was withdrawn from circulation by means of an exchange on fixed rates against the new treasury roubles. The new rouble was made legal tender. The volume of issue of the treasury roubles was limited to no higher than 50% of the chervontsi in circulation. Toward the end of 1924, a ratio of ten new roubles to the chervonetz was established.

After the reform of 1924, the monetary system in the Soviet Union acquired a stable character. Although on several occasions (1926, 1928, 1930, 1933) the stepping-up in the issuing of notes for financing industrialization, collectivization and defense industry caused inflationary fluctuations of the rouble, on the whole, the monetary system remained unshaken and the Soviet government, through relatively speedy control measures, maintained the rate of the rouble. After the monetary reform, there was further established in the U.S.S.R. a system of stable deficitless budget. On April 1, 1936, after the devaluation of world currencies (the dollar and the pound), the Soviet government established the fine gold content of the rouble at 0.1776 grams. The strengthening of the economic system (monopoly of foreign trade, prohibition upon the export of currency, stabilization of the budget system, introduction of domestic checking accounts, strict regulation of the volume of merchandise and money in circulation), and, to a certain extent, the rapid growth of gold production, all contributed to the strengthening of the Soviet monetary system. The commissariat of finance periodically publishes the official foreign exchange rates, according to which it conducts payments on foreign trade. In order to arrest inflation which had developed in the U.S.S.R. during World War II, the Soviet government on Dec. 14, 1947, established a new currency; one new rouble was exchanged for ten roubles of the old currency. Under the revaluation of the rouble of Feb. 28. 1950, the rate of exchange was set at 11.20 to the pound sterling and 4.00 to the U.S. dollar. (See also RUSSIA: Finance.) (A. A. Y.; X.)

ROUEN, a city of France, capital of the *département* of Seine-Inférieure and the ancient capital of the province of Normandy, on the Seine, 87 mi. N.W. of Paris by rail. Pop. (1954) 113,062.

History.—*Ratuma* or *Ratumacos,* the Celtic name of Rouen, was modified by the Romans into Rotomagus, and by the writers of mediaeval Latin into *Rodomum,* of which the present name is a corruption. Under Caesar and the early emperors the town was the capital of the Veliocasses, and it did not attain to any eminence till it was made the centre of Lugdunensis Secunda at the close of the 3rd century, and later the seat of an archbishop. Rouen owed much to its first bishops—from St. Mello, the apostle of the region, who flourished about 260, to St. Remigius, who died in 772.

Under Louis le Débonnaire and his successors, the Normans several times sacked the city, but after the treaty of St. Clair-sur-Epte in 912, Rouen became the capital of Normandy and the principal residence of the dukes. In 1087 William the Conqueror, mortally wounded at Mantes, died at Rouen. The succeeding Norman kings of England tended to neglect Rouen in favour of Caen and afternards of Poitiers, Le Mans and Angers; but it maintained an importance during the 12th century indicated by the building of churches. notably that of St. Ouen. In 1203 Rouen was the scene of the murder of Arthur of Brittany at the hands of King John of England. Ostensibly to avenge the crime, Philip Augustus invaded Normandy and entered the capital unopposed. Philip confirmed its communal privileges and built a new castle.

A convention between the merchants of Rouen and those of Paris relating to the navigation of the Seine was followed by treaties with London, with the Hanseatic towns and with Flanders and Champagne. In 1302 the seat of the exchequer or sovereign court, afterward the parlement, of Normandy was definitely fixed at Rouen. A stubborn resistance was offered to Henry V of England, who after a long siege occupied the town in 1419. The prosperity of Rouen continued under the English domination, and during this period the greater part of the church of St. Ouen was constructed. In 1431 Joan of Arc was tried and burned in the city. From that year the French began attempts to recapture the town, which they did in 1449. During the close of the 15th century and the first half of the 16th, Rouen was a metropolis of art and taste. In 1562 the town was sacked by the Protestants. This did not prevent the league from gaining so firm a footing there that Henry IV besieged it unsuccessfully, and only obtained entrance after his abjuration. The revocation of the edict of Nantes in 1685 greatly affected Rouen. During the Franco-German War the city was occupied by the invaders from Dec. 1870 till July 1871. In World War I Rouen played a great part in the supporting organization of the British army in France.

Monuments. — The old city lies on the north bank of the river in an amphitheatre formed by the hills which border the Seine valley. It is surrounded by the suburbs of Martainville, St. Hilaire, Beauvoisine, Bouvreuil and Cauchoise; 2½ mi. east is the industrial town of Darnétal (pop. 1946, 7,604). and on the opposite bank of the Seine is the manufacturing suburb of St. Sever with the industrial towns of Sotteville (pop. 18.469) and Le Petit Quevilly (pop. 19,9j3) in its immediate neighbourhood. Finally in the centre of the river. northeast of St. Sever, is the Ile Lacroix, which also forms part of Rouen. Communication across the Seine is maintained by three bridges. including a *pont transbordeur,* or moving platform, slung between tuo lofty columns and propelled by electricity. The central point of the old town is the Place de *l'Hôtel* de *Ville,* occupied by the church of St. Ouen and the *hôtel* de *ville.*

The cathedral was built on the site of a previous cathedral

burned in 1200, and its construction lasted from the beginning of the 13th century (lateral doors of the west portal), to the beginning of the 16th century (Tour de Beurre). The western façade belongs, as a whole, to the Flamboyant style. But the northern tower, the Tour St. Romain, is in the main of the 12th century, its upper stage having been added later. The southern tower, the Tour de Beurre, so named because funds for its building were given in return for the permission to eat butter in Lent, is of a type essentially Norman, and consists of a square tower pierced by high mullioned windows and surmounted by a low, octagonal structure, with a balustrade and pinnacles. These contrasted towers are the most striking feature of the wide facade. The portals of the transept are each flanked by two towers. The most remarkable part of the interior is the Lady Chapel (1302–20) behind the choir with the tombs (1518–25) of Cardinal Georges d'Amboise and his nephew, the statuary of which is of the finest Renaissance workmanship. Behind the cathedral is the archiepiscopal palace, a building of the 14th and 15th centuries.

St. Ouen was formerly the church of an abbey dating to the Roman period and reorganized by Archbishop St. Ouen in the 7th century. It was founded in 1318 in place of a Romanesque church which previously occupied the site and of which the only relic is the chapel in the south transept. The choir alone was built in the 14th century. The nave of the church belongs to the 15th century, by the end of which the central tower with its octagonal lantern and four flanking turrets had been erected. The western façade dates from 1846. The large stained glass windows are of the 14th, 15th and 16th centuries. The Portail des Marmousets, the entrance to the south transept. has a projecting porch, behind and above which rises a magnificent rose window. The north facade has no entrance.

The church of St. Maclou, behind the cathedral, begun in 1437 and finished early in the 16th century, is a rich example of the Flamboyant style, and has a rich portal with five arched openings. It is celebrated for carving attributed to Jean Goujon.

The church of St. Vincent, near the Seine, is a building of the 16th century and contains very fine stained-glass windows at the end of the north aisle, by Engrand and Jean le Prince, artists of Beauvais. The stained glass in the churches of St. Patrice (16th century) and St. Godar (late 15th century) is inferior only to that of St. Vincent.

The most important secular building in Rouen is the Palais de Justice, once the seat of the exchequer and, later, of the *parlement* of Normandy. It is in the late Gothic style and consists of a main building flanked by two wings. The left wing, known as the Salle des Procureurs, was built in 1493 and has a lofty barrel-roof of timber. South of the Palais de Justice is the Porte de la Grosse Horloge, an arcade spanning the street and surmounted by a large clock of the 15th century with two dials. The Tour de la Grosse Horloge, which rises beside the arcade, was built in 1389. The tower known as the Tour de Jeanne d'Arc was the scene of her trial, and is all that remains of the castle built by Philip Augustus early in the 13th century. The Porte Guillaume-Lion, opening on to the Quai de Paris, is a handsome gateway built in 1749.

Rouen is the seat of an archbishop, a prefect, a court of appeal and a court of assizes, and headquarters of the III. army corps. Its public institutions also include a tribunal of first instance, tribunals of commerce and of maritime commerce, a board of trade-arbitrators and a chamber of commerce. All the more important nations have consulates in the city.

Rouen is an important centre for trade in wines, spirits, grain and cattle. Grain, wine, coal, timber and petroleum are leading imports. Besides its manufactures it exports plaster and sand. The principal industries of Rouen and its district are the spinning and weaving of cotton, notably the manufacture of *rouenneries* (cotton fabric woven with dyed yarn), the printing and dyeing of the manufactured material and the spinning of other fibres; shipbuilding and the making of various articles of clothing are also carried on, and there are distilleries, petroleum-refineries and manufactories of chemicals, soap, machinery, carding-combs and brushes. The port of Rouen comprises the marine docks below the Boïeldieu bridge, and the river dock, the timber dock and the petroleum dock above it. There is also a repairing dock. The Seine is tidal beyond Rouen. The port is accessible for ships drawing 19½ to 25 ft. of water, and its quays have a superficial area of about 194 acres. It is served by the lines of the Orleans, the Ouest-État and the Northern railways and these, in addition to the waterways connected with the Seine. make Rouen a convenient centre for the distribution of merchandise.

See A. Chervel, *Histoire de Rouen pendant l'époque communale* (Rouen, 1843); id., *Sous la domination anglaise* (Rouen, 1840); C. Enlart, *Rouen* (Paris, 1904); J. Levainville, *Rouen.*

ROUERGUE, formerly a French province, derives its name from the Gallic tribe of the *Rutheni.* It was bounded on the north by Auvergne, on the south and south-west by Languedoc, on the east by Gévaudan and the Cévennes and on the west by Quercy. It included (1) the county of Rodez, (2) Haute and Basse Marche; and it was divided between the dioceses of Rodez and Vabres (province d'Alby after this province had been separated from that of Bourges in 1678). Administratively it formed first a *sénéchaussée,* dependent on Languedoc (capital Villefranche, in the Basse Marche), and later it was attached to the military governments of Guienne and Gascony. It was then part of the departments of Aveyron and of Tarn-et-Garonne.

ROUGE: *see* COSMETICS.

ROUGET DE LISLE, CLAUDE JOSEPH (1760–1836), French author, was born on May 10, 1760, at Lons-le-Saunier, Jura. He entered the army as an engineer, and attained the rank of captain.

The song which has immortalized him, the *Marseillaise,* was composed at Strasbourg, where Rouget de Lisle was quartered in April 1792. He wrote both words and music in a fit of patriotic excitement after a public dinner. The piece was at first called *Chant de guerre de l'armée du Rhin,* and only received its name of *Marseillaise* from its adoption by the Provencal volunteers whom Barbaroux introduced into Paris. and who were prominent in the storming of the Tuileries. The author was a moderate republican, and was cashiered and thrown into prison; but the counterrevolution set him at liberty. He died at Choisy-le-Roi, Seine et Oise, on June 26, 1836.

Rouget de Lisle published *Chants français* (1825), in which he set to music 50 songs by various authors. His *Essais en vers et en prose* (1797) contains the *Marseillaise,* a prose tale of the sentimental kind called *Adélaïde et Monville* and some occasional poems.

See J. Tiersot, *Histoire de la Marseillaise: oeuvres musicales de Rouget de Lisle (1915).*

ROUGH CAST, in architecture, a term used in the United States for the rougher textures of a stucco surface, obtained either by throwing on the finished coat in unequal masses or by sprinkling over the finished surface, while still wet, a coating of coloured pebbles, tile or brick fragments, marble chips, etc. In England the term is used for any stucco or mortar combined with gravel and sand, employed as the finishing coat of covering plaster over a rough structure of masonry and frequently decorated by the addition of pebbles of different colours or even small pieces of glass.

ROUHER, EUGÈNE (1814–1884), French statesman, was born at Riom. Puy-de-Dôme, on Nov. 30. 1814. He entered the chamber in his native *département* in 1848, and held office from 1849, with short intervals, until 1852. Napoleon entrusted him (1851) with the redaction of the new constitution, and made him (1852) vice-president of the council of state. As minister of agriculture, commerce and public works, from 1855 onward. he greatly improved the economic situation of France, and in 1863 became minister president. He resigned in 1867, but shortly afterward resumed office as finance minister.

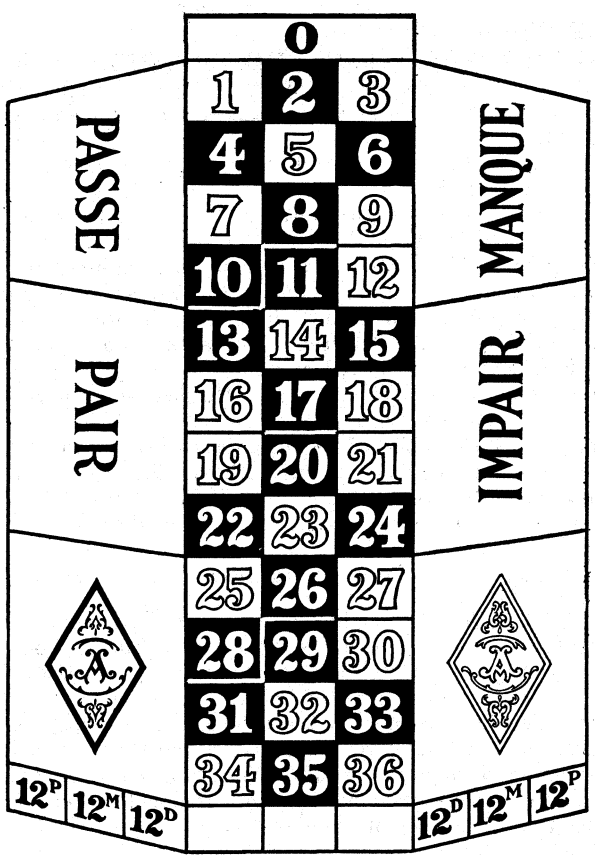
After the fall of the empire he fled to England, but returned to France in 1872 to work for the interests of the prince imperial. He returned to the chamber as deputy of Ajaccio and later sat for Riom. After the death of the prince imperial, Rouher supported the claims of Prince Napoleon, son of the former king Jerome. He died on Feb. 3. 1884.

See the references under NAPOLEON III.

ROULERS, a town in the province of West Flanders, Belgium. 13 mi. N.W. of Courtrai. on the Mandel. Its Flemish name is Roeselare. Pop. (1955 est.) 33,966. Its weavers were already famous in the 11th–12th centuries and the neighbourhood cultivates flax. Lace, carpets and linen are manufactured.

ROULETTE, a gambling game of French origin, is universally played in the gambling casinos of Europe, North and South America, but is especially identified with the gaming rooms at Monte Carlo. It is not very old as games go. dating probably from the late 18th to the early 19th century. In the C.S. its popularity as a heavy-bet game has been superseded by other games, notably craps (see DICE). Roulette is a banking game, and all bets must be placed against the bank (proprietor of the game); as a rule it. is very fairly conducted. As many players may bet as can get near the table.

Equipment for roulette, which is very expensive. consists of an oblong table, 15 ft. × 20 ft., in which is mounted a compartmented wheel and one or two layouts, usually enameled on green cloth. However. small portable wheels of relatively low price are available for home use.



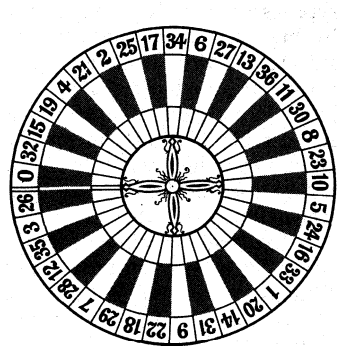
ROULETTE CLOTH OR LAYOUT, EUROPEAN STYLE

The original French terminology of roulette has been replaced in English-speaking countries by equivalent English terms, and both will be used in this description.

The game begins when the *tourneur,* one of the croupiers in attendance nho represents the house. calls. "Make your bets, gentlemen" (Faites *vos* jeux, *messieurs*), whereupon players indicate on the layout their bets on the number, or classification of number, they hope will win. The *tourneur,* by spinning the cross handle at the top, then spins the wheel in one direction and in contrarotation spins a small ivory ball which. when the wheel slows down sufficiently, falls into one of the numbered compartments and thus designates the winning number. When it appears to the *tourneur* that the ball will soon come to rest, he calls. "The betting is closed" (Rzen ne *va plus*). So bet may be placed thereafter.

When the ball rests, the *tourneur* announces the winning number and whether it is red or black, odd or even, low (1 to 18) or high (19 to 36). The bank pays winning bets at the established rates (see below) and collects all losing bets, which a croupier gathers in with a rake.

For a ninning bet on red (rouge), black (*noir*), high (passe), low (*manque*), even (pair) or odd (intpair), the bank pays "even money"—the amount of the bet. For a winning bet on the dozen (1 to 12. 13 to 24 or 25 to 361 in which the number falls, the bank pays 2 to 1; these bets are indicated on the layout as 12^{p}, 12^{m} and 12^{d} (respectively, *première, milieu* and dernibre *douzaine*). Likewise, the bank pays 2 to 1 for a ninning bet on the column in which the number lies.



ROULETTE WHEEL

Numbers above the white panels are red, other numbers are black, except zero, which is green

Other bets, and the rate of payment when they win, are: (1) on a single number (en *plein*), 35 to 1; (2) on two numbers (*á cheval*), if either wins, 17 to 1. Such a bet is placed on the line betneen the two numbers. A bet may be made *à* cheval on two adjacent columns, or two adjacent dozens, and pays $\frac{1}{2}$ to 1. (3) On three numbers (*transversale pleine*), if any wins, 11 to 1. A bet on 4, 5 or 6 would be indicated by placing a coin on the line between 4 and passe, or between 6 and *manque*. (4) On four numbers (en *carré*), if any wins. 8 to 1. A bet on the point of intersection between 14, 15, 17 and 18 would be a bet on those four numbers. (5) On six numbers (*transversale* six), if any wins, 5 to 1. A bet on the point of intersection between 15, 18 and *impair* would be a bet on 13, 14, 15, 16, 17 and 18.

The zero may be played *à* cheval with any adjoining number; or en *carré* (but called *quatre premièrs*) with 1, 2 and 3; or in combination with 1 and 2, or with 2 and 3.

The advantage of the bank arises when the zero shows. Only bets on the zero en *plein* or in combination with 1, 2 and 3 are paid; all other bets are collected. Thus the bank should win one part in 37, or 2.7%, of all bets made against it.

At Monte Carlo, and in a few other casinos, this advantage is reduced by almost one-half in the case of the even-money bets. When the zero occurs, the player who placed such a bet may let the bank take half his bet (partager) or may have the bet put "in prison," to be decided on the next coup; whereon if the player wins he may withdraw his bet but is not paid in any case.

In distinction to this practice, many American gambling houses have roulette wheels with 38 compartments including both a zero and a double zero (00) and if either of them occurs all bets are taken except those involving the winning zero. The bank's advantage is thus increased to 5.26%. Finally, some wheels (seldom seen except in the smaller U.S. gambling houses and in Mexico) have 0.00 and an eagle bird (equivalent to a third zero), giving the bank an advantage of 3 parts in 39, or 7.7%.

There is little possibility of the exercise of skill in roulette, though a certain judgment is advisable in betting; it would, for example, be unwise to place a bet on red and also on the number 17, which is black, for if one bet wins the other must lose.

Many books have been published on roulette. most of them being devoted to demonstration that no system of betting can be expected to win against the bank in the long run.

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ROUNDERS, an old English ball game played in Tudor times but not attaining any popularity before 1800. According to some, it was the immediate ancestor of baseball (*q.v.*), but there are several differences, the most radical being that the ball can be hit in any direction. Rounders in its primitive form was more of a romp than a regular game, but it experienced a big revival

in Scotland and England in *1889* when two governing bodies were formed, the National Rounders association of Liverpool and vicinity and the Scottish Rounders association, and later with the Gloucester and Ling Physical Education association when rules similar to the modern ones were drawn up. The National Rounders association was formed in *1943*.

A hard ball weighing 2½ oz to 3 oz. and measuring 73 in. in circumference is used; the rule by which a runner could be put out by hitting him with a thrown ball was abandoned, A round wooden stick is used measuring not more than 6¾ in. round the thickest part. not more than *18* in. in length and not more than *13* oz. in weight.

The playing field is marked in an elongated diamond, home base being at one end and first, second and third post at the other points, while fourth post is situated on the line of third post toward home and 28 ft. from the former, the sides of the diamond being 39½ ft. The bowler stands in a square in the centre of the diamond and tosses the ball to the batsman who must take a good ball, *i.e.,* one that passes over the batting square and is below the head and above the knee; three consecutive bad bowls scores half a rounder for the batsman. The batsman must run to first and second post and so on to home base and scores one rounder if he does so after hitting the ball or half a rounder if he does so without hitting the ball and without having an opposing player touch the post to which he is running. He can be put out if: the ball is caught on the fly; the post to which he is running is stumped or he is touched with the ball while it is in the possession of the fielder. If the ball is hit behind the home base, he can run only to first post until the ball has been thrown across the front line of the batting square or a continuation of it.

Nine players constitute a side and two innings apiece are played in each match. The back stop is placed directly behind the batsman; first, second, third and fourth basemen are stationed at the posts and there are three deep fielders. Two umpires preside over the game: (1) a batter's umpire who attends to balls that are too high or too low, first and fourth post catchers and to the bowler who must have both feet in the square during the bowling action and (2) a bowler's umpire who attends to balls that are too near or too wide and to second and third posts.

ROUNDHEAD, a term applied to the adherents of the parliamentary party in England during the great Civil War. Some of the Puritans, but by no means all, wore the hair closely cropped round the head, and there was thus an obvious contrast between them and the men of fashion with their long ringlets. "Roundhead" appears to have been first used as a term of derision toward the end of *1641* when the debates in parliament on the Bishops Exclusion Bill were causing riots at Westminster. John Rushworth *(Historical Collections)* is more precise. According to him the word was first used on Dec. 27, *1641,* by a disbanded officer named David Hide, who during a riot is reported to have drawn his sword and said he would "cut the throats of those round-headed dogs that bawled against bishops." Baxter ascribes the origin of the term to a remark made by Queen Henrietta Maria at the trial of Strafford; referring to Pym, she asked who the round-headed man was. The name remained in use until after the revolution of *1688*.

ROUND TABLE, the celebrated board of King Arthur (*q.v.*) around which he and his knights sat. The origin of the myth is obscure, and certainly cannot be said to have been yet settled; it has been traced by various scholars to Welsh, Irish and Breton sources. The story was at first independent of the Arthurian saga. The first known trace of it in an Arthurian connection is in the *Brut* of Wace (*q.v.*) in the reign of Henry II. Here the allusion is brief. Arthur made a round table at which, because of its shape, none of the "barons" could claim precedence over others. The size is left indefinite. Wace adds that the "Bretons" told many stories about the table. and this seems to indicate that there was a mass of Breton (or British) tradition about it known to Wace—a probability strengthened by the fact that elsewhere Wace shows signs of knowing many stories unknown to his main authority, Geoffrey of Monmouth (*q.v.*).

Half a century later, Layamon adds considerably to our information, and it would seem almost certain that he was drawing on Welsh tradition. There had been a great slaughter of the knights through disputes as to who should be greatest; and a Cornish carpenter, hearing of it, told Arthur he would make him a table at which more than 1,600 men could sit, so that there would be no more quarrels for the place of honour. Yet Arthur would be able to carry it about with him. It was finished in four weeks. "This," added Layamon, repeating Wace's words, "was the table about which the Britons told many tales." There is no reason to think that the poet was inventing; he makes more than 30 additions to Wace, some of which are certainly not original; nor does he show anywhere a trace of inventive capacity.

Addition to the Legend.—Later romancists added many details. For example, the "Diot" *Perceval (see* PERCEVAL) tells that just after Arthur's coronation Merlin related past history. A round table, said the seer, had been made for Joseph of Arimathaea (*q.v.*) and a new one for Arthur's father, Uther Pendragon; let the king use it for his knights; without it the Romans could not be overcome. The table was also brought into connection with the Holy Grail *(see* GRAIL, THE HOLY) and with the "Siege Perilous" which is so prominent a feature in the Percival legend, and became ultimately an inseparable adjunct of the Arthurian cycle.

Whether the tale reached Wace and Layamon directly from Wales or from Brittany, it is certainly of ancient Celtic origin. A round table seems to have been a feature of primitive Celtic life; a circular form was the rule in primitive Irish architecture, and the primitive Celtic watch house, both in Gaul and in Ireland, was circular. To what this in its turn is to be traced is more doubtful; it is not unlikely that it arose from sun worship or possibly *(cf.* the "four weeks") from the moon. The magical character of the table seems, again, to be of a peculiarly Celtic cast; it resembles that of the enchanted bowls, bushels and horns so often found in Irish and Welsh saga; and it was inevitable that when the attractive force of the Arthurian legend was felt, such a magical table should be assigned to the king along with his sword, boat, lance and shield.

The Table at Winchester.—The famous round table fixed in the wall of the great hall at Winchester is certainly of considerable antiquity. It is a tabletop *18* ft. in diameter, divided into *25* sectors, one for the king and one for each of the knights (whose number had long been reduced from the 1,600 of Layamon). The present colouring of the sections (green and white successively) is due to Henry VIII. Hardying, in his *Chronicle (c.* 1436), differing slightly from *Perceval,* says that it is the very table made by Joseph of Arimathea for the brethren of the Grail, which was transferred to Winchester by Uther to comfort Ygerne. He speaks in a manner that implies a great age for this table.

A good summary of the story is given by A. C. L. Brown in *Harvard* Studies in *Philology and Literature,* vol. vii, where other authorities are referred to. Incidental references will be found in the various works on different aspects of the Arthurian saga. (E. E. K.)

ROUNDWORM, the common name for the parasitic worms of the genus *Ascaris,* and especially for *A. lumbricoides,* which occurs in the intestine of man. Closely allied species inhabit the pig and the horse. The name roundworm is often extended to include all members of the class Nematoda (*q.v.*).

ROUS, FRANCIS (1579–1659), English Puritan, was born at Dittisham, in Devon, in 1579, and educated at Oxford (Broadgates hall, afterward Pembroke college) and at Leyden. For several years he lived in seclusion in Cornwall and occupied himself with theological studies. producing among other books *The Arte of Happines (1619)* and *Testis Veritatis,* a reply to Richard Montagu's *Appello Caesarem.* He entered parliament in 1625 as member for Truro, and continued to represent that or some neighbouring west country constituency in such parliaments as were summoned till his death. He obtained many offices under the Commonwealth, among them that of provost of Eton college. At first a presbyterian. he afterward joined the independents. In 1657 he was made a lord of parliament. He died at Acton in Jan. 1658–59. The subjective cast of his piety is reflected in his *Mystical Marriage . . . Betweene a Soule and Her Saviour* (1635), but he is best known by his metrical version of the Psalms, *(1643).*

ROUSSEAU, HENRI JULIEN FELIX, called LE DOUANIER (1844–1910), French painter famous for his "primitive" or untutored style, was born at Laval, Mayenne, May 20, *1844.*

A soldier in Mexico in 1862–66, he served intermittently till 1871 when he entered the customs service (hence the title Le Douanier or customs official). but retired in 1885, at the age of 41, to professionally adopt his hobby of painting. He then began to exhibit portraits, still-life paintings and views of Paris and its people, such as "Un Soir de Carnaval" (1886; L. E. Stern collection, U.S.), "Myself: Portrait-Landscape" (1890; Prague) and "The Centenary of Independence" (1892). These are deceptively simple and arranged frontally with clear contours separating fields of even, solid, often brilliant colour; but their strength lies in their wholehearted regard for the occasion they represent. Between 1886 and 1890 Rousseau exhibited 20 works at the Paris Salon des Indépendants and was attacked by critics both "advanced" and orthodox. But he was defended by Degas and Toulouse-Lautrec, and later was befriended by Picasso and A. Jarry, the author. After 1890 his work became less static and included jungle and animal scenes. Some landscape studies are unexpectedly tentative and atmospheric; large works such as the "Sleeping Gipsy" (1897; Museum of Modern Art, New York city) have an imaginative, remote lyricism which later recommended them to Jean Cocteau and Guillaume Apollinaire. Some of Rousseau's best work dates from 1900 on; it includes "Jungle With a Lion" (1904–06; Museum of Modern Art) and "The Cart of Père Juniet" (1908; Mme. Paul Guillaume's collection, Paris). He died in Paris, Sept. 4. 1910.

See also PAINTING: *Early 20th-Century Trends*.

See D. C. Rich, *Henri Rousseau,* 2nd ed., with bibliography (1946); M. Garçon, *Le Douanier Rousseau accuse' naif* (1953). *(D. C.* T. T.)

ROUSSEAU, JEAN BAPTISTE (1671–1741), French poet. who enjoyed great renown in his day, was born at Paris on April 6. 1671. of humble parentage. As a young man he began to move in literary circles and received some encouragement from Boileau. Rousseau wrote a number of plays of which *Le Flatteur* (1696) was the most successful, several cantatas (an original genre in France), and many poems, some of them serious and reflective. like his ode to La Fare, others frivolous and even scandalous. The libellous character of some of these involved him more than once in trouble. In 1712, because of defamatory couplets which he denied having written, he was expelled from France. He remained in exile until his death in Brussels on March 16 or 17, 1741. He was a member of the Acadkmie des Inscriptions.

See H. A. Grubbs, *Jean-Baptiste Rousseau* (1941). (RT. S.)

ROUSSEAU, JEAN JACQUES (1712–1778). French-Swiss moralist whose writings are among the most influential of the 18th century in political and social theory and literature. was born at Geneva. Switz., on June 28, 1712. His ancestor. Didier Rousseau, a convert to Calvinism. had taken refuge in Geneva in the middle of the 16th century, and Jean Jacques belonged to the fifth generation of his descendants. His mother. Suzanne *(nde* Bernard) died a few days after his birth. His father Isaac. a watchmaker. an affectionate but irritable and feckless man. looked after him until he was ten years old, giving him no regular schooling but encouraging a precocious taste for Plutarch and for novels. In June 1722, Isaac. after a quarrel with a fellow citizen in which he was probably the aggressor. had to take refuge at Nyon in the Pays de Vaud, leaving his two sons. Jean Jacques and his elder brother Franqois. in charge of their maternal uncle. Gabriel Bernard. Franqois was apprenticed. and Jean Jacques sent to live with Pastor J. J. Lambercier at Bossey. near Geneva. He returned from Bossey to his uncle in Geneva in Sept. 1724 and was soon afterward set to work as a clerk to J. L. Masseron. a notary. with whom he stayed only a fen. n-eeks. In April 1725 he was apprenticed to Abel du Commun. an engraver, with whom he stayed until he fled from Geneva on March 14. 1728. In his *Confessions* Rousseau complains that du Commun treated him brutally, though he admits his own idleness. untruthfulness and dishonesty. which he ascribes to his master's harshness. He felt humiliated and was made rebellious by his master's punishment. but earlier Mlle. Lambercier at Bossey had had to give up beating him because he had enjoyed it too much. Fierce resectment at injustice and masochism were both strong motives with him.

His Formative Years.—From Geneva Rousseau found his way to Annecy, in Savoy, to Mme. de Warens (Louise Éléonore de Latour de Pil), who had left her husband and become a convert to Catholicism, receiving a pension from the king of Sardinia for helping to make other converts. Through Mme. de Warens he was sent to Turin, to the Hospice of the Holy Spirit, which he entered on April 12, 1728. According to the register of the hospice, he abjured the heresies of Calvin on April 21 and was received into the Roman Catholic Church two days later, though in the *Confessions* he describes a much longer resistance to conversion and says that he finally succumbed in order to escape the pernicious moral atmosphere of the hospice. For several months he stayed in Turin working as an engraver and as a lackey. He returned to Mme, de Warens in the spring of 1729 and was sent for a time to a Lazarist seminary, but he soon found that he had no vocation for the priesthood and later went to the choir school attached to the cathedral at Annecy. In 1730, while Mme. de Warens was away in Paris, he returned to Switzerland and set himself up at Lausanne and then at Neuchâtel as a teacher of music (though he had no proper qualifications). After several months of vagabondage and precarious living, he was sent to Paris in the autumn of 1731 by the marquis de Bonac (Jean Louis d'Usson), the French ambassador at Soleure. This first visit to Paris led to nothing and lasted only a few days. Rousseau returned on foot to Mme. de Warens, who by this time had moved to Chambéry. She offered herself to him as his mistress in 1733, saying that she thought it would be good for him, and he accepted. though he continued to feel himself more her son than her lover and knew that he would have to share her favours with her steward: Claude Anet. Except for occasional journeys to Switzerland and France, he stayed with her. either at Chambéry or in the country nearby, at a house called Les Charmettes. until 1740. It was during this time that he became a diligent but unsystematic reader and that he first began to write.

In May 1740 he went to tutor the children of M. de Mably, *prévôt des maréchaux* for the Lyonnais and elder brother of Etienne Bonnot de Condillac and of the abbé de Mably; but when his year's contract was over he was not asked to stay. He returned for a time to Mme. de Warens. who received him coolly. Though she had begun to grow tired of him several years before and had acquired a new and younger lover, she had not lost all maternal solicitude for him. especially as he had been ill several times since 1731. He suffered from uraemia and his condition grew worse as he grew older. In 1742 he went to Paris for the second time. taking with him a new scheme of musical notation, an opera, a comedy and a collection of poems.

Rousseau went to Paris seeking fame and fortune, but for years had no success. He was invited tc read his scheme for musical notation to the Académie des Sciences but nothing came of it; he spent a year. from Sept. 1743 to Aug. 1744, in Venice as secretary to the French ambassador there, but quarrelled so violently with his master that he had to leave; he wrote a ballet, *Les Muses galantes,* which was eventually performed at the Opéra in Paris in 1747 but attracted only slight notice. On two occasions he was so deeply humiliated that he fell ill: once, when he declared his love to Mme. Dupin, his protectress, who left the room and for a long time forbade him her house; and again, when an opera, with words by Voltaire and music by J. P. Rameau, whose score he had been asked to alter for a shortened version, was played at Versailles without his name being mentioned. Rousseau. at this period. devoted more of his energies to music and to the writing of comedies than to social and political matters. He lived in frequent, but not intimate or equal, contact with the rich and the famous. His best, perhaps his only true. friend was Denis Diderot, who commissioned him to write the articles on music for the *Encyclopkdie.* He dined once a week at the Hôtel du Panier Fleuri with Diderot and with Condillac, and these were the happiest moments of an otherwise awkward and anxious period of his life. Early in 1745, soon after his return from Venice. he had taken up with Thérèse le Vasseur. a servant at the hotel where he was staying. He kept her for the rest of his life and had five children by her, who were all sent to a foundling hospital. In disposing of his children in this way, he was doing what was often done at that time and felt, so he says in the *Confessions,* no

shame. He was poor and sickly and for years was heartlessly exploited by Thérèse's mother and some of her relatives. Later, after he had become famous as a moralist, he was morbidly sensitive about his abandoned children, and the emotional burden of a guilt that he would not admit helped in the end to put him out of his mind.

The Citizen and the Moralist (1749–62).—One day, toward the end of July 1749, Rousseau, on his way to Vincennes to visit Diderot who was in prison there, read in the *Mercure de France* that the academy of Dijon offered a prize for an essay on the question whether the revival of the sciences and the arts had helped to corrupt or to purify morals. Rousseau tells us, in his *Confessions,* that when he read that notice "he saw another world and became another man" and that when he reached Diderot he was so excited as to be almost delirious. Diderot urged him to compete for the prize and even (so some of his friends said afterward) suggested to Rousseau that he should treat the subject in an unexpected way, arguing that science and art had corrupted morals. Whether or not it was from Diderot that Rousseau got this idea (and Diderot never said that it was), the idea itself was more congenial to Rousseau than to his friend. It released emotions pent up within him for years. The result of the competition was announced in July 1750, and Rousseau got the first prize. His essay, subsequently known under the abbreviated title of *Discours sur les sciences et les arts,* was published at the end of the year, and he found himself famous. In his *Confessions,* he gives the impression that, soon after the publication of his first *Discours,* he decided abruptly to change his way of life, to give up all hope of fortune and of worldly success and always to remain poor and independent. Though the change was more gradual and hesitant than he afterward remembered it, it is true that he never, for all his fame, was a worldly success. He never sought riches and never allowed himself to be lionized. He resented both indifference and flattery; he wanted to be emotionally independent of others and yet felt a need for their affection and respect. Self-absorbed as he was, he demanded that others should feel toward him as he, though he did not know it, was incapable of feeling toward them.

Whatever he did, whether it was liked or disliked, seemed, for the rest of his life, to add to his fame. In 1752 he composed an operatic intermezzo, *Le Devin du village,* which was first performed at Fontainebleau before the court. Next day he was to be presented to Louis XV to receive a pension, but he refused to go, partly from pride, partly from shyness and partly because of his peculiar illness. That same year his comedy, *Narcisse,* was played at the Théâtre Français. Next year, the *Lettre sur la musique française,* in which he expressed a strong preference for Italian over French music, was widely and hotly discussed. In the summer of 1754 he visited his native Geneva, was well received there, became once again a Protestant and recovered his citizen rights. Early in 1755, he published his *Discours sur l'origine de l'inégalité parmi les hommes,* greatly superior in thought and argument to his first *Discours,* though the academy of Dijon, for which it was also written, gave it no prize; in the same year appeared also his *Discours sur l'économie politique* commissioned by Diderot for the *Encyclopédie.* In April 1756 he moved out of Paris to the Hermitage, a house near Montmorency placed at his disposal by Mme. d'Épinay (*q.v.*), where he began work on his novel *Julie, ou la nouvelle Héloïse.* It was there that he fell genuinely in love, perhaps for the first time in his life. with Mme. d'Houdetot (*q.v.*), nearly 20 years his junior and herself in love with another man. Rousseau did not expect her to return his love but believed in her friendship; and his passion for her deeply affected his novel, which is as remarkable for eloquence and for subtlety as for the artificiality and even absurdity of many of its situations and attitudes. It is the novel of a man who has dreamed of love more than he has known it. Out of this unfortunate passion there arose misunderstandings with Mme. d'Épinay, which quickly, other causes supervening, led Rousseau to break with her, with her lover Baron von Grimm and (saddest of all) with Diderot. It was then that he first gave obvious signs of the persecution mania from which he suffered, intermittently but with increasing severity, for the rest of his life.

In Dec. 1757 Rousseau moved to Montlouis, another house near Montmorency, at which he stayed until June 1762. This shelter he owed to the maréchal-duc de Luxembourg (Charles François de Montmorency) and his wife, who were among the most devoted, tactful and considerate of his powerful friends. At Montlouis he spent his most productive and in some ways his happiest years. In Oct. 1758, there appeared his *Lettre à M. d'Alembert,* commonly known as the *Lettre sur les spectacles,* against the establishment of a theatre at Geneva. This letter, criticizing an article on Geneva written by d'Alembert for the *Encyclopédie,* marks his final breach with the coterie of the philosophers and contains in its preface a quotation from *Ecclesiasticus* deeply offensive to Diderot. At Montmorency he completed *La Nouvelle Héloïse,* which was published early in 1761 and was immediately and enormously popular. Du *contrat social* appeared in April 1762 and the first copies of *Émile,* a long treatise on education in the form of a novel, a month later.

Exile in Switzerland and in England (1762–67).—Both *Du contrat social* and *Émile,* which contains a long profession of faith (the "Profession de foi du vicaire savoyard") equally critical of dogmatic Christianity and of philosophical scepticism, were offensive to authority. An order was issued for Rousseau's arrest, and he was obliged to leave France, taking refuge at Môtiers-Travers in the territory of Neuchâtel, which was then subject to the king of Prussia and governed in Frederick II's name by Marshal Keith, a Jacobite in the Prussian service. Rousseau stayed at Mbtiers from July 1762 to Sept. 1765 and found a good friend and protector in Marshal Keith. In 1763 he published the *Lettre à Christophe de Beaumont,* an attack on the archbishop of Paris who had condemned *Émile.* In the same year he renounced his citizenship of Geneva; and in 1764 he wrote the *Lettres écrites de la montagne* in reply to J. B. Tronchin, procurator-general of the Genevan republic, who had written in defense of the executive council of Geneva (the Petit Conseil) for having ordered the burning of *Émile* and of *Du contrat social.* In Sept. 1764 Rousseau was asked by Matteo Buttafuoco, a friend of Pasquale Paoli, to prepare a constitution for Corsica. He never completed the task, though he did make a rough draft (published in 1861 under the title *Projet de constitution pour la Corse*). On the last day of 1764 he received an anonymous pamphlet, *Le Sentiment des citoyens,* attacking him savagely as a hypocrite, a heartless father and an ungrateful friend. It was written by Voltaire, and its effect on Rousseau was terrible. When he recovered from the shock, he decided to write his autobiography, the *Confessions.*

The *Lettres écrites de la montagne* had turned the Protestant pastors, both in Geneva and in Neuchâtel, even more strongly against him, and in Sept. 1765, after some stones had been thrown at his house, he decided to leave Môtiers, though he still enjoyed Frederick II's protection. He fled to the fle Saint Pierre, on Bernese territory, but was not allowed to stay there and eventually, on the advice of Keith and other friends and with the help of David Hume, went to England, where he arrived in Jan. 1766. Well received in London, he moved in March to Wootton in Derbyshire, to a house let to him at a nominal rent by Richard Davenport, a friend of Hume. Even before his departure for Wootton, he had heard that a mocking letter to himself, supposedly from the king of Prussia but actually written by Horace Walpole, was being circulated in Paris; and he had suspected that Hume might have had a hand in it. At Wootton his suspicions grew stronger, causing him to receive equivocally an offer of a pension from George III, which he badly needed but was loath to obtain through the good offices of Hume, whom he now believed to be a false friend, won over by the "philosophers" into a conspiracy to ruin his name. This fear and Hume's excessive zeal to justify himself publicly at Rousseau's expense led to an open quarrel between them, which excited and amused all cultivated Europe. In May 1767 Rousseau, by this time more than a little mad, fled in panic from England to France, where the order for his arrest, issued in 1762, was still unrevoked.

His Last Years in France (1767–78).—Rousseau went first to stay for a few days with the marquis de Mirabeau (Victor Riqueti)

and then, taking the name of M. Renou, moved to the Chbteau de Trye, near Gisors, lent to him by the prince de Conti (Louis François de Bourbon). While he was at Trye his *Dictionnaire de musique,* which he had been working on for years, was at last published. He left Trye abruptly in June 1768, again in a panic, going first to Bourgoin near Lyon, where he married Thérèse le Vasseur, and then to Monquin, whence he moved to Paris early in the summer of 1770, to defend himself against the "conspirators." There he resumed his own name, but was left unmolested. To justify himself to the world, he read extracts from his *Confessions* in various Parisian drawing rooms until, at the request of Mme. d'Épinay, he was asked by the police to desist. In 1771 Count Wielhorski begged him to advise the Poles how they should reform their institutions, and he wrote the *Considkrations sur le gouvernement de la Pologne,* first published in 1782. Still eager to justify himself, he wrote the *Dialogues: Rousseau juge de Jean-Jacques.* He tried in Dec. 1775 to place his work under God's protection on the high altar of Notre Dame, but was prevented from doing so by the iron grille surrounding the choir, which he had never noticed on his many previous visits to the great church. It seemed to him that God had joined his persecutors, and for a time he was in despair. During the last two years of his life, his madness weighed less heavily on him, and he wrote the most serene and the most delicate of his works, the *Rêveries du promeneur solitaire,* which contains descriptions of nature and of man's feelings for nature of a wonderful freshness and beauty. In May 1778 he moved to Ermenonville, to a pavilion on the estate of the marquis René de Girardin, where he died, about six weeks later, on July 2. He was buried on the fle des Peupliers in the lake at Ermenonville, but his remains were moved to Paris to the Panthéon during the Revolution.

The Importance of his **Writings.**—Rousseau was not a systematic, lucid or rigorous thinker. It has been said that he was not original, that he discovered nothing but merely gave passionate and eloquent expression to other men's ideas. This denial of his originality is probably based on a misunderstanding of the nature of political and social theory. Most of the ideas that the political and social theorist uses have a long ancestry; they do not, of course, always remain the same, for they change imperceptibly as a result of continual discussion and argument. Reputations for originality are more often made by giving names to ideas already coming into circulation than by inventing new ideas. In this way the fruits of many men's thinking are appropriated by the more lucid and articulate among them. The man with a gift for sorting out ideas is apt to be the first to see what new expressions are needed to prevent confusion between old and new ways of thinking, but his having this gift is not enough to make him original. New ideas do not usually get their distinctive names until some time after they have begun to circulate, and so their novelty is often not noticed even by the people who are influenced by them. Rousseau invented no new expressions. not even "the general will," for that phrase was used before him by Diderot. But that does not mean that he lacked originality. On the contrary, he had it in much larger measure than he appeared to have it, for he put a great deal of new wine into old bottles. To the utilitarian and to the positivist he has appeared extravagant and superficial, but the idealist has seen much more that is admirable in him.

Rousseau, when he said that man is naturally good, did not mean that the savage is better than the civilized man; he meant only to deny original sin and to suggest that, if civilized man is now feeble, anxious and unhappy, it is not because of any evil inherent in him but because his social environment is not suited to his nature. Man is born neither good nor bad, but with certain potentialities which he strives to realize; and if he is thwarted, he acquires ambitions and needs which cannot satisfy him, either because they are in themselves insatiable or because they bring him into conflict with other men. Rousseau saw a close connection between the structure of society and the moral and psychological condition of the individual. It seemed to him that society in his own day necessarily set men against one another and also frustrated and bewildered them, preventing them from acquiring the self-knowledge and self-mastery which alone bring happiness and social harmony. He believed that discord and moral confusion are the ineluctable consequences of excessive inequalities of wealth and of the size and complexity of modem society. Man cannot be happy and free, cannot be on good terms with himself and with his neighbours, except in a community simple enough to be intelligible to him and small enough to enable him to take a full and equal part in its government. In a vast community with a complex economy, there must be hierarchy and inequality, and the great majority of passive citizens are inevitably controlled and exploited by the active few. No community, he thought, can be united and strong unless its members share certain fundamental beliefs and loyalties, and men cannot be truly free unless they are emotionally secure, which they will be only in a society of equals, where each man depends, not on the caprice or protection of some person or group stronger or wealthier than himself, but on a system of laws which are the same for all men and are made by the entire community. Though his ideal of the small and simple egalitarian state could not be realized, even in his own day, his criticism of contemporary society went deep. He taught men to think about society and the individual in new ways and to put new questions; and it is here, much more than in the specific solutions which he offered, that his originality and his insight are revealed.

If the reader is not to get a distorted and misleading conception of Rousseau's social and political theory, the *Discours* on inequality, which discusses the probable origins of actual society and government, and *Émile,* which lays down a plan of education to make an ordinary child morally and intellectually self-reliant and therefore well-balanced and free, must be studied as carefully as *Du contrat social,* which only describes an ideal. This outsider, this misfit, this vagabond, who felt that evil was thrust upon him by his position in a society where he could not feel spiritually at home, was the first and the most eloquent of the great radical thinkers, of the men who protested that modem society is rotten even at its roots. That he was sometimes, indeed often, one-sided and extravagant is obvious; what is less obvious, but not less true, is that he was also many-sided and equally passionate on every side. No one insisted more than he did that a people are made what they are by their customs and prejudices, that faith is stronger than reason, that freedom is the fruit of a moral self-discipline as slowly acquired as it is easily lost. He never preached revolution, believing that victims of oppression are so much debased by servitude as to be made unfit for freedom and have therefore to be brought gradually to it, as invalids to food too strong for their stomachs. In the *Projet de constitution pour la Corse* and in the *Considkrations sur le gouvernement de la Pologne,* we find a cautious Rousseau, respectful of fact and of tradition. His influence was revolutionary, not because he approved of violence or of precipitate change (for that he never did), but because he felt the evils of society passionately and denounced them so eloquently that he brought the established order into hatred and contempt. He did not attack religious obscurantism or make fun of the church as Voltaire and the "philosophers" did; on the contrary, his attitude to Christianity was equivocal, for he was as much attracted by it as a moral and spiritual force as he was critical of some of its dogmas and practices. He was more dangerous than the "philosophers" precisely because he struck at the social order rather than at the old religions and because so many of the motives and emotions to which he appealed were of Christian inspiration. Among the great writers of his century, he had most in common, in his notion of society (though not in his feelings toward the established social order), with the baron de Montesquieu and with Edmund Burke (*qq.v.*); and in his notion of freedom and what constitutes the moral dignity of man, with Kant (*q.v.*).

Rousseau was much more than a moralist and a social and political theorist; he was also one of the greatest writers of his age, and the most eloquent. By his descriptions of the beauties of nature, by his idealization of romantic love and also of chastity and of fidelity as virtues that go naturally with that love, by his acute and delicate analysis of introspective moods, by his revealing and essentially sincere (though not always accurate) autobiography,

he greatly enriched European literature. There was about his writings a warmth, an intimacy and a freshness not common in his day. and to these qualities, above all others, he owed his immense contemporary reputation, which was second to none, not even to Voltaire's.

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(J. Pz.).

ROUSSEAU, (PIERRE ÉTIENNE) THEODORE (1812–1867), French landscape painter. a leading member of the Barbizon (*q.v.*) school. was born in Paris on April 15, 1812. The son of a tailor, he began his artistic education in 1826 under a relative, Pau de St. Martin, and then studied landscape with Charles Remond and figure painting with Guillon Lethiilre. Rémond and Lethiilre mere painters in the neoclassical tradition, but the formation of Rousseau's style was based rather on extensive study of such painters as Claude Lorrain, Jan van Goyen, Jacob van Ruisdael and Karel du Jardin.

After a visit to the Auvergne in 1830. he first exhibited at the Salon in 1831, then again in 1833 ("Shores of Granville") and 1831 ("Edge of the Wood, Compiègne," which earned him a third class medal).

In 1836 Rousseau's big work, "Descent of Cattle," resulting from a visit to the Jura mountains, was rejected by the Salon, as were all his entries during the next seven years. He was however vigorously defended by Etienne Thoré and was intimate with such painters as Ary Scheffer. N. V. Diaz and Jules Dupré.

Rousseau first visited the Fontainebleau area in 1833 and, in the following decade, finally settled at Barbizon, where eventually he became intimate with J. F. Millet. Unlike Millet. Rousseau continued to travel widely throughout France in search of subjects. In 1848. with the changes governing the composition of the Salon jury, Rousseau was elected a member, and in the same year received a state commission. Official recognition of his work increased so that he was well represented in the International exhibition of 18jj and became president of the fine art jury for the Exposition of 1867. He died at Barbizon on Dec. 22, 1867.

Rousseau's reaction against the neoclassical landscape puts him midway between the romantics and the realists. He made studies direct from nature ("The Valley of St. Vincent," National gallery, London), but his exhibition pictures were developed over long periods in the studio ("The Marsh in the Landes." Louvre, Paris, begun in 1844 but not exhibited until 1853). A traditional procedure of preparation in grisaille, with 'colour added in the later stages, was used for this painting. Comparison of "Edge of the Forest at Fontainebleau; Sunset" (Louvre) with the nearly identical composition of "A Glade in the Forest of Fontainebleau" (Wallace collection, London) suggests a willful reorganization of nature in the manner of the Dutch tradition and somewhat at variance with the intense analysis of appearances to be found in such works as "Oak at Fontainebleau."

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(R. A. Dy.)

ROUSSEAU DE LA ROTTIÈRE, JEAN SIMÉON (b. 1747), French decorative painter, was the youngest son of Jules Antoine Rousseau, "sculpteur du Roi." He studied at the Académie Royale in 1768, winning the medal given to the best painter of the quarter. He appears, with his brother Jules Hugues, to have been employed by his father for the decorative work executed by the family at Versailles. Many of the attributions are fairly determined by dates, Jules Antoine Rousseau having been at work at Versailles for years before the birth of his famous son. There can be little doubt that the "Bains du Roi." the "Salon de la Méridienne," part of the bedchamber of Madame Adelaïde and the "Garde-robe of Louis XVI" were shared in by Rousseau de la Rottière. His most individual and most famous undertaking was, however, the decoration of the lovely "Boudoir de Madame de Sévilly," purchased for the Victoria and Albert museum in 1869.

There is no information as to Rousseau's later life. The last known mention of him is in 1792.

ROUSSEL, ALBERT (1869–1937), French composer, was born at Tourcoing on April 5, 1869. He left the navy in 1894 to study music in Paris, and in 1902 became professor at the Schola Cantorum. The delightful *Rustiques* (1904–06), the first symphony *Le Poème de la Forêt* (1904–06) and the charming ballet *Le Festin de l'Araignée* (1912) were all manifestly the work of a gifted composer. The *Divertissement* (piano and wind instruments, 1906), *Evocations,* three symphonic poems, one with chorus (1910–11), the orchestral prelude *Pour une Fête de Printemps* (1920), the second symphony (op. 23. 1919–20) and the opera-ballet *Padmâvati* (1923) are among his other works.

ROUSSILLON, a former province of France. corresponding geographically to the fertile plain bounded by the eastern Pyrenees. the Corbières and the Mediterranean and to the modern *département* of Pyrenees-Orientales (*q.v.*). It derives its name from a Roman town, Ruscino, near Perpignan, the later capital. It formed part of the Roman province of Narbonensis and. in the jth century. of the Visigothic kingdom that extended over Spain and Aquitaine. Even after the defeat of Xlaric II at Vouillé (507) and the loss of Aquitaine, Roussillon long remained in Visigothic hands, as did the rest of Septimania (from the lower Rhône to the Pyrenees). Only after being overrun by the Arabs, from 719 to 759, was it occupied by the Franks. Under Charlemagne it was incorporated in the Marca Hispanica, but in 86j Charles the Bald detached the districts around Narbonne. Henceforth Roussillon was closely linked with Catalonia and looked mostly southward to Barcelona. In 873 Joffre the Hairy, count of Barcelona. killed the Frankish count, occupied the country and gave it to his brother Miron, who was the head of a line of hereditary counts that lasted until 1172, when Gerard II left his inheritance to the count of Barcelona. King Alphonso II of Aragon. Yet it remained legally part of the French kingdom till 1258, when, by the treaty of Corbeil. Louis IX surrendered it with the countship of Barcelona to James I of Aragon. Under Aragonese rule the province was prosperous; Collioure. the port of Perpignan. became a centre of Mediterranean trade. From 1276 to 1344 Roussillon was part of the ephemeral kingdom of Majorca created by James I in favour of his younger son, James, and the new state had Perpignan as its capital. But in the 1jth century the French king became interested in Roussillon. and in 1462. by the treaty of Bayonne, Louis XI promised to help John II of Aragon against the rebellious Catalans and was to occupy the castles of Perpignan and Collioure as a security for the reimbursement of his expenses. In fact he had the whole of Roussillon and Cerdagne occupied and annexed to France in 1463. French rule was most unpopular, and Roussillon revolted in 1472, but after two sieges (1473 and 1475) Perpignan was retaken by the French and the country subdued. Still, in 1493 by the treaty of Barcelona. Charles VIII gave it back to Ferdinand of Aragon to win his good will for the Italian campaign. However, in 1639 and in 1641 (when Catalonia revolted against Spain) the French invaded Roussillon; Perpignan was taken after a long siege (Jan.–Sept. 1642), and the treaty of the Pyrenees (1659) secured Roussillon and half of Cerdagne to the French crown. During the revolutionary wars, Roussillon was for a short time invaded by a Spanish army (1793–94). The 19th century was marked by the steady growth of left-wing opinion and by a complete transformation of agriculture which made the country a rich producer of early vegetables and fruits, as well as of wines.

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(F. Cr.)

ROUTLEDGE, GEORGE (1812–1888), English publisher, was born at Brampton in Cumberland on Sept. 23, 1812. He started in business for himself as a bookseller in London in 1836, and as a publisher in 1843. He was a pioneer of cheap classics; the shilling volumes called the "Railway Library" were a success, including as they did *Uncle* Tom's Cabin. He also published in popular form writings of Washington Irving. James Fenimore Cooper. Edward Bulu-er-Lytton and Benjamin Disraeli. A branch of Routledge's publishing business was established in New York in 1854. Routledge died in London on Dec. 13, 1888.

ROUVIER, MAURICE (1842–1911). French statesman, was born at Aix on April 17, 1842. He supported Léon Gambetta's candidature at Marseilles in 1867, and in 1870 he founded an anti-imperial journal, *L'Egalité*. In July 1871 he was returned to the national assembly for Marseilles at a by-election. He became a recognized authority on finance, and repeatedly served on the budget commission as reporter or president. In 1881 he joined Gambetta's cabinet as minister of commerce and the colonies, and in the 1883–85 cabinet of Jules Ferry he held the same office. He became premier and minister of finance on May 31, 1887, with the support of the moderate republican groups, the Radicals holding aloof in support of Gen. Georges Boulanger, who began a violent agitation against the government. Then came the scandal of the decorations in ahich Pres. François Grévy's son-in-law Daniel Wilson figured, and the Rouvier cabinet fell Rouvier was minister of finance in a succession of ministries between 1889 and 1893.

He was driven out of office by the Panamá scandals; in 1902, after nearly ten years of exclusion from office, he joined the Radical cabinet of Combes; and on the fall of the Combes ministry in Jan. 1905 he became premier. with Theophile Delcassé at the head of the foreign office. Delcasse, reproached with imprudence in the Morocco affair (see ECROPE: History), resigned, and the prime minister took over foreign affairs and came to an agreement with the German government. His ministry fell in 1906 over questions connected with the Separation law. Rouvier died at Neuilly on June 7, 1911.

ROUX, PIERRE PAUL EMILE (1853–1933), French bacteriologist, was born at Confolens. Charente, on Dec. 17, 1853. He studied medicine, and obtained an appointment to the faculty of medicine in Paris, which he held from 1874 to 1878. He then worked for ten years in Louis Pasteur's laboratory. before being appointed to a post in the Pasteur institute. He was director of the institute from 1904 to 1918.

Roux did a great deal of research in collaboration with Pasteur, and studied the treatment of infectious diseases, including hydrophobia. He studied anthrax in conjunction with Pasteur and Charles Edouard Chamberland, and produced vaccines against this disease. He was associated with the Swiss bacteriologist Alexandre Yersin in the study of the diphtheria bacillus and its toxins. With Emil von Behring he introduced the use of an antitoxin in diphtheria. He made a famous communication on this subject to the International Congress of Medicine at Budapest, Hung., in 1894. He claimed antitoxin as of value prophylactically and as a remedy. Figaro opened a public subscription and in a few weeks more than 1,000,000 fr. rolled in. The money was devoted to the preparation and distribution of diphtheria antitoxin by the Pasteur institute.

See *Lancet,* vol. 225, p. 1124 (1933).

ROUYN, a mining city in northwest Quebec, Can., on Lake Osisko, on the Canadian National and Nipissing Central railways, 340 mi. N.W. of Montreal and 320 mi. N. of Toronto. Pop. (1951) 14,633; with its twin city of Noranda (immediately adjoining but under separate administration) the 1951 population totalled 24,305, compared with 13,346 in 1941. The rapid expansion from raw bush in 1923 to modern urban development was a result of the discovery of minerals and the completion in 1927 of a branch of the Canadian National railway. Rouyn lies east, and is on the continuation of the mineral-bearing rocks of the Porcupine gold district and the Cobalt silver district of Ontario. Its chief industry is copper-gold production, and the Noranda mine (with capital expenditure of more than $12,000,000 by mid-century on smelter and concentrator equipment) is the most important in the Rouyn area. It ships copper anodes to Montreal for refining. (C. CY.)

ROVERETO, a town of the province of Trento. Italy, 15 mi. by rail southwest of the town of that name. Pop. (1951) 22,642 (commune). Built on the left bank of the Xdige. in the widest portion of the valley, it is divided into two parts by the Leno torrent. Save in the newer quarter of the town, the streets are narrow and crooked, one being named after the most distinguished native of the place, Antonio Rosmini-Serbati (*q.v.*). The finest church is that of Sta. Maria del Carmine, the old 14th-century church now serving as a sacristy to that built from 1678 to 1750. The church of San Marco dates from the 15th century, and so do the municipal palace and the savings bank. The town is dominated by the castle (containing a war museum), which was reconstructed in 1492 by the Venetians, after it had been burned in 1487 by the count of Tirol. It was very much damaged in World War I, but its industries (silk, cotton. gloves, paper, metals, etc.) later revived.

In 1132 the emperor Lothair found the passage of the gorge above the site of the town barred by a castle, which he took and gave to one of his Teutonic followers, the ancestor of the Castelbarco family. The first record of the town dates from 1154. In 1411 it was taken by the Venetians. In 1509 the town gave itself voluntarily to the emperor Maximilian, to whom it was ceded formally by Venice in 1517, and next year incorporated with Tirol.

ROVIGNO, a seaport of Italy, in Istria, 23 mi. N.N.W. of Pola by rail. Pop. (1936) 9,035 (town), 10,028 (commune). It is on the west coast of Istria. and possesses a cathedral. built on the summit of Monte di Sant' Eufemia. Its campanile, built after the model of the famous campanile in Venice, is crowned with a bronze statue of St. Eufemia, the patron saint of the town, whose remains are preserved in the church. In the neighbourhood are vineyards and olive gardens. Rovigno is the principal centre of the local sardine fishery and cannery.

Rovigno is the ancient Arupenum or Rubinum. It became Venetian in 1283.

ROVIGO, town of Venetia, It., capital of the province of Rovigo. It stands between the lower Adige and the lower Po, 50 mi. S.W. of Venice by rail and 27 mi. S.S.W. of Padua, and on the Adigetto canal. 17 ft. above sea level. Pop. (1936) 14,561 (town), 39.954 (commune). It is a station on the line between Bologna and Padua. with branches to Legnago and Chioggia. The architecture of the town bears the stamp both of Yenetian and of Ferrarese influence. The finest church is the Madonna del Soccorso, an octagon with a lofty campanile. begun in 1594 by Francesco Zamberlan of Bassano, a pupil of Andrea Palladio. The town hall contains a library including some rare early editions and a fair picture gallery. The Palazzo Roncale is a fine Renaissance building by Sanmicheli (1555). Two towers of the mediaeval castle remain (920). Rovigo (Neo-Latin Rhodigium) is mentioned as Rodigo in 838.

ROVNO (Pol. ROWNE), a city of the Ukrainian S.S.R.. capital of Rovno oblast, on a tributary of the Goryn; formerly in Yolhynia province, Poland. Pop. (1931) 40,788. Though it never had the political importance of Luck or Ostrog, Rovno grew to be a larger town than either of these. It is an important railway junction, the centre of an agricultural district, near the Volhynian forests and in a region famous for its horses and cattle. It is on the famous route west from Kiev along which many Russian conquerors. Tatar raiders and foreign armies have passed. It is first mentioned in 1282, and formerly possessed a royal palace. It was taken by the U.S.S.R. in 1939 and by Germany in 1941, and was ceded to the U.S.S.R. in 1945.

ROVUMA, a river, about 500 mi. long, forming the boundary between Tanganyika territory and Portuguese East Africa. The lower Rovuma is formed by the junction of two branches of nearly equal importance, the longer. the Lujenda, coming from the southwest; the other. the Rovuma, from the west. Its source lies on a plateau of Archaean rocks 3.000 ft. high, east of Lake Nyasa. In its eastward course the Rovuma flows near the base of the escarpment of an arid plateau to the north, from

which direction the streams, which have cut themselves deep channels in the plateau edge, have almost all short courses. On the opposite bank the Rovuma receives, besides the Lujenda, the Msenga and Luchulingo, flowing in broad valleys running from south to north.

ROWAN, STEPHEN CLEGG (1808–1890), U.S. naval officer, was born near Dublin, Ire., Dec. 25, 1808, and brought to the United States at the age of ten. Becoming a midshipman in Feb. 1826, he circumnavigated the globe on his first cruise, in the "Vincennes," the first U.S. naval vessel to accomplish this feat. Rowan served in California with great distinction during the Mexican War, as executive officer of the "Cyane." In command of the steam sloop "Pawnee" in 1861, he participated in many of the early operations of the Civil War. He was at the capture of Hatteras inlet, and also at Roanoke Island (where he contributed his most distinguished service), Elizabeth City, Edenton and New Bern, N.C. Under the act of congress of July 16, 1862, he was promoted to captain and, as reward for gallantry, to commodore. In the "New Ironsides" he served in the campaign against Charleston, S.C., being under fire 14 times and having his flagship struck 164 times. He became a rear admiral July 25, 1866, vice-admiral Aug. 15, 1870, and was retired in 1889. Rowan's recollections of the Mexican War were published in the *Proceedings* of the Naval institute, vol. xiv (1888). He died in Washington, D.C., on March 31, 1890. (J. B. HN.)

ROWE, NICHOLAS (1674–1718), English dramatist and miscellaneous writer, was baptized at Little Barford in Bedfordshire on June 30, 1674. Nicholas Rowe was educated at Westminster school under Richard Busby. He became in 1688 a King's scholar, and entered the Middle Temple in 1691. On his father's death he became the master of an independent fortune. His first play, *The Ambitious Stepmother,* the scene of which is laid in Persepolis, was produced in 1700, and was followed in 1702 by *Tamerlane.* In this play the conqueror represented William III, and Louis XIV is denounced as Bajazet. It was for many years regularly acted on the anniversary of William's landing at Torbay. In *The Fair Penitent* (1703), an adaptation of Massinger and Field's *Fatal Dowry,* occurs the character of Lothario, whose name passed into current use as the equivalent of a rake. Calista is said to have suggested to Samuel Richardson the character of Clarissa Harlowe, as Lothario suggested Lovelace. Other plays are: *The Biter* (1704), *Ulysses* (1706), *The Royal Convert* (1707), *The Tragedy of Jane Shore* (1714) and *The Tragedy of Lady Jane Grey* (1715). In 1715 Rowe succeeded Nahum Tate as poet laureate. He died on Dec. 6, 1718.

Rowe was the first modern editor of Shakespeare. It is unfortunate that he based his text (6 vol., 1709) on the corrupt Fourth Folio, a course in which he was followed by later editors. We owe to him the preservation of a number of Shakespearean traditions, collected for him at Stratford by Thomas Betterton. These materials he used with considerable judgment in the memoir prefixed to the *Works.* He divided the play into acts and scenes on a reasonable method, noted the entrances and exits of the players, and prefixed a list of the dramatis personae to each play.

ROWELL, NEWTON WESLEY (1867–1941), Canadian jurist, was born on Nov. 1, 1867, in Middlesex county, Ont. He was called to the bar in 1891, and became head of a law firm in Toronto. He was elected to the Ontario legislative assembly for North Oxford in 1911, and from that year to 1917 was leader of the liberal opposition in the Ontario legislature. In Oct. 1917 he entered the federal government as president of the council and vice-chairman of the war committee of the cabinet, and was a member of the dominion lower house 1917–21. He was a member of the imperial war cabinet and Imperial War conference, 1918; representative at the International Labour conference at Washington, 1919; and a delegate to the first assembly of the League of Nations at Geneva. 1920, subsequently becoming vice-president of the League of Nations society in Canada. He wrote *The British Empire and World Peace* (1922) and *Canada,* a *Nation* (1923). He became a king's counsel in 1902, and was chief justice of Ontario, 1936–38. He died Nov. 22, 1941.

ROWING, the propulsion of a boat by means of oars in a succession of strokes. An oar is a shaft of wood with a rounded handle at one end and a blade at the other. The blade, a thin broadened surface, is either flat or slightly curved to offer increased resistance to the water (spoon oar). The loom or middle portion rests in a notch or rowlock or between tholepins on the gunwale or outrigger of the boat.

Racing oars are provided with leather buttons to prevent the oar from slipping outward. An oar may be regarded as a lever of the first order, the weight to be moved being the water and the fulcrum being the lock or tholepin; or as a lever of the second order, the weight to be moved being the boat, and the fulcrum the water pressing against the blade. Theoretically an oar functions at one and the same time in both capacities, but practically the lock or pin is the fulcrum, and the point at which the oar is buttoned determines the leverage and is a fundamental factor in the mechanics of rowing.

Rowing a boat and paddling a canoe (*q.v.*) have in common the propulsion of a floating craft through the water by muscular power applied to a lever, oar or paddle, in a succession of strokes. But in rowing, the oarsman, seated on a thwart, faces toward the stern and pulls the oar handle toward his body with the tholepin or oarlock as a fixed fulcrum, while in paddling a canoe the canoeist, generally in a kneeling position, faces toward the bow and throws forward the weight of his body, using one arm as a moving fulcrum.

In nautical use sculling is the propulsion of a boat by a single 'long oar worked to and fro from a notch in the stern transom, the blade being turned under water so as to give both projection and direction and acting like the tail of a fish. "Sweeps" and "sculls" are traditional terms for long and short oars.

As rowing developed into a form of competitive sport new terms were introduced and traditional terms acquired special meanings. Technically a stroke includes all the motions of an oarsman from the time he dips his oar for the catch to the time when it is again in the same position. The recovery is the part of the stroke during which the blade is in the air. Feathering is turning the blade by a wrist motion as it is lifted from the water and carrying it toward the bow in a nearly horizontal position until it is squared or bevelled (*i.e.,* the upper edge inclined slightly to the stern) for the next stroke. If the oarsman fails to clear the water with his blade on the recovery, because he has feathered too soon or too much or too little or because the boat has lurched down on his side, he "catches a crab."

Sculling as distinguished from its nautical sense is propelling a light racing craft with an oar in each hand. Oars so used are called sculls. "Singles" and "doubles" are popular entries in all regattas, and champion scullers have won wide acclaim. Rowing in the specialized sense is the art of propelling a racing craft by two or more oarsmen, each of whom handles a single oar, called a sweep. Paddling in boat racing parlance is rowing at reduced speed and at a leisurely pace. Sweep oarsmen row in pairs, fours, sixes (obsolete) and eights. Eights are numbered from the bow, and number eight is known as stroke.

The coxswain (cock, a small boat; swain as in boatswain) not only steers but gives the necessary commands and in a race calls for spurts and in a stern chase informs the captain or the stroke of the position of the competing boats.

History.— Rowing is now confined almost entirely to small boats and racing shells, but in ancient times it was the chief means of propelling vessels of war. As the size of vessels increased, sails gradually displaced oars, in both warships and merchant ships, but large galleys (*q.v.*) continued to be rowed in the Mediterranean until the 18th century. The oarsmen, generally captives of war or criminals, were chained to the benches, whence the term "galley slaves." Ancient galleys were rated according to the number of rowing banks or tiers of oars. The first recorded Roman fleet consisted of triremes (three-bank galleys). The earliest recorded amateur oarsmen were the islanders who entertained Ulysses on his return to Ithaca. Boat races probably formed part of Panathenaic and Isthmian festivals *(see* **BOAT**).

Virgil, in his account of the funeral games instituted by Aeneas for his father Anchises, gives a vivid description of a boat race:

The waiting crews are crowned with poplar wreaths;
Their naked shoulders glisten, moist with oil.
Ranged in a row, their arms stretched to the ***oars,***
All tense the starting signal they await.
Together at the trumpet's thrilling blast
Their bent arms churn the water into foam;
The sea gapes open by the oars up-torn;
With shouts and cheers of eager partisans
The woodlands ring, the sheltered beach rolls up
The sound, the hills re-echo with the din.

The earliest invasions of England were effected with the help of oars. The Britons. paddling wicker coracles. were no match for the legions that Caesar landed on their beachheads from his Roman triremes. Later the Anglo-Saxons, rowing and sailing across the North sea, and after them the Danes. entered the estuaries of the east coast. Sails are mentioned oftener than oars in Old English literature, and rowing had not yet become a sport that could be described in Shakespeare's words:

There be some sports are painful, and their labour
Delight in them sets off.

William of Malmesbury (c. 1080–*c.* 1143) records that Edgar the Peaceful was rowed in state on the river Dee by tributary kings, himself acting as coxsaain.

Boat Racing in England. — The Thames may fairly be called the cradle of rowing as a pastime and competitive sport in modern times. The nobility and gentry who had mansions on the banks of the river relied almost entirely on their elaborately fitted barges as a means of conveyance. As early as 1454 Sir John Norman mayor of London. "built a noble barge. and was rowed by watermen with silver oars." The lord mayor's procession by water to Westminster was an annual event until 1856. From the 15th century on, a considerable body of men lived by "the trade of rowing" as the statutes define the occupation of the watermen. In Queen Anne's time the river was still the highway of London, and there were about 10,000 licensed natermen on the tidal reaches of the Thames above London bridge. There were undoubtedly competitions betneen these in the 16th and 17th centuries. but the first race of which there is record is that for the "Doggett's Coat and Badge." Thomas Doggett. an Irish comedian, in 1715 offered an "orange livery with a badge representing Liberty to be rowed for by six watermen from London Bridge to Chelsea. annually on the same day, August 1. forever '' Except during World Wars I and II, the race was rowed regularly under the administration of the Fishmongers' company.

The first English regatta (Italian *regata,* originally a gondola race in Venice) took place on the Thames in 1775. Though there are numerous instances of professional matches at the beginning of the 19th century, the increased participation in boat racing by amateur oarsmen, after the Napoleonic mars. overshadowed professional rowing, nhich never had the vogue in England which it attained in the United States (see belou) Eton had a ten-oared boat, the "Monarch," and three eight-oars as early as 1811, but there is no record of any formal racing between amateur crews until 1817, the date of the founding of the Leander club. a hich rapidly gained the prestige it maintained from that time, as the oldest and most distinguished rowing club, whose eights, composed mainly of Oxford and Cambridge varsity oarsmen, upheld the highest standards of English rowing and sportsmanship.

The first race betneen Oxford and Cambridge was rowed in 1829 over a 2-mi. course at Henley, but it was not renewed until 1836. In 1845 the race nas rowed over a 4¼-mi. course from Putney to Mortlake, and in 1856 became an annual event except during World Wars I and II, attracting huge crowds along the banks of the river.

The Henley Royul Regatta. — The reaches of the Thames at Henley are not only the most beautiful along the river, but because of a straight stretch of more than a mile immediately below the town, offer an ideal course for racing shells.

The Henley Royal regatta established in 1839. has brought together not only the pick of English crews but. in the open events, has attracted competitors from Europe, America and Australia, Like other comparable events, it was interrupted by World Wars I and II. The course is 1 mi. 550 yd uith its finish near the town bridge in sheltered water, with sunny meadows and the shaded lawns of country houses on each side of the river. The races are rowed in the first week of July and furnish three days of continuous excitement to the spectators that throng the towpath and the enclosures at the finish. Because of the narrowness of the river and the many entries, the races are now rowed in heats of two or more entries. The course is protected by booms on each side. behind nhich spectators in punts and on houseboats moored along the banks obtain an unobstructed and close view of the competing, oarsmen. There have for many years been eight events, four of which are open to all amateurs; viz., the Grand Challenge cup for eight oars (the oldest. established in 1839), the Stewards' cup for fours, the Silver Goblets for pair-oars and the Diamond Sculls for single scullers. In 1939 a ninth event, the Double Sculls, was added. The Grand Challenge cup and the Diamond Sculls have long been the most coveted trophies in the rowing world.

Australia and Canada. — Rowing as a sport began in Tasmania about 1830, and by 1880 eight-oared races between crews representing the various states had become annual fixtures, held alternately in the six capital cities. Interuniversity rowing originated in 1870. In 1893 Old Blues from Oxford and Cambridge presented the magnificent Oxford and Cambridge cup. which thereafter was contested for by the six state universities and like the interstate contest is roned in each capital city by rotation.

In Canada, the 1870s were the heyday of the professional scullers. Purses ran from $50 upward to $1,000 and in international matches from £500 to £2 000. The outstanding norld champion was Edward Hanlan of Toronto. who defeated the best scullers of Canada, the U.S., England and Australia. As the distinction betueen professional and amateur rowing became more sharply drawn, following the lead of England, Canada developed numerous amateur rowing clubs, among them the famous Argonauts of Toronto. There is a Royal Canadian Henley regatta held annually at Port Dalhousie. Ont.

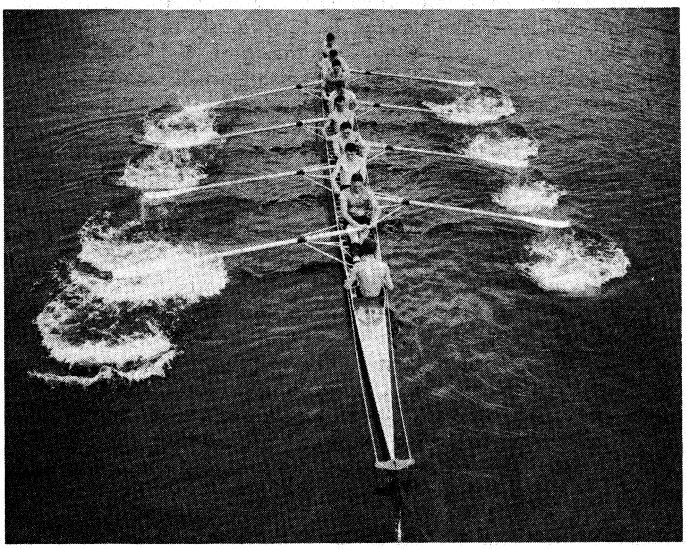
United States. — In the United States, as in England, rowing as a competitive sport originated in contests between "occupational" oarsmen. In 1811 and 1823 the ferrymen of Whitehall in Kew York city defeated their Long Island and Staten Island rivals on the Hudson. In 1823 they outrowed a cren of Thames watermen from the visiting British frigate "Hussar." in a four-mile race finishing at the Battery. This international race aroused tremendous local interest and the betting far exceeded the original stake of $1,000 offered by the captain of the "Hussar." Light keelless racing shells soon displaced the service boats of the early contests. The cleavage betneen amateur and professional, following the organization of the National Association of Amateur Oarsmen (N.A.A.O.) in 1872, inaugurated the golden age of professional sculling. Among the scullers who won national and international fame were James Hamill, J A. Ten Eyck, Wallace Ross. George Hosmer, Fred A Plaisted, Walter Bronn and Joshua Ward. The four Ward brothers had won an international race at Saratoga, N.Y., in 1871. Charles Courtney, who had begun as an amateur, turned professional and became the leading rival of the great Canadian Hanlan for championship honours and rewards. He was defeated by Hanlan in an exciting race at Lachine. Ont., in 1878. A return match for a purse of $6 000 at Lake Chautauqua was never rowed because Courtney's shell was found hacked in two on the morning of the race. This fiasco and the suspicion that betting and shady "deals" influenced the results of races were responsible for the decline of professional sculling in the United States. Courtney's later reputation was based on his striking success as coach of the Cornell crews, as was Ten Eyck's as coach of the Syracuse university crews for 35 years.

Amateur Clubs.—The first organization of amateur clubs was the Castle Garden Boat Club association of New Pork (1834); pleasure boating rather than racing nas the main interest of these early clubs, their membership being based on social rather than aquatic prestige. The Detroit Boat club. 1839, the oldest survivor of these early clubs. became one of the most important members of the N A A O and has entered crens in many regattas. In 1858 the boat clubs along the Schuylkill river. Philadelphia, Pa., were organized as the Schuylkill Navy. The boathouses of the

Navy stretch for nearly a quarter-mile along the banks of the river in Fairmount park, and until the silting up of the river, the Schuylkill course was one of the most popular and picturesque in the U S , during the years when Philadelphia was a centre of the two great English sports of cricket and roning. The first regatta to which only amateur oarsmen were admitted followed the organization of the N.A A O in 1872 and was rowed on the Schuylkill under the auspices of the Schuylkill Navy. The N.A.A.O. thereafter was the chief promoter of rowing among the amateur clubs, holding annual regattas for the championship of the United States in singles, doubles, quadruples, fours and eights.

Intercollegiate Rowing —The first formal intercollegiate boat race was rowed between Harvard and Yale in 1852 on Lake Winnepesaukee. With a few exceptions the race was rowed at four miles after 1876, at Nen London. The Yale-Harvard boat race is the oldest intercollegiate contest in the United States and antedates football by 17 years.

In the 1870s rowing became popular at a number of eastern colleges. In 1875 there was a regatta on Saratoga lake in which 13 colleges participated. When Yale and Harvard in 1878 went to New London for their dual race, Lake George became the scene of college races in fours in which Cornell or Pennsylvania generally won, Wesleyan. Bowdoin, Columbia and Princeton affording good competition. In 1887 eights took the place of fours, and, until the establishment of the Poughkeepsie regatta in 1895, these races



EWING GALLOWAY

AN EIGHT-OARED SHELL AND CREW. THE COXSWAIN SITS IN THE STERN FACING THE OARSMEN

were rowed at New London, Cayuga lake. Lake Minnetonka and one on the Delaware at Torresdale (1894). From the inauguration of the four-mile race at New London Harvard and Yale regarded this as the culmination of their rowing season. Though the record of the Cornell crews in the 1890s, the defeats of Yale and Harvard by Cornell and Princeton crews in the decade 1911–21, and the appearance of California and Washington and the U.S. Naval academy at Poughkeepsie challenged the leadership in college rowing that formerly could fairly be claimed by Harvard and Tale, the picturesqueness of the New London course, the tradition of the race and the prestige of Yale and Harvard among U S. universities continued to surround the Harvard-Yale boat race nith an interest analogous to that surrounding the Oxford-Cambridge race in England, the one rowed on the English Thames at London and the other on the United States Thames at New London. In 1895 Cornell. Columbia. Syracuse and Pennsylvania joined in a rowing association nith annual regattas open to invited crews at Poughkeepsie. The Poughkeepsie regatta continued not only to attract the foremost eastern college crews but also brought to the Hudson winning eights from the universities of California, Sl'ashington and Wisconsin and the United States Naval academy. Because of unsatisfactory water conditions and lack of interest, the Intercollegiate Rowing association (I.R.A.) regatta was moved to Marietta, O.. for 1950 and 1951. Bad water conditions there caused its removal to Onondaga lake. Syracuse, N.Y., where a satisfactory regatta, the 50th anniversity of the I.R.A., was held in 1952 and each year thereafter.

In contrast to the dual race at New London, Poughkeepsie has had as many as twelve starters in the interuniversity race. From 1895 to 191j Cornell led in number of victories. Thereafter the U.S. Naval academy, Washington. California and Cornell were the most frequent winners. Navy set a U.S. record in winning 31 successive races, including the Olympic championship in 1952 and three intercollegiate championships, from 1952 through 1955.

Rowing was established on the Pacific coast in 1899. The first race, in fours, uas between Washington and California. In 1907 eights displaced fours, and the Washington-California race. alternating between Lake Washington and the estuary at Oakland, Calif.. became the roning feature in the far west, and these crews began winning laurels at Poughkeepsie and in Olympic competitions. The favourable climatic conditions of the far west, permitting rowing in the open the year round. the abundance of material in the great state universities and the program of rowing developed in the western universities all contributed to the enviable record of the western crews.

Princeton had abandoned rowing in 1884, but, as a result of Andrew Carnegie's gift of a lake formed by the damming of two streams and affording $3\frac{1}{2}$ mi. of rowing water, resumed the sport in 1910. At this time the only races that college crews trained for uere the long-distance contests at New London and Poughkeepsie. Princeton's revival of rowing was responsible for the inauguration of a series of short-distance races, $1\frac{7}{8}$ to 2 mi., rowed on college waters and during term time, generally participated in by three crens and called triangular races. In 1912 the Childs cup race. next to the Yale and Harvard race the oldest intercollegiate fixture. was revived. This trophy had been given in 1879 by George W. Childs, the publisher of the *Philadelphia Ledger*, to be competed for by Columbia, Princeton and Pennsylvania, but the race had lapsed after 1884. In 1911 Princeton inaugurated intercollegiate rowing on Lake Carnegie with a triangular race between Yale, Cornell and Princeton, in which Princeton defeated Yale and came in as a close second to a fast Cornell crew that later won at Poughkeepsie. The Carnegie cup offered for this race in 1921 came into annual competition. Later races between Yale, Columbia and Pennsylvania for the Blackwell cup, between the U.S. Naval academy, Pennsylvania and Harvard for the Adams cup, between Harvard, Princeton and Massachusetts Institute of Technology for the Compton cup and between Navy. Cornell and Syracuse for the Goes cup became annual fixtures. All these races are alternately rowed on college waters, on Cayuga lake, Carnegie lake, the Charles river, the Housatonic river, the Schuylkill river and the Severn river at Annapolis, and before the close of the spring term. Rutgers, Boston university, Wisconsin, Dartmouth and Stanford are other colleges participating in the major regattas.

An annual regatta conducted by a group of smaller colleges under the name of the Dad Vail Rowing association, in honour of a former coach of Wisconsin, is participated in by Xmherst college, Boston university. Brown university, Dartmouth college. Florida Southern college, La Salle college. Marietta college, Rollins college, Rutgers university and the University of Tampa.

The increased interest in roning at the colleges led to the organization of lightneight crews averaging 150 lb. per man. Some of these crens made up in skill and speed for lack of weight, and in competing at the Royal Henley for the Thames Challenge cup defeated some of the best English college crews.

Roning became a popular sport among both public and private schools particularly by Kent school. Kent, Conn. U.S. schoolboy creus have non the Thames cup at Henley. There are various regattas especially for school crews and attracting numerous entries.

In 1902 the American Rowing association was formed to increase intercollegiate competition by means of short-distance races in the early season, concluding with an annual regatta at the

Henley distance of 1 mi. 550 yd. Thus this regatta became popularly known as the American Henley. This association, with the introduction of short-distance races. did a great deal to stimulate college rowing. It likewise had events at its annual regatta open for club crews who thereby matched their skill against college crews.

G.S. College Crews in Europe.—In 1869 Harvard challenged Oxford and Cambridge to a four-oared race on the Thames from Putney to Mortlake; Oxford accepted and won.

In the only other interuniversity race between English and Americans, Cambridge in 1906 defeated Harvard by about two lengths. There have been many U.S. entries at Henley. In 1878 a four from Columbia university won the Visitors' cup. In 1881 a Cornell four was defeated for the Stewards' cup, and in 1895 a Cornell eight lost to Trinity hall. Cambridge. In 1896 Leander beat a Yale crew coached by Bob Cook. In 1901 a University of Pennsylvania eight lost by a few seconds to Leander in the finals for the Grand Challenge cup. In 1914 the survivors in the finals for the Grand Challenge cup were Harvard and the Union Boat club of Boston, composed of former Harvard oarsmen; Harvard won, bringing the cup to the United States for the first time. Princeton in 1934 was defeated by Leander in the finals of the Grand Challenge; both crews broke the Henley record established in 1891. In 1939 and 1950 Harvard again brought the Grand Challenge cup to the U.S. and in 1955 it was won by the University of Pennsylvania's champion sprint eight. In 1957 Cornell defeated Yale in the first All-American final, breaking the course record. Princeton in 1930 and 1934 and Uale and Harvard in 1938 entered 150-lb. crews for the Thames cup. which was won by Kent school in 1933, 1938, 1947 and 1950, by Tabor academy in 1936, 1937 and 1939 (both schoolboy crews), and by the University of Pennsylvania in 1951 and 1952 and by M.I.T. in 1954 and 195j and Princeton in 1956 and 1957.

Strokes, Styles and Coaches.—Sweep rowing was early differentiated from sculling in England. The so-called "English stroke" was developed by Oxford and Cambridge oarsmen. As exemplified by the best Leander crews and described by Edmond Warre, provost of Eton (A Grammar of Rowing, Oxford, 1909), and R. C. Lehman of Cambridge (The Complete Oarsman, London, 1924), this stroke was based on early fixed-seat rowing, when body swing was the main source of power and the arms were used chiefly as connecting rods to transfer the weight of the body to the oar. When the sliding seat, an American invention, was introduced. the leg drive was added but the main stress was still on the body swing with shoulders carried well beyond the perpendicular at the finish. This required muscles which only years of practice could develop. The first challenge to this "orthodox" stroke came from a Cambridge student, Stephen Fairbairn, who had entered Jesus college from Australia in 1881 and as a member and coach of his college crews upset tradition by winning races in a style taboo to the "rigidly righteous" of the old school. Fairbairn (Rowing Notes; *Chats on* Rowing, Cambridge, 1934) emphasized leg drive and arm pull and considered smooth bladework more important than what he called the "showy style" of body work. If the proponents of the traditional stroke sometimes laid more emphasis on form than on speed, Fairbairn's stroke sacrificed form for speed.

The success of his and foreign crews was responsible for the adoption of innovations from abroad. such as the lengthened slide, the use of the swivel lock in place of tholepins and the seating of crews amidships in straight alignment instead of in the staggered order formerly used to increase leverage.

The British have devoted much time to the technical and theoretic aspects of rowing. A good exposition of the British system is G. C. Bourne's *A* Text-Book of Oarsmanship. R. C. Lehman, a, leading exponent of the British system, was in 1896 invited to coach the Harvard crews. To Yale in 1914 went Guy Nickalls as head coach, and to Pennsylvania his brother Vivian. Though all these men had brilliant records as oarsmen and coaches in England and stimulated interest in rowing at the universities they visited, the English system did not permanently strike root in the U.S. Many of the dons in the English universities assisted in coaching their college crews. Sir Leslie Stephen was an enthusiastic coach in his Oxford days. At Henley may frequently be seen on the towpath coaches who are equally at home among books and boats and who combine reading as a vocation with rowing as an avocation.

In the United States as in England the colleges first popularized rowing as a competitive amateur sport. The first college coaches were former professional scullers. Charles Courtney at Cornell, Ellis Ward at Pennsylvania. James Ten Eyck at Syracuse, Richard Glendon at Annapolis. William Haines at Harvard and M.I.T. were types of "professionals" who instilled into their charges principles of sportsmanship, besides rowing technique and strict conformity to training rules.

The stroke they taught was essentially a sculling stroke adapted to sweep rowing. The first attempt to introduce a stroke differentiated from sculling and based on the scientific principles of the English stroke was made by Robert Cook of Yale, who, as an undergraduate in 1881, when captain of his crew, went to England and studied the system prevailing at Oxford and Cambridge. The Yale crews of the next 20 years coached by him were noted both for speed and form. The "Bob Cook" stroke was characterized by a hard catch with squared shoulders, straight back, straight arms, quick hand shoot and slow slide on the recovery, length in the water and lower beat than the prevailing sculling strokes. After the Cornell experience at Henley in 1895, Courtney, always ready to experiment and improve both rigging and rowing, modified the short sculling stroke his crew had previously rowed, and in the Poughkeepsie regatta of 1896, in which both Yale and Harvard participated. it was difficult to distinguish Cornell from Yale.

In later years Courtney modified the hard catch, shortened the swing at the finish and developed the slow slide and run between strokes that enabled Cornell to defeat crews rowing a much higher stroke. The advocates of the lower stroke say, "If men were machines, the crew rowing the highest stroke would always win, but men are not machines and a lower stroke and smooth form conserve power." Richard Glendon at the U.S. Naval academy taught a stroke with exaggerated swing of the body at the finish. The fine physique of the midshipmen, combined with their finished watermanship, brought victories to this stroke at Poughkeepsie and in the Olympics. The nearest approach to what may be called an "American stroke" was made by Hiram Conibear and his pupils at the University of Washington. Conibear, himself not an oarsman, when appointed rowing coach at Washington in 1907, studied Yale, Cornell and Syracuse methods, and on his return became an expert technician. He developed at the University of Washington, aided by the Pocock brothers, expert builders and riggers of racing shells, a system that by the 1940s dominated college rowing east and west. Edward Leader at Yale, Thomas Bolles and Harvey Love at Harvard, Fred Spuhn and Delos Schoch at Princeton, Russell Callow at Pennsylvania and Navy, Harrison Sanford at Cornell, Walter Raney at Columbia, Gosta Eriksen and Loren Schoel at Syracuse, Norman Sonju at Wisconsin, Alvin Ulbrickson at Washington, Carroll Ebright at California, Robert Mock and James McMillin at Massachusetts Institute of Technology and Charles Logg at Rutgers were all products of the University of Washington and as coaches belonged to what fairly may be called the "Washington school" of rowing. As a matter of fact, there were only a few universities whose coaches were not former Washington oarsmen; viz., James Ten Eyck of Syracuse, Charles S. Walsh of the U.S. Naval academy, Hubert Glendon of Columbia, Allen W. Walz of Wisconsin and Iale, James Rathschmidt of Yale and Joseph W. Burk of Pennsylvania.

While in England college coaches are "invited" by the captains of crews or boat clubs, in the United States intercollegiate athletics became increasingly subject to faculty control, and coaches of major sports such as football and rowing are appointed by college authorities and considered part of the salaried staff of the institution.

Robert F. Herrick at Harvard, Averell Harriman and Mather Abbott at Yale, J. Duncan Spaeth and Gordon Sikes at Princeton and Father Frederick H. Sill at Kent acted as volunteer amateur coaches at their institutions; similar examples among the rowing

clubs could be noted. However, the system of salaried but otherwise nonprofessional coaches described above became prevalent in the United States.

Governing Bodies. — The first duty of the governing bodies for rowing in each nation is to establish an amateur rule specifying the qualifications necessary for anyone to engage in amateur rowing competition. The governing body's authority and rulings must be respected by the organizations and individuals participating in the sport, and it must have power to disqualify and suspend those who violate the amateur status or other rules prescribed for rowing competition.

It is also the responsibility of the national governing body in each nation to hold a championship regatta each year which shall be open to all classes that are eligible under the amateur rule. It is also the duty of the governing body, which in the U.S. is the Olympic Rowing committee, to conduct tryouts every four years to select those who are to compete in the international Olympic regatta.

The National Association of Amateur Oarsmen is the governing body in the U.S. for the clubs. For college rowing the Intercollegiate Rowing association and the Eastern Association of Rowing Colleges are the governing bodies in all regattas. In Canada it is the Canadian Association of Amateur Oarsmen, and in Great Britain it is the British Amateur Rowing association.

For international competition, the International Rowing federation, whose exact name is the Fédération International Societes d'Aviron (F.I.S.A.), is composed of the recognized national rowing organization in each nation. The International Rowing federation is the only organization that is recognized by the International Olympic committee; it is given charge of organizing and conducting the rowing competition in the Olympic games which are held every four years. In addition to this the international federation conducts a European championship regatta every year. At this regatta entries are accepted only from the nations whose governing bodies are members of the international federation. For the Olympic regatta, entries from any nation are acceptable providing that the amateur status of the oarsman entered is in accordance with the Olympic rules.

The National Association of Amateur Oarsmen was organized in **1872** in order to make a necessary distinction between amateur and professional competition. There was much professional rowing up to that time; amateurs and professionals were competing together and it was necessary that some means be found to meet this situation.

Outstanding Oarsmen. — Records indicate that the three most outstanding English oarsmen were Guy Nickalls, Sr., who won the Diamonds five times and stroked pairs, fours and eights to victory many times at Henley; F. S. Kelly, a great sculler who won the Diamonds three times; and J. Beresford, Jr., who won the Diamonds four times and competed in five Olympic regattas, being a victor in three and second in two.

Among the oarsmen of the United States, perhaps the most outstanding were James Ten Eyck, John B. Kelly, Paul Costello, Walter M. Hoover, William G. Miller, Joseph W. Burk, Joseph Angyal and John B. Kelly, Jr. The elder Kelly was the most versatile. In addition to winning three Olympic championships, he stroked pairs, fours and eights to victory many times. Burk made a most remarkable record in single sculling. In four years, 1937–40 inclusive: he won a total of **46** races in single sculls. These included the United States national championship four times, the Canadian championship four times, the Diamond Sculls twice and the Philadelphia Gold Challenge cup. He was voted the most outstanding athlete in the United States in 1939 when he was awarded the James E. Sullivan trophy.

In Canada, the dean of rowing and the most outstanding was Joseph Wright, Sr., of the Argonaut Rowing club, who won many races as stroke of pairs, fours and eights and as such competed at Henley five times. Other outstanding Canadian oarsmen were Lou Scholes, first Canadian to win the Diamonds, Robert Dibble, Joseph Wright, Jr., and later H. R. Pearce; the last represented Australia in his first Olympic competition in 1928 and thereby under the rules was required to represent Australia in 1932, although he had in the meantime transferred his residence to Canada.

Australia produced many good crews and scullers. An Australian crew won the Grand Challenge cup at Henley and the Diamond Sculls. In single sculling, the most outstanding was H. R. Pearce, who won the Olympic single sculls championship in 1928 and 1932, and Mervyn Wood, who was world champion single sculler for nearly a decade until his defeat at the XVth Olympiad in 1952 by J. Tjukalov of the U.S.S.R. Stuart MacKenzie won the Diamond Sculls in 1957.

See OLYMPIC GAMES. (J. D. S.; H. P. B.; C. Gs.; A. DA.)

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ROWLAND, HENRY AUGUSTUS (1848–1901), U.S. physicist, was born at Honesdale. Pa., on Nov. **27, 1848.** He graduated as a civil engineer at Rensselaer Polytechnic institute at Troy in 1870, and two years later returned there as instructor in physics, becoming assistant professor in 1877. While at Troy he made investigations on magnetic induction, permeability and distribution, which established fundamental results. In 187j he was chosen to occupy the chair of physics in the newly founded Johns Hopkins university, a position which he held until his death, at Baltimore, on April 16, 1901. Before beginning his work at Johns Hopkins he went to Europe, to visit the various physics research centres of the continent, and to purchase laboratory apparatus. He studied under Helmholtz in Berlin: where he carried out experiments proving that an electrostatic charge carried at a high rate of speed had the same magnetic action as an electric current. At Johns Hopkins he carried on a long series of experiments in which he computed the accepted value of the mechanical equivalent of heat, experiments which necessitated more careful thermometric and calorimetric methods than had ever been used before. Similar refined apparatus and technique enabled him to make a more nearly accurate determination of the value of the ohm. than had been calculated before. Becoming interested in the study of spectrum analysis, he realized the importance of securing more accurate diffraction gratings, and to this end constructed a dividing engine which allowed from 14,000 to **20.000** grating lines to be ruled to the inch on a plane surface of either glass or speculum metal. He next investigated the action of a grating ruled on a spherical concave surface, and, discovering the advantages proceeded to rule them. These gratings came to be used in physics laboratories the world over, and the modern study of spectroscopy as an exact science dates from this work. With these gratings Rowland studied and photographically mapped the solar spectrum for the first time. He then undertook the systematic study of the arc-spectra of all the elements so far as possible, and published his results between **1895** and 1900. In his last years he became interested in alternating currents and their practical application to motors, measuring instruments, etc. He devised a system of multiplex telegraphy depending upon synchronous motors which received a grand medal at the Paris Exposition of 1900. He was the recipient of many honours, including the Rumford and Draper medals. His *Physical Papers* **(1902)** contains a bibliography of his writings.

ROWLANDSON, THOMAS (1756–1827), English caricaturist, was born in Old Jewry. London, in July 1756, the son of a tradesman or City merchant. On leaving school he became a student in the Royal Academy, but at the age of **16** he went to study in Paris and afterward made frequent tours on the continent. In 1775 he exhibited at the Royal Academy a drawing of "Delilah Visiting Samson in Prison." He took to drawing caricatures as a means of livelihood. His Academy drawing of Vauxhall **(1784)** had been engraved by Pollard, and the print was a success. Rowlandson was largely employed by Rudolph Ackermann, the art publisher, who in 1809–11 issued in his *Poetical Magazine* "The Schoolmaster's Tour" — a series of plates with" verses by William Coombe which became very popular. Again engraved by Rowlandson himself in **1812**, and issued under the title of the "Tour of Dr. Syntax in Search of the Picturesque,"

they had reached a fifth edition by 1813 and were followed by "Dr. Syntax in Search of Consolation" (1820) and by the "Third Tour of Dr. Syntax in Search of a Wife," (1821). The same collaboration of designer, author and publisher resulted in the English "Dance of Death" (1814–16) and the "Dance of Life" (1822). Rowlandson also illustrated Smollett, Goldsmith and Sterne. Other designs are in *The Spirit of the Public Journals* (1825). *The English Spy* (1825) and *The Humourist* (1831). He died in London on April 22. 1827.

Rowlandson's designs were usually executed in outline with a reed pen and delicately washed with colour. They were then etched by the artist on copper and afterward aquatinted — usually by a professional engraver, the impressions being finally coloured by hand. As a designer the quality of his work suffered from haste and overproduction.

See J. Grego, *Rowlandson the Caricaturist, a Selection From His Works,* etc., 2 vol. (1880).

ROWLEY, WILLIAM (*c.* 1585–*c.* 1642), English actor and dramatist, collaborator with several of the dramatists of the Elizabethan period, especially with Thomas Middleton (*q.v.*). He is not to be identified with the "Master Rowley" whom Francis Meres described in his *Palladis Tamia.* William Rowley is described as the chief comedian in the Prince of Wales's company. He joined the King's Servants in 1623 and retired from the stage about four years later. He is supposed to have died about 1642. The following plays attributed to his sole authorship are extant: *A New Wonder, A Woman Never Vext* (printed 1632), *A Match at Midnight* (1633) and *A Shoomaker a Gentleman With the Life and Death of the Cripple That Stole the Weathercock at Paules* (1637). They are distinguished by effectiveness of situation and ingenuity of plot. It is recorded by Langbaine that he "was beloved of those great men Shakespeare, Fletcher and Jonson." With George Wilkins and John Day he wrote *The Travailes of the Three English Brothers* (1607); with Thomas Heywood he produced *Fortune by Land and Sea* (printed 1655); he was associated with Thomas Dekker and John Ford in *The Witch of Edmonton* (printed 1658); *A Cure for a Cuckold* (printed 1661) and *The Thracian Wonder* (printed 1661) are assigned to the joint authorship of Webster and Rowley, while Shakespeare's name was unjustifiably coupled with his on the title page of *The Birth of Merlin: or, The Childe Hath Found His Father* (1662). Rowley also wrote an elegy on Hugh Attwell, the actor, and a satirical pamphlet describing contemporary London entitled *A Search for Money* (1609).

SAMUEL ROWLEY (d. 1633?), the dramatist, described without apparent reason by J. P. Collier as William Rowley's brother, was employed by Henslowe as a reader of plays. He wrote some scriptural plays. now lost. with William Borne (or Bird, or Boyle) and Edward Juby. His only extant pieces are: *When You See Me, You Know Me, or the Famous Chronicle Historie of King Henry the Eighth, With the Birth and Vertuous Life of Edward Prince of Il'ales* (1605), of interest because of its possible connection with the Shakespearean play of *Henry VIII;* and *The Noble Souldier, or, A Contract Broken, Justly Reveng'd* (1634), which. however, was entered in the Stationers' Register as the work of Thomas Dekker, to whom the major share is probably assignable.

ROWLEY REGIS, a municipal borough (since 1933) in the Rowley Regis and Tipton parliamentary division of Staffordshire. Eng.. in a hilly district 7 mi. W. of Birmingham. Pop. (1951) 49,402. Area 6 sq.mi. The word Regis was added to Rowley (Roughlea) in 1140. Dud Dudley at Cradley forge first used coal instead of charcoal for smelting iron (patented 1620). The oldest and biggest industries are nail making (17th century) and chain making. By 1820 "Rowley rag." a basaltic stone, was being quarried extensively for roads and Rowley was thoroughly industrialized. Heavy engineering, enamelled hollow ware, brickworks at Blackheath and clay mines at Netherton are other industries. Haden Hill park was given to the council in 1921 and the Elizabethan house is used as a restaurant.

ROWLOCK (pronounced in England *rollock),* a device, on the gunwale of a boat, in or on which an oar rests, forming a fulcrum for the oar in rowing. The word is a corruption due to "row" of the earlier "oarlock," O.E. *ārlōc,* a lock or enclosed place for an oar. The simplest form of rowlock is a notch. square or rounded. on the gunwale. in n-hich the oar rests; other kinds are formed by two pins or pegs. tholepins ("thole" being ultimately the same word as Norw. *toll,* a young fir tree). and by a snivel with two horns of metal, pivoted in the gunwale or on an outrigger. (*See* ROWING.)

ROWTON, MONTAGUE WILLIAM LOWRY-CORRY, BARON (1838–1903), is remembered as the originator of the scheme known as the Rowton houses. Son of Henry Corry. a prominent Conservative: he was born in London on Oct. 8, 1838, educated at Harrow and at Trinity college. Cambridge. and called to the bar in 1863. In 1866 Corry became private secretary to Disraeli. When Disraeli resigned in 1868 Corry declined various offers of public employment to continue his services, now given gratuitously. to the Conservative leader; and when the latter returned to power in 1874. Corry resumed his position as his official private secretary. On the defeat of the Conservatives in 1880, Corry was raised to the peerage with the title of Baron Rowton, of Rowton castle, Shropshire. After Beaconsfield's removal to the house of lords. Rowton assisted him in keeping in touch with the rank and file of the party, and on Beaconsfield's death he was put in charge of his correspondence and papers. Consulted by Sir Edward Guinness, afterward Lord Iveagh (*q.v.*) about his projected endowment of a trust for the improvement of the dwellings of the working classes. Rowton made himself familiar with the conditions of the poorest inhabitants of London. and determined to establish "a poor man's hotel." which should offer better accommodation than the common lodginghouses at similar prices. The first Rowton house was opened at Vauxhall in Dec. 1892, the cost (£30,000) being defrayed by Lord Rowton. and it proved so successful that in 1894 a company. Rowton Houses (Limited). was incorporated to extend the scheme which was imitated throughout Great Britain, Europe and America. Lord Rowton died in London on Nov, g, 1903. As he was unmarried, the title became extinct.

ROXANA or ROXANE, daughter of the Bactrian king Oxyartes and wife of Alexander the Great. After the latter's death she gave birth at Babylon to a son (Alexander IV), who was accepted by the generals as joint king with Arrhidaeus. Having crossed over to Macedonia and thrown in her lot with Olympias, mother of Alexander the Great. she was imprisoned by Cassander in the fortress of Amphipolis and put to death (310 or 309 B.C.). The marriage of Alexander and Roxana was the subject of a famous painting by Aetion.

See Plutarch, *Alexander,* 47, 77; Arrian, *Anab.,* iv, 18, vii, 27; Diod. Sic. xviii, 3, 38, xix, 11, 52, 105; Strabo xi, p. 517, xvii, p. 794.

ROXAS CITY (formerly CAPIZ), in the province of Capiz, Phil. Is.. is an important town and port on the north side of Panay Island. at the mouth of the Panay river. The town is 11° 33' N. and 122° 45' E.; the port, 2½ mi. away, is 11° 36' N. and 122° 43' E. The town is the terminus of a railway from Iloilo and has an aeroplane field. The population of the municipality steadily increased for several decades and was 32,353 in 1948. The town is on the border of a region of rich tropical agricultural products— principally rice, sugar cane and coconuts on the plain, abaca in the mountains.

The harbour, in Capiz bay, protected from the open water. of Jintotolo channel by Culasi hill on the north and strong moles on the west and south, can accommodate vessels of a draught of ten feet. Typhoons occur from time to time and do considerable damage. The villages of Culasi and Libas are on the harbour, the landward vicinity of which has dense growths of nipa and other swamp vegetation. The port does a coasting trade with Manila, Iloilo and other Philippine ports and has a fishing industry and fish canneries. Two roads connect the port with the town of Roxas City.

The town is celebrated for weaving abacá and pineapple fibre.

With the province of Capiz, Roxas City suffered heavily during World War II, but later recovered considerably. It was named after Manuel Roxas y Acuna, first president of the Philippine republic. (J. W. CR.)

ROXAS Y ACUNA, MANUEL (1892–1948), first president of the Republic of the Philippines, was born at Cadiz, Panay Island, P.I., on Jan. 1, 1892. He studied law at the University of the Philippines, entered politics, and in 1917 was appointed to the municipal council of Capiz (now Roxas City). He was governor of Capiz from 1919 to 1921, when he was elected to the house of representatives in the Philippines, later becoming speaker of the house. He was a member of the Philippine constitutional convention in 1934 and secretary of finance from 1938 to 1940.

During World War II he served as a colonel under Gen. Douglas MacArthur and later was captured by the Japanese. He helped to co-ordinate underground resistance to the invaders for three years, however. In 1945 he mas president of the senate when, as a Liberal candidate, he was elected president of the Philippine commonwealth. When the country achieved its independence, July 4, 1946, Roxas became the first president of the new republic. He died at Clark field, Pampagna, on April 15, 1948.

ROXBURGHE, EARLS AND DUKES OF. ROBERT KER, 1st earl of Roxburghe (c. 1570–1650), was the eldest son of William Ker of Cessford (d. 1606) and the grandson of Sir Walter Ker (d. c. 1584), who fought against Mary queen of Scots both at Carberry hill and at Langside. He was descended from Sir Andrew Ker of Cessford (d. 1526), who fought at Flodden and was killed near Melrose in Jan. 1jz6 by the Scotts of Buccleuch. After a turbulent life on the border Robert Ker became a Scottish privy councillor in 1599 and was made Lord Roxburghe about the same time; he accompanied King James to London in 1603 and was created earl of Roxburghe in 1616. He was lord privy seal for Scotland from 1637 to 1649, and in the Scottish parliament he showed his sympathy with Charles I; but he took no part in the Civil War, although he signed the "engagement" for the king's release in 1648. His titles and estates passed by special arrangement to his grandson. WILLIAM DRUMMOND id. 1675), the youngest son of his daughter Jean and her husband John Drummond, 2nd earl of Perth. William took the name of Ker, became 2nd earl of Roxburghe and married his cousin Lord Ker's daughter Jean.

JOHN, 5th earl and 1st duke of Roxburghe (c. 1680–1741), received the dukedom in 1707 for his services in connection with the union. This was the last creation in the Scottish peerage. The duke was a representative peer for Scotland in four parliaments; George I made him a privy councillor and keeper of the privy seal of Scotland. and he was loyal to the king during the Jacobite rising in 1715. He was again a secretary of state from 1716 to 1725.

His grandson JOHN, 3rd duke of Roxburghe (1740–1804), was a famous bibliophile. The duke's library, including a unique collection of books from Caxton's press and three rare volumes of broadside ballads. was sold in 1812, when the Roxburghe club was founded to commemorate the sale of Valdarfer's edition of Boccaccio. Roxburghe's cousin William. 7th Lord Bellenden (*c.* 1728–1805), who succeeded to the Scottish titles and estates, died childless in Oct. 1805, and for seven years the titles were dormant.

Then in 1812 SIR JAMES INNES, Bart. (1736–1823), a descendant of the 1st earl, established his claim to them, and, taking the name of Innes-Ker, became 5th duke of Roxburghe. In his family the dukedom remained. Its holder has a seat in the house of lords as Earl Innes in the peerage of the United Kingdom.

ROXBURGHSHIRE, a border county, Scotland, bounded north by Berwickshire, east and southeast by Northumberland, south by Cumberland, southwest by Dumfriesshire and northwest by Selkirkshire and Midlothian. It has an area of 425,564 ac. or 664.9 sq.mi. The only low ground is in the north and in the valleys of the larger rivers, and the whole of the south is markedly hilly, though the Cheviots, forming for a considerable distance the natural boundary with England, mostly belong to Northumberland. The Tweed flows through the north of the shire for 26 out of its total run of 97 mi., though for about 2 mi. (near Abbotsford) it is the boundary stream with Selkirkshire, and for 10 mi. lower down with Berwickshire. On the right its affluent is the Teviot with its tributaries, and on the left the Allan and the Eden. The Teviot is the principal river entirely in Roxburghshire. From its source near Causeway Grain Head on the Dumfriesshire border, it follows mainly a northeasterly direction of 37 mi. to its confluence with the Tweed at Kelso. The Liddel is the main stream in the south. The Kershope and Liddel, during part of their run, serve as boundaries with Cumberland. Excepting the Liddel. which drains to the Esk, much the greater portion of the surface is drained. by the Tweed, to the North sea Teviotdale, Liddesdale, Tweedside and Jedvale are the principal valleys. The county contains a considerable range of sedimentary rocks from the Ordovician to the Carboniferous systems, and with these are associated large tracts of volcanic rocks. The Ordovician and Silurian rocks occupy the northwest and west part of the county. Two divisions of the Old Red Sandstone occur; the lower is confined to the Cheviots; the strata are unconformable upon the upturned Silurian beds. The upper division, which in its turn is unconformable upon the lower, occupies about one-third of the county, being well developed in the north, where volcanic rocks come in. An interesting section about half a mile south of Jedburgh exposes the meeting of the Old Red Sandstone with the Greynacke. Carboniferous rocks are represented by the Calciferous sandstone series in the southwest in Liddesdale and on the uplands of Carter Fell. etc. An interesting series of volcanic "necks" belonging to the Carboniferous period is exemplified in Dunain Law, Black Law. Maiden Paps, Ruberslaw and other hills. Glacial deposits are represented by boulder clay and beds of sand and gravel.

History and Antiquities. — Among the more important remains of the original inhabitants are the standing stones and circles at Plenderleath between the Kale and Oxnam: on Hownam Steeple, a few miles to the northwest; and at Midshiels on the Teviot. The stones on Ninestane Rig, near Hermitage castle, and on Whisgill are supposed to commemorate the Britons of Strathclyde who. under Aidan, were defeated with great slaughter by Aethelfrith of Bernicia, king of Northumbria, at the battle of Daegsastan in 603. There are hill forts in Liddesdale on the Allan. in the parish of Oxnam, and on the most easterly of the three Eildons. This last is said to be the largest example of its kind in Scotland. One of the most important and most mysterious of British remains is the Catrail. or Picts' Work Dyke. In its original condition it is supposed to have consisted of a line of double mounds or ramparts, with an intervening ditch 6 ft broad. It is now far from perfect and in places has disappeared for miles. Beginning at Torwoodlee, northwest of Galashiels, it ran southwest to Yarrow church. where it turned first south and then southeast. following a meandering course to Peel Fell in the Cheviots, a distance of 48 mi. Roman remains are also of interest. Dere street crossed the border north of Brownhart Law in the Cheviots, then took a mainly northwestern direction across the Kale. Oxnam. Jed and Teviot to Newstead. near Melrose, where it is conjectured to have crossed the Tweed and run up Lauderdale into East Lothian. Another so-called Roman road is the Wheel Causeway or Causey, a supposed continuation of the Maiden way which ran from Overburgh in Lancashire to Bewcastle in Cumberland, and so to the Border. It entered Roxburghshire north of Deadwater and went (roughly) north as far as Wolflee, nhere its direction becomes a matter of surmise. Of Roman camps the principal appear to have been situated at Cappuck, to the southeast of Jedburgh, and near Newstead, at the base of the Eildons. the alleged site of Trimontium. After the retreat of the Romans the country was occupied by the Britons of Strathclyde in the west and the Bernicians in the east. It was then annexed to Northumbria for more than four centuries until it was ceded. along with Lothian, to Scotland in 1018.

David I constituted it a shire, its ancient county town of Roxburgh (see KELSO) forming one of the Court of Four Burghs. The castle of Roxburgh, after changing hands more than once, was captured from the English in 1460 and dismantled. Other towns were repeatedly burned down. and the abbeys of Dryburgh. Jedburgh, Kelso and Melrose ultimately ruined in the expedition of the earl of Hertford (the Protector Somerset) in 1544–45. The Border freebooters — of whom the Armstrongs and Elliots were the chief — conducted bloody frays on their own account. Of the ancient castles, that of Hermitage, though now only a shell, is still the most striking. Dating from the 13th century, it is one of the oldest baronial buildings in Scotland.

Agriculture and Industries.— The soil is chiefly loam in the level tracts along the banks of the larger streams, where it is also very fertile. In other districts a mixture of clay and gravel is mostly found, but there is besides a considerable extent of mossy land. Many districts on the Tweed and Teviot are beautifully wooded.

More than half the county is under rough grazings carrying flocks of the smaller south country Cheviots and, to a less extent, the hardier and thriftier Blackface Highlands. On the intermediate ground, where there is some cropping, the larger north country Cheviot is crossed with the Border Leicester to produce half-bred lambs. On the lower-lying fertile farms half-bred ewes crossed with Oxford or Suffolk rams produce large quick-fattening Down cross lambs. In September the largest outdoor ram sales in Scotland are held at Kelso and are attended by buyers from all parts of the country and from overseas. Great numbers of sheep are sold at the autumn sales at Hawick. Arable farming is important in the rich low-lying areas around Kelso, where wheat, barley and some sugar beets are grown in addition to oats and roots, which are the common crops on upland stock iarms.

On the hills herds of Galloway cows are increasingly common. On arable farms Blue Grey cows are much favoured. Dairying, however, is not an important feature. The arable farms are highly mechanized. In some parts of Tweedside and Jedvale several kinds of fruit are successfully grown.

The "Common Ridings," celebrated each year with much pageantry at Hawick, Selkirk, etc, date from the time when the community grazed their stock on common land which had to be held against encroachment.

The county is a principal seat of the tweed and hosiery manufactures in Scotland. Iron founding and dyeing are also carried on at Hawick and tanning at Jedburgh, and agricultural implements, chemical manures and fishing tackle are made at Kelso. The salmon fisheries on the Tweed are of considerable value.

Population and Administration.— Thepopulation in 1951 was 45,557 and there were 92 persons who spoke Gaelic and English, but none Gaelic only. The small burghs are Hawick (1951 pop 16,717), Kelso (4,119), Jedburgh (4,083), the only royal burgh and the county town. and Melrose (2,146). The four county districts have the same names.

The county returns one member to parliament with Selkirkshire and Peeblesshire. The shires of Roxburgh, Berwick and Selkirk form a sheriffdom, and a resident sheriff-substitute sits at Jedburgh and Hawick. The county offices are at Newton St. Boswells. There are secondary schools at Hawick and Jedburgh.

ROXBURY, since 1868 a section of Boston (*q.v.*), Suffolk county, Mass.. and previously a town of Norfolk county situated between Boston and Dorchester. Earliest spellings included Rocksbury, Roxburie and Rocsbury.

The town was founded in 1630 by Puritan immigrants who came with Gov. John Winthrop. The early settlers were led by William Pynchon, who in 1636 led a party from there and founded Springfield. Mass. Anne Hutchinson (*q.v.*) was held in custody during the winter of 1637–38 at the home of the first minister, Thomas Welde. John Eliot, the apostle to the Indians, moved to Roxbury in 1632 and died there in 1690. Roxbury was the home of Thomas Dudley (*q.v.*), of his son Joseph and of his grandson Paul; of Robert Calef (d. 1719), the leader of the opposition to the witchcraft craze; of Gen. Joseph Warren (*q.v.*); and of William Eustis (1753–1825): U.S. secretary of war (1809–12) and governor of Massachusetts (1823–25). Theodore Parker (*q.v.*) was the pastor of the Unitarian Church of West Roxbury from 1837 to 1846.

The Roxbury Latin school, a boys' preparatory school, was founded in 1645 by a group of town fathers, among them John Eliot; it was first known as the Free School of Roxburie.

West Roxbury was the scene of the Brook Farm (*q.v.*) experiment. (J. F. Co.)

ROY, WILLIAM (*fl.* 1527), English friar, studied at Cambridge university and later joined the Franciscan order at Greenwich as a friar observant. As secretary to William Tyndale (c. 1492–1536), Roy assisted him in the translation of the New Testament at Cologne and later at Worms, 1625–26.

Roy's works included *A lytle treatous or dialoge very necessary for all Christen men to learne and to knowe* (1526; 1527–28; reprinted at Vienna, 1874); *Rede me and be nott wrothe, for I say no thynge but trothe* (Worms, 1526; Strasbourg, 1528; London, 1546); *An exhortation to the diligent studye of scripture, made by Erasmus Roterodamus, and translated into English, to which is appended an exposition unto the seaventh chapter of the first epistle to the Corinthians* (Marburg, 1529); A *proper dyalogue betwene a gentillman and a husbandman, eche complaynynge to other their miserable calanzitie through the ambicion of the clergy* (Marburg, 1530; London, 1863); and A *corn-pendious olde treatyse howe that we ought to have ye Scripture in Englysshe* (Marburg, 1530; Bristol, 1863).

ROYAL AIR FORCE COLLEGE: *see* MILITARY, NAVAL AND AIR ACADEMIES.

ROYAL CANADIAN MOUNTED POLICE. This organization. Canada's federal police force, was originally the North-West Mounted Police instituted in 1873 to establish law and order between the Manitoba border and the Rockies. Three hundred members assembled at Dufferin. Man., in the summer of 1874 and on July 8, with freight wagons, oxcarts, cattle for food. field guns, mortars and an assortment of farm machinery, struck out across the plains to the Old Man's river, in what is now southern Alberta, where they built Ft. Macleod and took up the task of policing 300.000 sq.mi. of wilderness. As the only authority in the region the force inherited a variety of work in caring for the stream of settlers that followed in its wake. It abolished the whisky traffic that had been ruining the Indian, tracked and brought to justice murderers, horse thieves and desperadoes and contained the warlike Sioux who had fled to Canada to escape U.S. wrath at the annihilation of General Custer's command in 1876. Just treatment of the Indian by the force resulted in the neutrality of the powerful Blackfoot Confederacy during the Northwest Rebellion of 1885. and under its vigilance the western extension of the Canadian Pacific railway was completed. Anticipating the gold rush of 1898. the North-West Mounted Police preceded the vanguard of prospectors to the Yukon and in 1904 the prefix "Royal" was added to its title in recognition of its services. In 1905 the provinces of Saskatchewan and Alberta were formed and retained the services of the Royal North-West Mounted Police. In 1920 the force received its present title, undertook the enforcement of federal legislation throughout Canada, and transferred its headquarters from Regina to Ottawa.

The 1930s saw the inception of the present "marine" and "air" divisions of the force, the-dog section and the first of three crime detection laboratories. R.C.M.P. patrols emphasized Canada's claim to arctic sovereignty, ranging far and wide from detachments in the northland, and between 1940–42 the R.C.M.P. vessel "St. Roch" became the first ship to complete the west to east journey through the Northwest Passage.

The Royal Canadian Mounted Police employs several thousand uniformed personnel, special constables, civilians and civil servants in its 17 divisions across Canada; its operations are directed by a commissioner from headquarters at Ottawa. As well as the federal statutes throughout Canada, it is responsible for the enforcement of the provincial statutes and the criminal code in all provinces except Ontario and Quebec and polices some 128 municipalities. It is charged with the internal security of the country and is the only police force in the Yukon and Northwest Territories where on behalf of other government departments it performs numerous administrative duties. The facilities of the national police services of the R.C.M.P., comprising the crime detection laboratories and the identification branch of the force, including scenes of crime, single fingerprint. crime index, ticket-of-leave and other sections, are available to all authorized police forces. The R.C.M.P.–sponsored Canadian Police college is attended by selected members of the force and outside forces. The R.C.M P, holds membership in the International Criminal Police organization and maintains liaison officers at London, Eng., and Washington, D.C. Contingents from the force have gone to the South African War and World Wars I and II.

Applicants for the Royal Canadian Mounted Police are required to be British subjects or Canadian citizens and if accepted must engage for an initial term of five years. Recruits are trained at Regina, Sask.. and Ottawa, Ont., and upon completion of training may be posted to any point in Canada excepting the extreme northern regions where service is voluntary.

The dress of the force has several variations, but symbolic of the R.C.M.P. is the broad-brimmed hat. scarlet tunic, blue breeches with wide yellow stripe, brown top boots, spurs and Sam Browne equipment. Horses, long ago supplanted by the patrol car, find their only application to the modern force at the training centres, on ceremonial occasions and in the world famous R.C.M.P. musical ride.

ROYAL FERN, the common name for *Osmunda regalis,* a fern native to Asia. Europe, North America and South America,

growing along lakes, in bogs or in marshy woods. It is a showy plant with bipinnate fronds (bisymmetrical, feathery leaves) two to six feet long and one foot or more broad; the apical portions, or tips, of the fronds are fertile. the fertile pinnae being cylindrical and densely covered with spore cases, giving the appearance of a dense cluster of flowers. whence the name flowering fern There are several varieties. some of which are cultivated This fern belongs to an ancient group of plants that originated during or before the Permian period.

Two related species, *O cinnamomea* (cinnamon fern) and **O.** *claytoniana* (interrupted fern), native to North America, are known in Great Britain as handsome greenhouse ferns *See* also FERN (*W*. R. Bs)

ROYAL MARINES: *see* MARINES.

ROYAL MILITARY ACADEMY: *see* MILITARY, NAVAL AND AIR ACADEMIES.

ROYAL NAVAL COLLEGE: *see* MILITARY, NAVAL AND AIR ACADEMIES.

ROYAL OAK, a city of Oakland county. Mich. C.S, 11 mi. N. of Detroit, has backed its slogan, "city of homes." by zoning three-fifths of its area for single dwellings. The population has grown rapidly from 25.087 in 1940 to 80,612 in 1960. The site of early settlement, which dates from the 1820s, was originally surrounded by marshlands. The name is credited to Gov. Lewis Cass, who rested there in 1818 under a giant oak tree which he supposedly likened to the "royal oak' in Scotland whose foliage once concealed Prince Charles from the Roundheads Royal Oak was chartered in 1921; the commission-manager government, in effect since 1917, includes a full-time planning director and municipal court.

Cultural life (literary, historical, dramatic and musical activities for all age groups) centres on the public library The Detroit zoo lies partly within Royal Oak. The Shrine of the Little Flower has become well known mainly because of the former radio activities of the church pastor, Father Charles E. Coughlin Industry, which is of minor importance, includes tools, paint. hydraulic mechanisms and automotive parts. (E. R. I)

ROYAL OBSERVER CORPS: *see* OBSERVER CORPS *IN* AIR DEFENSE

ROYAL PALM (*Roystonea*), a small genus of tropical American palms formerly known as *Oreodoxa.* They occur in southern Florida and the West Indies. *Roysfonea regia* is much planted as an ornamental, especially in avenues. *See* PALM.

ROYAL SOCIETY, THE, the oldest scientific society in Great Britain and one of the oldest in Europe. The Royal society (more fully. The Royal Society of London for Improving Natural Knowledge) is usually considered to have been founded in 1660, but a nucleus had been in existence for several years before that date. As early as the year 1645 weekly meetings were held in London of "divers worthy persons. inquisitive into natural philosophy and other parts of human learning, and particularly of what hath been called the *New Phzlosophy* or *Experzmental Philosophy*," and there can be little doubt that this gathering of philosophers is identical with the "Invisible college" of which Robert Boyle speaks in sundry letters written in 1646 and 1647.

Some of these "Philosophers," resident in Oxford about 1648 formed an association there under the title of the Philosophical Society of Oxford, and used to meet. most usually in the rooms of John Wilkins, warden of Wadham college A close intercommunication was maintained between the Oxford and London philosophers; but ultimately the activity of the society was concentrated in the London meetings, which were held principally at Gresham college.

On Nov. 28, 1660. the first journal book of the society was opened with a "memorandum," from which the following is an extract. "Memorandum that Novemb. 28, 1660, These persons following, according to the usuall custom of most of them, mett together at Gresham Colledge to heare Mr. Wren's lecture, viz., The Lord Brouncker, Mr. Boyle, Mr. Bruce, Sir Robert Moray, Sir Paul Neile, Dr. Wilkins Dr. Goddard. Dr. Petty, Mr Ball, Mr. Rooke Mr Wren, Mr. Hill. And after the lecture was ended, they did. according to the usuall manner. withdrawe for mutuall converse. Where amongst other matters that were discoursed of, something was offered about a designe of founding a Colledge for the promoting of Physico-Mathematicall Experimental Learning." It was agreed at this meeting that the company should continue to assemble on Wednesdays at three o'clock; an admission fee of 10*s*. with a subscription of 1*s*. a week was instituted; Wilkins was appointed chairman; and a list of 41 persons judged likely and fit to join the design was drawn up. On the following Wednesday Sir Robert Moray (or Murray) brought word that the king (Charles II) approved the design of the meetings; a form of obligation was framed, and was signed by all the persons enumerated in the memorandum of Nov. 28 and by 73 others. On Dec. 12 another meeting was held at which 5j mas fixed as the number of the society—persons of the degree of baron, fellows of the College of Physicians and public professors of mathematics, physics and natural philosophy of both universities being supernumeraries.

Gresham college was now appointed to be the regular meeting place of the society. Sir Robert Moray was chosen president (March 6, 1661) and continued from time to time to occupy the chair until the incorporation of the society, when Lord Brouncker was appointed the first president under the charter. In Oct. 1661 the king offered to be entered one of the society, and next year the society was incorporated under its present title. The name "Royal society" appears to have been first applied to the "Philosophers" by John Evelyn, in the dedication of his translation of a book by Gabriel Naudé, published in 1661.

The charter of incorporation passed the great seal on July 15, 1662, to be modified, however, by a second charter in the following year. repeating the incorporating clauses of the first charter but conferring further privileges on the society. The second charter passed the great seal on April 22, 1663, and was followed in 1669 by a third, confirming the powers granted by the second charter, with some modifications of detail, and granting certain lands in Chelsea to the society. The council of the Royal society met for the first time on May 13, 1663.

At this early stage of its history the "correspondence" which was actively maintained with continental philosophers formed an important part of the society's labours, and selections from this correspondence furnished the beginnings of the *Philosophical Transactions* (a publication now of world-wide celebrity). At first the publication of the *Transactions* was entirely "the act of the respective secretaries." The first number, consisting of 16 quarto pages, appeared on Monday, March 6. 1664–65, under the title of *Philosophical Transactions: giving some Accompt of the present undertakings, studies and labours of the Ingenious in many considerable parts of the world,* with a dedication to the Royal society signed by Henry Oldenburg, the first secretary of the Royal society. The society also from its earliest years published, or directed the publication of. separate treatises and books on matters of philosophy, most notable among these being the *Philosophiae naturalis principia mathematica Autore Is. Newton. Imprimatur: S. Pepys, Reg. Soc. Praeses. Julii j, 1686, 4to Londini 1687.*

In 1887 the *Philosophical Transactions* were divided into two series, labelled A and B. respectively, the former containing papers of a mathematical or physical character and the latter papers of a biological character. More than 480 quarto volumes had been published by 1955. In 1832 appeared the first volume of *Abstracts of papers, printed in the Philosophical Transactions from the year 1800.* This publication developed in the course of a few years into the *Proceedings of the Royal Society,* which has been continued up to the present time.

It is, however. certain that one of the most important functions of the society at its inception was the performance of experiments before the members. In the royal warrant of 1663 ordering the mace n-hich the king presented to the society, it is described as "The Royal Society for the improving of Natural Knowledge by experiments"; and during its earlier years the time of the meetings was principally occupied by the performance and discussion of experiments. The society early exercised the power granted by charter to appoint two "curators of experiments," the first holder of that office being Robert Hooke, who was afterward elected a secretary of the society.

Another matter to which the society gave attention was the formation of a museum, the nucleus being "the collection of rarities formerly belonging to Mr. Hubbard," which, by a resolution of council passed in 1666, was purchased for the sum of £100. This museum, at one time the most famous in London, was presented to the trustees of the British Museum in 1781, upon the removal of the society to Somerset house. A certain number, however, of instruments and models of historical interest have remained in the possession of the society. and some of them, more peculiarly associated with its earlier years, are still preserved at Burlington house. The remainder have been deposited in the Victoria and Albert museum, South Kensington.

After the Great Fire of London in Sept. 1666 the apartments of the Royal society in Gresham college were required for the use of the city authorities, and the society was invited by Henry Howard (later duke of Norfolk) to meet in Arundel house. At the same time he presented them with the library purchased by his grandfather Thomas, earl of Arundel, and thus the foundation was laid of the important collection of scientific works, exceeding 140,000 volumes, which the society possesses. Of the Arundel manuscripts the bulk was sold to the trustees of the British Museum in 1830 for the sum of £3,559, the proceeds being devoted to the purchase of scientific books. These manuscripts are still kept in the British Museum as a separate collection. The society, however, still possesses a valuable collection of scientific correspondence. official records and other manuscripts, including the original manuscript. with Newton's autograph corrections, from which the first edition of the *Principia* was printed.

Under date Dec. 21, 1671, the journal book records that "the lord bishop of Sarum proposed for candidate Mr. Isaac Newton, professor of the mathematicks at Cambridge." Newton was elected a fellow Jan. 11, 1671–72, and in 1703 he was appointed president, a post which he held till his death in 1727. During his presidency the society moved to Crane court, its first meeting in the new quarters being held on Nov. 8, 1710. In the same year they were appointed visitors and directors of the Royal observatory at Greenwich, a function which they continued to perform until the accession of William IV, when by the new warrant then issued the president and six of the fellows of the Royal Astronomical society were added to the list of visitors.

In 1780, under the presidency of Sir Joseph Banks, the Royal society removed from Crane court to the apartments assigned to it by the government in the new Somerset house, where it remained until its removal to Burlington house in 1857. The policy of Sir Joseph Banks was to raise the status of the fellowship. A step in pursuance of the same policy was taken in the year 1847, when the number of candidates recommended for election by the council was limited to 15, and the election was made annual. This was augmented to 20 in 1938, and seven years later the number was raised to 25. Concurrent with the gradual restriction of the fellowship was the successive establishment of other scientific bodies. The founding of the Linnean society in 1788 under the auspices of several fellows of the Royal society was the first instance of the establishment of a distinct scientific association under royal charter; and this has been followed by the formation of the large number of societies now active in the promotion of special branches of science.

From the time of its royal founder onward the Royal society has constantly been appealed to by the government for advice in connection uith scientific undertakings of national importance. The following are some of the principal matters of this character upon which the society has been consulted by, or which it has successfully urged upon the attention of, the government: the improvement and equipment of the Royal observatory. Greenwich, in 1710, when it was placed in the sole charge of the society; the change of the calendar in 1752; ventilation of prisons; protection of buildings and ships from lightning; measurement of a degree of latitude; determination of the length of a pendulum vibrating seconds; comparison of the British and French standards of length; the Geodetic survey in 1784. and the General Trigonometrical survey begun in 1791; expeditions to observe the transits of Venus in 1761. 1769 (commanded by Capt. James Cook). 1874 and 1882; the antarctic expeditions of 1772 (under Captain Cook, whose voyage extended to the circumnavigation of the globe), 1839 (under Sir James Clark Ross) and 1900; help with the reports of the British Antarctic expedition of 1910–13; observations for determining the density of the earth; arctic expeditions of 1817 (in search of the northwest passage), of 1819 (under Sir William Parry), of 1827 (Parry and Ross), of 1845 (under Sir John Franklin), of 1875 (under Sir George Nares); numerous expeditions for observing eclipses of the sun; 1822, use of coal tar in vessels of war; best manner of measuring tonnage of ships; 1823, corrosion of copper sheathing by sea water; Charles Babbage's calculating machine; lightning conductors for vessels of war; 1825, supervision of gasworks; 1832, tidal observations; 1835, instruments and tables for testing the strength of spirits; magnetic observatories in the colonies; 1862, the great Melbourne telegraph; 1865, pendulum observations in India; 1866, reorganization of the meteorological department; 1868, deep-sea research; 1872, "Challenger" expedition; 1879, prevention of accidents in mines; 1881, pendulum observations; cruise of the "Triton" in Faeroe channel; 1883, borings in delta of Nile; 1884, Bureau des Poids et Mesures; international conference on a prime meridian; 1888, inquiry into lighthouse illuminants; 1890, the investigation of colour blindness; 1895, examination of the structure of a coral reef by boring; 1896, inquiry into cylinders for compressed gases; the establishment of an International Geodetic bureau; 1897, determination of the relations between the metric and imperial units of weights and measures; an inquiry into the volcanic eruptions in the West Indies; international seismological investigation; international exploration of the upper atmosphere; measurement of an arc of the meridian across Africa. During 1913–17 the society completed a magnetic survey of the British Isles. In 1920 it sent two expeditions to observe the total solar eclipse of May 29, and to note any deflection of rays of light by the sun's gravitational field, as required by Albert Einstein's general theory of relativity. In later years also the society, acting at the request of the government, has taken the leading part in investigations, in the course of which important discoveries have been made: in relation to various tropical diseases, beginning with the tsetse-fly disease of cattle in Africa, followed by investigations into malaria, Mediterranean fever and sleeping sickness. In 1924 the society received a bequest of £10,000 for medical research on tropical diseases, etc., and sent an expedition to study kala azar in north China. The society has also shown an active interest in problems of respiration and circulation in high altitudes (Peru expedition, 1921), and in investigations into glassworkers' cataract. It has taken a leading part in the promotion of the *International Catalogue of Scientific Literature* and of the International Association of Academies.

In addition to the occasional services enumerated above, the Royal society has exercised, and still exercises, a variety of important public functions of a more permanent nature. It still provides seven of the board of visitors of the Royal observatory, has 11 representatives on the Joint Permanent Eclipse committee and has a Solar Research committee of its own. From 1877 until the reconstitution of the meteorological office in 1906 the society nominated the meteorological council, which had the control of that office. The Gassiot and other committees of the society continued to co-operate with the meteorological office. Since 1919, when the meteorological office was attached to the air ministry, the society has two representatives on the Meteorological committee. The society has the custody of standard copies of the imperial standard pard and pound. The president and council have the scientific control of the National Physical laboratory, an institution established in 1900 in pursuance of the recommendations of a treasury committee appointed by H.M. government in response to representations from the Royal society (the financial control was transferred to the Department of Scientific and Industrial Research in 1918). It also appoints the British delegates to the meetings of the International Research council.

One of the most important duties which the Royal society performs on behalf of the government is the administration of an annual grant of (in 1955) nearly £60,000 for the promotion of scientific research and the assistance of scientific publications. This grant originated in a proposal by Lord John Russell in 1849

that at the close of the year the president and council should point out to the first lord of the treasury a limited number of persons to whom the grant of a reward or of a sum to defray the cost of experiments might be of essential service. The majority of these grants are utilized to provide apparatus, and they are made with the advice of nine scientific boards of eight experts each.

A proposal for bursaries to assist investigators of proved ability to work in other parts of the commonwealth for short periods when this would augment their capacity to advance knowledge was put forward by Sir Edward Salisbury in 1952. This was implemented as the Royal Society and Nuffield Foundation Bursaries scheme, and is mainly financed by the Nuffield foundation and contributions from various countries of the commonwealth.

A statement of the trust funds administered by the Royal society will be found in the *Year Book* published annually, and the origin and history of these funds will be found in the *Record of the Royal Society*.

Five medals (the Copley medal, two royal, the Davy and the Hughes) are awarded by the society every year, the Rumford and the Darwin medals biennially, the Sylvester triennially and the Buchanan quinquennially. The first of these originated in a bequest by Sir Godfrey Copley (1709), and is awarded "to the living author of such philosophical research, either published or communicated to the society, as may appear to the council to be deserving of that honour"; the author may be an Englishman or a foreigner. The Rumford medal originated in a gift from Count Rumford in 1796 of 1,000 3% consols, for the most important discoveries in heat or light made during the preceding two years. The royal medals were instituted by George IV and are awarded annually for the two most important contributions to science published in the British dominions not more than ten years nor less than one year before the date of the award. The Davy medal was founded by the will of John Davy. F.R.S., the brother of Sir Humphry Davy. and is given annually for the most important discovery in chemistry made in Europe or Anglo-America. An enumeration of the awards of each of the medals and the conditions of the awards are published in the *Year Book*. In 1953 the Royal society and the Nuffield foundation jointly provided funds for a scheme of commonwealth bursaries.

Six special lectures endowed by the benefactors named are delivered to the society, namely the Croonian (William Croone, 1684), the Bakerian (Henry Baker, 1775) and the Ferrier (Sir David Ferrier, 1928), to be delivered triennially, on the advances in knowledge of the structure and function of the brain; the Wilkins (J. D. Griffith Davis, 1947) on the history of science; the Leeuwenhoek (George Gabb, 1948) on some microbiological subject; and, in 1952, lectures in memory of Lord Rutherford.

Under the existing statutes of the Royal society every candidate for election into the society must be recommended by a certificate in writing signed by six or more fellows, of whom three at least must sign from personal knowledge. From the candidates so recommended the council annually selects 25, and the names so selected are submitted to the society for election by ballot. Princes of the blood, however, and not more than two persons selected by the council on special grounds once in two years, may be elected by a more summary procedure. Foreign members, not exceeding 50, may be selected by the council from among men of the greatest scientific eminence abroad, and proposed to the society for election.

The anniversary meeting for the election of the council and officers is held on St. Andrew's day. The council for the ensuing year, which includes the president, treasurer, two scientific secretaries (one for the biological and one for the physical sciences) and a foreign secretary, must consist of 11 members of the existing council and ten fellows who are not members of the existing council. These are nominated by the president and council previously to the anniversary meeting. The president and foreign secretary normally hold office for five years, the two scientific secretaries and the treasurer for ten years. There is also a permanent assistant secretary who is not usually a fellow. The session of the society is from November to June; the ordinary meetings are held on Thursdays during the session, at 4:30 P.M. The selection for publication from the papers read before the society is made by the Committee of Papers, which consists of the members of the council for the time being aided by committees appointed for the purpose. The papers so selected are published either in the society's *Philosophical Transactions* (quarto) or *Proceedings* (octavo).

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(R. W. F. H.; A. Wo.; E. J. S.)

ROYALTIES. This article deals chiefly with authors' royalties for literary works. For the rights of authors of literary, musical and artistic works and international agreements providing copyright protection, *see* COPYRIGHT. (For a detailed account of laws protecting rights to make, sell or use products that are the result of invention or discovery, *see* PATENTS.) *See* also BOOKSELLING; PUBLISHING; and BROADCASTING: *Broadcasting* as a *Business*.

Payment by royalties based on a percentage of the published price is the customary method of sharing receipts between publisher and author from sales of a book. The amount of royalty agreed upon depends on the cost (including advertising) and the estimated sale of the book, as well as on the respective bargaining powers of publisher and author. Most contracts for fiction in the U.S. and Great Britain contain a provision for publication in cheaper editions and reprints.

Another phase of royalties is the advance. When it became apparent that the royalty system was fairer to publisher and author than the old system of payment outright for all rights, the author was prompt to point out that he might starve while waiting for his money—hence the publishers' custom of paying an advance on account of royalties. Authors whose previous sales had been large commanded proportionately large advances. When advances are paid to the author before any royalties are earned they are customarily made (1) upon the signing of the agreement, (2) upon delivery of the complete manuscript ready for publication and (3) on the publication date.

The usual practice of publishers is to sell the reprint edition rights, when possible, to firms who specialize in such editions, giving the author half of the royalties.

A compromise between the percentage royalty on the retail price of every copy sold and the outright payment for the copyright was extensively adopted by European publishers, the system being the payment of an outright sum for every 1,000 copies printed. The advance on such payment usually covers the number of copies printed in the first edition.

The royalty system underwent notable changes in the 20th century. It was formerly customary for the publisher to contract for the world rights of his author, reselling on a basis of half receipts to himself and half to the author such rights as he could not use—*e.g.*, foreign rights, serial rights, dramatic rights and, at first, motion-picture rights. But such contracts became rare, the author selling each right separately.

The same tendency was observable in play sales. If the play is sold first in England, the English manager claims a share in the U.S. rights and the film rights—and vice versa if the play is sold in the United States. If the author is in a strong position he claims and gets a separate royalty in each country for each right, with somewhat lower royalties for translation rights on account of the cost of translation and possibly adaptation. He also reserves the royalties obtainable on his amateur rights, broadcasting rights, and book publication rights.

In the United States the American Society of Composers, Authors and Publishers (ASCAP) was founded in 1914 to collect performing right royalties for allocation to members whose copy-

righted musical works are used in public performances for profit. Dissension between radio broadcasters and ASCAP led to the formation of Broadcast Music, Inc.. by broadcasters in the early 1940s; thereafter the two organizations competed.

Earlier Systems. — The royalty system became general only in the 19th century, although before that authors were occasionally paid a stipulated sum for the first impression of a book, and a further sum if a further impression were called for. Samuel Simmonds paid Milton £5 for *Paradise* Lost and agreed to pay a further £5 at the end of the sale of each of the first three impressions. Richard Baxter records that he arranged with Thomas Underhill and Francis Tyton to publish his *Saints' Everlasting Rest,* a quarto of nearly 1 000 pages, for a payment of £10 for the first impression and £20 for every subsequent impression up to 1665.

Sidney Lee records that the highest price known to be paid before 1599 to an author for a play by the manager of an acting company was £11. "A small additional gratuity, rarely exceeding 10s., was bestowed on a dramatist whose piece on its first production was especially well received, and the author was customarily awarded. by way of benefit, a certain proportion of the receipts of the theatre on the production of a play for the second time. The 19 plays which may be set to Shakespeare's credit between 1591 and 1599 combined with such revising work as fell to his lot during those nine years cannot consequently have brought him less than £200 or some £20 a year. Between 1599 and 1611 his remuneration as both actor and dramatist was on the upward grade. The fees paid dramatists rose rapidly. The exceptional popularity of Shakespeare's work after 1599 gave him the full advantage of the higher rates of pecuniary reward in all directions. The 17 plays that were produced by him between that time and the close of his professional career could not have brought him less on an average of £25 each, or some £400 in all." Later prices improved and Fielding, for example, received £1,000 from Andrew Millar for Amelia, while Gibbon received two-thirds of the proceeds on his history.

Edward Chapman, of Chapman and Hall, in a letter to Forster (1837) said: "There was no agreement about *Pickwick* except a verbal one. Each number was to consist of a sheet and a half, for which we were to pay 15 guineas, and we paid him for the first two numbers at once: as he required the money to go and get married with. We were also to pay more according to the sale, and I think *Pickwick* cost us altogether £3,000." Forster adds: "I had always pressed so strongly the importance to him of some share in the copyright that this at last was conceded in the deed above mentioned (though five years were to elapse before the rights should accrue) and it was only yielded as part consideration for a further agreement entered into on the same date (Nov. 19, 1837) whereby Dickens engaged to write a new work (*Nickleby*) the first number of which was to be delivered on the 15th of the following March and each of the numbers on the same day of each of the successive 19 months. which was also to be the date of the payment to him by Chapman and Hall, and 20 several sums of £150 each for five years' use of the copyright, the entire ownership in which was then to revert to Dickens.!'

On July 2, 1840, Dickens wrote to Chapman and Hall: "Your purchase of *Barnaby Rudge* is made upon the following terms: It is to consist of matter sufficient for ten monthly numbers of the size of *Pickwick* and *Nickleby,* which you are. however, at liberty to divide and publish in 1j smaller numbers if you think fit. The terms for the purchase of this edition in numbers and for the copyright of the whole book for six months after the publication of the last number are £3,000. At the expiration of six months, the whole copyright reverts to me." (C. BN.; X.)

See Philip Wittenberg, *Protection and Marketing of Literury Property* (Sew York, 1937); F. E. S. James (ed.), *Copinger and Skone James on the Law of Copyright,* 8th ed. (London, 1948); and Margaret Nicholson, *Manual of Copyright Practice for Writers, Publishers and Agents* (New York, 1956).

ROYALTIES, IN MINING. In some countries (*e.g.* France) minerals are owned by the state which may grant concessions to private individuals or corporations. In others (*e.g.* the United States) they belong to the landowner.

Until the coming into force of the Coal Mines act of 1938 all minerals in Great Britain — apart from special customs and excepting mines of gold and silver, which are the property of the Crown (*i.e.* "Royal" metals, hence the term "royalty")—were privately owned. But under the Coal Mines act the coal and associated mineral substances (fireclays, stratified ironstone) pass to the state under a system of compulsory purchase, the total amount of the compensation payable being £66,450,000. A Central Valuation board was appointed in Sept. 1938 to divide this amount as between the coal "regions" in accordance with the terms of the act. which specified that the amount allocated to each "valuation region" should bear the same proportion to the global figure as the value of all the principal coal hereditaments in the said region bears to the value of all such hereditaments in Great Britain.

The valuation of the individual ownerships, region by region, commenced in Jan. 1, 1939, the date determined by the act. from which date the coal was held as if all existing owners had entered into a contract for the sale of the coal to the Coal commission (a body set up by parliament to control the nationalized coal property, and clothed with certain other powers), the contract being completed on the "vesting date," July 1. 1942.

The royalty rent was made payable either (1) as a tonnage rate pure and simple. (2) a sum per acre per foot thick of coal in the seam, (3) simply a sum per acre as a proportion of the value of the mineral raised, or (4) by way of a sliding scale. The first two proved to be the methods most commonly adopted. In the case of metalliferous ores. both in Great Britain and in other countries, the royalty is assessed as a proportion of the .'dressed' ore (*i.e.* as ready for smelting) : *e.g.* 1/20th to 1/30th. China clay, ganister, and other "clays." oil shale, slate! building stone, and stratified ironstone are also subject to royalty.

In the Cnited States the royalty payable on coal is usually based upon a fixed rate per ton, which in the case of bituminous coal would be a uniform rate for all coal sold; but in the case of anthracite the rate per ton frequently varies with the size, a higher royalty being paid upon larger sizes; and. in some instances, the royalty is a sliding scale varying with the sale price. Royalties vary from a few cents per ton in the case of bituminous. to as much as $1.00 per ton for the highest grades and largest sizes of anthracite.

Natural petroleum does not occur in commercial quantity in Great Britain, but in the United States, where it is produced in vast quantities, oil lands are usually leased on a royalty basis, the royalty being paid to the owner of the land on a percentage of the oil produced. In the case of natural gas, royalties are rarely paid on a percentage basis, but usually as a stipulated amount for the right to pipe and sell the gas.

Crude oil for royalty purposes usually means crude oil after deduction of water, foreign substances, and oil consumed in production. (R. R.; X.)

ROYAN, a town of W. France, in the department of Charente-Maritime, on the right bank of the Gironde at its mouth 63 mi. below and N.N.W. of Bordeaux. Pop. (1954) 11,256. It belonged to the family of Trémoille. in whose favour it was made first a marquisate and then a duchy. During the first half of the 15th century it was held by the English. During the wars of religion it was the centre of Calvinism and in 1622 was besieged by Louis XIII. At the end of the 18th century it had about 1,000 inhabitants and was noticeable only for its priory. Its prosperity dates from the Restoration, when steamboat communication was established with Bordeaux.

ROYCE, JOSIAH (1855–1916), American philosopher and teacher, mas born at Grass Valley, a California mining town, on Nov. 20. 1855. At 16 he entered the newly-opened University of California. inclined to the study of engineering. But the teaching of Joseph LeConte, the geologist, and of Edward Rowland Sill, the poet, roused his extraordinary speculative power; and on receiving his baccalaureate degree, 187j, he gave himself to the study of philosophy, first in Leipzig and Gottingen (under Lotze) and then. as one of the first fellows of Johns Hopkins university, with William James and Charles Peirce. Here he received the degree of Ph.D., 1878. After teaching English for four years in

the University of California he was called to Harvard university as lecturer in philosophy, becoming assistant professor in 1885, professor in 1892 and succeeding George Herbert Palmer as Alford professor in 1914. He received various honorary degrees and was made in 1916 Honorary Fellow of the British Academy. He died at Cambridge. Mass., Sept. 14. 1916.

His effect as teacher and writer was profound: no previous American thinker had so united moral energy with wide historical learning, command of scientific method and intense interest in logical technique. His versatile mind concerned itself effectively with a wide range of subjects; he contributed to mathematical logic, psychology, social ethics. literary criticism and history as well as to metaphysics. His thought was massive and intimately human; yet it was sustained with a dialectical skill of such evident virtuosity as, on the one hand, to excite the critical opposition first of pragmatic and then of realistic schools, and, on the other hand, to set a new standard in the systematic treatment of philosophy. In this latter respect, Royce did for American philosophy what his older contemporary, F. H. Bradley. did for British philosophy: in many ways the views of these thinkers are akin. Like Bradley, Royce teaches a monistic idealism. Scientific laws he describes — anticipating certain developments of recent physics — as statistical formulae of average behaviour. His absolute idealism is supplemented, not corrected, by the ethical and social teachings of his later years and, in particular, by the conception of the world of human selves as the Great Community, the literally personal object of moral loyalty.

BIBLIOGRAPHY—Among his more important publications (selected from a far greater number) are: *The Religious Aspect of Philosophy* (1885); *The Spirit of Modern Philosophy* (1892); *The Conception of God* (1895), with Supplementary Essay (1897); *Studies of Good and Evil* (1898); *The World and the Individual* (Gifford Lectures), vols, i , ii. (1900–01); *The Conception of Immortality* (1900); *Outlines of Psychology* (1908); "The Relation of the Principles of Logic to the Foundations of Geometry," in *Transactions of the American Mathematical Soc.,* vi., 3 (1905); *The Philosophy of Loyalty* (1908); *The Sources of Religious Insight* (1912); "Prinzipien der Logik," *Enzyklopädie der Philosophischen Wissenschaften,* Bd. i. (1912), English translation in *Encyclopaedia of the Philosophical Sciences,* vol. i. (1913); *The Problem of Christianity* (lectures delivered at the Lowell Institute, Boston, and at Manchester college, Oxford), vols. i., ii. (1913); "The Mechanical, the Historical and the Statistical," *Science,* n.s. xxxix. (1914); *Lectures on Modern Idealism* (1919). For a bibliography (exclusive of posthumous publications) *see* B. Rand, *Philosophical Rev.,* xxv. (1916). (M. W. C.; W. E. H.)

ROYDEN, AGNES MAUDE (1876–1956), one of the first British women preachers and pastors, was born in Liverpool, Nov. 23, 1876. After social and pastoral work, in 1908 she became a member of the executive of the National Union of Suffrage societies. In 1914 she decided to prepare for the ministry, and as women were not allowed to preach in the Anglican church, in 1917 became assistant at the Congregational City Temple. London, although remaining an Anglican. In 1920 she started undenominational services at Kensington and in 1921 founded the Guildhouse, Eccleston square, where she remained until 1936, gathering a large following by her magnetic personality, zeal for social reform and power as a preacher. Her books included Prayer as a *Rorce* (1923); *Sex and Commonsense* (1922); *Here—and Hereafter* (1933); and *A Threefold Cord* (1947), the story of her love for Rev. W H. Shaw (1859–1944), whom she married in 1944. She died in London, July 30, 1956

ROYER-COLLARD, PIERRE PAUL (1763–1845), French statesman and philosopher, was born on June 21, 1763, at Sompuis, near Vitry le Français (Marne), the son of Antoine Royer, a small proprietor. He was sent to the college of Chaumont of which his uncle, Fr. Paul Collard, mas director. He folloued his uncle to St. Omer, where he studied mathematics. At the outbreak of the Revolution he was practising at the Parisian bar. He was returned by the Island of Saint Louis to the Commune, of which he was secretary from 1790 to 1792. After the revolution of Xug. 10, 1792, he was replaced by J. L. Tallien. His sympathies were now with the Gironde, and after the insurrection of 12 Prairial (May 31, 1793) he was in danger of his life. He returned to Sompuis, and was saved from arrest possibly by the protection of Danton. In 1797 he was returned by his *département* (Marne) to the Council of the Five Hundred. He made one great speech in the council in defense of the principles of religious liberty, but retired into private life at the coup d'état of Fructidor (Sept. 4, 1797).

From that time until the restoration Royer-Collard devoted himself to the study of philosophy. His opposition to the philosophy of Condillac arose from the study of Descartes and his folloners. and from his early veneration for the fathers of Port Royal. He desired to establish a system which should provide a moral and political education consonant with his view of the needs of France. From 1811 to 1814 he lectured at the Sorbonne.

Royer-Collard was the moving spirit of the "Doctrinaires," led by Guizot. P. F. H. Serre, Camille Jordan and Charles de Rémusat, who met at the house of the comte de Ste. Aulaire and in the salon of the duchesse de Broglie. In 1820 Royer-Collard was excluded from the council of state by a decree signed by his former ally Serre. In 1827 he was again elected; in 1828 he became president of the chamber, and fought the reactionary policy which precipitated the revolution of July. In March 1830 he presented the address of the 221. From that time he took no active part in politics, although he retained his seat in the chamber until 1839. He died at his estate of Chbteauvieux, near Vitry, on Sept. 2, 1845. He had been a member of the Academy since 1827.

Fragments of Royer-Collard's philosophical work are included in Jouffroy's translation of the works of Thomas Reid. The standard life of Royer-Collard is by his friend Prosper de Barante, *Vze politique de M. Royer Collard, ses discours et ses écrits* (2 vols., 1861). *See* E. Faguet, *Politique et morale du xix^e siècle* (1891); *H.* Taine, *Les Philosophes français du xix^e siècle* (1857); L. Séché, *Les Derniers Jansénistes* (1891); and Lady Blennerhasset, "The Doctrinaires" in the *Cambridge Modern Hzstory* (vol. x. chap. ii., 1907).

ROYSTON, a market town and urban district in the Hitchin parliamentary division of Hertfordshire, Eng., 13½ mi. S.S.W. of Cambridge by road, where Icknield way crosses Ermine street. Pop. (1961) 6,160. Its industries are agricultural, the Wednesday produce market being of ancient origin. Royston priory stands where a house of Austin canons was founded by Ralph of Rochester. The hooded or Royston crow is said never to winter south of Royston.

ROYTON, an urban district in the Heywood and Royton parliamentary division of Lancashire, Eng., to the north of Oldham, with which it is contiguous. Pop. (1961) 14,476. It owes its rise to the cotton trade

ROZAS, JUAN MARTINEZ DE (1759–1813), the earliest leader in the Chilean struggle for independence. was born at Mendoza in 1759. In early life he was a professor of law, and of theology and philosophy at Santiago.

He was acting governor of Concepción at one time, and was also colonel in a militia regiment. In 1808 he became secretary to the last Spanish governor, Francisco Antonio Carrasco, and used his position to prepare the nationalist movement that began in 1809. After resigning as secretary, Rozas was mainly responsible for the resignation of the Spanish governor, and the formation of a national Junta on Sept. 18, 1810, of which he was the real leader. Under his influence many reforms were initiated, freedom of trade was established, an army was organized and a national congress was called in July 1811. Rozas died at Mendoza March 3, 1813.

RUANDA-URUNDI, a former United Nations trust territory in east-central Africa which, from July 1, 1962, became two independent states with the official names of Rwanda and Burundi. The area is bounded on the north by Uganda, on the east and south by Tanganyika and on the west by the Republic of the Congo (Kivu province). Area 20,916 sq.mi. (Rwanda 10,169 sq.mi.; Burundi 10,747 sq.mi.). Pop. (1960 est.) 4,941,000.

The greater part of the country is mountainous and lies at a high altitude. The Luvironza river in southern Urundi is considered to be the remotest headstream of the Nile. Most of the people are Hutu (Bahutu) peasants, of Bantu stock, but 10%–15% are Tutsi (Watutsi), of Hamitic origin, who were the former ruling caste. There are a small number of pygmy Twa (Batwa). In the early 1960s there were still about 3,000 Europeans (chiefly Belgians), though many of these were leaving the area, and about 2,500 Asians.

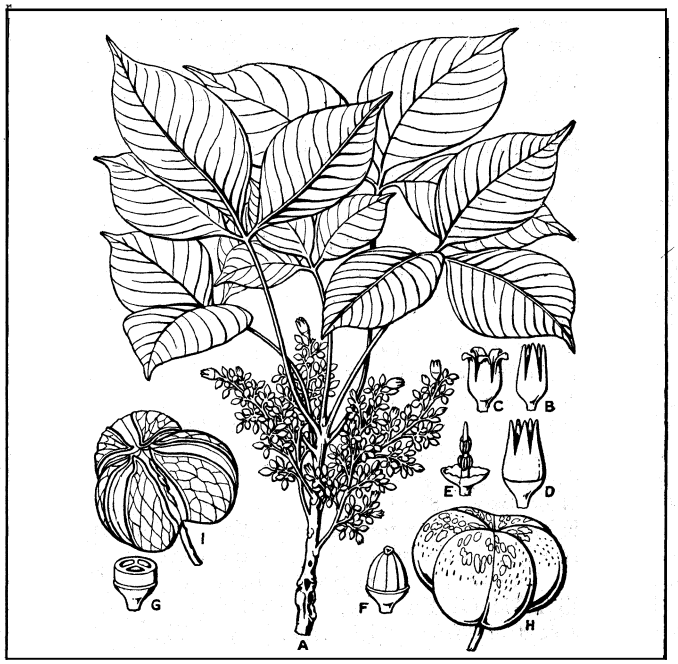
As a result of the distance from the sea and lack of cheap transport, trade developed slowly. The only major cash crop is coffee,

with an average annual production of 32,000 tons, though this fell substantially with the breakdown in organization following the departure of Belgian officials. Most of the people live by subsistence farming with a low standard of living, and in the early 1960s both countries were overpopulated and underdeveloped. With independence, it was decided to retain a degree of economic interdependence, in customs, telecommunications and foreign exchange. in order to make the two states viable.

The new state of Burundi is a constitutional monarchy and has its capital at Usumbura (pop. [1959 est.] 45,714). The new state of Rwanda is a republic headed by a president and a premier. Its capital is Kigali (pop. [1959 est.] 4,173). There are no railways. Roads totaled 4,803 mi., including 216 mi. of principal roads.

After World War I Belgium assumed administration under a mandate of the League of Nations. Ruanda-Urundi had previously been a part of German East Africa. In Dec. 1946 the United Nations placed it under CN trusteeship. Under the law of Aug. 21, 1925. Ruanda-Urundi was organized as an integral part of the Belgian Congo. from which it was separated in 1960 when the Belgian Congo gained its independence It continued under Belgian administration until the formation in 1962 of the two independent states. (P. W. I.; X.)

RUBBER: BOTANY, CULTIVATION AND CHEMISTRY. During his second visit to South America, Columbus was astonished to see the native Indians amusing themselves with a black, heavy ball made from a vegetable gum. Later explorers were equally impressed by these balls, and an historian of the time remarked that they rebounded so much that they appeared alive. Three centuries elapsed before the material was brought into commercial use in Europe, and it was then marketed not for its elastic properties but to rub out lead pencil marks—hence the name indiarubber or rubber. Since then the principal constituent (caoutchouc) of this material has been found as a vegetable product in many parts of the world, sometimes mixed with as little as one twentieth and sometimes with eight times its own weight of other substances. Some of these mixtures are strong and elastic, others are weak and brittle, but they are all classified as rubber. In addition, the term has been broadened by common use to include a wide range of vulcanised products derived from rubber by heating with sulphur, generally after mixing with large proportions of powders and plastic solids.



FROM "MEDIZINAL PFLANZEN" (KOEHLER)

FIG. 1—HEVEA BRASILIENSIS

(A) Sprig bearing trifoliate leaves and several inflorescences, (B, C, D) detached naked unisexual flowers, (E) androecium, (F) gynaecium, (G) section through the trilocular ovary, (H) ripe, (I) dehiscent capsule, showing the large oleaginous seeds

Although raw rubber is a coherent, elastic solid, it is obtained from a milky liquid known as *latex,* which occurs in special tubes in the roots, stem, branches, leaves and fruit of a wide variety of trees growing for the most part in the tropics. Rubber latex consists of a watery solution (serum), in which float small globules of rubber visible under a microscope. Although neither the rubber nor the serum is definitely opaque in thin layers, the many reflecting surfaces presented by these globules cause the latex to have the appearance of cows' milk, but whereas cows' milk contains only about 12% solid matter, rubber milk contains 30–40%. When rubber milk is suitably treated the globules unite (coagulate) and float in the serum as a soft, doughy mass (coagulum), which can be easily rolled to a sheet or other convenient form. On drying the coagulum loses its doughy character and becomes the firm, elastic solid known as raw or crude rubber.

Sources of Supply.—The numerous varieties of trees which contain rubber latex belong to many different botanical families, but nearly the whole of the world's rubber supply is obtained from a tree known as *Hevea brasiliensis* belonging to the family Euphorbiaceae. The rubber obtained from the latex of this tree usually contains over 90% caoutchouc of excellent quality. Few other trees furnish rubber of a purity and quality approaching this. In some cases the latex yields a product which consists chiefly of resin. Jelutong rubber, for example, obtained from *Dyera costulata,* a large tree growing in the East Indies, is very resinous, as also is the rubber produced from shrubby species of *Euphorbia* indigenous to South Africa.

Certain tropical African plants yield rubber of good quality, but the methods of preparation employed by the natives are crude and tend to degrade the product. The most important are *Funtumia elastica,* a tall and stately tree, and various species of *Landolphia,* which are big woody climbers.

A tree which is well known because it is cultivated in Europe as an ornamental plant under the name of the indiarubber tree is *Ficus elastica,* indigenous to Assam and Burma, where it grows to a considerable size. It yields moderately resinous rubber.

Guayule rubber from *Parthenium argentatum*—*a* silvery-leafed shrub found in north Mexico and is also moderately resinous.

The tropical American rubbers include Ceara rubber from *Manihot Glaziovii,* a tree of moderate size growing in Brazil, and Caucho rubber from *Castilloa elastica,* a large tree found in Central America and portions of Brazil. In both cases tlie rubber is of fairly good quality. The purest and best, however, is undoubtedly the Para rubber obtained chiefly from *Hevea brasiliensis* and to a lesser extent from *Hevea Benthamiana.* Both these trees are found in the Amazon valley. the former around the southern and the latter around the northern tributaries. *Hevea Benthamiana* is not so widely distributed as *Hevea brasiliensis,* but both yield rubber which is classed as "hard fine para'—the highest grade on the market.

Origin of Plantations.—At one time the trees in the Amazon valley were the only source of *Hevea* rubber, but as early as 1834 Thomas Hancock (the English rubber manufacturer who, after examining samples made by Charles Goodyear, discovered that sulphur alone is sufficient to efiect the vulcanization of rubber) called attention to the high price of rubber and the possibility of growing it in the East. The requisite climate conditions appeared to be a heavy, well-distributed rainfall (about 100ins. per annum) and a temperature of 70°–90° F. These conditions are obtained over wide areas in the East. Eventually Sir Joseph Hooker, Director of the Royal Botanical Gardens, Kew, London, interested himself in the problem, and in 1873 2,000 Hevea seeds from the Amazon were delivered to Kew by a Mr. Farris. Only a dozen germinated, and six sent to the Royal Botanical Gardens, Calcutta, did not thrive. Arrangements were then made for further supplies of seeds. The most successful collector was H A. Wickham (now Sir Henry Wickham) who displayed much enterprise and care in successfully bringing to Kew a consignment of 70.000 seeds of *Hevea brasiliensis.* Hot houses were summarily emptied, and within two weeks of the arrival of

the seeds in England there were over 2,000 young plants, nearly all of which were despatched to Ceylon, where they proved very successful.

After the establishment of Hevea trees in Ceylon steps were taken to distribute plants and seeds to other countries. Difficulties were experienced in exporting seeds in a sound condition, and the problem was studied by H. N. Ridley in the Botanical Gardens at Singapore. He found that seeds packed in moist, powdered charcoal retained their fertility for a long time, and when shortly after the beginning of the twentieth century planters began to take an increasing interest in rubber, large quantities of seeds were distributed by this means from Malaya.

The countries producing the largest quantities of plantation rubber are Malaya, the Dutch East Indies, and Ceylon. Smaller amounts are also obtained from India, Sarawak, Borneo, French Indo-China, Siam and various parts of Africa. Owing chiefly to the demands of the motor car industry the production of plantation rubber has made phenomenal progress. The first occasion on which a considerable amount of plantation rubber was offered on the market was in 1910, when the output reached 11,000 tons. By 1920 it was nearly 317,000 tons and in 1927 it amounted to 567,000 tons. In this period there were wide fluctuations in price, ranging from 12s. od. per lb. in 1910 to 7½d. per lb. in 1921.

While the production of plantation rubber has continued to increase that of wild rubber has decreased until in 1927 the world's production of all grades of wild rubber was only 6% of that produced on plantations. The reason for this is that not only is plantation rubber of good quality, comparable with that from the Amazon, but it is put on the market in a clean, dry condition.

Description of Principal Rubber **Tree.**—*Hevea brasiliensis* is a large tree which on occasions grows to a height of over 100ft. with a well developed trunk more than 12ft. in circumference. The usual height on plantations is from 60 to Soft. The leaves are three-lobed, the segments being long and narrow and tapering at each end. The flowers are usually pale green and inconspicuous, separate male and female flowers being borne on the same tree. The fruit is a capsule containing three seeds which are oval and have a mottled brown, smooth coat. When ripe the capsules explode violently and eject the seeds to a distance of 20yd. or more, well beyond the shadow cast by the parent tree.

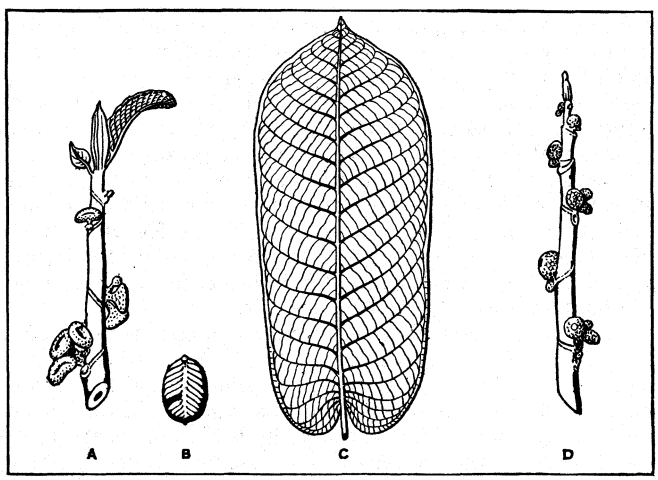


FIG. 2.—CASTILLOA ELASTICA
(A) Sprig bearing **male** flowers, **(B)** a **seed, (C)** a leaf, **(D)** twig bearing female flowers

The structure of what is popularly known as the bark is of considerable importance in Hevea *brasiliensis*, because, as already indicated, the latex vessels in this part of the tree are the chief source of the world's rubber supply. The trunk of a tree may be divided roughly into an inner portion of wood and an outer portion of bark. At the junction of the bark and the wood is a layer of cells about the thickness of a sheet of paper, known as the cambium, which appears as a slimy layer when the bark is torn away from the tree. This layer is the seat of growth, on the one hand adding new cells to the wood and on the other new cells to the bark. Next to the cambium and in the soft portion of the bark are found the latex tubes. Outside the soft bark is a hard portion where there are comparatively few latex tubes. The whole is protected by an external layer of cork. The diameter of the latex tubes is considered to be about 0·0015 inch.

Cultivation.—*Hevea* brasiliensis is planted on many types of soil and thrives remarkably well as long as reasonable precautions are taken to avoid swampy, undrained or exposed lands. It is sometimes grown at an altitude of over 2,000ft., but the trees do not flourish so well at this altitude as at a lower level.

In opening up a new plantation the land is cleared of all growth as soon as possible not only to make room for the rubber trees but also to avoid the possibility of disease from rotting timber.

At one time it was the practice on rubber plantations to remove all weeds and leave bare the ground between the trees, but this is no longer regarded as an attribute of a well-kept estate. It is still the practice to remove the weeds, but heavy tropical rains have caused such loss of top-soil, particularly on sloping land, that many estates find it necessary to plant cover crops. Shrubby types of plants such as species of *Crotalaria* and *Tephrosia* which are periodically lopped and mulched into the soil, or herbaceous types such as *Centrosema pubescens* and *Vigna oligosperma* are among those used.

On sloping land cover crops are not sufficient to prevent the loss of valuable top-soil. In Ceylon for example stone walls are sometimes built across the hills. As a general rule however it is considered better to level the land in a series of contours about 15 to 20ft. apart, cutting into the side of the hill at a slight gradient to a depth of about six feet.

The loss of top-soil can also be reduced by drains which prevent the accumulation of a continuous stream of water during heavy rain. In Ceylon a series of lateral drains empty into main drains (herring-bone drains) which carry the water away, but in Malaya and Sumatra the water is trapped in blind drains (silt pits) from which it ultimately percolates into the soil.

Where considerable erosion has taken place or the soil has been impoverished by previous cultivation it is sometimes possible to effect great improvement in the health of the trees by the addition of manures, particularly those containing nitrogen and phosphorus. This increased health is reflected in a more vigorous canopy of leaves, better replacement of bark removed for collection of latex, and a greater yield of latex.

The number of trees planted per acre on estates is largely dictated by local conditions, such as the quality of the soil and the contour of the land. Most estates plant out more trees than will eventually be required and thin them out, removing weak ones or those which prove low yielders, leaving about 90 trees per acre.

The rubber tree is by no means free from disease but a careful watch is kept by scientific officers, and nowhere in the East have the diseases assumed serious proportions. The most troublesome are an abnormal leaf-fall (not to be confused with that which occurs while the trees are wintering) and a pathological condition of the bark often associated with heavy tapping. Measures have been devised to counteract both, but they still occur.

Selection of Planting Material.— Most trees on estates yield 4 to 5lb. of rubber per annum, but there are a few which yield as much as 30lb. growing by the side of others which yield only 2-lb. As yield capacity is partly hereditary, it seems probable that the yield per acre may be greatly increased by propagating from high-yielding trees only. For this purpose two methods of propagation have received considerable attention. In one the plants are raised from seeds from carefully selected high yielding mother-trees. In the other a bud from a high yielding mother-tree is grafted on to a vigorous young plant grown from seed. Unless special care is taken a high yielding mother tree is liable to be fertilised by pollen from neighbouring low yielders, so that the daughter trees grown from seed may not be particularly good yielders. On the other hand it is to be expected that the budded material will have the vegetative characteristics of the mother tree.

Tapping.— The trees are ready for tapping for latex when about five years old, but the yield of latex and the quality of rubber obtained are not so good as when the trees are a few years

older. Tapping is a very delicate and important operation, consisting in the removal of a shaving of bark with a sharp knife. The cut passes through the latex tubes and there is a flow of latex in consequence. If the cut is too deep, it penetrates into the cambium and bark renewal is hindered, but if it is not deep enough only a portion of the latex tubes are pierced and the yield of latex is reduced. For perfect tapping it is necessary to cut within $\frac{1}{25}$ in. of the wood, an operation requiring practice and skill.

The only tapping tools in general use on the plantations are a gouge (straight or bent) and the ordinary farrier's knife (or its modification).

It is the usual practice to make the first cut at between two and four feet from the ground. A shaving is then taken at definite intervals of time from the lower edge of the exposed bark. The thickness of the shaving removed is so arranged that the consumption of bark is between half an inch and one inch per month, some districts, such as Ceylon,. preferring thin shavings while others, such as Malaya, prefer thicker shavings.

The length of the shaving varies from one-half to one-quarter of the circumference, some estates employing a single spiral cut at an angle of about 30° to the horizontal and some a V cut. In Ceylon it is the practice to change the tapping panel every six or twelve

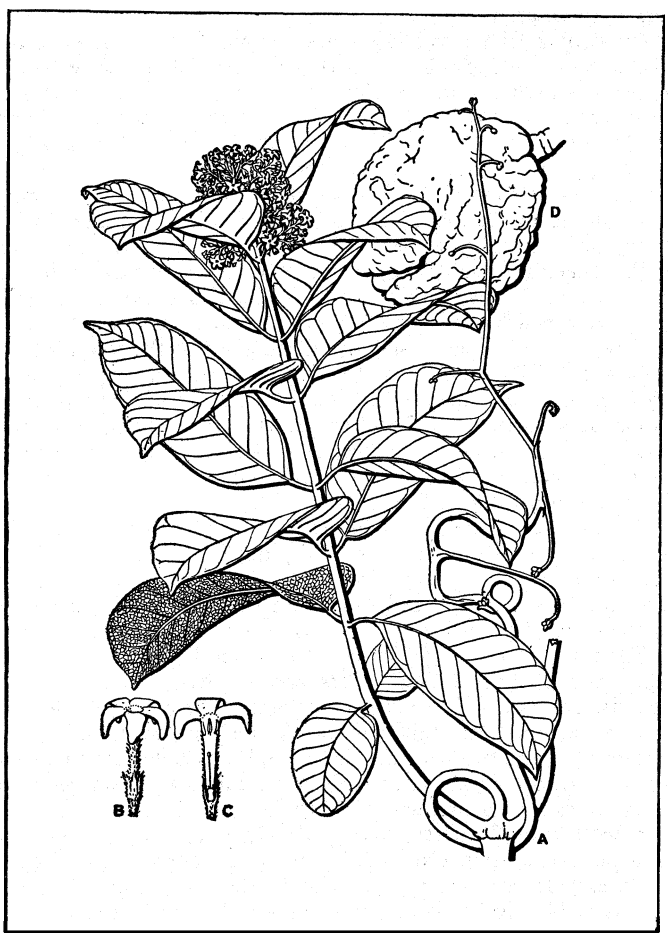


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FIG. 3.— LANDOLPHIA COMORENSIS

(A) Sprig bearing leaves and inflorescence, (B) detached flower, (C) vertical section through flower, (D) fruit

months, but elsewhere it is customary to continue tapping on one panel down to the ground before commencing a fresh panel. Tapping is generally carried out every alternate day, one portion of an estate being rested while the other is tapped.

After the bark has been cut away, it is regenerated complete with latex vessels in a few years. With the most conservative system it is eventually necessary to tap on renewed bark. As the replacement of bark becomes more difficult each time a panel is tapped, there is a limit to the economic life of the tree, but the industry is too young for definite information on this point.

Tapping operations are always carried out in the early morning when the flow of latex is greatest. The latex from each tree is collected in a cup, transferred to a pail and taken to the factory as quickly as possible. Sometimes sodium sulphite is added to prevent premature coagulation. When the latex has ceased to drip there remains on the bark a thin film which dries in the sun leaving a strip of rubber. This is collected, washed in the factory and sold as "tree scrap"—an inferior grade.

Preparation.- he details of the methods employed in the preparation of plantation rubber depend upon the shape and appearance of the product to be put on the market, but in nearly all cases the outlines of the procedure adopted are the same. The sieved and diluted latex containing 15–25% rubber is treated with a coagulant such as acetic or formic acid or sodium silicofluoride. This causes the rubber to rise to the surface as a wet, white, doughy coagulum leaving in solution a smail quantity of mineral and organic matter. The coagulum is then pressed between rollers until it is the required consistency, thickness and shape. After that it is hung to dry and eventually packed in wooden cases and shipped to its destination.

The two most important forms of plantation rubber are sheet and crêpe. Sheet is generally dark brown in colour because it is dried in smoke, whilst crêpe is a straw colour and is dried in air.

Sheet is obtained from latex coagulated in shallow tanks divided into compartments of suitable dimensions, each piece of coagulum being pressed by light machinery to the required thickness.

In the preparation of crêpe the coagulum is machined much more drastically, heavy rollers being necessary. During this process the coagulum is torn and pressed until it is sufficiently thin to dry in air without artificial heat. The rubber is dried by hanging on racks in well ventilated sheds for about a week.

Sheet is thicker than crêpe and requires artificial heat to dry it in a reasonable time. It is therefore exposed to the smoke of a wood fire for about 14 days. It was at one time presumed that smoking had a beneficial effect on quality because the highest grade rubber was obtained from the Amazon where the latex is coagulated with smoke, a wooden paddle being repeatedly dipped into the latex and exposed to the smoke of burning Urucuri nuts until a fairly large sized ball of rubber is built up. Experimental evidence does not support this view however and it is probable that as firewood becomes more difficult to obtain other means of drying sheet rubber will be developed on estates.

Both crêpe and sheet are sold largely on appearance. It is customary therefore to add sodium bisulphite to latex when preparing crêpe so that the rubber may be as pale as possible, and p-nitrophenol to latex in the preparation of sheet so that the development of mould may be prevented. Sheet rubber contains more mechanically enclosed serum substances than crêpe and is therefore a more suitable medium for the growth of mould. Not even drying in smoke entirely prevents this when conditions are favourable, but p-nitrophenol is an effective safeguard.

A considerable proportion of plantation rubber is prepared on native estates without machinery of any kind. In these cases the latex is coagulated with a convenient coagulant, not necessarily a suitable one. Sulphuric acid and alum have been used for this purpose although they affect adversely the behaviour of the rubber during manufacturing processes. The coagulum is lightly pressed by hand and whilst still wet is sent to a central factory where it is milled to crêpe and sold as an inferior grade of rubber.

Chemistry.— The microscope has been particularly useful in yielding information concerning the structure of rubber latex. The array of globules dancing here and there (Brownian movement) are easily seen at moderate magnifications, and it is possible to measure them and show that they vary in shape and size. In Hevea latex the globules are shaped like a pear and vary in length from 0·00002in. to six times that size. In spite of their minute size the expert has been able to ascertain that the globules in Hevea latex consist of an outer skin of non-rubber material, enclosing a viscous rubber shell surrounding semifluid rubber.

When Hevea latex is treated with any but very weak acids, the Brownian movement of the globules ceases, and they unite to form a coherent coagulum. Dehydrating agents such as alcohol and pro-

tein precipitants such as tannic acid also cause Hevea latex to coagulate.

In the presence of suitable proportions of an alkali such as ammonia or caustic soda, Hevea latex retains its liquid condition for many years, but in the absence of such additions bacterial action occurs, acids are developed and the latex quickly coagulates. Disinfectants also have a preserving effect on latex.

As already indicated, undiluted Hevea latex usually contains 30–40% of rubber. There are also present a number of other substances, amongst which by a remarkable chance are small quantities of compounds essential to the commercial applications of the product. When latex is coagulated with an acid only a portion of the accessory substances are coagulated with the rubber. The rest remains in the serum. The active non-rubber substances still mixed with the rubber are ample, however, to satisfy commercial requirements. For this reason methods of preparing rubber by evaporating latex have not met with general approval. In such cases the pure rubber may only amount to 85% of the solid material, whereas commercial crêpe and sheet prepared by acid coagulation may contain as much as 95%.

The following table shows the average percentage of the different non-rubber substances in dried Hevea latex in comparison with the amounts present in crêpe and sheet.

Non-rubber constituent	*Amount present in*	
	Dried latex per cent	*Crêpe and Sheet* per cent
Protein and nitrogenous matter	4–5	2
Constituents soluble in acetone	4–5	3
Mineral matter (ash)	1½	0·3
1-methyl inositol	1½	traces
Sugars	½	traces

Some of the constituents of the accessory substances are particularly active in accelerating vulcanisations and are therefore of great importance to the rubber manufacturer. A similar effect may also be produced by another of the accessory substances, viz., the ash which consists chiefly of potassium compounds.

Constituents soluble in acetone (a solvent which does not affect the rubber portion of the product) contain an appreciable amount of fatty acids such as oleic and stearic which dissolve and disperse some of the mineral powders mixed with rubber during commercial operations. The acetone-soluble material also contains a substance (allied in chemical composition to the sterols) which is particularly useful in preserving vulcanized rubber goods against the effects of atmospheric oxidation, so that they remain supple and elastic for a longer period than they otherwise would.

Pure rubber (caoutchouc) is a compound containing carbon and hydrogen only, in the proportion corresponding to five atoms of carbon and eight of hydrogen (C_5H_8). It belongs to the class of bodies known as terpenes and is related in chemical composition to the constituents of turpentine.

The specific gravity of rubber is a little less than that of water. It decreases regularly with increase of temperature except between 30 and 35° C when the decrease is greatly accelerated. At the temperature of liquid air rubber is transparent and brittle like glass. At 0–10° C it is hard and opaque, but quickly reverts to a soft and translucent condition above 20° C. As the temperature increases the rubber becomes softer, stickier, weaker and less elastic. These changes are greatly accelerated at temperatures of 50–60° C. At a little below 200° C rubber decomposes yielding liquid hydrocarbons of the terpene series.

When rubber is repeatedly pressed between rollers it becomes more plastic and sticky and less elastic. While in this condition large quantities of powders and plastic solids may be mixed with the rubber merely by repeatedly passing through rollers.

Rubber is insoluble in water and is unaffected by alkalis or moderately strong acids, but these substances may react with the non-rubber accessory substances present. Rubber is dissolved by benzol, petrol, carbon disulphide, chlorinated hydrocarbons, etc. It forms compounds with halogens, halogen acids, ozone, certain oxides of nitrogen, chromyl chloride and certain metallic halides. It is oxidized by nitric acid, potassium permanganate and hydrogen peroxide. It is also slowly affected by atmospheric oxygen, particularly in the presence of copper salts. It is reduced by hydrogen in the presence of a catalyst.

When rubber is heated at 120–160° C with sulphur it forms a product known as vulcanized rubber, which is stronger, more elastic and less affected by changes of temperature than the raw material. It is also insoluble in all the usual solvents. These changes are considerably modified by the amount of sulphur and heat applied and also (although to a lesser extent) by powders and other substances which may have been mixed with the rubber.. With suitable adjustments it is possible to obtain from the raw materials a product which is as soft and elastic as an inner tube or as hard and brittle as a piece of vulcanite.

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RUBBER: PRODUCTION AND MANUFACTURE.

Columbus and Spanish explorers who followed him to the new world found the natives playing games with a ball made from latex, the fluid exudate of a tree. The first written reference to this gum was by Gonzalo Fernandez de Oviedo y Valdes in *La historia natural y general de las Indias*, published in Seville, 1535–57. The natives of tropical America referred to rubber by the names *Hevea*, "Olli" ("Ule"), "kik" and "cauchuc" (Spanish adaptation). In ancient Peru "cauchos" was regarded as one of three substances with magical properties. Charles Marie de la Condamine, who was dispatched by the French government in 1731 on an expedition to study the shape of the earth, sent back from the Amazon a dark-coloured resinous material from *Hevea* trees called caoutchouc, and reported: "Linen is covered with this material and used like oil-cloth at home; the natives make shoes of it which are waterproof. They also cover molds of earth, in the shape of bottles, with this material and when the resin is dry they smash the mold, take the pieces of earth out through the bottle neck, and have an unbreakable bottle which is useful for preserving all kinds of liquids." Some of the crude rubber found its way to England, where Joseph Priestley, discoverer of oxygen, observed that it rubbed out pencil marks and gave it the name rubber. By 1825 "gum boots" of native make were imported into the United States. These were soon to be made on wooden lasts supplied by Yankee traders. This business reached a volume of 462,230 pairs in 1842. In 1831 similar shoes, made in a factory in the United States by coating fabric with a solution of rubber in turpentine, proved unsatisfactory as the rubber became soft in summer and stiff in winter and was degraded by turpentine. People in Europe and America who had taken an interest in rubber became disgusted with its limitations. The German F. Ludersdorff, 1832, and the American Nathaniel Hayward had found sulphur effective in lowering the tendency of rubber to grow sticky. Yet, it was Charles Goodyear's experiment (Jan. 1839) in cooking a mixture of rubber, white lead and sulphur on a kitchen stove that pointed the way to the commercial use of rubber. Thomas Hancock in England, working on the same problem, was shown samples made by Goodyear. The sulphur bloom on these samples prompted him to heat raw rubber in molten sulphur which effected "vulcanization" of the rubber as his friend William Brockedon termed the operation. Hancock patented his discovery in England in 1843, while Goodyear's U.S. patent was issued in 1844.

The discovery of hot vulcanization led to great activity in the manufacture of rubber in Europe and the U.S. In the United States, rubber footwear, waterproofed clothing, bumpers for railway cars, rubber balls and other articles were made until, by 1858, 10,000 workers, located mainly in New England and New Jersey, were engaged in making rubber goods valued at nearly $5,-

000,000. In 1870 rubber manufacturing was started in Akron, O., by The B. F. Goodrich Co., followed in the late 1890s by the Diamond Rubber Co. (purchased by The B. F. Goodrich Co. in 1912), the Firestone Tire and Rubber Co. and the Goodyear Tire and Rubber Co. By 1910 Akron had become the greatest centre of rubber manufacture in the world. The manufacture of rubber articles at mid-20th century was being conducted on every continent and in all parts of the world, but most extensively in the United States, United Kingdom, France, Canada and Germany. Important types of manufactured rubber goods include transportation items (used in the assembly of automobiles, aeroplanes, farm machinery, bicycles and other vehicles; see TIRE); industrial products (belting, hose, packing, jar rings, typewriter platens, shock absorbers, sponge rubber and a host of other items); footwear and clothing; sports items (rubber balls, shoes and wearing apparel); druggists' sundries (hot-water bottles. bulbs, syringes and gloves); novelty items (toys. balloons, aprons, stationers' bands. etc.); and latex foam products (mattresses, cushions for furniture and automobile seats).

TABLE I.—Consumption by Countries of Natural and Synthetic Rubbers

(In long tons)

Year	U.S.	U.K.	France	Germany	Total Europe	Australia	Canada	India	World Total*
Natural Rubber									
1940	648,500	147,056	35,000	26,500	137,500	20,000	36,996	11,047	1,100,000
1941	775,000	156,549	14,883	22,000	97,500	22,500	53,232	13,249	1,240,000
1942	376,791	97,056	10,193	26,000	85,000	13,106	42,144	14,398	765,000
1943	317,634	74,391	1,126	4,000	35,000	14,810	29,208	10,631	615,000
1944	144,113	45,195	250	2,500	32,500	14,360	9,588	12,110	387,500
1945	105,429	27,275	3,553	1,000	32,500	8,515	5,892	15,233	262,500
1946	277,597	96,647	29,767	1,668	70,000	15,569	9,580	14,037	555,000
1948	627,332	103,731	86,471	45,555	377,000	26,321	41,567	19,719	1,422,500
1950	720,268	219,668	102,616†	78,602	430,250	34,152	46,118	17,735	1,705,000
1955	634,800	246,350	134,374†	147,630	551,250	44,843	44,322	27,543	1,867,500
Synthetic Rubber									
1940	2,560			40,000	40,000				42,500
1941	6,259			50,500	65,000				72,500
1942	17,651		6,060	69,000	95,000				112,500
1943	170,891	3,339	10,247	88,500	115,000	2	3,688		292,500
1944	566,670	41,782	5,426	80,000	100,000	73	24,722	2	737,500
1945	693,580	63,772	17,419	22,500	55,000	4,773	35,944	2	865,000
1946	761,699	30,123	28,705	11,852	75,000	4,421	29,616	7	912, 100
1948	442,078	2,555	7,401	4,422	15,000	191	20,554	1	480,000
1950	538,289	2,757	7,400	3,372	16,000	220	22,577	1	580,000
1955	894,899	20,454	19,419	25,393	78,750	1,104	40,206	106	1,062,500

*Excluding the U S.S.R. and satellite countries. †Previous to 1950, data exclude sole crepe.

Rubber Consumption. — The world consumption of natural rubber in Iong tons was 100,000 in 1910, 297,500 in 1920, 710,000 in 1930, 1,110,000 in 1940, 1,705,000 in 1950 and 1,867,500 in 1955. The increased rate of consumption was caused mainly by the development of automotive transportation. In each of the years 1910 to 1950 (except 1944) 40% to 75% of the crude rubber used was consumed in the United States. In the period 1950 to 1955 U.S. consumption dropped to 33% because of increased usage of synthetic rubbers. The importance of synthetic rubber for general-purpose uses began to be recognized after 1940.

Two basic developments anticipated the growth of the modern rubber industry — the discovery of the hot vulcanization of rubber by Charles Goodyear of New Haven, Conn., 1839, and the noteworthy contributions of Thomas Hancock, England, 1820–56, who invented processes and machines the basic principles of which have continued to find widespread use in the industry. Hancock invented the masticator for kneading tough natural rubber into soft masses; the calender, a set of squeeze rolls to sheet rubber or coat it on fabrics; and he used moulds, 1846, to form rubber articles under heat and pressure. Hancock was also among the first to recognize the advantages of forming articles from natural rubber latex. Both these pioneer inventors were unusually productive of new ideas. Between them they anticipated the use of rubber in making hundreds of new articles and laid the groundwork for almost every important development made by the industry. Contemporary with these two men were Charles Macintosh of London who introduced the practice of spreading fabrics with rubber solutions and doubling the plies to give the mackintosh raincoat fabric, and Edwin M. Chaffee of Massachusetts who introduced the smooth roll mill for mixing rubber batches in 1835, and the first set of calender rolls for the frictioning of rubber masses onto fabric in 1836.

Other prominent technical advances in the rubber industry were the development of the applied science of compounding; the introduction of reclaimed rubber made from discarded rubber articles by a number of methods: the development of reinforcing pigments such as the fine particle size carbon blacks which impart to cured rubber marked improvement in resistance to tear and abrasion; the advantageous use of rubber in composite structures with materials such as textiles. metals, wood. glass, asbestos and other components; the invention of many ingenious machines for use in the assembly of rubber articles; and the development and extensive use of synthetic rubber. The discovery of organic accelerators by George Oenslager of Akron. O., in 1906, benefited the industry by speeding up the vulcanization step and by making possible products of better quality and higher uniformity. The discovery of age resisters, chemicals which retard the deterioration of rubber goods without affecting the state of vulcanization, was announced by Herbert Winkelmann and Harold Gray in 1923 and by Sidney Cadwell in 1924.

Crude Rubber. — (See RUBBER: BOTANY, CULTIVATION AND CHEMISTRY.) The source of natural rubber is the latex of certain plants, mainly the tree Hevea *brasiliensis*. In plantation practice coagulated latex may either be washed and air dried to make "pale crepe," or sheeted and cured to form "smoked sheets." These two grades are the standard types of commercial rubber. Commercial grades include various types of ribbed smoked sheets, latex crepes, brown crepes, remilled crepes. flat bark crepes. fine Para, central scrap. Congo and guayule rubbers. Crude rubber is usually shipped in rectangular bales wrapped in sheets of similar rubber. The weight of a bale is about 224 lb. Originally, rubber came from wild trees and vines and was collected by natives of the region where these grew. Great variability and scores of different grades prevailed even for some time after the advent of plantation rubber, about 1910. Washing and drying operations formerly uidespread in the manufacturing industry are most extensively practised near the source of the rubber. A great deal of the rubber used by the factories is cleaned by straining in a screw-fed machine in the head of which is mounted a screen to retain foreign matter.

Synthetic Rubber. — After 1941 the use of synthetic rubber was necessary in the manufacture of rubber articles; first, because Japan captured Malaya, Indo-China and Indonesia — source of more than 90% of the world's rubber — and withheld crude rubber from world markets until its defeat in 1945; and, second, because the world production of crude rubber was inadequate to supply the demand after World War II. Scientists from mid-19th century had envisaged the possibility of getting from chemical reactions a product like rubber. The idea started when Michael Faraday, at the request of Hancock, made a chemical analysis of natural rubber and reported. 1826. the empirical formula C_5H_8; the German, C. Himly, in 1838 named the volatile distillate which he derived from rubber "Faradayine." a tribute to the pioneer chemist in the field of rubber; the French chemists, A. Bouchardat. 1837, and G. Bouchardat, 1875, starting from this type of distillate, made resinous products from it. C. Greville Williams in England. 1860, found that isoprene. key to the puzzle, was the probable main component in Faradayine and that rubbery masses could be made from isoprene. His countryman, W. Tilden. 1892, reported that isoprene from turpentine gave rubberlike yellowish masses on standing. But none of these products was rubber. The intense nationalism and bickering which marred the progress of scientific discovery in the search for

synthetic rubber during the 1900–40 period virtually vanished in the years after World War II. Three Russian scientists made significant early discoveries. I. Kondakow in 1900 made leatherlike plastic masses from 2.3-dimethyl butadiene-1,3, the substance which about 1910 was to serve as the basis of the earliest chemical rubber made independently both in the United States and in Germany. S. V. Lebedev in 1910 converted butadiene-1,3 to a rubberlike product, which later became the most important molecule with which to start in the making of chemical rubbers; Lebedev also originated one of the simplest methods ior obtaining butadiene from alcohol. A third Russian scientist, I. Ostromislensky, not only contributed valuable information on the source of butadiene. 1915, but also worked on the polymers of vinyl chloride, 1916. new giant molecules which by 1940 had proved of great industrial importance in supplementing rubber.

The German attempts to make synthetic rubber from dimethyl butadiene, 1910–18, led to a production of only 2,350 tons of the "methyl" rubbers — grades "W" for use in soft rubber goods and "H" in hard rubbers—but these rubbers were not competitive with natural rubber. Parallel with this early German effort, L. P. Kyrides (Kyriakides) and Richard Earle. 1910–13, worked out three processes for synthetic rubber for the Hood Rubber company near Boston. Mass. The most promising of these depended upon dimethyl butadiene from acetone and gave rubber from which satisfactory footwear was made at a high cost. C. Harries in Germany and F. E. Mathews and E. H. Strange in England independently in Oct. 1910 found metallic sodium an excellent catalyst for polymerization of butadiene and isoprene. This type of rubber was rnade commercially in the U.S.S.R. after 1928 under the designation SKB (based on alcohol) or SKA (based on petroleum).

The first commercially important and successful synthetic rubber, neoprene. was announced in 1931 for sale by E. I. du Pont de Nemours and company. Xeoprene (first called Duprene) stemmed from the work of the Rev. Julius Arthur Nieuwland, C.S.C.. and was perfected by the work of du Pont chemists, Wallace Carothers. Elmer K. Bolton and others. which was started about 192j. Neoprene, made from 2-chlorobutadiene-1,3 (chloroprene), resembles natural rubber more closely than any of the other chemical rubbers made prior to 1954. Its finished products resist oil, sunlight and ozone, and are used widely. Production of neoprene in the U.S. rose from 2.469 long tons in 1940 to 50,067 long tons in 1950 and to 91,357 long tons in 1955.

In December 1954 Goodrich-Gulf Chemicals. Inc., announced the synthesis oi a new rubber, a cis-1,4-polyisoprene, using a Ziegler type catalyst and isoprene. In August 195j The Firestone Tire and Rubber Co. announced the synthesis of a cis-1,4-polyisoprene using metallic lithium dispersion and isoprene. Both of these synthetic rubbers closely resemble *Hevea* rubber and heavy-duty truck tires made of each of these rubbers were successfully road tested. Each type performed as well as the *Hevea* rubber control tires. These two examples of directed polymerizations (referred to as stereo-specific) are indeed notable achievements in high polymer chemistry. The Goodrich-Gulf announcement reported also the synthesis of trans-1,4-polyisoprene, a polymer essentially like natural gutta percha or balata. Subsequently, directed polymerizations of butadiene were announced.

In July 1956, Dr. Howard J. Teas, U.S. department of agriculture: and Dr. Robert S. Bandurski. Michigan State university. announced the test tube synthesis in small amounts of natural rubber from C^{14} (radioactive carbonj–labelled acetate by the activity of enzymes that had been separated by centrifugation from freshly tapped *Hevea* latex.

Buna Rubbers. — German chemists of I. G. Farbenindustrie A. G. began an intensive search for a commercial synthesis of rubber about 1925. The numbered Buna rubbers. such as Buna 8j and Buna 115, were made by Lebedev's method from Butadiene and sodium (*Na*trium) whence the name "Buna," but these rubbers which ranged from a rubbery to a pitchy consistency were not of good enough quality to replace crude rubber in general use. Hence, the search was continued and led to the emulsion copolymerization of butadiene and styrene, two chemicals which the German industry could provide abundantly from grain alcohol and coal, respectively. The copolymer Buna S was made by charging the butadiene and styrene into a pressure vessel with soap, water and minor ingredients. The emulsion thus formed was transformed overnight into a suspension of rubbery particles, an opnque latex from which Buna S rubber was derived by coagulation with salts and acids. When washed and dried Buna S resembled crude rubber. By a similar method Buna N was formed from the reactants butadiene and acrylonitrile. The first large factory, capacity 24,000 metric tons, for the synthesis of these "lettered" Buna rubbers by the emulsion process mas subsidized by the Nazi government and began operation about 1939. Those who were required to use Buna S to make rubber goods complained that it took two to three times as much milling capacity as natural rubber. but reports indicated that tires made from it gave good mileages. During the shortage of neoprene in 1937, Buna N from Germany was sold in the United States under the name Perbunan Manufactured articles made from it gave good service in withstanding oil exposure.

After 1925 several polymers other than neoprene with properties akin to rubber mere perfected and produced mainly in the United States. Some of these. such as the plasticized polyvinyl esters (Koroseal. Vinylite, Geon). are of the nonvulcanizing type and arc often listed as plastics. but their performance in uses once rendered only by cured rubber entitles them to rate as rubbery materials. The noncuring polyisobutylene and polyethylene were also used commercially to supplement rubber. Thiokol. 1928, a polyalkylene polysulphide, had a limited use, mainly for articles required to nithstand lacquer solvents.

Perbunan, Hycar. Chemigum and Butaprene, all nitrile-butadiene rubbers of the oil-resistant type, not only replaced natural rubber in parts exposed to various oils but were used extensively in new fields such as compounding with synthetic resins to replace plasticizer (polyblends) in making films for food packaging or as latex in paper impregnation. Silicone and Silastic rubbers, organic polymers containing silicon, support loads at temperatures in the range from −50° F. to 550° F. without loss of shape or insulating properties. At temperatures somewhat lower than 500° F the sun-resistant Hycar P.A. (acrylate type) rubbers impart good elasticity under both compression and elongation.

In June 1940 the B. F. Goodrich company announced the Ameripol tire in which more than 50% of the rubber consisted of a butadiene copolymer, and the Standard Oil Development company announced butyl rubber for inner tubes. Butyl rubber is a polymer made at temperatures about — roo° F. from isobutylene with only about 2%–5% of a diene such as isoprene.

GR-S.—In 1940 the United States began to recognize the threat of war to the world's supply of rubber The Rubber Reserve company of the Reconstruction Finance corporation was created June 28. 1940, to build up domestic stocks of crude rubber from the alarmingly low level of 125,000 long tons at the end of 1939. The National Defense Advisory committee in Aug. 1940 held meetings with informed men in the rubber industry and drew up a program for 100 000 long tons a year capacity of synthetic rubber since private companies appeared unwilling to risk the capital needed to go ahead on this scale. Even the government at that time was reluctant to approve such a large operation, and in May 1941 scaled it donn to about 40,000 long tons with plans for four plants, each of 10,000 tons capacity. Meantime, privately financed plants of 30,000-ton capacity were in prospect by 1942. After the attack by Japan on Pearl Harbor this government program was increased tenfold, and again doubled after the fall of Singapore. With relatively slight alterations these programs when completed had a capacity of 1,000,000 long tons a year of synthetic rubber. Even after their authorization the public was not convinced that they could be completed in time to supply the needs of the United Nations in a global war. Hence, on Aug. 6. 1942, Pres. Franklin D. Roosevelt appointed the Rubber Survey committee to study the rubber situation and make recommendations, with Bernard M. Baruch as chairman. The specific recommendations of the committee. Sept. 1942, were quickly enforced. These were rationing of motor fuel and tires,

limiting driving speeds to 3j m.p.h., and reorganizing and consolidating the government agencies then dealing with rubber in order to expedite the gigantic synthetic program. The president in Sept. 1942 created the Office of Rubber Director under the War Production board. Among the chemicals required each year to effect this synthetic program were 600.000 tons of butadiene. 220,000 tons from alcohol and the balance from petroleum feed stocks; 187,500 tons of styrene; about 100,000,000 pounds of soap. and smaller amounts of auxiliary chemicals, catalysts and solvents. Besides the plants to make these starting materials there were polymerization plants for GR-S (government rubber, styrene type, the general purpose rubber) and plants of entirely different design for the manufacture of butyl (GR-I) and neoprene (GR-M). Fifty-one plants were designed, built and operated by 49 rubber, chemical and industrial companies under the supervision of the Rubber Reserve company The estimated plant investment exceeded $700.000,000. These operations involved full co-operation of the industry with the pooling of patents and the exchange of technical information under an agreement which extended from Dec. 19, 1941, to March 31, 1949. Plants were located mainly in Connecticut, Pennsylvania, Ohio, West Virginia. Kentucky, Louisiana, Texas, Arkansas and California. The Canadian plant at Sarnia, Ont., under the dominion government, had a designed yearly capacity of 30,000 long tons of GR-S and 7,000 tons of butyl, with facilities for butadiene, styrene and isobutylene manufacture.

From 1945 on disposal of government-owned plants was actively studied by government agencies and by industry. U.S. public law 469 (1948) prescribed a minimum consumption of GR-S of 200,000 long tons a year with stand-by plant capacity up to 600,000 long tons to ensure national security, and with 65,000 long tons capacity for specialty rubbers, including those suitable for inner tube manufacture. The president of the United States, Jan. 1950, recommended the policy of selling government-owned plants to the industry under conditions that would ensure adequate supplies of the needed rubbers, encourage developments designed to improve their quality and restrain monopolistic ownership of the plants. These conditions were met and on May 1, 1955 the bulk of the GR-S plants for manufacture of monomers, polymers and ancillary materials together with inventories of rubber and raw materials on hand nere sold to private industry. Including $91,000,000 cash on hand in the Synthetic Rubber office of the Federal Facilities corporation, the government realized $401,565,000. The Baytown plant (with 447 pressurized tank cars for monomer shipment) was sold July 1S, 1955 for $10,923,700. In early 1956, the plant at Institute, West Virginia was sold for $11,000,000 leaving only the laboratory in Akron in government hands at the end of 1956. Transfer to private hands proceeded smoothly, drawing to a close an episode of magnificent co-operation knitted together by the fears, privations and urgencies of war.

TABLE 11.—Production of Synthetic Rubbers
(In long tons)

Year	United States S-Type*	Neoprene	Butyl	N-Type†	Canada Total	Germany Total	Total U.S., Canada, Germany
1939	—	1,738	—	12	—	21,998	23,748
1940	—	2,469	—	91	—	39,826	42,386
1941	227	5,423	—	2,464	—	69,361	77,475
1942	3,721	8,998	23	9.734	—	98,13j	120,611
1943	182,259	33,648	1,373	14,487	2,522	115,754	350,043
1944	670,268	58,102	18,890	16,812	34,829	101,624	900,515
1945	719,404	45,651	47,426	7,871	45,717	—	866,069‡
1950	358,248	50,067	55,832	12,037	58,440	—	534,624
1955	791,197	91,357	55,291	32,623	103,896	10,902	1,085,266

*Known as GR-S during government operation of the plants. S-type rubbers are copolymers of butadiene and styrene. Designation changed, 1955, to SB (styrene-butadiene) rubber.
†N-type rubbers are copolymers of butadiene and acrylonitrile.
‡Excluding German production in 1945.

The year 1948 marked the introduction of "cold" rubber made from the same basic ingredients as GR-S in an activated recipe at 41° F. compared with the temperature 122° F. ordinarily used. The road wear of tires made from cold rubber was improved over those from crude rubber by 10% to 25%. In 1955 GR-S plants produced 520,353 long tons of cold rubber, 66% of the total U.S. synthetic rubber production.

MATERIALS USED IN THE INDUSTRY

Rubber Materials. — The new rubbers consumed by the industry, including natural and synthetic, comprise the largest tonnage of any material used.

Reclaimed Rubber. — Vulcanized rubber scraps (tires, tubes, footwear, etc.) are plasticized and are available for reprocessing by the ordinary methods of rubber goods manufacture. The process of scrap treatment is known as reclaiming and the product as reclaimed rubber, reclaim or shoddy. The two methods most extensively used are the alkali process, patented by A. H. Marks, 1899, and the heater process, in which pans of scrap rubber, softeners and caustic are exposed to steam at about 350° F. Reclaim originates in at least 23 countries with an aggregate reclaiming capacity estimated as of 1945 at 530,000 long tons. Reclaim blends readily with crude rubber and GR-S to give compositions which process smoothly and is of great economic importance as a supplement to the new rubber consumed by the industry. In 1955 the tonnage of reclaim consumed by the C.S. manufacturing industry amounted to 312,781 long tons or just over 20% of the total new rubber consumption. Proportionate consumption in 1939 was 29% and in 1942 was 65%.

Scrap.—Unvulcanized trimmings containing no fabric or other materials are not waste. They map be blended with fresh stocks of the same composition and utilized with no loss of material value. Unvulcanized waste containing fabric may be treated to pulverize the fabric and utilized in rubber compositions with some reduction in value. Even vulcanized waste is incorporated in certain goods.

Dry Pigments. — Reinforcing and *Filling* Pigments. — Powdered materials are blended with rubber materials in order to modify the stiffness, strength and resistance to abrasion or chemical action of the vulcanized rubber. Reinforcing pigments possess the property of stiffeningand strengthening rubber compositions so that the total energy necessary to extend a strip of the compound to its breaking point is greater than that necessary to stretch a similar mix containing only rubber, sulphur and accelerator. Fillers, though they may stiffen the vulcanized compound, do not increase the total energy of rupture. Carbon blacks of two types (impingement and furnace), zinc oxide, certain clays, calcium silicate and magnesium carbonate are common reinforcing pigments. Whiting and barytes are extensively used as fillers.

Colours.—Most of the colours for rubber goods are useful in powdered form, and few colours soluble in rubber are used. For white goods, zinc oxide, lithopone, titanium oxide and zinc sulphide are used. Reds, blues, yellows and other colours and shades are secured with pigments such as ferric oxide, ultramarine blue and zinc chromate. The utilization of certain organic dyestuffs (phthalocyanine colours) and certain salts of azo dyes has enhanced the aesthetic appeal of rubber articles.

Other Compounding Ingredients. — Softeners. — For modifying the characteristics of the vulcanized rubber mixtures and for improving their properties for ease in processing, many kinds of softening materials are incorporated in rubber stocks. Petroleum products from oils to paraffin wax, tars, oxidized petroleum residues (mineral rubber); rosin, pine tar, fatty acids or their zinc salts, and many others are common to the industry. For use with the synthetic rubbers, resins derived from coal by distillation and by ensuing chemical treatments of distillates have been highly regarded.

Vulcanizing Agents.—By far the commonest vulcanizing agent is sulphur, used in the form of ground brimstone. The proportion used depends upon the character of the product required. Soft rubber goods carry from 2 to 10 parts of sulphur, but in most compounds not more than 34 parts per 100 of rubber are used. Synthetic rubber articles in general require about four-fifths as much sulphur as those made from crude rubber. Compositions unusually resistant to natural deterioration are produced containing less than 1% of sulphur. Hard rubber compositions carry 20% to 50%. Some organic sulphur compounds which liberate sulphur at vulcanizing temperatures have been used in special cases without addition of sulphur itself. Selenium and tellurium will produce vulcanization also, and have been used to some extent, usually, however, with some sulphur. Benzoyl peroxide, dinitro- and trinitro-aromatic compounds, dioximes, diisocyanates and dinitroso-compounds also vulcanize rubber.

Accelerators of *Vulcanization.*—Vulcanization of rubber by sulphur alone proceeds at a slow rate and almost invariably suitable materials, called accelerators, are added to the rubber mixes to hasten the process.

From the time of Goodyear's experiment, in which he used white lead, until 1906, the only accelerators used were inorganic oxides or hydroxides—litharge, white lead, quick or slaked lime, magnesia. Organic accelerators shortened the time of vulcanization and enhanced the tensile and other properties of the vulcanizate. The early accelerators (1906)—thiocarbanilid and para-amino dimethyl aniline—gave way to diphenyl guanidine, mercaptobenzothiazole, the aldehyde-amines, thiuram sulphides and many newer chemicals. The activity of accelerators is improved by secondary ingredients such as zinc oxide, litharge or magnesia, and even by other organic accelerators. They are often further assisted by acid materials, such as oleic or stearic acids or pine tar. Pneumatic tires, formerly requiring three hours for vulcanization without accelerators, are vulcanized by the action of organic accelerators in less than an hour. Deterioration of rubber may be greatly retarded by the use of certain accelerators.

Age Resisters.—Deterioration of vulcanized rubber in storage or in service may be retarded also by incorporating in the mixture, before vulcanization, 0.5% to 6% of certain organic chemicals which have practically no effect on the vulcanization rate hut greatly retard the rate of oxidation or change in properties of the vulcanized product. Some age resisters also impart to rubber comnounds resistance to deterioration by heat and resistance to cracking under repeated flexure. The age resisters used in largest volume are secondary amino compounds. The term "antioxidant" is widely used in referring to the behaviour of chemicals which retard the deterioration of rubbers While crude rubber from most sources contains a natural antioxidant, it is necessary to stabilize synthetic rubbers by the incorporation of 1% to 2% antioxidant in their manufacture to keep these rubbers fresh during storage. Usually, additional antioxidant is used in compounding these rubbers.

Other Materials.—The rubber softener and filler Factice is made either by the action of sulphur chloride on vegetable oils—white substitute—or by heating these oils with sulphur—broun substitute. White substitute is used in cold vulcanized articles (see below) and brown substitute in hot vulcanized goods.

TECHNOLOGY

"Compounding" is that branch of technology concerned with systematic study of the composition and physical properties of natural and synthetic rubbers and their vuicanizates in relation to the performance of rubber articles. Compounding, as an applied science, has contributed to the growth of the industry by testing and specifying those composi-

TABLE 111.—Properties *of* Widely *Used* Rubbers
(Sot loaded with pigment)

Property	Unit	Natural rubber (*Hevea*)		Synthetic rubber vulcanizates		
		Unvulcanized	Vulcanized	GR-S*	Butyl	Neoprene GN
Tensile	Kg./cm.²	20–40	275–350	22–24	220–240	350–400
Elongation	%	800–1,200	675–850	400–500	950	850–1,050
Hardness	Shore durometer A	20–30	40–45	37–40	35	38–42
Permanent set	After 200% elonration 24 hr.	75–125	3–5	2–4	3–5	8–12
Modulus of elasticity at 300% elongation	Kg./cm.²	5–10	11–24	14–16	12	10–20
Specific gravity at 20° C.		0.914	0.96	1.00	0.92	1.24
Permeability for Hz	Cm.³-atm. per cm.² per atm./cm. per sec.	—	40–50	—	5.5	11
Thermal properties						
Coefficient of linear expansion	10⁻⁵/° C.	15–20	16–19	—	—	—
Specific heat	Cal./g./° C.	0.55	0.5	0.35	0.44	0.49
Brittle point	° C.	62 –58	–58 –53	–60	–50 –45	–39
Electrical properties						
Volume resistivity	Ohm × cm.	10^{16}	10^{16}	10^{15}†	10^{16}	6.10^{10}
Dielectric strength	K.V./mm.	10–20	—	—	20	14
Dielectric constant × 10^{-3}	1,000 cycles	2.5	—	—	2.1–2.6	6.7–8
Power factor × 10^{-3}	1,000 cycles	2–3	—	—	4–5	18–20

*The corresponding values for Buna S are as follows: Tensile 30–60, elongation 300–450, hardness 50–55, permanent set 5–10, modulus of elasticity at 300% elongation 10–50, specific gravity at 20° C. 1.00, permeability for Hz 30, brittle point—58, volume resistivity 10^{14}, dielectric strength 20–25, dielectric constant × 10^{-3} 3–4, power factor × 10^{-3} 7–8.
†Special insulating mix.

tions which perform best under severe service. As a result of these technical advances by anonymous compounders, rubber has come to be properly regarded as a state oi matter rather than the specific hydrocarbon analyzed by Faradap in 1826 In the United States during World War II the consumption of new rubber changed from 96% natural in 1942 to 80% synthetic in 1944. The fact that the performance of rubber products remained without interruption at a very high level during this period is a tribute to the compounders. (The term "compounding" is also used to refer to the weighing of the various ingredients in preparation for the factory mixing of rubber batches, but in this article "compounding" will be used only in the technological sense.) Certain physical properties of compositions based upon natural and synthetic rubbers are shown in Table III and Table IV.

TABLE IV.—*Properties* d Widely Used ***Rubbers***
(Loaded with carbon black and vulcanized)

Property	Unit	Natural rubber	Buna S	GR-S	Nitrile rubber Hycar O.R.-15	Neoprene GN
Formulation		*	†	‡	§	‖
Physical properties						
Tensile	Kg /cm.²	275–350	200–250	170–250	250–290	250–310
Elongation	%	550–650	400–750	600–650	500–550	500–750
Hardness	Shore durometer A	62–67	65–70	60–65	60–70	62–67
Permanent set	After 200% elongatton 24 hr.	8–12	5–15	5–10	3–6	4–8
Modulus of elasticity at 300% elongation	Kg./cm.²	50–90	30–115	85	60–130	45–75
Specific gravity at 20° C		1.13	1.2	1.2	1.15–1 25	1.4
Thermal properties						
Coefficient of linear expansion	10⁻⁵/° C.	12–15	21–23	—	—	20–22
Specific heat	Cal./g./° C.	0.4	0.35	0.35	—	0.42
Brittle point	° C.	–58 –56	–58	–60	–34	–40

*Compounded with 25% carbon black + 10% softener.
†Compounded with 30% carbon black + 25% softener.
‡Compounded with 30% carbon black + 10% softener.
§Compounded with 30% carbon black + 20% softener.
‖Compounded with 20% carbon black.

Properties of Vulcanized Rubber.—Typical uses of rubber in the unvulcanized state are for cements, surgical adhesive tape, insulating tape and crepe soling. Nearly all rubber depends upon vulcanization and compounding for the properties which make it useful The primary properties which lead to the wide use of rubber comprise high elongation with rapid recovery over a wide range of temperatures, the cohesive strength with flexibility needed to cushion shocks and impacts, impermeability to gases and to water, and low specific gravity. Moreover, rubber compositions are relatively unaffected by oxygen, acids, bases, many organic solvents and other chemicals, and show good electrical properties. Outstanding among other materials is the performance of rubber against abrasive wear which accounts for many of its applications such as in transportation, conveyor belts, chutes, linings and air hose Among the various rubbers, natural rubber compounds have relatively the lowest hysteresis and the best resistance to cutting, chipping and crack growth. Of the compounded synthetic rubbers, butyl has the lowest permeability by gases, GR-S (cold rubber) shows the best tread wear, the nitrile rubbers show the least swelling in oils and most solvents, the acrylate rubbers (consisting mainly of polyethyl acrylate) are remarkably resistant to dry heat and sunlight, and neoprene is notably unaffected by ozone.

Laboratory Controls and Specifications.—Incessant technological changes within the industry have been made possible only by vigilant control over quality at every step in manufacture. Chemical and physical tests on the raw materials. the rubber mixtures in process and on the end products of manufacture have become routine. For example. tread mixings are tested for specific gravity, for plasticity and for cured hardness to ensure uniform performance on the road. More accurate testing methods have led to rigorous specifications governing the selection of materials, the operations of processing and assembly and the performance of finished products.

Cleaning and Straining.—See section on Crude Rubber above.

Washing and Drying.—See section on Crude Rubber above.

Mastication.—Unvulcanized rubbers are soitened by the influence of temperature, oxidation and mastication. Crude rubber breaks down and loses toughness when masticated. This type of softening is due to oxidation. As of the latter 1950s it was thought that under the shearing forces generated by milling the long rubber molecules are broken, forming free radicals, that is, chemically reactive ends. These reactive ends can recombine to reform the original molecule or they can combine with other free radicals to form new molecular shapes when the milling is done in inert atmospheres. But inasmuch as commercial milling is done in air, these free radicals at the ruptured ends of the molecule react with oxygen thus producing, for example, two shorter rubber molecules instead of the originally long one—and hence a more plastic rubber. Both crude and synthetic rubbers are more quickly masticated for large production operations at temperatures around 350° F. in which process temperature is the important variable. Since much heat is generated in the process the mill rolls are often chilled to keep the temperature down to that desired. Chemical softeners usually of the thio-aromatic type may be incorporated in amounts customarily under 1% to facilitate mastication, but these are not used in most batches. Rubber is often

plasticized on two-roll mills and in internal mixers, but by far the largest tonnages are passed through poweriul extrusion type (Gordon) plasticators in preparation for the subsequent steps.

Mixing.— Mixing mills vary in size from 24 in. to 84 in. in width. The 84-in. mills consist of two parallel, horizontal rolls set close together side by side and revolving in opposite directions. The back roll is fixed in position and geared directly to a drive shait, the front roll is floating. The clearance between the rolls is adjustable. Rolls are made of cast iron mith chilled surface. The rolls of 84-in. mills are 24 in. or 26 in. in diameter, cast hollow and fitted for service mith internal perforated pipes for the introduction of cooling water The procedures for mixing batches containing crude rubber, reclaim or one of the chemical rubbers will differ somewhat from each other. It is essential, however, in all cases, that all parts of the batch be uniformly blended. This blending is secured by cutting the sheet on the mill roll with a sharp knife, beginning at one end and rolling it on itself until the sheet has been cut almost entirely across. The roll thus formed is permitted to sheet out again on the mill and the process repeated in the opposite direction. This is repeated six or seven times to secure uniform mixtures Internal (Banbury) mixers have been used extensively since about 1927 for nearly all large tonnage formulations These closed mixers operate at higher temperatures than roll mills and may do the mixing in a time interval as short as five to eight minutes. A typical large Banbury mixer, three stories in height, is provided with a hydraulic ram which is lifted as soon as the rubber is sufficiently soitened and jammed home after the charge of carefully weighed pigments has been added. Two irregularly shaped opposing rotors knead the contents together by a powerful smearing action

Calendering.— The calendering operation produces sheeted stock by pressing the rubber between rolls to iorm sheets of predetermined size and thichness. The usual type, a three-roll calender, consists of a heavy vertical trame holding adjustable horizontal rolls The rolls can be driven either at even speed or at odd speed, and heated or cooled by internal circulation. Footwear calenders are four-roll machines with engraved or embossed rolls so mounted that they are quickly detachable. Frictioning calenders for rubberizing iabrics are run so as to squeeze the rubber into the meshes of the fabric. The driven middle roll bears the rubber and delivers the sheet at a slightly faster speed than the bottom roll which supports the fabric. The frictioning process map be repeated on the opposite face of the fabric Coating calenders of the three-roll type operate with the lower two rolls at even speed The rubber sheet is firmly pressed against the prepared fabric as it passes through the calender but is not forced through the meshes as in frictioning Successive operations of irictioning and coating are frequently employed The use of the four-roll calender to coat both faces of the prepared iabric simultaneously has found wide acceptance, particularly in the tire industry. In a typical operation, parallel cords delivered from a creel are treated with latex, dried and fed between the squeeze rolls of the coating calender where uniform coats of rubber from the second and third rolls are compressed so as to join and surround the cords, thus forming a single ply of cord tire iabric.

Tubing Operations.— Tubing machines, or extruding machines, are devices ior forcing continuous strips of rubber from a die. These strips may be tubular, rectangular or any one of a great variety of irregular cross-sectional shapes. The tubing machine consists of a horizontal cylinder in which a power-driven screw rotates, forcing the rubber stock through a die inserted at the end of the machine They are used for the production of tubing, hose tubes, pneumatic tire treads, solid tire treads, inner tubes for pneumatic tires, channel rubber slides for the windows of automobiles and many other articles.

Cements.— Among the oldest of all operations in the industry is the preparation of solutions of rubber in organic solvents (cements) For each rubber variety the solvent must be properly chosen. Cements are usually prepared in enclosed churns with stirring. The relative importance oi cements to dry mixing operations and to latex applications has lessened since about 1930.

Spreading.— The fabric is drawn over a roller under a spreader kniie, which can be set at varying distances from the roll, carrying from a cement feed a thin layer oi the cement, and then over steam-heated pipes to evaporate the solvent. This process is repeated until the required thickness of rubber coating is built up. By this method the rubber surfacing is applied to shoe cover and backing cloth, balloon iabrics, printers' blankets for offset work and similar products Thin coatings similarly applied are used to improve the adhesion to fabric of rubber layers later applied on a calender.

Vulcanization (Curing).—Before vulcanization, rubber is weak, softened by moderate heat, rendered stiff by cold, soluble in gasoline or other solvents and easily plasticized and sheeted between narm rolls. After vulcanizing it is strong, not greatly softened by heat nor stiffened by cold, insoluble in gasoline, and will crumble if run between rolls. Unvulcanized rubber is easily deformed to assume new shapes permanently; vulcanized rubber returns to its original form after deformation Hot vulcanization, the process most generally used, is conducted in a number of ways.

Press Curing in *Molds*.—Many articles are given their final form and vulcanized at the same time by application of heat and pressure to the rubber material in metal molds The presses used consist of parallel-faced, steam-heated plates between which are placed metal molds in which the articles are formed. Pressure between the plates (platens) is secured hydraulically with the article receiving its heat only by conduction through the plates and mold faces, not by contact with steam. Most presses in production are provided with more than two platens to accommodate the work scheduled ior them. Hollow articles like syringe bulbs, tennis or toy balls are vulcanized in molds under inflation either by air or by nitrogen generated by the action of heat upon such a mixture as sodium nitrite and ammonium chloride in pelleted form. Special presses are made for curing long flat belts, a section of 20 to 36 ft. being cured at one time. Heavy conveyor belts, made in this fashion, may weigh 30,000 lb.

Tire Curing.—The trend toward automation in the rubber industry is illustrated by the general adoption of automatic tire curing presses of the Bag-0-Matic and Autoform type. Once the uncured drum-built tire (at this stage it is barrel-shaped) is placed in the open press the hinged halves of the steam-heated mold (which forms the outer shape of the tire) closes and at the same time a rubber bag in the centre is inflated with steam to press against the inside of the tire (like an inner tube) and so forces the tread and sidewall oi the tire into the design cut in the metal mold. Passenger car tires become fully vulcanized in 20 to 30 min. at temperatures of 300" to 320" F.

Lead Coating *for* Curing.—Garden hose made in long lengths is run through a lead press and covered with a lead sheath. A 500-ft. length thus covered is wound on a drum, placed in a cylindrical vulcanizer, and water connections leading outside are made to each end of the hose. Hot water is run through the hose while steam is admitted to the vulcanizer. In this manner, heat is applied simultaneously on both sides of the rubber structure and the internal water pressure compacts the hose against the lead sheath. Aiter cure, the lead covering is stripped, melted and used again for covering.

Open *Steam* Curing.—Articles mhich require no further forming than is produced in building operations may be vulcanized without enclosure in molds. Steam is permitted to come into contact either with the bare goods or with met iabric wrappings around them. For example, air brake hose is built on mandrels, wrapped tightly with wet cloth and vulcanized by steam directly surrounding the wrapped hose.

Continuous Curing of Insulated Wire.—Wire covered with a rubber insulation compound which cures rapidly is passed continuously through superheated steam in long steel pipes to effect vulcanization of the rubber in about one minute. The nipples ior passing the wire in and out of the vulcanizer are sealed by a slip fit between the rubber cover of the wire and the wall of the nipple.

Water Curing.—Some rubber goods are cured immersed in hot water under pressure. The pressure may be equal to or greater than that of saturated steam at the same temperature. Rubber sheet to be cut into thread is wrapped with wet cloths on drums, covered mith a vulcanized rubber sheet and cured under water. To secure a smooth surface on sheets of hard rubber the unvulcanized stock is rolled on sheeted tin, a number of these slabs piled together and vulcanized under water.

Air *Curing*.—Varnished footwear and shoes containing wool fabrics are cured by heating in air, which is used most effectively under pressure and circulated by pumps.

Sulfur Chloride *Curing*.—The process of cold vulcanization was discovered in 1846 by Alexander Parkes in England. It is conducted by exposing rubber surfaces to sulfur monochloride as vapour or in solution. The method is practical only with thin goods like surgeons' gloves or dental dam and is not much used commercially any more.

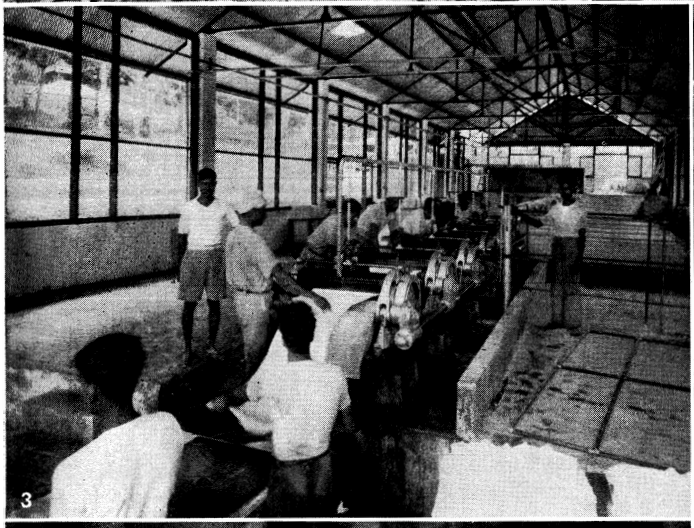
Radio-Frequency Heating to Effect *Vulcanization*.—In ordinary commercial practice, steam is used as a cheap source of heat for curing rubber stocks. Rubber stocks can also be heated by placing them in an intense field of radio waves of 5 to 30 mc. Thick rubber articles are thus heated throughout more quickly than with steam heat but the equipment needed is very costly.

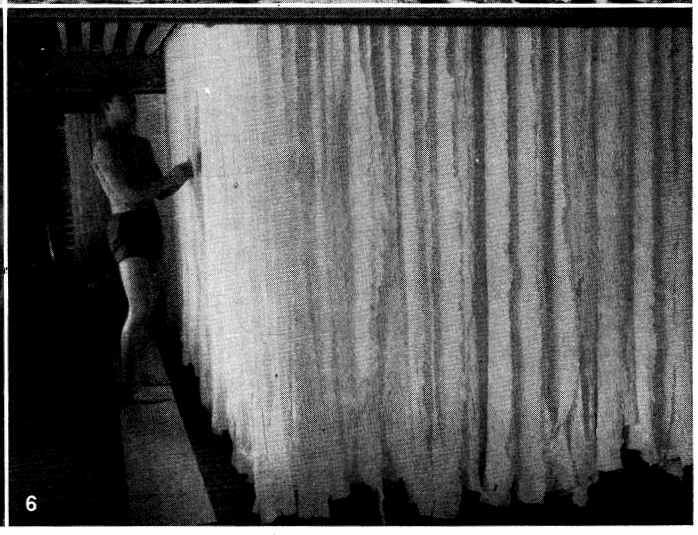
Vulcanization by *High-Energy* Radiation.—In 1927 E. B. Newton discovered that Hevea rubber could be vulcanized by high energy radiation. Sheets of rubber 0.20 in. thick exposed in a nitrogen atmosphere to high-speed electrons from a Coolidge tube operating with 1 milliampere at 250,000 volts became fully vulcanized in about 20 sec. With the advent of stronger beta and gamma ray sources in recent years, renewed interest in this type of curing has developed. No sulfur is required. Saturated polymers like polyethylene can also be cross-linked by this method.

Hard *Rubber* Vulcanization.—The commercial heating of rubber with large proportions of sulfur was first actively studied by Nelson Goodyear, who patented in 1851 a process for making hard rubber (ebonite). Articles of hard rubber are ordinarily formulated with 30% to 50% sulfur on the weight of the rubber, often with numerous other ingredients. Typical cures for these articles are carried out at higher temperatures and over longer periods than for soft rubber articles. Extensive heat evolution, and volume shrinkage and the generation of some hydrogen sulfide gas accompany ebonite vulcanization. Hence, cures are most frequently conducted in steam or water. Small masses of hard rubber can be cured in molds.

Latex.—*Hevea* latex from far eastern and Liberian plantations usually reaches the market in concentrated form of about 60% total solids with ammonia as the preservative. Various synthetic rubbers, mainly oi U.S. production, including the nitrile rubbers, are also available as latices. Suitably compounded with ingredients in finely divided aqueous dispersions, these latices find extensive use commercially in the treatment of tire cord for improved adhesion and

RUBBER: PRODUCTION AND MANUFACTURE



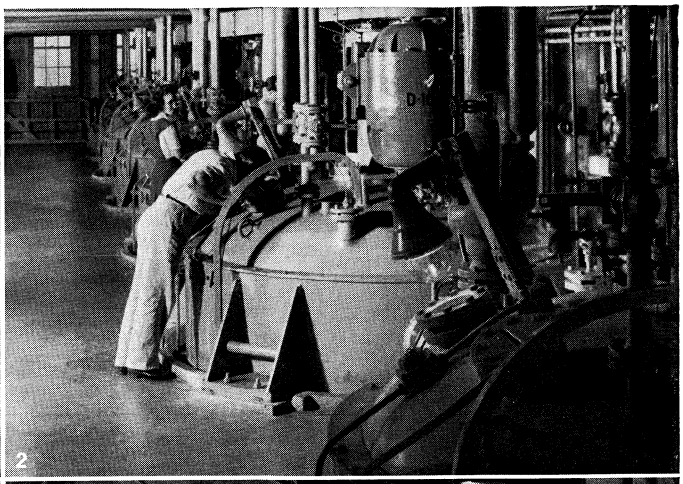


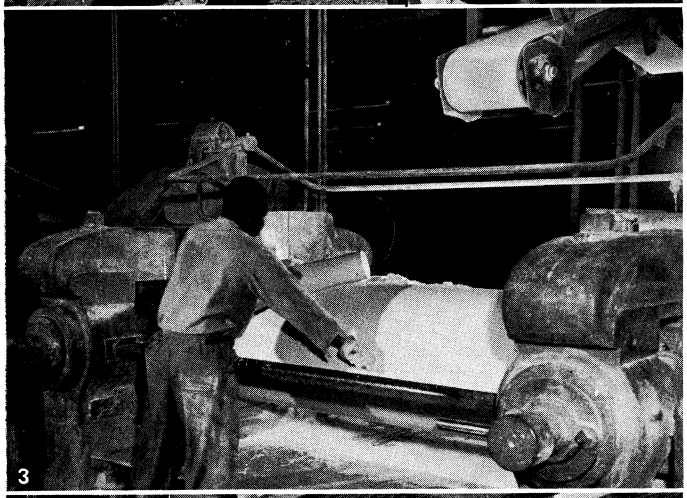
BY COURTESY OF (1) GOODYEAR TIRE AND RUBBER CO.; (2-4) THE B. F. GOODRICH CO.; PHOTOGRAPHS, (5, 6) EWING GALLOWAY

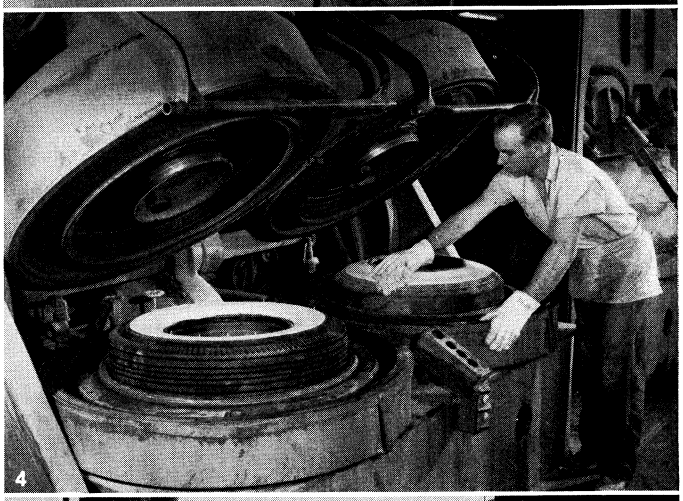
PREPARING **RUBBER** FOR COMMERCIAL USES

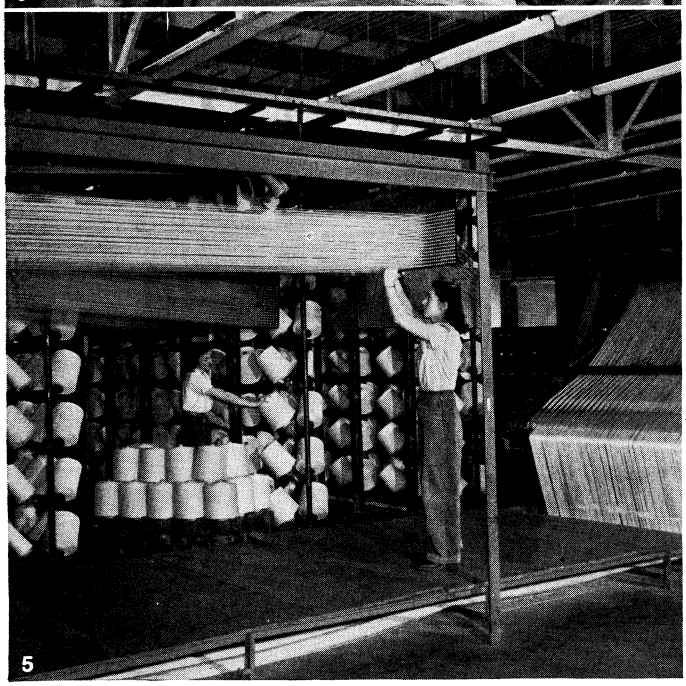
1. Native tapping a rubber tree for latex
2. The latex, after being sieved and diluted, is placed in tanks containing acetic acid or other coagulant. The rubber rises to the surface in the form of white coaaulum
3. The coagulum is passed through a series of sheeting rolls which press out most of the moisture. Following this operation, the sheets are cut to length and sent to the smokehouse
4. A plantation smokehouse, where the rubber sheets are hung on long racks. A fire is kept burning continuously in the lower part of the building. The smoke passes over baffles into the upper chamber, where it comes into contact with the sheets before it passes out through vents in the top. The smoking process takes from one to two weeks
5. Making crêpe rubber from coagulum. The roils rotate at different speeds, thus giving the typical crêping action
6. Crêpe rubber is air-dried in sheds in order to preserve the natural light colour. This drying process takes from four to five weeks

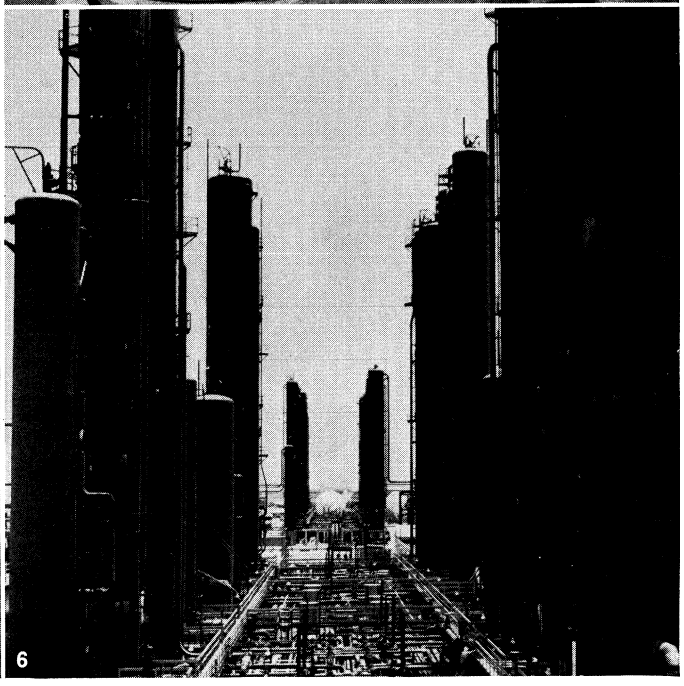
RUBBER: PRODUCTION AND MANUFACTURE











BY COURTESY OF (1) GRANITE ROCK CO., WATSONVILLE, CALIF., (2) U.S. OFFICE OF RUBBER RESERVE AND THE B. F. GOODRICH CHEMICAL CO., (3.5) THE B. F. GOODRICH CO., (6) U.S. OFFICE OF RUBBER RESERVE AND THE NECHES BUTANE PRODUCTS CO.

RUBBER MANUFACTURE AND PRODUCTS

1. Rubber conveyor belt elevator, 14 stories high, lifts 100 tons of rock every hour
2. GR-S polymerizers in a U.S. government rubber plant, Port Neches, Tex.
3. Two-roll mixing mill. The batch shown is white sidewall stock for passenger-car tires
4. Mould curing. Dome-type vulcanizers are hinged like waffle irons. The tire is shown before (right) and after cure. Internal curing bags transmit both heat and pressure
5. The creel starts about 3,000 parallel cords on their way to form the sandwich between sheets of rubber at the coating calender. Such a sandwich makes up one ply in a passenger-car tire
6. Butadiene row, in Port Neches, Tex. Still columns which separate butadiene from cracked petroleum feed stock

in numerous novel applications whereby articles are formed by coating, dipping, casting inside or outside of porous forms, by ionic coagulation and by electrodeposition. The largest tonnage of both *Hevea* latex and synthetic S-type latex in the 1950s was consumed in the manufacture of foam latex cushions for automobile seat topper pads, for furniture upholstery and for mattresses. S-type latex having sufficient fluidity at 60% dry rubber content must be a large particle size variety which can be grown in the polymerization vessel or more recently by a freeze-agglomeration process of the Sponge Products Division of the B. F. Goodrich Co. starting with ordinary S-type latex. Most latex foam articles are manufactured either by the Dunlop process of mechanically frothing a heat-sensitized (by addition of sodium silico fluoride) latex mix, followed by vulcanization (in the met state), washing and drying or by the Talalay process of frothing the latex mix with the enzyme catalase (from live yeast) and hydrogen peroxide. followed by freezing the foam, coagulation of the frozen foam with carbon dioxide, then vulcanization in the wet state, washing and drying.

Prevulcanized latex compounds are available in most countries made by a process originated by Philip Schidrowitz, of London, Eng. For the most part latex compounds have been made available both to industry and to artists and craftsmen by the large manufacturers of rubber. Those latices which require vulcanization give sheets of tensile strengths in excess of 5,500 psi. while sheets made from prevulcanized latex test over 4,000 psi. Because of rapidly increasing consumption, natural and synthetic latices had become substantial items of commerce by the latter 1950s.

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(H. L. TL.; E. B. NN.)

RUBELLZTE, a red variety of tourmaline used as a gemstone. It generally occurs crystallized on the walls of cavities in coarse granitic rocks, where it is often associated with a pink lithia-mica (lepidolite). The most valued kinds are deep red; the colour being probably due to the presence of manganese. Some of the finest rubellite is found in Siberia. Other localities include the island of Elba, the Urals, Burma and Minas Gerais, Braz. Fine rubellite is found in the United States, notably at Paris. Me., where the crystals are often red at one end and green at the other. Mt. Rubellite near Hebron and Mt. Apatite at Auburn are other localities in the same state from which fine specimens are obtained. Chesterfield, Mass., also yields red tourmaline. frequently associated with green in the same crystal. Pink tourmaline also occurs, with lepidolite and kunzite. in San Diego county, Calif. For discussion of composition, crystal forms, electrical and optical properties, etc.. *see* TOURMALINE.

RUBENS, PETER PAUL (1577–1610), Flemish painter and diplomat, was born at Siegen, Westphalia, June 28, 1577. His father Jan Rubens, although born a Roman Catholic, had appeared on a Calvinist list as early as 1566. After the decapitation of the counts of Egmont and Horne in Brussels in 1568, Jan fled from Antwerp to Cologne with his wife Maria Pypelincx and their four children, there to become agent and adviser to Anne of Saxony, second wife of William the Silent. An unfortunate pregnancy revealed in this princess of Orange the extent of her relationship with Jan, for whom however she obtained some clemency from her husband. Jan was nevertheless under house arrest at Siegen when both Peter Paul and his elder brother Philip were born.

These boys had their grounding in the classics from their exiled father, a *doctor utriusque juris.* But Jan died in 1587, after he had been allowed to go back to Cologne. Maria then thought it prudent to bring her four surviving children to Antwerp, where their father had been an alderman.

Antwerp Training. — At the age of ten, Peter Paul was sent with Philip to the Latin school of Rumoldus Verdonck, where the future painter befriended a contemporary who was to be a future patron, as head of the Plantin press, Balthasar Moretus. In 1590 shortage of money, and the need to provide a dowry for his sister Blandina, forced Maria to take Peter Paul away from school and make him a page to the countess of Lalaing. Soon tired of courtly life, he was allowed to turn to his real vocation. He mas sent first to his kinsman Tobias Verhaecht, a painter of mannerist landscapes in the stale tradition of Joos de Momper. Having quickly learned the rudiments of his profession he was apprenticed for four years to an abler master. Adam van Noort, and subsequently to the most distinguished of the Antwerp Romanists, Otto van Veen Vaenius, as he called himself, had been in Italy an active admirer of Federigo Baroccio as well as of the strictly Roman tradition in painting, and was learned in emblems. His culture and vision impressed Rubens, whose earliest independent works are known to have resembled his style.

Italian Period. — In May 1600, with two years' seniority as a master in the Antwerp Guild of St Luke, Rubens set out with Deodati del Monte, his constant traveling companion and first pupil, for the visual and spiritual adventure of Italy. Reaching Venice in about a month, he had early the fortune to meet a gentleman in the service of Vincenzo I Gonzaga, duke of Mantua. He nas offered employment in Mantua, which duchy held the largest and finest collections outside the Vatican of works from all Italian schools. Its capital, moreover, was ideally placed for sightseeing in Lombardy. Emilia and the Veneto. During the eight years that Rubens was to call Vincenzo his lord he had unmatched opportunities of fulfilling his expressed intention "to study at close quarters the works of the ancient and modern masters. and to improve himself by their example in painting." Andrea Mantegna and Giulio Romano were his admired predecessors in Gonzagan service. The abundant achievement in decoration and architecture of Giulio Romano. artistic heir of Raphael, had a lasting and highly productive effect on him.

Recommended to Cardinal Montalto in Rome, Rubens nas sent (1601–02) to paint copies for the duke. There, through his Flemish connection, he obtained his first public commission, three altarpieces for the crypt chapel of St. Helena in Sta. Croce in Gerusalemme, formerly titular church of the cardinal Archduke Albert, who was by this time consort to Isabella, regent of the Spanish Netherlands. In Rome, Annibale Carracci and his school were at work in the Farnese gallery. From their bold scale in drawing and characteristic working methods Rubens formed the decisive habits of his life. Through Annibale's exnmple he mas first enabled to digest the power of Michelangelo. Raphael and Leonardo da Vinci were his other High Renaissance heroes for nobility and energy of design. He assimilated Venetian colour, light and application of paint first through the works of Tintoretto, then through those of Veronese, long before he could penetrate the inward meaning of Titian's art. His copies, and his renorking of drawings, offer the most complete conspectus of 16th-century achievement in a pungently personal revision.

In 1603 he was entrusted with his first embassy, to bring Philip III and the Spanish court costly presents from Mantua. This mission gave him a first view of the Habsburg treasures, including more than 70 works by Titian. Two paintings in the groups of copies offered to Philip's favourite, the duke of Lerma, being rain-sodden beyond repair, mere promptly replaced by him with a "Democritus and Heraclitus" of his own invention. His resource, and his tact nith the regular llfantuan agent at Valladolid, whither the Spanish court had moved, raised him in Vincenzo's estimation and prepared him for future diplomatic voyages. His equestrian portrait of the duke of Lerma initiated his masterpieces in this genre: its pattern of presentation inspired Van Dyck. His fruitful association with the banking patriciate of Genoa began with his return voyage and his meeting with Nicolb Pallavicini, Vincenzo's banker, in order to recoup expenses.

His only major work for Mantua, a conspicuous challenge to the memory of Michelangelo, Raphael and Tintoretto, was the threefold decoration for the Jesuit church of SS. Trinità. Nothing of his but portraits of court beauties mas commissioned for the Gonzaga gallery itself, although he induced Vincenzo to buy for the gallery Caravaggio's rejected "Death of the Virgin." and he negotiated the purchase of a Cristofero Koncalli for the duchess. After his work for SS. Trinità (1604–05) and for the high altar of the Jesuit church in Genoa (1605), he obtained leave to continue

his studies in Rome. There he shared a house with his brother Philip, then secretary and librarian to Ascanio Cardinal Colonna. Daily contact with Philip, the most brilliant pupil of Justus Lipsius and the hope of classical studies, added zest to his personal renascence of the antique world. The combined fruits of their learning were strung into the text and illustrations of *Electorum Libri II* (1608), published by the Plantin press. Apart from a summons in 1607 to accompany the Gonzagan court on a summer progress to the seaside resort of San Pier d'Arena, where he invented splendid means to portray the Genoese aristocracy, Rubens was left largely undisturbed. But chronic arrears in payment of his salary, and ambition to establish himself as a metropolitan, not just a Mantuan painter, caused him to seek the backing of a Genoese patron, Jacopo Serra, in obtaining the coveted commission at the Chiesa Nuova. The protracted difficulties of this work for the Roman oratory, during which he brought off at speed a superb altarpiece for the Oratorians of Fermo, still occupied him when, in Oct. 1608, his brother Philip, already back in Antwerp, summoned him to their mother's death bed.

Return to Antwerp.— Riding irom Rome in haste, Rubens was nevertheless too late to see his mother alive. His first altarpiece for the Chiesa Nuova, which had been offered in vain to Mantua, became at last her monument. Although soon "bound with golden fetters" to the service of the Habsburg regents in Flanders (Sept. 23, 1609), then and for long after Rubens contemplated a return beyond the Alps to re-enter the lists of the Roman painters. As late as the 1620s he supplied cartoons to Genoa. Of six languages which he used with ease, Italian remained his favourite for correspondence. The house which he built for himself, the pride of Antwerp, had a model Pantheon which he enriched with statuary, cameos, coins and jewels. *Palazzi di Genova* (1622) was his published souvenir of civilized modern architecture. He practised the spirit of his preface in the magnificent new church of the Antwerp Jesuits. St. Charles Borromée, where he, assisted in the execution of ceiling paintings by Van Dyck, was the master decorator and, with Peter Huyssens, the chief designer of the facade, tower and all architectural detail. This building. with the almost contemporary banqueting house designed by Inigo Jones at Whitehall, London, where Rubens was to achieve his long-cherished ambition to fill the huge ceiling with paintings (delivered 1634), was the architectural sensation of northwest Europe.

He settled in Flanders. marrying Isabella, daughter of Jan Brandt, the Antwerp lawyer and humanist (Oct. '1609). and establishing himself not only as court portraitist but, by a trilogy of altarpieces: as the leading painter of his country. These altarpieces were: the fully baroque "Erection of the Cross" for St. Walpurga's. Antwerp (1610), a mature criticism of his treatment of the subject in Sta. Croce in Gerusalemme; the more classical "Descent from the Cross" for Antwerp cathedral; and for the cathedral of St. Bavo, Ghent. "The Miracle of St. Bavo," which. although conceived as a triptych like the others. was much modified to fit a single field. Relieved of the obligation to live at the Brussels court he was also exempt from guild regulations, and so free to engage pupils or collaborators nithout having to have them enrolled. By 1611 he wrote that he had to refuse more than 100 applicants to join his studio. As his international reputation grew, in part through careful organization of printmaking to advertise his designs, numbers of large-scale works issued from his studio which were only in certain areas, or generally retouched. by his hand. But to almost the last year of his fabulously productive life he painted unaided a superior class of very large works, as well as of cabinet pieces, oak panels being favoured for their supports. During 1606–07 he used small panels prepared with gesso for the various categories of oil sketches required to facilitate his manifold activity. sketches to work out his pictorial ideas. to present models to clients or to instruct engravers, sculptors, tapestry weavers and painting assistants They are small works in inches only, marvellous drawings in paint. whether *en grisaille* or fully coloured But he never entirely abandoned the Renaissance practice of evolving compositions in chalk and ink.

ALINARI

THE CHILD JESUS AND ST. JOHN. DETAIL FROM "THE HOLY FAMILY" BY PETER PAUL RUBENS. IN THE PITTI GALLERY. FLORENCE. ITALY

Diplomatic Activity.––Archduke Albert died in 1621, the year in which the 12 years' truce between Spain and the Netherlands ended. Rubens became adviser to the widowed archduchess, of whom he was to write (1628): "Long experience has taught her how to govern these people and not to be taken in by ialse theories which every newcomer brings irom Spain." She. like him, desired to prolong peace France grew suspicious. The French ambassador wrote from Brussels (1624). "Rubens is here to take the likeness of the prince of Poland, by order of the infanta I am persuaded he will succeed better in this than in his negotiations ior the truce" Early in 1622 Rubens had been summoned by Marie de Médicis, whose wedding by proxy he had attended in Florence in 1600. for his first visit to Paris. After six weeks of discussion he returned to Antwerp to begin nork on the *Histories of Marie de Médicis* for the walls of the first of two great galleries to be decorated by him in her new Luxembourg palace. This cycle of 21 canvases, his most important secular commission. was completed in two years. Being again in Paris for their installation in 1625. he met the duke of Buckingham, to whose persistence in bidding high for his iamous collection of antiquities and paintings he was eventually to accede for diplomatic reasons. Buckingham was in Paris for the marriage by proxy of Charles I and Henrietta Maria of France. With him was his master of the horse, painter and agent. Sir Balthasar Gerbier. Secret correspondence between Rubens and Gerbier was maintained even after the fresh outbreak of war between England and Spain, which led to Buckingham's disastrous expedition to Cádiz. Not until the assassination of the Stuart favourite was the way reopened for Rubens to negotiate peace on behalf of the sorely tried Spanish Ketherlands. He described Antwerp to Louis XIII's librarian as "languishing like a consumptive body, declining little by little." Unfortunately Philip IV's minister, the count of Olivares and duke of San Lucar, known as the *conde-duque,* had persuaded his master to make a close pact with France to reconquer England for Catholicism. In 1628 Rubens had therefore to travel in secret haste to Madrid. The papal nuncio reported of his arrival. "It is considered certain that Rubens, the Flemish painter, is the bearer of a negotiation. for we hear that he often confers in secret with the *conde-duque,* and in a manner very different from that which his profession permits. They say that he left England a short time ago; and since he is said to be a great friend of Buckingham, it is believed that he comes with some peace treaty between the two crowns. Others think his main object is the truce of Flanders, and that he has received this commission as one who enjoys the confidence of all that country."

During nine months in Madrid, besides negotiations and royal portraiture. Rubens set himself to school again before Titian's masterpieces, revisiting the Escorial with Velázquez. He overcame Philip IV's prejudice against him as a suitable negotiator, and was named secretary of the privy council of the Netherlands to conduct a special mission to England. He hastened across

France, past the hostile Richelieu, to report to Archduchess Isabella. News awaiting his return to Brussels made his mission yet more urgent and difficult. England had made a treaty with Frsnce (April 24, 1629). Charles I wished to treat with Rubens as a plenipotentiary, without waiting for the exchange of regular envoys. The Dutch alliance and the restitution of the Palatinate were crucial to Anglo-Spanish relations. Rubens succeeded, however, in laying the groundwork for the peace treaty (Nov. 15, 1630). For this he was knighted by Charles I and given an honorary degree by Cambridge university. "The Blessings of Peace," (National gallery, London), featuring Gerbier's children, is his painted proclamation of success. He discussed painting with Charles I, the only prince to whom he vouchsafed a self-portrait (Windsor castle), and, in particular, projects for the Whitehall ceiling. He was struck by the beauty and peacefulness of the English scene. The "Landscape with St. George" (Buckingham palace) was his private souvenir of the Thames view from his lodgings, with the royal pair envisaged in masquerade as patron saint and rescued princess. But a general peace was far away. His letter of March 12, 1638, explains "The Horrors of War," a late masterpiece sold to the Medici in Florence. He identifies the figures of the allegory: "that grief-stricken woman clothed in black, with torn veil, robbed of all her jewels and other ornaments, is the unfortunate Europe, who for so many years now has suffered plunder, outrage, and misery."

Later Works.—On his return to Flanders in 1630 Rubens mas rewarded with exemption by the archduchess from further diplomacy. "This favour I obtained with more difficulty than any other she ever granted me," he was to write. "Now, for three years, I have found peace of mind, having given up every sort of employment outside my beloved profession."

Having been four years a widower he married (Dec. 1630) the 16-year-old Helena Fourment, whose charms recur frequently among his later figure subjects. Many of his grandest and most romantic interpretations of landscape belong to this decade of his retirement from court affairs, when he owned the Château de Steen. But his active interest in landscape had been unbroken since at least the drawings of his Roman period. Long-established interests were revived also in his co-ordination of the work of every Antwerp painter for the stagings designed and partly executed by him to welcome the Infante Ferdinand, successor to Archduchess Isabella, in 1635. Thirty-six years before, he had assisted Vaenius to convert their city into a theatre. The great commission of Rubens' last years was, however. for the infante's brother Philip IV, the provision of models for about 120 scenes from Ovid to decorate the Torre de la Parada near Madrid.

Rubens died at Antwerp on May 30, 1640, when gout, which had for months troubled his painting arm, reached his heart.

Achievement.— Rubens remains unchallenged even by the longer-lived Picasso as the most methodically assimilative, the most prodigiously and variously productive among European artists. Schooled in the congested traditions of Xntmerp mannerism, he educated himself to be heir of the full range of Renaissance design to be seen both north and south of the Alps. And he saw the masterpieces of the Renaissance as yet undisturbed from their intended places. The abundant energy and warmth of his nature not only fired him to emulate the masters both of antiquity and of the 16th century in Rome, Venice and Parma, but made him responsive to the artistic revolutions being worked by living artists: to Adam Elsheimer's plein *air* study of nature and times of day in the Roman campagna; to Federico Barocci's colour combinations and delicate appreciation of warm and cool tones vibrant on flesh; to Michelangelo da Caravaggio's emotive exploitation of strong chiaroscuro; and, most profoundly and lastingly, to Annibale Carracci's impassioned yet strenuously disciplined approach to the practise of figure composition.

Robust powers of comprehension nourished his limitless resource in invention. The larger the scale of the undertaking the more congenial it was to his spirit. The success of his public performance as master of the greatest studio organization in Europe since Raphael's in Rome has obscured for many the personal intensity of his vision as evinced in such works as his oil sketch for "All Saints" and in his deeply felt study for the head of St. John in the Antwerp "Descent from the Cross," as well as in portraits of his family and friends and in his treatment of the mood and grandeur of landscape. Not only Van Dyck, Jacob Jordaens and his immediate following in Flanders, but artists at almost every period have responded to the force of his genius. Giovanni Lorenzo Bernini, the other seminal mind of the early baroque, developed in his Roman altarpieces figurative ideas and the dramatic handling of light instituted by Rubens. And in the fulfillment of the Italian baroque Domenico Feti, Castiglione and Bernardo Strozzi are in individual ways Rubensians. Watteau, Fragonard, Delacroix and Renoir are only the four most distinguished in the long succession of French painters who were attracted after the late 17th century to some aspect of his production. Reynolds, Gainsborough, Constable and Etty are outstanding among his active admirers in England. In the history of western art he is a central figure.

His own deepest love as a painter, consummated by his second visit to Spain, was for the poetry, the control of glowing colour and the sheer mastery in handling of oil paint that excelled in the art of Titian. In these qualities Rubens himself became supreme, whether with the brilliant play of fine brushes over the white reflecting surface of a small panel. or with masterful gestures often more than six feet long, sweeping a richly loaded brush across some huge canvas.

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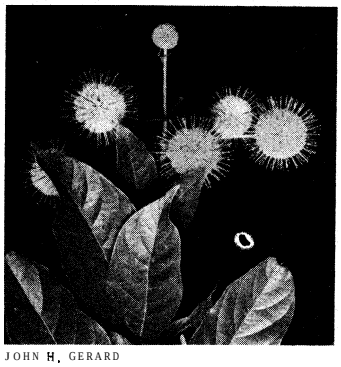
RUBIACEAE, the madder family, a large family of angiospermous flowering plants, dicotyledons. belonging to the sympetalous order Rubiales and containing about 450 genera with approximately 5,500 species. The Rubiaceae have a world-wide distribution with centres in the tropics of the old and new worlds. They vary in form from herbs to trees, but most of the species are inconspicuous and subordinate elements of the vegetation. Some, such as coffee and quina bark trees, have attained major economic importance.

Well-known British and North American examples of Rubiaceae are species of *Galium* such as bedstraw (*q.v.*), woodruff, cleavers (*q.v.*), etc.

Rubiaceae are characterized by opposite (or whorled), entire stipulate leaves, rotate sympetalous flowers, mostly with four or five lobes to the corolla and the same number of alternate stamens. The ovaries are nearly always inferior with a single style. The Rubiaceae have probably been derived from ancestors closely allied to recent Loganiaceae (Contortae) by gradual submergence of the superior ovary.

The taxonomy of the Rubiaceae is still a matter of some debate. Six subfamilies with many tribes may be recognized: Cinchonoideae, Crophylloideae, Ophiorrhizoideae, Guettardoideae, Ixoroideae and Rubioideae. The general phylogenetic trends nithin the family are manifold. Their form varies from woody trees and shrubs, predominant in the tropics. to dwarf shrubs. perennial and annual herbs, mostly found in subtropic, temperate 'and arctic-alpine regions. The leaves are mostly large and evergreen in tropical groups, often deciduous in temperate groups and needle- or scalelike in xeromorphic groups. The stipules tend to merge to medium stipular regions which in the Rubioideae develop from one to many leaflike stipules. In primitive groups of Rubiaceae the flowers are relatively large, single and situated in leaf axils; in derived groups they are reduced in size and combined into various kinds of inflorescences. From monomorphic hermaphrodite floners the development is to dimorphic (long- and short-styled), or unisexual and eventually dioecious flowers. Further phylogenetic trends include shortening of corolla tubes, loss of calyces, reduction in the number of carpels from five and six to two, and of



JOHN H. GERARD

BUTTONBUSH (CEPHALANTHUS OCCIDENTALIS), WIDELY DISTRIBUTED IN MARSHES OF NORTH AMERICA

the number of ovaries per ovary chamber to one. Each chamber contains, depending on species, from one to numerous ovules. The fruits vary in form from dry capsules and drupes to schizocarpous nutlets which are sometimes covered with hooked hairs and similar devices for epizoöic dispersal (*e.g.*, "cleaver" species of *Galium*).

Pollination is effected by insects or birds (very rarely by the wind) or by self-pollination. Some fluctuations of the basic chromosome number and especially polyploidy (multiplication of basic chromosome number) have played an important role in the evolution of the family. Of biological interest are the tropical epiphytes (*Myrmecodia* and *Hydnophytum*), which develop swollen stems inhabited by ants. Other genera have leaves with symbiotic, nitrogen-binding bacteria.

Rubioideae species with whorled leaves and leaflike stipules are widespread in temperate regions; *e.g.*, common species in Britain are *Galium mollugo* (hedge bedstraw), G. *verum* (lady's bedstraw) and G. *aparine* (cleavers or goosegrass); in North America species of *Cephalanthus* (buttonbush), *Mitchella* (partridge berry), Houstonia (bluets, innocence), Kelloggia and *Galium* are found.

Some of the Rubiaceae are of economic importance. The bark of Cinchona (*q.v.*) and some other tropical South American genera contain quinine (*q.v.*). Coffee is produced from the seeds of Coffea, particularly *C. arabica* and C. *liberica*. The ipecacuanha root (Uragoga) contains vomitive glucosids. Other species provide tanning and dyeing (*e.g.*, madder, Rubia *tinctorum*) substances. Some tropical trees furnish timber. Members of the genera *Ixora, Manettia, Bouvardia,* Rondeletia, Gardenia, *Phuopsis, Galium, Asperula* and others are of horticultural value. (F. EH.)

RUBICON, a small stream of ancient Italy, which flowed into the Adriatic between Ariminum and Caesena and formed the boundary between Italy and Cisalpine Gaul in republican times. Hence Caesar's crossing of it in 49 B.C. meant a declaration of war against Pompey and the senate. The importance of this event gave rise to the phrase "crossing the Rubicon" for a step which definitely commits a person to a given course of action.

Its upper course is represented by that of the Pisciatello and its lower portion by the Fiumicino.

RUBIDIUM, a rare chemical element of the alkali metal group, the most reactive of all metals except cesium (*q.v.*). The uses of rubidium and its compounds are limited but noteworthy. Its natural radioactive isotope, Rb^{87} (half life, 53,000,000,000 years), has been used to determine the age of the solar system. An estimated age of 4,500,000,000 years, based upon the decay of Rb^{87} to strontium (Sr^{87}) in a stony meteorite, is consistent with results based upon the decay of uranium to the final end product, lead. For the opposite extreme of precision, an atomic clock whose ticks are the natural vibrations of rubidium atoms has been proposed; ammonia clocks and cesium clocks are now in use. The purpose of such devices is to establish an invariant standard for time units, quite independently of the earth's rotation, which would be accurate to 1 part in 10.000.000.000 or more.

The discovery of rubidium (and of cesium), the first of many new elements to be detected by the spectroscope, was a crucial step in the development of the science of spectroscopy (*q.v.*). R. W. Bunsen and G. R. Kirchhoff. who perfected the spectroscope, used it to study alkali metal compounds extracted from the mineral lepidolite. They obtained a chloroplatinate whose flame spectrum had two unusually prominent red lines which did not match those of any known element. In their report, made in 1861, Bunsen and Kirchhoff told how they named the new element:

> The magnificent dark red colour of these rays of the new alkali metal led us to give this element the name rubidium and the symbol Rb from *rubidus,* which, with the ancients, served to designate the deepest red.

Although ranking 16th (0.031%) in the estimated abundances of the elements in the earth's crust; rubidium is widely dispersed among minerals (lepidolite, carnallite and some feldspars) and mineral waters containing other alkali metals. The highest concentration of rubidium is found in lepidolite (lithium mica), the deposits of South-West Africa containing as high as 3% of Rb_2O. To extract rubidium, the finely ground calcined mineral is treated with sulfuric or hydrochloric acid. Rubidium and cesium are then separated from the solution by fractional crystallization, generally of their alums, which are less soluble than those of lithium, sodium and potassium. The rubidium may be partially separated from cesium by precipitation as chloride from a hot HCl solution to which is added ethyl alcohol; or, by precipitation as carbonate in ethyl alcohol. Rubidium may be quantitatively separated from the other alkali metal ions and from those of other metals in a column of cation exchange resin.

Metallic rubidium can be prepared by heating the carbonate, hydroxide or chloride with a suitable reducing agent; magnesium, aluminum, calcium, barium azide, $Ba(N_3)_2$, and calcium carbide have been used.

Rubidium is a silver-white metal which inflames in air, reacts vigorously. with cold water liberating hydrogen and forming the hydroxide, RbOH, a very strong base. Other properties are summarized in the Table.

Physical and Atomic Properties

Atomic number	37
Chemical atomic weight	85.48
Outer electron configuration	$4s^2, 4p^6, 5s^1$
Density of solid at 20° C., g. per c.c.	1.53
Melting point, ° C.	38.5
Boiling point, ° C.	696.
Ionization potential, volts	4.18
Potential for $Rb \rightleftarrows Rb^+ + e$, volts	2.99
Specific heat at 0 C., cal. per g.	0.080
Metallic radius, A	2.16
Ionic radius, A	1.48

The salts of rubidium resemble those of potassium and cesium; they are mostly ionic and those of the common acids, chloride, sulfate, nitrate, carbonate and phosphate, are soluble in water. The perchlorate, acid tartrate, picrate, the hexafluorosilicate, hexanitrocobaltate, hexachlorostannate, hexachloroplatinate and the tetrachloroantimonite are relatively insoluble. Some of the rubidium salts are used in microchemical analysis.

For bibliography *see* POTASSIUM. (J. B. Ps.)

RUBINSTEIN, ANTON GRIGORIEVICH (1829–1894), Russian pianist, was born of Jewish parentage on Nov. 28, 1829, at Vykhovatinets, Volhynia. Besides his mother Anton had but one teacher. the piano master Alexander Villoing, of whom he declared at the end of his own career that he had never met a better. In July 1839 Rubinstein appeared in the theatre of the Petrovsky park at Moscow; and in the following years in the principal centres of Europe, including London. He then studied in Berlin and Vienna. The years 1848 to 1854 were spent in St. Petersburg in performing and composing. His opera *Dmitry* Donskoy was produced there in 1852, and Tom the Fool in 1853. The Siberian Huntsmen, written about the same time: was produced at Weimar in 1854. In 1857 he paid his second visit to London where, at a Philharmonic concert he introduced his own concerto in G. In 1858 he was appointed concert director of the Imperial Russian Musical society and in 1862, in collaboration with Carl Schuberth, he founded the St. Petersburg conservatory, of which he was director until 1867, and again from 1887 to 1890. For 20 years from 1868 he made prolonged concert tours in Europe and the United States, enjoying prodigious success wherever he went and being accounted by some the superior even of Liszt. He died on Nov. 20, 1894. Rubinstein left compositions in almost every known form, but it is as one of the greatest of all pianists that he will be remembered. His autobiography was published in an English translation in 1890.

His brother NIKOLAY GRIGORIEVICH RUBINSTEIN (1835–1881) was also a fine pianist and teacher. He founded the Russian Musical society in 1859 and the Moscow conservatory in 1864, and was

the latter's director until his death. Tschaikovsky wrote his pianoforte *Trio in A minor* in memory of him, although he had quarreled with him on the B-flat minor concerto.

RUBRUQUIS (or RUBROUCK), **WILLIAM** OF (c. 1215–1270; *fl.* 1253–55), Franciscan friar, one of the chief medieval travelers and travel writers. Nothing is known of him save what can be gathered from his own narrative, and from Roger Bacon, his contemporary and brother Franciscan. The name of Rubruquis ("Fratris Willielmi de Rubruquis," probably meaning "of Rubrouck," Flanders) is found in the imperfect manuscript printed by Hakluyt in his collection, and followed in his English translation, as well as in the more complete issue of the English by Purchas. (*Itinerarium fratris Willielmi de Rubruquis de ordine fratrum Minorum*, Galli, *Anno gratiae* 1253, *ad partes Orientales.)*

Friar William went to Tartary under orders from Louis IX (St. Louis). That king, at an earlier date, viz., December 1248, when in Cyprus, had been visited by alleged envoys from Elchigaday (Ilchikadai, Ilchikdai), who commanded the Mongol hosts in Armenia and Persia. The king then despatched a return mission consisting of Friar Andrew of Longjumeau or Lonjumel and other ecclesiastics, who carried presents and letters for both Ilchikadai and the Great Khan. They reached the court of the latter in the winter of 1249–50, when there was no actual khan on the throne; they returned, along with Tatar envoys, bearing a letter to Louis from the Mongol regent-mother which was couched in terms so arrogant that the king repented sorely of having sent such a mission. The envoys reached the king at Caesarea, between March 1251 and May 1252. But not long after the king, hearing that the Tatar prince Sartak. son of Batu, was a "baptized Christian," felt moved to open communication with him, and for this purpose deputed Friar William of Rubrouck. The former rebuff had made the king chary of sending formal embassies, and Friar William on every occasion, beginning with a sermon delivered in St. Sophia's on Palm Sunday (*i.e.*, April 13) 1253, disclaimed that character.

Friar William apparently received his commission at Acre, but he traveled by way of Constantinople and there received letters to some of the Tatar chiefs from the emperor, Baldwin de Courtenay, the last of the Latin dynasty.

Rubrouck and his party landed at Soldaia, or Sudak, on the Crimean coast, then a centre of intercourse between the Mediterranean world and what is now S. Russia. Equipped with horses and carts for the steppe, they traveled successively to the courts (*i.e.*, the nomad camps) of Scacatai (Kadan?), Sartak and Batu, thus crossing the Don and arriving at the Volga; of both these rivers Friar William gives vivid and interesting sketches. Batu Khan (*q.v.*) kept the travelers for some time in suspense, and then referred them to the Great Khan himself, an order involving the enormous journey to Mongolia. The actual traveling of the party from Crimea to the khan's court near Karakorum cannot have been, on a rough calculation, less than 5,000 mi., and the return journey to Lajazzo in Cilicia would be longer by 500 to 700 mi. The envoys embarked on the "Euxine" on May 7, 1253. They were at the camp of the Great Khan from Dec. 27, 1253, to about July 10, 1254. They reached Tripoli on the way home on Xug 15, 1255.

Roger Bacon, in the geographical section of the *Opus Maius* (c. 1262), cites the traveler repeatedly and copiously. Add to this William's own incidental particulars as to his being—like his precursor. Friar John de Plano Carpini—a very heavy man, and we know no more of his personality, except the abundant indications of character afforded by the story itself. These paint for us an honest, pious, stouthearted, acute and most intelligent observer, keen in the acquisition of knowledge, the author of one of the best narratives of travel in existence. His language indeed is dog-Latin of the most un-Ciceronian quality; but it is in his hands a pithy and transparent medium of expression. In spite of all the difficulties of communication, and of the badness of his *turgemannus* or dragoman, he gathered a mass of particulars, wonderfully true or near the truth, not only as to Asiatic nature, geography, ethnography and manners, but as to religion and language.

The narrative of Rubrouck, after Roger Bacon's copious use of it, seems to have dropped out of sight, though five manuscripts are still known to exist: the chief of these are (1) Corpus Christi College, Cambridge, no. 66, fol. 67 v.–110 v. of about 1320; (2) No. 181 of the same library, fol. 321–98, of about 1270–90; (3) Leiden University Library, no. 77 (formerly 104), fol. 160 r.–190 r. of about 1290. *See* the two editions in the Hakluyt Society's publications, (i) *William of Rubrouck . . . John of Pian de Carpine,* trans. and ed. by William W. Rockhill (1900); (ii) *Texts and Versions of . . . Carpini and . . . Rubruquis . . .*, edited by C. Raymond Beazley (1903).

RUBY, the valued gem stone, is a red transparent variety of corundum, or crystallized alumina. It is named from the Latin *rubeus* ("red"). It is sometimes termed oriental ruby to distinguish it from the spinel (*q.v.*) ruby, which is a stone of inferior hardness, density and value. The blue variety of corundum is sapphire (*q.v.*).

The ruby crystallizes in the rhombohedra1 system *(see* CORUNDUM); the crystals have no true cleavage, but tend to break along certain gliding planes. The colour varies from deep cochineal to pale rose-red, in some cases with a tinge of purple, the most valued tint being that called pigeon's-blood. The ruby is a mineral of very limited distribution. Its most famous localities are in Upper Burma, principally in the neighbourhood of Mogok, in the Katha (*q.v.*) district, 90 mi. N.N.E. of Mandalay. It occurs in ruby-bearing earth and in bands of a crystalline limestone, associated with granitic and gneissose rocks, some of which are highly basic; the limestone also contains spinel, garnet, graphite, wollastonite, scapolite, feldspar, mica, pyrrhotite and other minerals. The ruby, like other kinds of corundum, suffers alteration under certain conditions, and passes by hydration into gibbsite and diaspore, which by further alteration and union with silica, etc., may yield margarite, vermiculite, chlorite and other hydrous silicates.

Rubies and sapphires have been produced artificially with success. It mas once the practice to make "reconstructed rubies" by fusing together small fragments of the natural stone; but this process gave way to the Verneuil method of forming artificial ruby from purified ammonia-alum with a certain proportion of chrome-alum. The finely powered material is caused to fall periodically into an oxyhydrogen flame, the heat of which decomposes the alum, and the alumina thus set free forms liquid drops which collect and solidify as a pear-shaped mass. When of the characteristic pigeon's-blood colour, the synthetic ruby contains about 2.5% of chromic oxide. The manufactured ruby possesses the physical characters of corundum, but may generally be distinguished by microscopic bubbles and striae. *See* also GEM: *Synthetic Gems.*

RŪDAGĪ (d. 954). Farīd-eddīn Mohammed ʿAbdallāh, the first great literary genius of modern Persia, was born in Rūdag, a village in Transoxiana, about 870–900. Most of his biographers assert that he was totally blind. but the accurate knowledge of colours shown in his poems makes this very doubtful. The fame of his accomplishments reached the ear of the Sāmānid Nasr II bin Ahmad, the ruler of Khurāsān and Transoxiana (913–42), who invited the poet to his court. Of the 1,300,000 verses attributed to Rūdagī, there remain only 52 kasidas, ghazals and rabāʿīs; of his epic masterpieces we have nothing beyond a few stray lines in native dictionaries. But the most serious loss is that of his translation of Ibn Mokaffa's Arabic version of the old Indian fable book *Kalilah and Dimnah*. Fragments are preserved in the Persian lexicon of Asadi of Tus (ed. by P. Horn, 1897).

RUDD (*Scardinius erythrophthalmus),* a Cyprinid fish of Europe and western and northern Asia, deep-bodied. with reddish fins, and with the dorsal fin farther back than in the roach. It reaches a length of 18 in. and a weight of 3½ lb. It is called pearl roach in the Gnited States where it has been introduced.

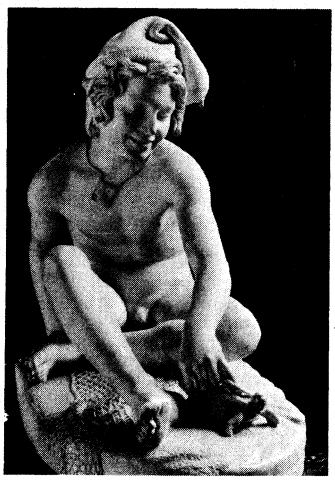
RUDDER, that part of the steering apparatus of a ship which is fastened to the stern outside, and on which the water acts directly (O.E. *rother, i.e.,* "rower"). The word may be found to be used as if it were synonymous with "helm." But the helm (A.S. *hillf,* "a handle") is the handle by which the rudder is worked. The tiller, which is perhaps derived from a provincial English name for the handle of a spade. has the same meaning as the helm. In the earliest times a single oar, at the stern, was used to row the vessel round. In later times oars with large blades were fixed on

the sides near the stem. In Greek and Roman vessels two sets were sometimes employed, so that if the pitching of the ship lifted the after pair out of the water, the foremost pair could still act. As these ancient ships were, at least in some cases, sharp at both ends and could sail either way, steer (or steering) oars were fixed both fore and aft. The steer oar in this form passed through a ring on the side and was supported on a crutch, and was turned by a helm, or tiller. Norse and medieval vessels had as far as we can judge, one steer oar only placed on the right side near the stern —hence the name "starboard," *i.e.*, steerside, for the right side of the ship looking forward.

In the case of small vessels the steer oar possesses an advantage over the rudder, for it can bring the stern round quickly. Therefore it is still used in whaling boats and rowing boats which have to work against wind and tide, and in surf when the rudder will not act. The side rudder was generally displaced by the stern rudder in the 14th century.

RUDE, FRANÇOIS (1784–1855), French romantic-realist sculptor, was born in Dijon on Jan. 4, 1784. After the death of his father, whom he had assisted in his metalworker's shop, he went to Paris determined to perfect himself in the art of sculpture. He won the Prix de Rome in 1812, but could not go to Rome because of the condition of Europe. He was an enthusiastic Bonapartist.

The attention of the public was first attracted to Rude by the Mercury attaching his winged sandals (1828; Louvre). This shows his training as a neoclassicist, but Rude was obviously uncomfortable within the restrictions of the classical canon and might be called rather a romantic-realist. In his Neapolitan fisherboy playing with a tortoise (1833; Louvre) the unusual pose and the open mouth both break with tradition. In the statue of Marshal Ney in the Avenue de l'Observatoire in Paris, the hand with the sword raised above the head and the open mouth again violated neoclassic principles. The group of "Volunteers" (for the revolutionary campaign of 1792) on the Arc de Triomphe, although classical in detail, is romantic and impetuous in feeling. The reclining figure of Bonaparte (1847) at Fixin near Dijon (plaster cast in the Louvre). where he is represented as reclining on a rock awakening from sleep and shaking off his campaign cloak, is a famous failure. Toward the end of his life Rude returned to his early classical style.



GIRAUDON

"NEAPOLITAN FISHERBOY PLAYING WITH A TORTOISE" BY FRANÇOIS RUDE. IN THE LOUVRE, PARIS

Rude died in Paris on Nov. 3, 1855.

See J. Calmette, *François Rude* (1920). (A. K. McC.)

RUDINÌ, ANTONIO STARABBA, MARQUIS DI (1839–1908), Italian statesman, born at Palermo on April 6, 1839, joined the revolutionary committee in 1859. After spending a short time at Turin as attaché to the Italian foreign office he was elected mayor of Palermo. In 1866 he quelled a separatist insurrection. He was then appointed prefect of Palermo, and put down brigandage throughout the province; in 1868 he was prefect of Naples. In Oct. 1869 he became minister of the interior in the short-lived Menabrea cabinet. On the death of Minghetti in 1886, he became leader of the Right. Early in 1891 he succeeded Crispi as premier and minister of foreign affairs by forming a coalition cabinet with a part of the Left under Nicotera; his administration initiated the economies by which Italian finances were put on a sound basis, and also renewed the Triple Alliance. He was overthrown in May 1892 by a vote of the chamber and succeeded by Giolitti.

Upon the return of his rival, Crispi, to power in Dec. 1893, Rudini resumed political activity, allying himself with the Radical leader Cavallotti.

The crisis consequent upon the disaster of Adowa (March 1, 1896) brought Rudini back to power as premier and minister of the interior in a cabinet formed by the veteran Conservative, General Ricotti. He concluded peace with Abyssinia, but endangered relations with Great Britain by the unauthorized publication of confidential diplomatic correspondence in a Greenbook on Abyssinian affairs. To satisfy the Anti-Colonial party he ceded Kassala to Great Britain, provoking thereby much indignation in Italy. He was overthrown in June 1898. His conduct of affairs had gravely divided his party.

Rudini died on Aug. 6, 1908.

RUDOLF (otherwise known as BASSO NOROK and GALLOP), a large lake of eastern equatorial Africa, forming the centre of an inland drainage system, occupying the south of the Abyssinian highlands and a portion of the great equatorial plateau. The lake itself lies towards the north of the great east African rift valley, between 2° 26′ and 5° N., while the meridian of 36° E. passes through the lake. The lake is in part in Uganda, in Kenya, in Ethiopia and in Sudan. The length along the curved axis is 154 mi., the maximum width 20 mi. Its altitude is 1,230 ft. Towards the south it is deep, but comparatively shallow in the north. Its water is brackish, but drinkable. The country bordering the lake on almost every side is composed of Archaean metamorphic rock and is sterile and forbidding. The southern end is shut in by high cliffs—the escarpments of a rugged lava-strewn country, which shows abundant signs of volcanic activity. In particular, the great Teleki volcano stands at the southern end of the lake. The highest point of the southeast side of the lake is Mt. Kulal. 7.520 ft., while the culminating height within the basin of the lake is Mt. Nyiru, 9,203 ft., which lies about 20 mi. S. of Lubburua. Farther north, on the west side, sandy plains alternate with lines of low hills. Lagoons cut off from the lake are the haunt of great numbers of water birds. In 3° 8′ N. the dry bed of the Turkwell approaches the lake. Near the northern end mountains again approach the shores, the most prominent being Mt. Lubur (5,334 ft.), an extinct volcano with a well-preserved crater. At the extreme northwest a bay some 35 mi. long (Sanderson gulf) is almost separated from the rest of the lake by two long points of land. On the east side, open arid plains, with few trees, occupy most of the north country. One hill, in 3° 20′ N.. has a height of 3,470 ft., and at the northeast end, separating the lake from Lake Stefanie, is a hilly country, the highest point between the lakes being 3,524 ft. Immediately north of these hills rises the Hummurr range, with one peak exceeding 7,000 ft. Near the south end is the volcanic island of Elmolo, 10 mi. long, and there are a few small islets. Just north of 4" N. is a small volcanic island with highest point 2,100 ft. At the north end of the lake a level swampy plain is traversed by various arms of the lake and by the Nianam river (identical with the Omo). Lake Rudolf was discovered in 1888 by Count Samuel Teleki and Lieut. Ludwig von Hohnel.

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RUDOLPH II (1552–1612), Roman emperor, son of the emperor Maximilian II by his wife Maria, daughter of the emperor Charles V, was born in Vienna on July 18, 1552. In 1563 he was sent to Spain, where he was educated. In 1572 he was crowned king of Hungary, in 1575 king of Bohemia; and in Oct. 1575 he was chosen German king, at Regensburg, becoming emperor on his father's death in Oct. 1576.

The more active part of the emperor's life was the period from his accession to about 1597. During that time he attended the infrequent imperial diets, and took an interest in the struggle in the Netherlands and the defense of the empire against the Turks. He was at times suspicious of the papal policy, while his relations with Spain were somewhat inharmonious. He forwarded the progress of the counterreformation, and in general the tolerant

policy of Maximilian II. was reversed. Political as well as religious privileges were attacked; and discontent became very pronounced about the opening of the 17th century. Meanwhile Rudolph had become increasingly subject to attacks of depression, which bordered on insanity. In 1604, after a war with Turkey had been in progress since 1593, many of the Hungarians rebelled against Rudolph and chose Stephen Bocskay as their prince. In April 1606 the Habsburg family declared Rudolph incapable of ruling, and recognized one of his younger brothers, the archduke Matthias, afterwards emperor, as their head; and in the following June Matthias, having taken over the conduct of affairs, made peace by granting extensive concessions to the rebellious Hungarians, and concluded a treaty with the sultan in November of the same year. Then shaking off his lethargy Rudolph prepared to renew the war with the Turks, a move which Matthias met by throwing himself upon the support of the national party in Hungary. Matthias also found adherents in other parts of his brother's dominions, with the result that in June 1608 the emperor was compelled to cede to him the kingdom of Hungary together with the government of Austria and Moravia. Rudolph now sought the aid of the princes of the empire, and even of the Protestants; but he had met with no success in this direction when trouble arose in Bohemia. Having at first rejected the demand of the Bohemians for greater religious liberty, the emperor was soon obliged to yield to superior force, and in 1609 he acceded to the popular wishes by issuing the Letter of Majesty (*Majestätsbrief*), and then made similar concessions to his subjects in Silesia and elsewhere. A short reconciliation with Matthias was followed by further disorder in Bohemia, which was invaded by Rudolph's cousin, the archduke Leopold (1586–1632). The Bohemians invoked the aid of Matthias, who gathered an army; and in 1611 the emperor, practically a prisoner at Prague, was again forced to cede a kingdom to his brother. Rudolph died at Prague, his usual place of residence, on Jan. 20, 1612, and was succeeded as emperor by Matthias.

Rudolph was greatly interested in chemistry, alchemy, astronomy and astrology; he was a patron of Tycho Brahe and Kepler, and was himself something of a scholar and an artist. He was the greatest collector of his age, his agents ransacking Europe to fill his museums with rare works of art. His education at the Spanish court and an hereditary tendency to insanity, however, made him haughty, suspicious and consequently very unpopular.

The sources for the life and times of Rudolph II. are somewhat scanty, as many of the official documents of the reign, which were kept at Prague and not at Vienna, were destroyed, probably during the Thirty Years' War. The best authorities, however, are: *Rudolphi II. epistolae ineditate*, edited by B. Comte de Pace (Vienna, 1771); M. Ritter, *Quellenbeiträge zur Geschichte des Kaisers Rudolf II.* (Munich, 1872); and *Deutsche Gesclzichte im Zeitalter der Gegenreformation und des dreissigjährigen Krieges* (Stuttgart, 1887 fol.); L. von Ranke, *Zur deutscken Geschichte: Vom Religionsfrieden bis zum 30-jährigen Kriege* (Leipzig, 1868); A. Gindely, *Rudolf II. und seine Zeit* (Prague, 1862–68); F. Strieve, *Die Verhandlungen über die Nnchfolge Kaiser Rudolfs II.* (Munich, 1880); in the *Allgemeine Deutsche Biographie*, Band xxix. (Leipzig, 1889); and *Der Ursprung des dreissigjährigen Krzeges* (Munich, 1875); F. von Bezold, *Kaiser Rzidolj II. und die Izeilige Liga* (Munich, 1886); J. Janssen, *Geschichte des Dezitschen Volks seit dem Ausgang des Mittelalters* (Freiburg, 1878 fol.), of which there is an English translation by M. A. Mitchell and A. M. Christie (1896 fol.); and H. Moritz, *Die Wahl Rudolfs II.* (Marburg, 1895).

RUDOLPH or RAOUL (d. 936), king of the Franks and duke of Burgundy, was a son of Richard duke of Burgundy, and was probably a member of the Carolingian family. He succeeded his father in 921, married Emma, daughter of Robert duke of the Franks, and assisted his father-in-law to drive the Frankish king, Charles III. (the Simple), from his throne. Robert then became king of the Franks, but was killed in battle in June 923 and was succeeded by Rudolph. At Limoges Rudolph defeated the Normans, the Aquitanians and Herbert of Vermandois. Rudolph died at Auxerre, leaving no sons, on Jan. 14, 936.

See W. Lippert, *König Rudolf von Frankreich* (Leipzig, 1886).

RUDOLPH (d. 1080), German king, and duke of Swabia, was a son of Kuno, count of Rheinfelden, who possessed estates in both Burgundy and Swabia. He received the duchy of Swabia from Agnes, regent and mother of the young king, Henry IV., in 1057, and two years later married the king's sister Matilda, and was made administrator of the kingdom of Burgundy. When Henry was excommunicated and deposed by Pope Gregory VII., the princes met at Forchheim, and elected Rudolph as German king. He renounced the right of investiture, disclaimed any intention of making the crown hereditary in his family, and was crowned at Mainz, on March 27, 1077. He found no support in Swabia, but, uniting with the Saxons, won two victories over Henry's troops, and, in 1080, was recognized by the pope. On Oct. 1j, 1080, Rudolph was severely wounded at Hohenmolsen, and died the next day. He was buried at Merseburg, where his beautiful bronze tomb is still to be seen.

See O. Grund, *Dze Wahl Rudolfs von Rheinfelden zum Gegenkonig* (Leipzig, 1880).

RUDOLPH I. (1218–1291), German king, son of Albert IV. count of Habsburg, and Hedwig, daughter of Ulrich count of Kyburg, was born at Limburg, on May 1, 1218. At his father's death in 1239 Rudolph inherited the family estates in Alsace, and in 1245 married Gertrude, daughter of Burkhard III. count of Hohenberg. A partisan of the emperor Frederick II. and his son Conrad IV., he was richly rewarded by them, but in 1254 was excommunicated by Pope Innocent IV. In the general disorder after the fall of the Hohenstaufen, he increased his estates largely at the expense of his uncle, Hartmann of Kyburg, and the bishops of Strassburg and Basle, becoming the most powerful prince in south-western Germany. His election as German king at Frankfurt (Sept. 29, 1273) was largely due to the efforts of his brother-in-law, Frederick III. of Hohenzollern, burgrave of Nuremberg. The support of Albert duke of Saxe-Lauenburg, and of Louis II. count palatine of the Rhine and duke of upper Bavaria, had been purchased by betrothing them to two of Rudolph's daughters; so that Ottakar II. king of Bohemia, a candidate for the throne, was almost alone in his opposition. Rudolph was crowned at Aix-la-Chapelle on Oct. 24, 1273. To win the approbation of the pope Rudolph renounced all imperial rights in Rome, the papal territory and Sicily, and promised to lead a new crusade; and Pope Gregory X., in spite of Ottakar's protests, not only recognized Rudolph himself, but persuaded Alphonso X. king of Castile, who had been chosen German king in 1257, to do the same. From 1274–78 Rudolph mas engaged in an intermittent struggle with Ottakar, which ended with the latter's death. (See AUSTRIA, EMPIRE OF.) Rudolph then set about consolidating his authority in Austria and the adjacent countries, where he met much opposition. At length in Dec. 1282 Rudolph invested his sons Albert and Rudolph with the duchies of Austria and Styria at Augsburg, and so laid the foundations of the greatness of the house of Habsburg.

In 1281 Rudolph compelled Philip I. count of upper Burgundy to cede some districts to him, forced the citizens of Berne to pay tribute, and in 1289 marched against Philip's successor, Otto IV., and compelled him to do homage. He was much less successful, however, in maintaining order in Germany, although in 1289 he led an expedition into Thuringia and destroyed some robber castles. In 1281 his first wife died, and on Feb. j, 1284 he married Isabella, daughter of Hugh IV. duke of Burgundy. In 1291 he attempted to secure the election of his son Albert as German king; but without success, although Albert, the only son who survived him, was crowned German king after Rudolph's death. Rudolph died at Spires on July 1j, 1291 and was buried in the cathedral of that city. His reign is memorable rather for the house of Habsburg than for the kingdom of Germany.

See K. Hagen, *Deutsche Geschiclzte von Rudolf von Habsburg bis auf die neueste Zeit* (Frankfort, 1854–57); 0. Lorenz, *Geschichte Rudolfs von Habsburg und Adolfs von Nassau* (Vienna, 1863–67); A. Huber, *Rudolj von Habsburg vor seiner Thronbesteigung* (Vienna, 1873); J. Hirn, *Rudolf von Habsburg* (Vienna, 1874); H. von Zeissberg, *Ueber das Rechtsverfahren Rudolf von Habsburg gegen Ottokar von Böhmen* (Vienna, 1882); H. Otto, *Die Beziehungen Rudolfs von Habsburg zu Papst Gregor X.* (Erlangen, 1893); A. Busson, *Der Krieg von 1278 and die Schlacht bei Dürnkrut* (Vienna, 1880); and 0. Redlich, *Rudolf von Habsburg* (Innsbruck, 1903). *See* also GERMANY; AUSTRIA, EMPIRE OF; HABSBURG.

RUDOLPH or RAOUL, known as RUDOLPH GLABER (Rudolph the Bald) (d. *c.* 1050), French chronicler, was born in Burgundy

about 985, and was in turn an inmate of the monasteries of St. Leger at Champeaux and St. Bénigne at Dijon, afterward entering the abbey of Cluny, and becoming a monk at St. Germain at Auxerre before 1039. He also appears to have visited Italy. His Historiarum sui *temporis* libri *V*, dedicated to St. Odilon, abbot of Cluny, purports to be a universal history from 900 to 1044; but is an irregular narration of events in France and Burgundy.

The *Historiarum* was first printed in 1596, and published by A. Duchesne in the *Historiae Francorum Scriptores*, tome iv (1639–49). Extracts are printed in the *Monumenta Germaniae historzca*, Band vii; but perhaps the best edition of the work is the one edited by M. Prou in the *Collection de textes pour servir à l'étude et l'enseignement de lhistoire* (1886). Rudolph also wrote a *Vita* S. *Gulielmi, abbatis S. Benigni*, published by J. Mabillon in the *Acta Sanctorunz*, tome vi (1668).

See A. Molinier, *Les Sources de l'histoire de France*, tome ii (Paris, 1902); and A. Potthast, *Bibliotheca historica* (Berlin, 1896).

RUDOLPH OF HABSBURG (1858–1889), crown prince of Austria, was born on Aug. 21. 1858, the only son of the emperor Francis Joseph I of Austria (*q.v.*) and his wife Elizabeth. Great hopes centred on the boy, who possessed unusual talents. Although his father was chiefly intent on his military education, Rudolph's own chief interests were natural history and literature. The monumental description of the Austro-Hungarian monarchy. *Oesterreich-Ungarn* in *Wort und* Bild, was truly his conception and in part his work; he also wrote some minor works of his own. He early developed an interest in modem literature and thought; became known as a freethinker, and even a revolutionary. and made no secret of his anticlerical views. He thus drifted into increasing opposition to his father, which was accentuated by his notoriously easy morality. His marriage with Stephanie, daughter of the king of the Belgians, took place on May 10, 1881, and was at first happy, although its only fruit—unfortunately for the Austrian succession—was one daughter, Elizabeth (afterward Princess Windischgratz). Later he developed a deep passion for the young and beautiful Baroness Marie Vetsera, and on Jan. 30, 1889, the sudden and appalling news reached Vienna that the bodies of the two lovers had been found in Rudolph's hunting lodge of Mayerling, near Vienna. It was at once officially announced that the pair had committed suicide. All persons in any way connected with the story were sworn to secrecy, and the official dossier was excluded from the state archives. Numerous extraordinary rumours naturally arose, connecting the death with the Jesuits, the Hungarian nobles, or an injured husband; but it is generally accepted that the crown prince actually shot his lover, and afterward committed suicide in a fit of despair, partly due to his father's order to break off the liaison. (C. A. M.)

RUDOLSTADT, a town of Germany, in the district of Gera, on the left bank of the Saale, 18 mi. S.W. of Jena, by the railway to Saalfeld. Pop. (1950) 28,234. The name of Rudolstadt occurs in an inventory of the possessions of the abbey of Hersfeld in the year 800. After passing under various rulers, it came into the hands of the counts of Schwarzburg in 1335. Its civic rights were confirmed in 1404, and from 1599 it was the residence of the ruling house of Schwarzburg-Rudolstadt. The town is a favourite tourist resort. The former residence of the prince is the Heidecksburg, a palace which was rebuilt after a fire in 1735 on an eminence 200 ft. above the Saale. The Ludwigsburg is another palace in the town built in 1742. The town also has a hydropathic establishment. The industries of the place include the manufacture of porcelain, chemicals, machinery, dyestuffs and thermos flasks.

RUDRA, a minor god in Vedic India who doubtless personified lightning (the "red" one, probably), but also protected cattle against it. In the Rig Veda he is identified with Agni (*q.v.*), but in the later Vedas he is called an archer and his malevolence emphasized. Best known as father of the storm-gods (Maruts, *q.v.*), in the Epic period he becomes many Rudras and in modern Hinduism is identified with Siva (*q.v.*).

RUE, the name of a woody or bushy herb, belonging to the genus Ruta (family Rutaceae). especially R. graceolens, the common rue, a plant with bluish-green spotted leaves and greenish-yellow flowers, native to Europe and sparingly naturalized in eastern North America. It has a strong pungent smell and the leaves have a bitter taste. The plant was much used in medieval and later times as a stimulative and irritant drug. It was commonly supposed to be widely used by witches. From its association with "rue" (sorrow, repentance), the plant was also known as "herb of grace" and was taken as the symbol of repentance.

RUEDA, LOPE DE (1510?–1565), Spanish dramatist, was born at Seville, where, according to Cervantes, he worked as a metal beater. His name first occurs in 1554 as acting at Benavente, and between 1558 and 1561 he was manager of a strolling company. Rueda's more ambitious plays, such as Eufemia, *Armelina* and Los *Engañados*, are mostly adapted from the Italian. They follow the original so closely that they give no idea of his talent; but in his *pasos* or prose interludes he displays an abundance of riotous humour, great knowledge of low life, and a most happy gift of dialogue. Rueda, with his strollers, created a taste for the drama which he was able to gratify, and he is admitted by both Cervantes and Lope de Vega to be the true founder of the national theatre.

RUEIL-MALMAISON, a town of north France, in the *dé*partement of Seine-et-Oise, at the west foot of Mt. Valérien, 6 mi. W. of Paris. Pop. (1954) 25,795. Rueil has a church rebuilt by Napoleon III in the original Renaissance style and containing the tombs of the Empress Josephine and her daughter Hortense de Beauharnais. Rueil has important photographic works and manufactures of lime and cement, etc. Close to the town is the 18th century château of Malmaison, the residence of the Empress Josephine.

RUFA'A: see ARABS.

RUFF, a limicoline bird, taking its name from the frill of elongated feathers round the neck of the breeding male, to which the name is properly confined; the female, a much smaller bird, is termed the reeve. The plumage of the male is extremely variable, but the same markings are reproduced after every moult in each individual bird. The ruff (Machetes pugnax) no longer breeds in Britain, but its range extends across the whole of N. Europe and Asia, and it migrates south to India, Ceylon and Africa in winter. Except for its remarkable frill and its polygamous habit, the ruff does not differ in any marked manner from the ordinary sandpipers.

The extraordinary courtship antics of the cock bird are described in Montagu's Ornithological Dictionary, Stevenson's Birds of *Norfolk*, Selous' Realities of *Bird* Life (Constable & Co., London, 1926), and elsewhere.

The nest is made on the ground and, as in almost all polygamous animals, the male takes no interest in his offspring.

RUFFO, FABRIZIO (1744–1827), Neapolitan cardinal and politician, was born at San Lucido, Calabria, on Sept. 16, 1744. His father, Litterio Ruffo, was duke of Baranello, and his mother, Giustiniana, was a Colonna. Ruffo was placed by pope Pius VI among the chierici di camera—the clerks who formed the papal civil and financial service. He was later promoted to be treasurer-general, a post which carried with it the ministry of war. In 1791 he was removed from the treasurership, but was created cardinal on Sept. 29, though he was not in orders. He never became a priest. Ruffo went to Naples, and, when in Dec. 1798 the French troops advanced on Naples, he accompanied the royal family to Palermo. He was chosen to head a royalist movement in Calabria, where his family exercised large feudal powers. He was named vicar-general on Jan. 25, 1799. On Feb. 8, he landed at La Cortona with a small following, and began to raise the so-called "army of the faith" in association with Fra Diavolo.

Ruffo had no difficulty in upsetting the republican government established by the French and by June had advanced to Naples. (See NAPLES, KINGDOM OF and NELSON, HORATIO NELSON.) But he lost favour with the king by showing a tendency to spare the republicans. He resigned his vicar-generalship to the prince of Cassero, and during the second French conquest and the reigns of Joseph Bonaparte and Joachim Murat he lived quietly in Naples. During the revolutionary troubles of 1822 he was consulted by the king. and was even in office for a very short time as a "loyalist" minister. He died on Dec. 13, 1827.

The account of Ruffo given in Colletta's *History of Naples* (English trans., Edinburgh, 1860) is biased. *Cf.* the duca de Lauria, *Intorno alla storia del Reame di Napoli di Pietro Colletta* (Naples, 1877). Ruffo's own side of the question is stated in *Memorie Storiche sulla vita del Cardinale Fabrizto Ruffo,* by Domenico Sacchinelli (Naples, 1836). *See* also Baron von Helfert, *Fabrizio Ruffo: Revolution and Gegen-Revolution von Neapel* (Vienna, 1882).

RUFIJI, a large river of Tanganyika Territory, East Africa, entering the sea by a delta, between 7° 45' and 8" 13′ S. Its upper basin is drained by three main branches, of which the two southern, the Luwegu and the Ulanga, though shorter than the northernmost (the Ruaha), carry more water, as they come from a more rainy region, and by their junction in 8 35′ S., 37° 25′ E., the Rufiji proper may be said to be formed.

The Luwegu rises 10° 50′ S., 35° 50′ E., and flows in a narrow wooded valley and in its lower course it is 100 to 150 yd. wide. The Ulanga is formed by a number of streams descending from the escarpment which runs north-east from Lake Nyasa and in Uhehe becomes broken up in ranges of mountains. The most important head-stream is the Ruhuje. As a whole, the Ulanga valley is broad, level and swampy, the meandering river sending off many diverging arms. It is navigable throughout the greater part of its course, having in the dry season a general depth of 3 to 12 ft, with a width of 40 to 120 yd. In April and May nearly all the streams overflow their banks. Below the junction of the Luwegu and Ulanga, the Rufiji flows through a narrow pass by the Shuguli falls, and continues to the junction of the Ruaha, in 7° 55′ S., 37° 52' E The most remote branches of the Ruaha rise in the Livingstone Mountains. The united stream sweeps round the N. of the Uhehe Mountains, finally flowing to the Rufiji. Below the junction the Rufiji is broken by the Pangani falls, but is thence navigable by small steamers to its delta, receiving no large tributaries but sending out divergent channels The country on either side is a generally level plain, inundated, on the south. in the rains, and the river varies in width from 100 to 400 yd. The main mouth of the river is that known as Simba Uranga, the bar of which can be crossed by ocean vessels at high water, but all the branches are very shallow as the apex of the delta is approached. Much of the delta is suited for rice-growing. (For geology see TANGANYIKA.)

RUFINUS, TYRANNIUS, presbyter and theologian, was born at or near Aquileia at the head of the Adriatic, probably between 340 and 345. In early manhood he entered the cloister as a catechumen, receiving baptism about 370. About the same time a visit of Jerome to Aquileia led to a close friendship between the two, and shortly after Jerome's departure for the East Rufinus also was drawn thither (in 372 or 373) by his interest in its theology and monasticism. He first settled in Egypt. There, if not even before leaving Italy, he had become intimately acquainted with Melania, a wealthy and devout Roman widow; and when she removed to Palestine, taking with her a number of clergy and monks on whom the persecutions of the Arian Valens had borne heavily, Rufinus (about 378) followed her. While his patroness lived in a convent of her own in Jerusalem, Rufinus, at her expense, gathered together a number of monks in a monastery on the Mount of Olives, devoting himself at the same time to the study of Greek theology. When Jerome came to Bethlehem in 386, the friendship formed at Aquileia was renewed. Another of the intimates of Rufinus was John, bishop of Jerusalem, and formerly a Nitrian monk, by whom he mas ordained to the priesthood in 390. In 394, in consequence of the attack upon the doctrines of Origen made 'by Epiphanius of Salamis during a visit to Jerusalem, a fierce quarrel broke out, which found Rufinus and Jerome on different sides; and, though three years afterwards Jerome and John were reconciled, the breach between Jerome and Rufinus remained unhealed.

In the autumn of 39; Rufinus embarked for Rome, where he published a Latin translation of the Apology of Pamphilus for Origen, and also (398–99) a somewhat free rendering of the περὶ ἀρχῶν (or De *Principiis*) of that author himself. In the preface to the latter work he referred to Jerome as an admirer of Origen, and as having already translated some of his works with modifications of ambiguous doctrinal expressions. This led to a bitter dispute between Jerome and Rufinus. At the instigation of Theophilus of Alexandria, Anastasius (pope 398–402) summoned Rufinus from Aquileia to Rome to vindicate his orthodoxy; but he excused himself from a personal attendance in a written Apologia pro fide sua. The pope in his reply expressly condemned Origen, but left the question of Rufinus's orthodoxy to his own conscience. He was, however, regarded with suspicion in orthodox circles (cf. the Decretum *Gelassii,* § 20) in spite of his services to Christian literature. In 408 we find Rufinus at the monastery of Pinetum (in the Campagna?); thence he was driven by the arrival of Alaric to Sicily, being accompanied by Melania in his flight. In Sicily he was engaged in translating the *Homilies* of Origen when he died in 410.

The original works of Rufinus are—(I) *De Adulteratione Librorum Origenis—an* appendix to his translation of the *Apology* of Pamphilus, and intended to show that many of the features in Origen's teaching which were then held to be objectionable arise from interpolations and falsifications of the genuine teat; (2) *De Benedictionzbus XII. Patriarcharum Libri* 11.—an exposition of Gen. xlix.; (3) *Apologia* s. *Invectivarum in Hieronymum Libri II.; (4) Apologia pro Fide Sua ad Anastasium Pontificem;* (5) *Hzstorza* Eremttzca—consisting of the lives of thirty-three monks of the Nitrian desert; (6) *Expositio Symboli,* a commentary on the creed of Aquileia comparing it with that of Rome, which is valuable for its evidence as to church teaching in the 4th century The *Historiae Ecclesiasticne Libri XI.* of Rufinus consist partly of a free translation of Eusebius (10 books in 9) and partly of a continuation (bks. x. and xi) down to the death of Theodosius the Great.

See W. H. Freemantle in *Dict. Chr. Biog.* iv. 555–60; A. Ebert, *Allg. Gesch. d. Litt. d. Mittelalters im Abendlande,* i. 321–27 (Leipzig, 1889); G. Krüger in Herzog-Hauck's *Realencyk. für prot. Theol.,* where there is a full bibliography.

RUFUS, LUCIUS VARIUS (c. 74–14 B.C.), Roman poet of the Augustan age. He was the friend of Virgil, after whose death he and Plotius Tucca prepared the Aeneid for publication, and of Horace, for whom he and Virgil obtained an introduction to Maecenas. Horace and Virgil speak highly of his epic poetry. From Macrobius (Saturnalia, vi. 1, 39; 2, 19) we learn that Varius composed an epic poem De *Morte,* some lines of which are quoted as having been imitated or appropriated by Virgil. But his most famous literary production was the tragedy Thyestes, which Quintilian (*Inst. Orat.* x. 1. 98) declares equal to any of the Greek tragedies. It was presented at the games of 29 B.C.

Fragments in E Bährens, *Frag. Poetarum Romanorum* (1886); monographs by A. Weichert (1836) and R. Unger (1870, 1878, 1898); M Schanz, *Geschichte der römischen Literatur* (1899), ii. *1;* Teuffel, *Hist. of Roman Literature* (Eng. trans., 1900), 223.

RUGBY, a municipal borough (1932) in the Rugby parliamentary division of Warwickshire. Eng., south of the Warwickshire Avon, 1; mi. E N E of Warwick by road. Pop (1951) 45,428. Area 10.9 sq mi. Rugby was originally a hamlet of the adjoining parish of Clifton-upon-Dunsmore. and is separately treated as such in Domesday Book (where it is called Rocheberie). It became a separate parish in the reign of Henry III, who granted the town a meekly market and a yearly fair.

Oliver Cromwell was quartered there in 1645, and William III passed through on his way to Ireland. The town was not of great importance until the 19th century, its rise being mainly due to the advent of railways. It is an important railway junction with extensive engineering and electrical works, and a very large cattle market

Rugby boys' school was founded and endowed under the will (1567) of Lawrence Sheriff of Rugby. The endonment consisted of the parsonage of Brownsover. Sheriff's mansion house in Rugby and one-third (8 ac) of his estate in Middlesex, which, being let in building leases. gradually increased in value. The full endowment was obtained in 1653 The school originally stood opposite the parish church. and nas removed to its present site on the south side of the town between 1740 and 1750. In 1809 it was rebuilt from designs by Henry Hakewill (1771–1830); the chapel was rebuilt in 1872.

The Temple observatory, containing an equatorial refractor by Alvan Clark. was built in 1877 and the Temple reading room and the art museum were built in 1878. The Temple speech room was opened in 1909, the science schools in 1914 (enlarged in 1940) and

the music schools in 1925 (enlarged in 1939). The rebuilding enabled the school to expand rapidly and become one of the largest in the country.

Tom Brown's Schooldays by Thomas Hughes is a chronicle of the period of the headmastership of Thomas Arnold (1828–42). Rugby football originated at the school *(see* FOOTBALL).

RUGE, ARNOLD (1802–1880), German philosopher and political writer, was born at Bergen, on the island of Rügen, on Sept. 13, 1802. He studied at Halle, Jena and Heidelberg, and became an adherent of the party which sought to create a free and united Germany. For his zeal he was confined for five years in the fortress of Kolberg, where he studied Plato and the Greek poets. On his release in 1830 he published *Schill und die Seinen*, a tragedy, and a translation of *Oedipus in Colonus*. Ruge settled in Halle, where in 1837 with E. T. Echtermeyer he founded the *Hallesche Jahrbucher* fir *deutsche Kunst und Wissenschaft*. In this periodical he discussed the questions of the time from the point of view of the Hegelian philosophy. The *Jahrbiicher* was detested by the orthodox party in Prussia; and was finally suppressed by the Saxon government in 1843. In Paris Ruge tried to act with Karl Marx as co-editor of the *Deutsch-Französische Jahrbiicher*, but had little sympathy with Marx's socialistic theories, and soon left him.

In the revolutionary movement of 1848 he organized the Extreme Left in the Frankfurt parliament, and for some time lived in Berlin as the editor of *Die Reform*. The Prussian government intervened and Ruge soon afterwards left for Paris, hoping, through his friend Alexandre Ledru-Rollin, to establish relations between German and French republicans; but in 1849 both Ledru-Rollin and Ruge had to take refuge in London. Here, in company with Giuseppe Mazzini and other advanced politicians, they formed a "European Democratic Committee." From this Ruge soon aithdrew, and in 18jo went to Brighton, where he supported himself by teaching and writing. In 1866 and 1870 he vigorously supported Prussia against Austria, and Germany against France. In his last years he received from the German go\ernment a pension of 1,000 marks. He died on Dec. 31, 1880. After the publication of his *Gesammelte Schriften* (10 vols., 1846–48) he wrote, among other books, *Unser System, Revolutionsnovellen, Die Loge des Humanismus*, and *Aus früherer Zeit* (his memoirs). His *Letters and Diary* (1825–80) were published by Paul Nerrlich (1885–87).

RUGELEY, a market town and urban district in the Lichfield and Tamworth parliamentary division of Staffordshire, Eng., in the Trent valley, 9 mi. E.S.E. of Stafford by road and on the Grand Trunk canal. Pop. (1951) 8,525. Area 4.5 sq.mi. To the S.W. is Cannock Chase. A grammar school was founded in 1611. There are iron foundries, tanneries and collieries; electrical equipment is made. The urban district included Brereton after 1934.

RÜGEN, an island of Germany, in the Baltic, immediately opposite Stralsund, 1½ mi. off the northwest coast of Pomerania in Prussia, from which it is separated by the narrow Strelasund. or Bodden. Its shape is exceedingly irregular, and its coast line is broken by numerous bays and peninsulas, sometimes of considerable size. The general name is applied by the natives only to the roughly triangular main trunk of the island, while the larger peninsulas, the landward extremities of which taper to narrow necks of land, are considered to be as distinct from Rügen as the various adjacent smaller islands which are also included for statistical purposes under the name. The chief peninsulas are those of Jasmund and Wittow on the north, and Mönchgut, at one time the property of the monastery of Eldena, on the southeast; and the chief neighbouring islands are Ummanz and Hiddensöe, both off the northnest coast Rügen is the largest island in Germany. Its greatest length from north to south is 32 mi.; its greatest breadth is 25½ mi.; and its area is 358 sq.mi. The surface gradually rises toward the west to Rugard (298 ft.) —the "eye of Rugen"—near Bergen, but the highest point is the Hertaburg (528 ft.) in Jasmund. Erratic blocks are scattered throughout the island, and the roads are made with granite. The most beautiful and attractive part of the island is the peninsula of Jasmund, which terminates to the north in the Stubbenkammer (Slavonic for "rock steps"), a sheer chalk cliff, the summit of which, the Konigsstuhl, is 420 ft. above the sea. The east of Jasmund is clothed with an extensive beech wood called the Stubbenitz, in nhich lies the Borg, or Hertha lake. Connected with Jasmund by the narrow isthmus of Schabe to the nest is the peninsula of Wittow, the most fertile part of the island. At its northwest extremity rises the height of Arcona, with a lighthouse.

A ferry connects the island with Stralsund, and from the landing stage at Altefähr a railway traverses the island, passing the capital Bergen to Sassnitz, on the northeast coast. The other chief places are Garz, Sagard, Gingst and Putbus, the last being the old capital of a barony of the princes of Putbus. Sassnitz, Gohren, Sellin, Binz and Lauterbach-Putbus are favourite bathing resorts. Schoritz was the birthplace of the patriot and poet, Ernst Moritz Arndt. The inhabitants of Riigen are distinguished from those of the mainland by peculiarities of dialect, costume and habits; and even the various peninsulas differ from each other in these particulars. The inhabitants raise some cattle, and Rügen has long been famous for its geese; but the chief industry is the herring fishery.

The original Germanic inhabitants of Rügen were dispossessed by Slavs; and there are still various relics of the long reign of paganism that ensued. In the Stubbenitz and elsewhere Huns' or giants' graves are common; and near the Hertha lake are the ruins of an ancient edifice which some have sought to identify with the shrine of the heathen deity Hertha or Nerthus, referred to by Tacitus. On Arcona in Wittow are the remains of an ancient fortress, enclosing a temple nhich was destroyed in 1168 by the Danish king, Waldemar I. when he made himself master of the island. Rügen was ruled then by a succession of native princes, under Danish supremacy, until 1218. After being for a century and a half in the possession of a branch of the ruling family in Pomerania, it was finally united with that duchy in 1478, and passed with it into the possession of Sweden in 1648. With the rest of western Pomerania Riigen has belonged to Prussia since 1815.

See Fock, *Rügensch-pommersche Geschichten* (6 vols., Leipzig, 1861–72); R. Baier, *Die Insel Riigen nach ihrer archäologischen Bedeutung* (Stralsund, 1886); R. Credner, *Riigen, Eine Inselstudie* (Stuttgart, 1893); Edwin Müller, *Die Insel Riigen* (17th ed., Berlin, 1900); Schuster, *Führer durch die Insel Rügen* (7th ed., Stettin, 1901); Boll, *Die Insel Rügen* (Schmerin, 1858); O. Wendler, *Geschichte Rügens seit der ältesten Zeit* (Bergen, 1895); A. Haas, *Riigensche Sagen und Märchen* (Greifswald, 1891); U. John, *Volkssagen aus Riigen* (Stettin, 1886); and E. M. Arndt, *Fairy Tales from the Isle of Riigen* (London, 1896).

RUGS AND CARPETS. "Carpet" (M.E. *carpete* or *carpette*, from O. Fr. *carpite* or direct from Med. Lat. *carpita*) was used until the 19th century for any cover made of a thick material, especially a table cover, but now it means almost exclusively a floor covering. This may be of felt, tapestry, a shuttle-woven material or a pile fabric, but the last is the most frequent and typical. Some kind of covering for the floor is indispensable for comfort, especially for the beaten-earth floors in the ancient and primitive orient. Even in the west the advantages of a fabric underfoot are so obvious and even imperative that carpets of some kind have been an almost universal adjunct of civilization, and in both the east and west their manufacture finally developed into a prodigious industry. Such floor coverings offer most interesting opportunities for ornamentation, and in the orient, where both the craft and the art originated, carpet-weaving and design attained, over a period of at least 2.500 years, a remarkable degree of excellence which warrants ranking the finest specimens with man's most notable artistic achievements.

Felt (*q.v.*) is almost certainly the most ancient of the carpet techniques for it probably originated as bark felt, even as early as the Upper Palaeolithic period, about 25,000–30,000 years ago. It is noteworthy that the earliest existing specimen (4th or 3rd century B.C.) which might be classed as a carpet is felt: a rectangle of black wool or hair felt, about 3½ x j ft., with a white border along one side, to which are appliquéd with split-stitch, silhouettes of feline heads about. 6 in. high. cut from red or blue felt and evenly spaced in a straight row. This piece, now in the

Hermitage museum, Leningrad, together with saddle (cushion) covers in the same technique and style, was found in a tomb at Pasyryk in the Altai mountains.

Floor coverings of plaited rushes were also very ancient. Evidences of basket plaiting also appear in the Upper Palaeolithic period, and archaeological finds in Iraq indicate by the jth or 4th millennium floor coverings of plaited rushes, such as grea in the Mesopotamian swamps. These made stout, durable, portable mats, and even at an early period they were probably handsomely ornamented, judging from the competence in decorative pattern shown on contemporary painted pottery and on the decorated walls of the Chalcolithic village at Persepolis. The weaving of rush mats has continued to the present in the near east, which had reached a high degree of artistic perfection and prestige by mediaeval times.

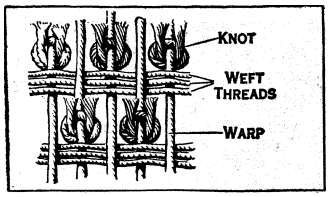


FIG. 1.— SPANISH OR SINGLE-WARP KNOT

Rug design, however, in western Asia at least, had long since evolved beyond the rudimentary scheme of the applique felt or the hypothetical iconographic geometry of plaited mats, for a threshold rug, represented in stone carving (now in the Musee du Louvre). from the Assyrian palace of Khursabad (8th century B.C.) has an all-over field pattern of quatrefoils, framed by a lotus border, completed by guard stripes. Other Assyrian stones of the period also show rich and handsome patterns that have survived in the repertoire of carpets ever since.

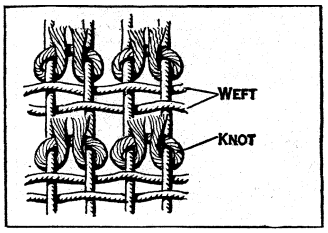


FIG. 2.— TURKISH OR GHIORDES KNOT, ONE OF THE TWO TYPES OF KNOTS USED IN ORIENTAL CARPETS

The general layout of the Assyrian type is more or less followed in the next oldest surviving carpets, embroidered felts found by Kozlov at Noin Ula in northern Mongolia, preserved by the frozen subsoil in chieftains' tombs (C. Trever. *Excavations in Northern Mongolia* [Leningrad, 1932]; W. P. Yetts, in *The Burlington .Magazine,* 1926), likewise now in the Hermitage museum. One, *e.g.* (originally *c.* 6 ft. 5 in by 8 ft. 6 in.). had the field filled with a spiral meander; a broad border with animal-combat groups (alternately tiger and yak, and griffon and elk), alternating nith a tree; an inner guard stripe of geometrical units; and a nide margin of Chinese lozenge-patterned silk. The patterns were executed with quilting (field), and couched cord on a quilted ground (main border; inner guard stripe solid couched cord), and the colours as reconstituted by chemical tests (\'. Komonov, bloscow-Leningrad, 1937) were vivid; yellow quilting on a red field; a red border with blue and green figures outlined with white; and green, red, yellow and blue in varying succession in the guard stripes.

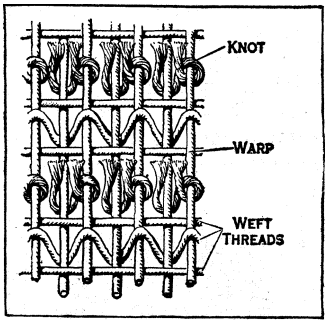


FIG. 3.—PERSIAN OR SEHNA KNOT, THE OTHER TYPE OF KNOT USED IN ORIENTAL CARPETS

Another piece embroidered in wool on wool in stem-and-satin stitches, was still more complex in organization: on the field, a diagonal lattice defined by scrolling stems. with a cross-treflé at each intersection and a tortoise alternating with a fish in each unit, in blue, purple and tans on a red ground; a diagonally-hatched field margin; beyond, an inner border system. aith double guard stripes on both sides; then the main wide border filled nith a concentric-lozenge diaper, with an inner guard stripe; and an outer binding of red and brown checked flax and wool material. These pieces are datable by a lacquer bowl found with them which is inscribed with the equivalent of A.D. 3. Some of them are of genuine beauty; their intricate patterns are clearly delineated and well co-ordinated.

Among these fragments and technically the most interesting are the earliest extant specimens of pile carpets They are woven of fine, lustrous, still-elastic wool. of deep indigo blue. The pile is very thick and dense, the knots or loops having been firmly compacted, though the strands are merely wrapped round one warp thread, a simple technique that later made its way to Spain. (A. U. Pope, in Pope [ed.], *A Survey of Persian Art,* Oxford, 1938. III, pp. 2272–73.) This same technique is also used in a number of fragments found by Sir Aurel Stein in Loulan, Niya and Tun-Huang in Chinese Turkistan, assignable to the first three centuries of our era *(see* Stein. *Serindia* [1921], Pls 3. 7, 8; and *Innermost Asia* [1928]), and was continued in this region at least into the 7th or 8th century, as is proven by a fragment discovered by A. von LeCoq at Kizil.

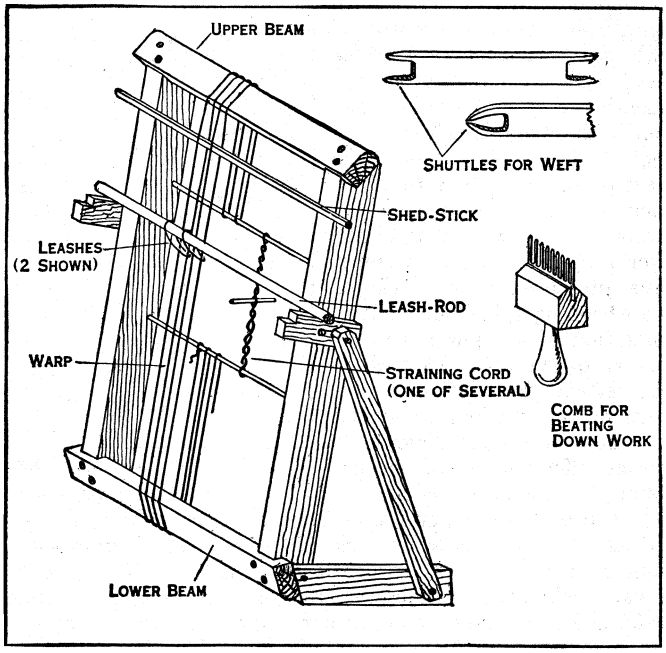


FIG. 4 —LOOM WITH FIXED BEAMS; SUITABLE FOR SMALL WORK AND ILLUSTRATES CHIEF PARTS OF LARGER LOOMS

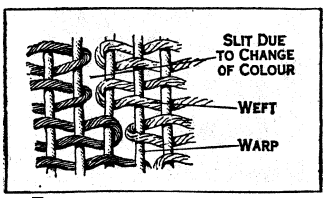


FIG. 5.—TAPESTRY WEAVING

By historic times thr carpets of the near east had attained fame and great magnificence. Classical authors speak nith admiration of the luxurious Babylonian carpets *(see* A. U. Dilley, *Rugs and Carpets,* p. 11), and in the tomb of Cyrus, Alexander the Great found the gold funeral couch resting on carpets of very fine fabric. Both Athenaeus and Xenophon indicate that some of these were thick and resilient, but whether pile woven or embroidered felt we cannot be sure, though some were evidently gold-enriched. Moreover certain types were reserved for court use, and so costly that they were important items in the royal treasury Carpet weaving nas always a kingly concern in near eastern lands

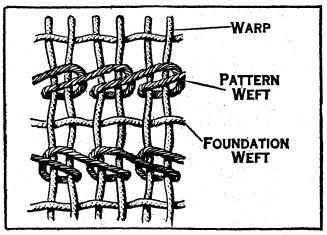


FIG. 6.—SHEMAKA WEAVING, A MODIFIED FORM OF THE TAPESTRY METHOD

By late Sassanian times (6th–7th century A D) carpet weaving in Persia had non international prestige, and according to the Sui annals noollen rugs mere being exported to distant China (*Sui-šu,* chap. 83; Berthold Laufer. *Sino-Iranica,* p. 493). The carpets of this period were of several kind:,: woollen or silk, either pile or tapestry aoven, embroidered. or even of shuttle-noven silk (*dibaj*) (Pope, *A Survey of Persian Art,* III, p. 2273).

Carpets made for the royal palace exceeded in cost and magnificence anything created or imagined either before or since. Surpassing them all was the so-called Spring or Winter carpet of Khusraw, made for the vast audience hall of the palace at Ctesiphon. It represented a formal garden with its water courses, paths, rectangular beds filled nith flowers and blossoming shrubs and fruit trees. The body of the rug was silk, the yellow gravel was represented by gold, the blossoms, fruit and birds were worked with pearls and every kind of jewel. The wide outer border representing a green meadow was solid with emeralds. The rug was about 84 ft. square, and when the great portal curtains were draan back and the sun flooded the sumptuously decorated and lofty interior (121 ft. high), it must have presented a spectacle of overwhelming splendour, a demonstration of the power and resources of the great king which was certainly not lost on ambitious nobles, restless provincial governors or foreign envoys. It was an effective use of the national treasure which would otherwise have been unproductively locked in dark vaults, and in addition to its political significance and its self-justifying beauty, happily alleviating the grim ninter months, such an eternal garden, forever at the perfection of its vernal loveliness, played another role obvious to all at the time; it affirmed with unmistakable authority the divine role of the king, the surrogate on earth of the Almighty on high, for it was the king's primal task to regulate the seasons, to guarantee and compel the return of the spring, thus renewing the earth's fertility and assuring the livelihood and prosperity of his subjects. This gorgeous carpet was the sympathetic call to nature to conceive and deliver the longed-for spring. Moreover the carpet had still further religious significance: it prefigured paradise, was a foretaste of the glory that is to come and the substance of things hoped for. For paradise is a Persian word meaning "walled park," and for the Persians. with its flowers. birds and water, so happily contrasting with the asperities of the desert, it was the abode of all felicity, the reward for struggle and suffering, the symbol of the perfect eternal moment. The whole notion of paradise seems to have entered into Jewish and Christian theology via the Babylonian captivity, and the Persian restoration of the Jens to Palestine.

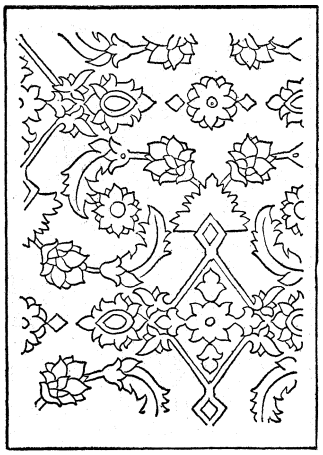


FIG. 7.— THE HERATI PATTERN

FIG. 8.— THE MINA KHANI PATTERN

The carpet was part of the fabulous booty of the Arabs, captured when they defeated the Persians and took Ctesiphon (635). It was cut up into small fragments; one-fifth went to the Caliph Omar, one piece to Ali, the prophet's son-in-law and the rest nas distributed to the 60,000 victorious soldiers, who in turn sold their pieces to a jeweller's syndicate in Baghdad for an average of $3,000 each, counting the drachma as worth only 25 cents This is on the authority of Tabari, one of the ablest of the Arab historians, whose account is confirmed by others and by certain internal and supplementary evidence as well. The originai value of the carpet mas thus certainly in excess of $200,000,000.

This most sumptuous of all fabrics made a profound impression on all, especially the Persians. It entered as a living, legendary power into history. poetry and art; and for centuries it served to sustain Persian morale. For more than 1,000 years it furnished the model and inspiration for subsequent carpets, though the most ambitious attempts of later years could no morr than hint at the general design of this fabulous creation. Of the subsequent renderings of the garden scheme the oldest is a printed cotton pane! to be dated between the 9th and 11th century (O. Wulff-W. F. Volbach, *Spätantike und* koptische *Stoffe,* Berlin. 1926, pl. 130) which shons in miniature essentially the same scheme, and this has persisted down to the present as one of the best defined carpet designs (fig. 9). The carpets for another of the royal palaces depicted the four seasons, also still a theme of carpet designing down to recent times.

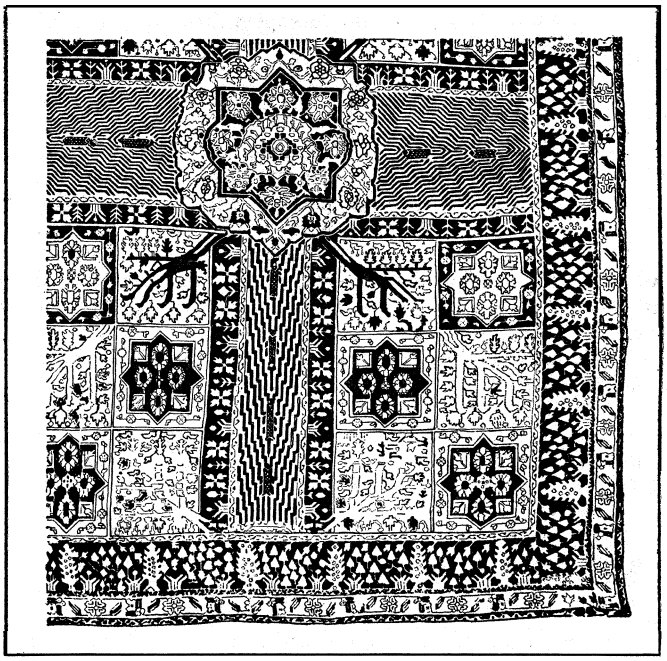


FIG. 9.— GARDEN CARPET, NORTHERN PERSIA, 18TH CENTURY

The carpets of the Abbasid caliphate at Baghdad (Haroun al-Rashid and his successors) seem almost to have rivalled the carpet of Khusraw Caliph Hashim, nho died in 743, had a silk, gold-enriched carpet that was approximately 150 x 300 ft. The history of this carpet can be traced for more than a century. It was finally inherited by Caliph Mutawakil about 850. Gorgeous carpets are mentioned in all the contemporary descriptions of the period. We know little about their actual appearance, but some had inscriptions; some actually attempted symbolic portraiture of the Sassanian kings; carpets decorated with all kinds of animals were made in Numaniya and Hira, showing a growing mastery of pictorial effects Dark blue was probably the commonest colour. but the Caliph El Mahdi owned a rose coloured carpet.

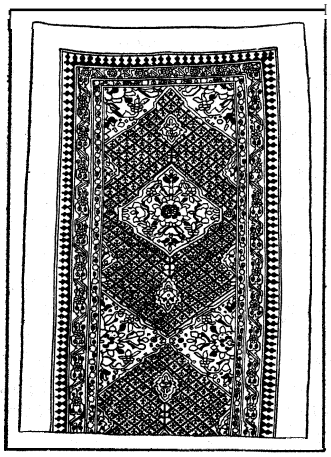
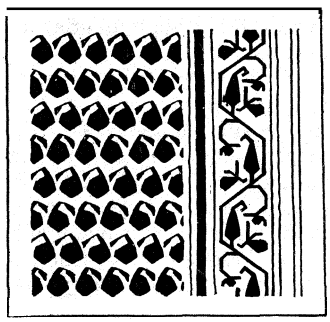


FIG. 10.— HAMADAN

Whether these Sassanian and early Islamic carpets were pile-knotted or tapestry-woven is impossible to say. There is no evidence to support the usual assumption that they nere all done in some kind of flat stitch, but tapestry (*q.v.*) [Lat *tapes*—covering for floors, walls, etc.; Gr. ταπες —carpet. rug; Fr. *tapisserie,* and also tapis-—carpet, cover] nas already by that time a much used technique as well as an old one, for it was well developed by 1500 B.C. (Ackerman, *Tapestry,* p. 12, New Pork. 1933.) Fragmentary examples, dating from the 7th to the 14th century. have been found on the rubbish heaps of Fustat (ancient Cairo), including some so stiff and heavy that they could only have been floor coverings. Many of these pieces are of genuine beauty, nith rich and harmonious colours and ingenious but rational patterns.

Various of the Arabic geographers give valuable though meagre

information about carpet weaving in the near east from the 8th to the 14th century. Armenia was certainly one of the most productive districts. Here were found good wool, clear water and fine dyes, especially a fine scarlet made from the *Coccus ilicis* called *kermez* and widely exported. Armenian rugs were famous in the 8th century, and we know that by the 10th such cities as Devin, Van, Kalikala (Ezerum), Bitlis, Vartan, Aklat and Tiflis, all produced famous rugs. Marco Polo credited the Armenians and Greeks in the towns of central Asia Minor (Konia, Sivas and Caesarea) with weaving the most beautiful carpets in the world (*Marco Polo,* Yule trans. p. xxx). But unfortunately have no description of these carpets.



PATTERN

In northwest Persia, the towns of Khoi, Bargari, Arjig, Nachshirvan and Mukhan are all credited with rug production. The south Caspian coast, Gilan dnd Mazanderan, evidently supported an immense industry. Its prajer carpets were exported everywhere, and in the 8th century 600 rugs were sent at one time as tribute to the Caliph hlamun.

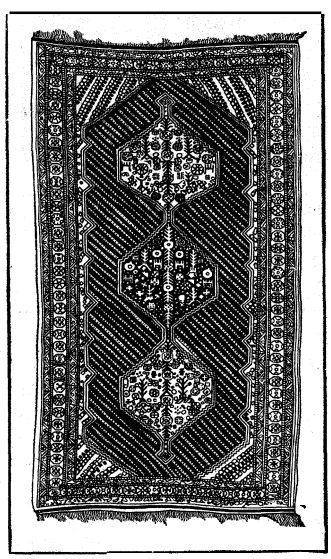


FIG. 12.—SHIRAZ RUG WITH PATTERN OF HEXAGONAL PANELS, LATE 19TH CENTURY

Rugs were an important part of the equipment of palaces and homes in northeast Persia and in Afghanistan. It is probable that there was local production, but we have no real knowledge of it. In the 8th and 9th centuries, Turkistan, according to contemporary literature. was famous for its carpets which were exported all over the world, particularly to China. Bukhara, Tashkent and Darzangi are all mentioned as producing fine rugs. Darzangi was especially noted for its tapestry rugs. The designs were probably all geometrical, as in the so-called Bukhara rugs of the day. Wall paintings from the Turfan oasis. from Kizil, and fragments of Manichaean book illustration depict floor coverings with hexagonal and other simple geometric designs.

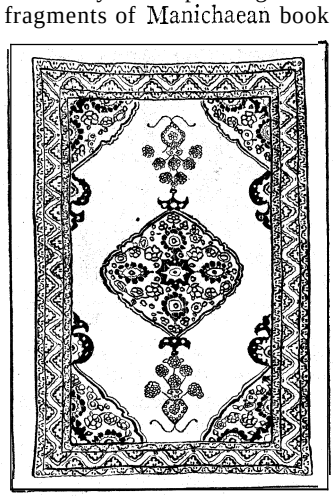


FIG 13.— MESHED CARPET, 19TH CENTURY, PATTERN BASED ON THE "CLASSICAL" MEDALLION CARPETS

Southern Persia, Khuzistan and Fars were also noted for carpet weaving. Basinna and Shustar were active centres of production. Gundigan. Fass, Darabjird, Jahrarn, all produced rugs, and the kilims are specially mentioned as of precious quality.

In the 13th, 14th and 15th centuries Asia Minor and the Caucasus were producing rugs, rather coarse in weave, of strong colour and simple geometric design—stars. polygons. entrelacs often nith border patterns of stylized Kufic writing. and a special group of rugs with simple, highly conventionalized animal forms. The most important of these are a group of three somewhat fragmentary carpets of strong repeating geometric patterns in somewhat harsh colours, red. yellow and blue. which mere found in the mosque of Ala-ud-Din in Konia and are now treasured in the Ewfkaf museum at Istanbul. Local tradition assigns them, reasonably enough, to the period of the Seljuks of Rum, cousins of the Persian Seljuks, who maintained their authority in Asia Minor through the 13th century. In the Berlin museum and in the National museum at Stockholm are a pair of rugs of very primitive design, the former a highly conventionalized dragon-and-phoenix combat, the latter stylized birds in a tree, both patterns that were later richly developed in the Caucasus, which warrants attributing them to the Caucasus of the early 13th century.

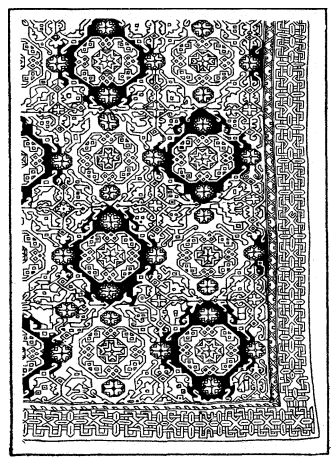


FIG. 14.— SO-CALLED "HOLBEIN" RUG, BLUE, RED, GREEN AND WHITE. ASIA MINOR, 16TH CENTURY

A little later there began to appear in Europe, coming from the same as yet unspecified region, a considerable number of rugs of finer weave, more delicate patterns and richer colours. These also are almost wholly geometrical in pattern. They were depicted by the Flemish painters such as Hans Memlinc, Van Eyck, Petrus Cristus, with such skill and loving care that the separate knots are sometimes visible, and the full artistic character of the rugs, which was considerable, is adequately presented. The designs of many of these rugs have been quite faithfully repeated in the later weavings from the Bergamo district in Asia Minor and from the southern Caucasus almost to the present day—an impressive evidence of the conservatism of rug design which so complicates the problem of dating.

CLASSIFICATION

Because of the difficulty of classification it has been customary to name the great court carpets of the 16th century in accordance with their presumed themes, and me read of "Hunting carpets," "Garden carpets." "Medallion carpets." "Compartment carpets," "Vase carpets" (so-called because of the presence of a vase in the design), "Praver carpets," "Animal carpets.;' This classification is hardly more than a temporary convenience, and really evades the problem. These various themes were embodied in the carpets of many different regions and over long periods. A more serious classification attempts to connect a given carpet style with some dominant cultural unit; the court of a great monarch; the locality in which the patterns mere developed: the actual place where the carpet was fabricated. including the sources of design elements. This method is difficult because of the dearth of contemporary documents, and because in a court-supervised art, material was often gathered in one place and shipped to some court-subsidized loom, while court-approved cartoons also were apparently supplied to the various weaving centres, and the provinces also copied the cosmopolitan styles in vogue at the capital On the other hand, we know from an actual document of Shah Abbas that even at his time nhen the imperial dominion was formally established, in all matters cultural as well as political and economic. the integrity of the local weaving centres was not only respected but the officers of the crown mere charged to see that they were preserved. The majority of the more important carpets of the 16th century, in colour, pattern, materials and

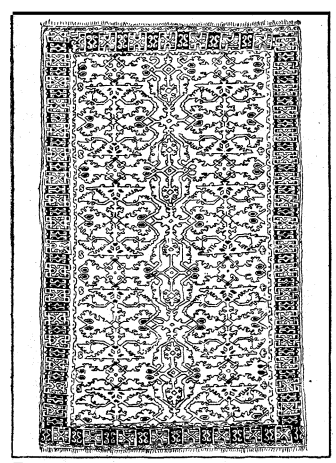


FIG. 15.— SO-CALLED "LOTTO" RUG. CONVENTIONALIZED ARABESQUES IN YELLOW ON RED GROUND. ASIA MINOR, 16TH-17TH CENTURIES

technique fall into groups of such marked individuality and integrity that we can be sure that in most cases we are in the presence of a real school. The finest of them are almost all now in museum collections. The complex designs are thought out with perfect lucidity controlled by a rigorous decorative logic, with imagination and frequently with deep feeling for a genuinely noble effect. They are in the proper sense a monumental art. Their very size is impressive. The more important of them may be from 20 to 40 ft. long, and in the 17th century, more than 50 ft., though such a size somewhat exceeds the power of unified comprehension.

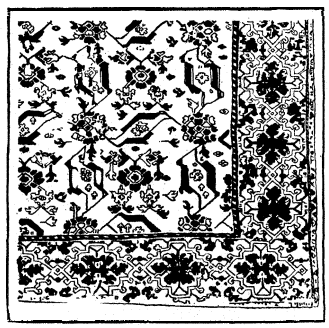


FIG. 16.—SO-CALLED "BIRD" RUG, ASIA MINOR, 17TH CENTURY

The materials, both dyes and wool, were of the finest that the unlimited power and wealth of the shah could command. Sheep were specially bred and tended; dye plantations cultivated like flower gardens; aspiring designers and weavers, could by submitting cartoons or finished work win a court appointment which conferred arestige and nrivileges which were greatly prized. The 15th and 16th centuries were the heirs to the slowly accumulated artistic tradition of a deeply artistic people. The ambition was there; the material and means were present; and a passion for perfection, which was a special attribute of the Timurid period, where "artists had no other thought than to make their work the most perfect possible," brought about just that unique combination of favourable circumstances which alone supports supreme artistic achievement.

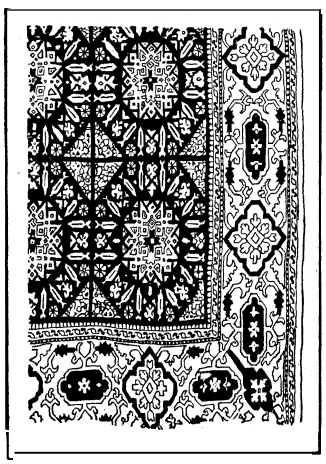


FIG. 17.— TURKISH COPY OF A CAIRENE RUG, 17TH CENTURY

The rugs of this period can with a certain confidence be divided into six well defined groups.

The stately Medallion carpets of northwest Persia, judging by the tonality, the materials and the subsequent history of the type seem to have been done in the vicinity of Karabagh in northern Azerbaijan. At the same time a special court atelier, possibly located at Sultaniya, as an elusive contemporary document hints, translated into carpets the most gorgeous and varied creations that the illuminators could devise. A dozen or more pieces of this group have survived. Each one is a separate masterpiece, and if they do form a class, it is first of all on the basis of outstanding artistic quality, superb design, majestic size, colours of great purity and depth, and perfection of detail. They all use a fine, crisp, very white wool, probably from Ahar in the extreme northwest, which today furnishes the most brilliant wool found in Persia, a wool which takes dyes most beautifully.

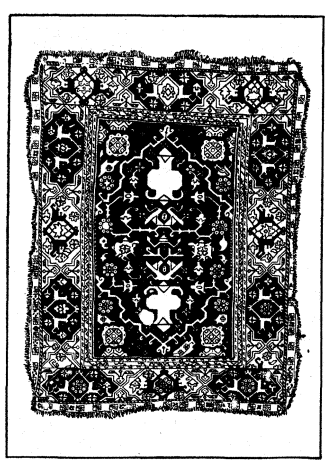


FIG. 18.— SO-CALLED "TRANSYLVANIAN" RUG. ASIA MINOR, 17TH CENTURY

This group includes the world's most famous carpets. The great pair of carpets from the mosque at Ardabil. dated 1539 (one owned by Paul Getty, the other by the Victoria and Albert museum, London), are the best known carpets of the period.

The ornamentation consists of an extremely rich and intricate system of stems and blossoms on a velvety glowing indigo field, which in turn is dominated by a complex golden star medallion. (The colour-quality designations belong only to the Getty piece, as the Victoria and Albert piece was still [1944] in grievous need of cleaning.)

The Ardabil weaving has a near rival in the Anhalt carpet, named for the duke of Anhalt who once owned it, now also onned by Duveen. An intricate star medallion dominates a brilliant yellow field covered with an ingenious system of scrolling arabesques and fluttering cloud bands, framed by a scarlet border. Another pair of carpets from the same region has a scarlet medallion on a white field, which is interspersed with lively animal forms and framed by a dark blue arabesque border. One belongs to the Berlin museum and the other to Paul Getty, the American collector. An impressive pair, one in the Musée des Tissus at Lyons, and the other in the Metropolitan museum in New York (the Lyons piece sadly wrecked, and the New York piece mutilated by reduction) is composed entirely of cartouche patterns enclosing in their irregular spaces brilliant little arabesque compositions. The effect is somewhat incoherent but the pair rise to greatness by virtue of the superb finesse of detail and the magnificent colour.

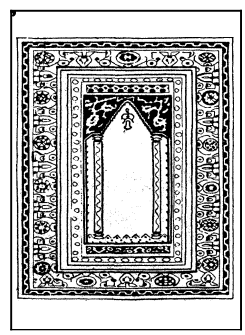


FIG. 19.—GHIORDES PRAYER RUG OF FINE TEXTURE AND SHORT PILE

One of the most beautiful in the series is the animal carpet half in the cathedral of Cracow and half in the Musee des Arts Decoratifs in Paris, by the same designers and weavers as the Anhalt carpet. It has the same glowing scarlet and gold, but with more subtle halftones (buff on yellow, gray on taupe) and a more pictorial presentation of the paradise park. One of the most striking of the series is the great Tree carpet, also somewhat reduced, that belongs to the estate of C. F. Williams, now in the Philadelphia museum. Like the Cracow-Paris carpet it is a garden scene, with cypresses and flowering trees of glowing vernal splendor.

Historically more important and in beauty a rival of any is the great Hunting carpet in the Poldi-Pezzoli museum in Milan, which carries the precious historical inscription: "It is by the efforts of Giyath-ud-din 'Jami that this renowned carpet was brought to such perfection in the year 1522–23." Again a rich scarlet and gold medallion dominates a field of deep blue, covered with an angular network of blossoming stems, across which in every direction hunters dash after their prey.

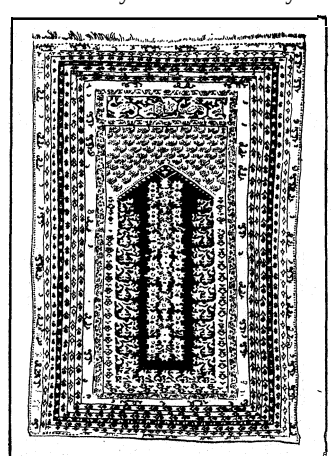


FIG. 20.—KULAH PRAYER RUG

This small group, in the opinion of many, represents the supremest achievement in the whole field of carpet desinning. None the less, other ateliers under royal direction were also producing many beautiful specimens. One type, also under the domination of the court and possibly done at Tabriz (possibly also at a little town near Hamadan, called Derguzin, in western Persia) reflects even more precisely the art of the illuminator. Some of these are in small size, all with medallions dominating the field which is covered with very intricate systems of two-toned arabesques beautifully co-ordinated and subordinated one with another, with inscription cartouches in the border. More than a score of these have survived and they are like pages from a 16th century manuscript. A few beautiful prayer rugs discreetly illuminated with silver and gold belong to the same group. Most of these rugs have come out of Istanbul

and may be part of a famous gift of rugs that Shah Tahmasp made in 1665 to the sultan of Turkey. The largest and best-known single example is a beautiful multiple-medallion carpet in the Victoria and Albert museum (London) which Dr. Bode mas inclined to ascribe to the end of the 15th century and to rank as the finest carpet extant.

But rug weaving was also the concern of other parts of Persia. In Kashan, in the second half of the 16th century, superlative silk animal rugs were woven, of which three large specimens survive. The finest—some think the finest of ail known carpets—is the silk, gold and silver enriched Hunting carpet which is one of the principal treasures in the Austrian state collection. It is a *tour* de *force* of both designing and weave. The cartoon was obviously the work of a master painter. Another large piece from the same looms is owned by the king of Sweden and a similar one belongs to the government of Poland. About a dozen smaller pieces of the type are known, each worth many times its weight in gold. The famous so-called Isfahan carpets, which were not from Isfahan at all, were made in east Persia in the vicinity of Herat and Sabzawar. They are the most abundant and most familiar of the so-called classical carpets. The typical field is a very rich claret or dark *rose* du *Barry,* covered with a delicious pattern of tendrils and graceful lanceolate leaves, framed by a broad border either in deep emerald green or dark blue, carrying magnificently constructed palmettes alternating with lotus or peony blossoms.

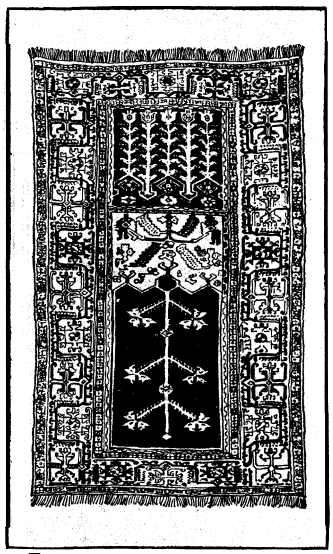


FIG. 21.—LADIK PRAYER RUG

North of Isfahan in the picturesque hill town of Joshaghan a strikingly beautiful and highly individual class of carpets was produced that has been called Vase carpets. The pattern structure is generally a series of ogival latticelike systems which carry a profusion of blossoms interspersed with foliage. Only a few of these whole carpets have survived, of which the pair divided between Lady Baillie and the Berlin museum is typical. The glowing blue of the background and the very finely divided clear colours are scarcely to be caught on a colour plate. There are a scant 20 whole pieces of this splendid type, though many very fine fragments still exist. These rugs were apparently not exported from Persia but used almost exclusively for court and mosque. They are woven on a solid double narp, which gives them a boardlike stiffness that holds them flat to the floor—a desirable feature for a carpet. They are still called in Persia "Shah Abbas carpets." The style (which was indigenous. very ancient and characteristically Persian), reinforced by the prestige of the court, exercised a nide influence, and derivatives show up in Kurdistan, the Caucasus and even in the embroideries of Bukhara, as well as in the court carpets of India.

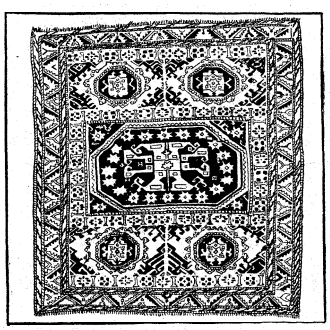


FIG. 22.—BERGAMO SQUARE RUG

There are other beautiful carpets of the 16th and early 17th centuries for which the Provenance is still doubtful. Magnificent rugs were, we know, woven in Kerman, Tazd and Fars, and perhaps Khuzistan, but just what they were like we can only guess, as we have no extant example that can with any surety be assigned to any of these places.

From time immemorial, the rugs of Persia had been enriched by gold and silver thread, a device that was discreetly used in some of the 16th century carpets from east Persia, but by the time of that mighty monarch, Shah Abbas, the scheme was carried to a most sumptuous perfection and many carpets of sheer opulence made of silk with great masses of interwoven silver and gold were made to delight the monarch and to dazzle the astonished ambassadors and travellers from Europe. The most gorgeous of these carpets is the so-called "coronation carpet," still preserved in its pristine splendor in the Rosenborg castle in Copenhagen. The gold background gleams as brightly as the day it uas woven and the velvetlike pile, aith its accurately drawn arabesques is no less perfect.

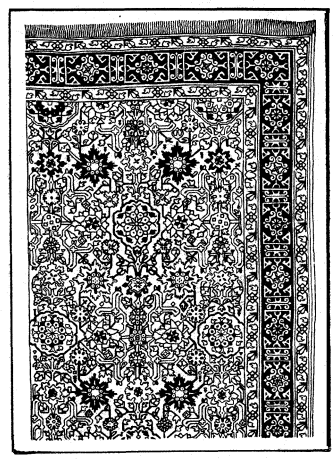


FIG. 23.— KUBA CARPET

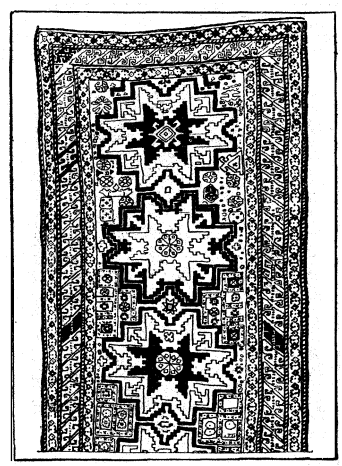


FIG. 24.— SHIRVAN RUG

As the 17th century wore on, both the demand for more luxury and the increasing wealth that sustained it, multiplied the manufacture of these carpets until they mere not only available for purchase to ordinary civilians in the bazaars, but were exported in great numbers to Europe, where more than 200 of them have been found. They are closer to the European Renaissance and baroque idiom, with their high-keyed fresh colours and demonstrative opulence, and the finest of them are indeed beautiful. A large number of these pieces were found in possession of some of the great families in Poland, for Poland had very close relations with Persia in the 17th century. and Polish royalty and nobility ordered gold-threaded rugs of this type from the looms in Kashan. There had been a rug-neaving industry in Poland in the 18th century and a silk-weaving industry also which used gold thread. So when these Polish rugs were first exhibited at the Paris exposition in 1878 it was natural to think that they were really Polish, for nothing quite like them had at the time been found in Persia. They were accordingly labelled *Tapis Polonazs,* and the name has stuck to the type ever since. Actuaily, they were primarily a product of the looms of Kashan but were probably also woven in the royal shops in Isfahan. The style degenerated rather rapidly. By the second half of the 17th century materials were cheapened. weaving coarser and more careless, the designs clumsy and confused.

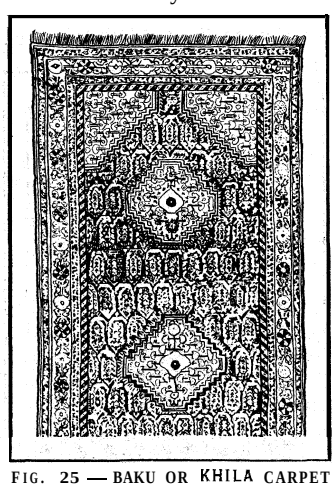


FIG. 25 — BAKU OR KHILA CARPET

Similarly the east Persian Herat carpets which came into the European market by way of India and the gulf export trade, partly in Portuguese control. partly in English, became known in Europe as the typical Persian carpet. The demand was furious and the competition among the great of the land to acquire them even had international political consequences, as when the duke of Buckinghain delayed signing a treaty with Spain until the Spanish ambassador could procure some of these carpets for his new

palace, Hampton Court. Many of the European artists of the period owned them, and Van Dyke and "Velvet" Breughel, particularly, rendered them with such complete fidelity in dated paintings that we can with a little care and stylistic analysis date these so-called Isfahan carpets to within a couple of decades.

FIG. 26.— DAGHESTAN PRAYER RUG

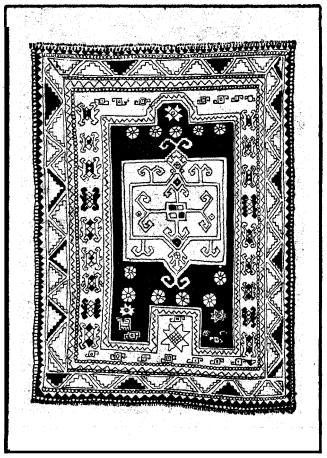


FIG. 27.— KAZAK PRAYER RUG

The Indian princes also were enamoured of them and acquired them by plunder and purchase alike. The result was mass production with the inevitable consequence of a rapidly deteriorating art. Designers were no longer employed. cartoons were wearily repeated ad *infinitum*, the weavers had little interest or pride in their work, the pressure for speed and for economy deteriorated every process, and the style finally expired in a repulsive mediocrity, painful proof of how and why a great art can be brought to ruin.

During the 17th century there was an increasing emphasis, where the court could afford it, on refinement and luxury, but on the whole a steadily slackening inspiration. Routine increasingly displaced invention. But in 1666, a set of silk carpets was woven to surround the sarcophagus of Shah Abbas II in the shrine at Qum, of such finesse that even orientalists have mistaken them for velvet. The drawing is beautiful, the colour varied, clear, brilliant and harmonious, and the set has the important merit of being dated and signed by a master artist, Nimat'ulla of Joshaghan. This set marks the last really high achievement in Persian rug weaving, although handsome carpets were woven throughout the century and even in the 19th century, and these, despite the increasing poverty of the time and the decline of all the arts, still surpass any floor covering ever conceived or rendered in the western world.

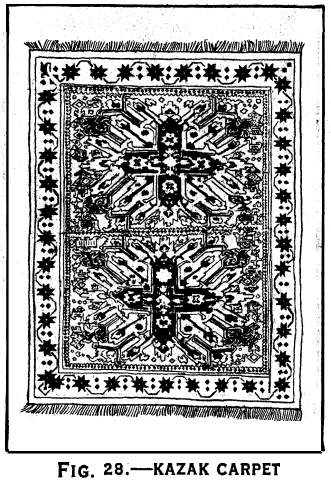


FIG. 28.—KAZAK CARPET

The carpets so far described were all specially made for the court or for the great nobles. They could afford to concentrate on perfection and disregard expense, which was often considerable. Indeed, a carpet like the Ardabil or the Austrian Hunting carpet cost as much as a small palace. Such rugs could be of silk, gold and silver, almost too fragile for anything but contemplation or the most lavish ostentation. They were cared for by special custodians. brought out only as actually needed, often for state occasions only. and even when the king sat on them they were generally partly covered with a lighter fabric for completest protection. The mosque carpets had severer and more continuous use. Carpets that reached Eurcpe were for the most part treasured with equal solicitude. They were precious items in royal treasuries like the Austrian Hunting carpet, which Peter the Great gave to the emperor of Austria, the Danish Coronation carpet or the Anhalt carpet, which are all almost as fresh and perfect as the day they were taken off the loom.

Persia. — Little is known of carpet weaving of the 13th and 14th centuries in Persia, but by the 15th the art was rapidly moving toward an artistic climax. The horrors and devastation of the Mongol invasion certainly depressed the artistic life of most of the 13th century, which was only partly restored by the magnificence of the architecture and miniature painting of the Ilkhan renaissance (1290–1335). The bloody conquests of Tamerlane were disastrous to Persia. but he spared and favoured artisans, who were removed in large numbers to work on his great palaces in Turkistan, particularly at Samarkand and Bukhara, where they were chiefly responsible for a new school of painting and decorative design.

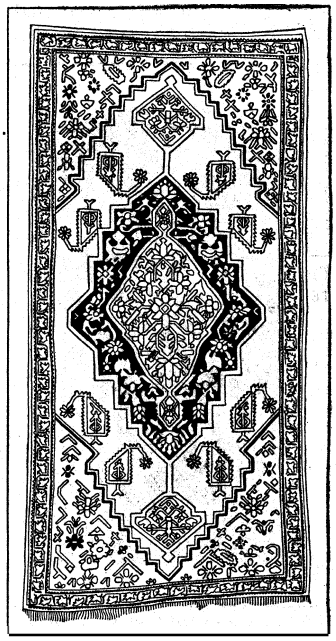


FIG. 29.— KARABAGH CARPET. BLUE AND MAGENTA

Out of this, under the enlightened and cultivated rule of Tamerlane's successors, particularly Shah Rukh (1377–1447) and Baizangur (1396–1433), literature and art in all its branches were brought to magnificent floriation. Out of this matrix came the supreme achievement of the carpets of the 16th century.

These great carpets of Persia, like most of the finest art of the times, were produced in the palace ateliers or on court-subsidized looms and this made for unity and integrity of style. while a sensitive and exacting clientele imposed the highest standards, and the lavish royal support guaranteed supreme technical proficiency, the most perfect materials and the utmost in skill. All these conditions obtained under the Timurids through the 15th century and under the Safavids (1501–1723).

Authoritative at court and generally supervising all artistic enterprises were the miniature painters, illuminators and book binders, for the art of the book had long been considered the supreme accomplishment and a genuinely great calligrapher outranked weaver, architect or even poet. The art of the book in the 15th century, nhich already had behind it centuries of superb achievement, reached a degree of elegance and sophistication that it has never known either before or since. Bindings, frontispieces, chapter headings, and in the miniatures themselves, canopies, panels, brocades and carpets, furnished the spaces, mostly rectangular, which by the taste of the time, called for the richest and most elegant patterning.

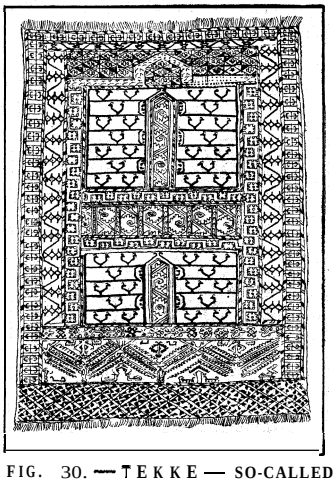


FIG. 30.— TEKKE — SO-CALLED KHATCHLI (CROSS) DESIGN

The beautiful designs thus conceived were in various degrees appropriated by the other arts and the illuminators were given authority over the weavers whom they tended to regard as mere assistants — at best only colleagues.

This domination of outstanding artists accounts in no small measure for the special character of the court carpets of the period, the variety of colour, the ingenuity and imaginative range of pattern schemes. the superlative draftsmanship which is both lucid and expressive, as well as the intensity of artistic percep-

tion which raised these products to the rank of great painting. Indeed, John Sargent and Sir Charles Holmes, both independently used almost the same words referring to two different 16th century carpets: "There is more art in a really great carpet than in any picture ever painted." *(See* Pope, *A Survey* of *Persian Art,* vol. I, p. 2.)

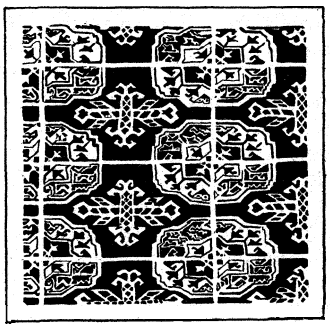


FIG. 31.— TEKKE RUG, FIELD PATTERN

FIG. 32.— YOMUD TENT BAG OF MEDIUM FINENESS

India.—Very little is known of early and indigenous carpet weaving in India where it was apparently a late development, for in a tropical country carpets are not so necessary as in northern climates where their warmth is an asset. As an art it was brought in from Persia by the Mogul princes in the 16th and 17th centuries. Akbar set up royal looms that were thought to surpass Persia's finest although, as his biographer Abul Fazl tells us, rugs were still imported from various centres in Persia. The Herat carpet-weaving establishments that made the so-called Isfahans, being nearest, furnished models and apparently weavers were brought thence to continue the style in India, where it was rapidly crystallized, with the elements reduced and formalized, the drawing rigid and meagre. Colours and wool also deteriorated and there were few compensating additions from Indian sources.

The carpets made for the courts of the Grand Moguls, however, were of extravagant and luxurious beauty. Shah Jehan, for example, had made for the palace of Amber a set of rugs from the most precious wool, imported from Kashmir and from remote Himalayan valleys. With the Mogul princes, expense was never

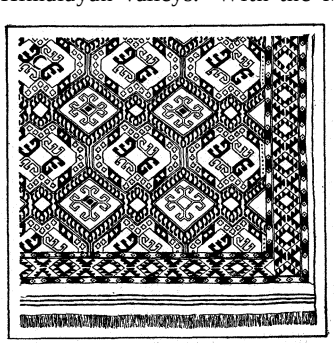


FIG. 33.— ERSARI PATTERN. CHIEFLY A BROWN RED

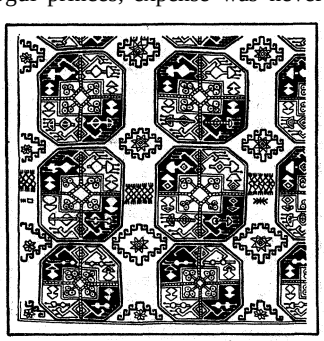


FIG. 34.— AFGHAN RUG, FIELD PATTERN

any object. The cost of fine weaving was quite ignored and a series of carpets turned out with 800 to 1 200 knots to an inch, which provided a luscious velvety texture. Special carpets were of even finer weave and a fragment of a prayer rug has survived (Metropolitan museum) which has the incredible fineness of nearly 2,400 knots to an inch. Master draftsmen, designers and dyers were, of course, employed and no obvious beauty neglected.

But the art was young and its sources nere in imitation, not deep in the life roots of the people. The standards of taste were too recent and too personal, and despite the magnificent models they worked from, despite the limitless subsidies which they could command, these wonderful fabrics never reached the artistic height that characterized many periods of Persian weaving. Their beauty is too obvious, there is no deep and significant organization of pattern, there is a want of imagination and a want of feeling for the possible and the appropriate. The aim was too pictorial, the stately palmettes and curving leaves of Persian carpets which were in themselves noble and significant compositions, are reduced in Indian carpets to a meticulous botany, faultless in detail but lacking in meaning, much too photographic to sustain any poetic fancy.

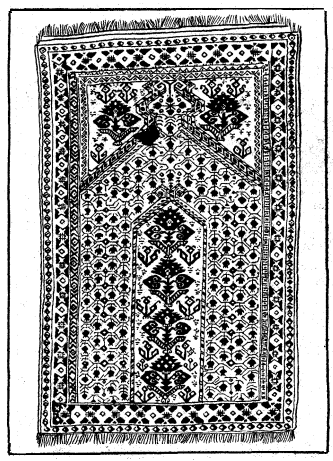


FIG. 35.— BESHIR PRAYER RUG

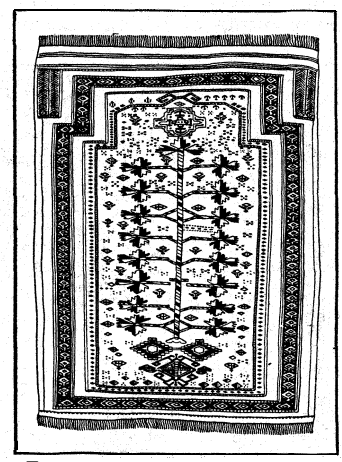


FIG. 36.— BELUCHI PRAYER RUG

The rug industry, once established, continued down to the present. It became a jail industry, particularly in the Punjab. The designs were increasingly meagre and the art could not longer sustain comparison with the Persian weaving.

The later Indian carpets are mostly very inferior, largely on account of the difficulty of obtaining good wool. Many still have the designs of Persia and of other countries but purely Indian patterns are also common. From time to time better carpets have been made in the factories and during the 19th century the government established a fairly successful manufacture in the jails, but it is rarely that in both design and quality they rival the better products of Persia. The best come from Agra and Warangal, the latter producing some good silk rugs. Carpets from Masulipatam, Mirzapore and Tanjore are very cheap and very substantial but the wool is so harsh and the colours so dull and gray that they are quite unattractive. Cotton rugs are made in Multan, and tapestry-woven ones, called *daris,* in many places. During the 20th century carpets of good quality, with any desired pattern. are being made in Kashmir, where some handsome reproductions of famous classical carpets have been made.

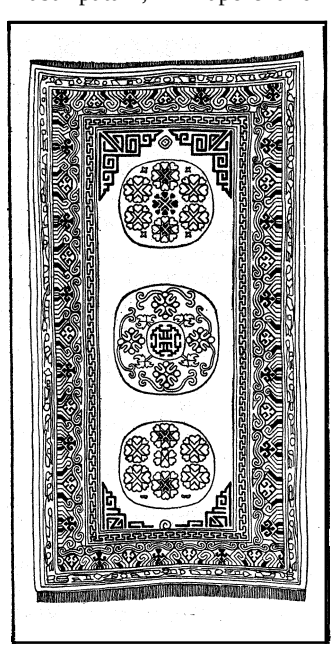


FIG. 37.—CHINESE TURKISTAN CARPET WITH THREE MEDALLIONS

Turkey.— Turkish rugs, after the 16th century, were of two markedly contrasting types, those made on court looms following Persian designs and possibly the work of imported Persian and Egyptian neavers. Exquisite cloud bands, feathery lanceolate leaves in white on grounds of pale rose relieved by blue and a deep emerald green, carry the rug-weaving art to a special type of perfection. These rugs are somewhat like Persian poetry which was so much admired and copied by the upper classes. The more indigenous Turkish styles are embodied in large and handsome carpets made for a clientele of mosques and nobles; styles best illustrated in the Oushak carpets, ornamented complex star medallions in gold and yellow and dark blue centring on a field of rich red. The so-called Holbein carpets (fig. 14) with Caucasus-like polygon on a

ground of deep red often with green borders and a conventionalized interlacing Kufic such as is shown in Holbein's famous portrait of George Gyscze. A handsome carpet of interlacing yellow arabesques on a ground of deep red appears so often in the paintings of Lorenzo Lotto that the rugs are now designated

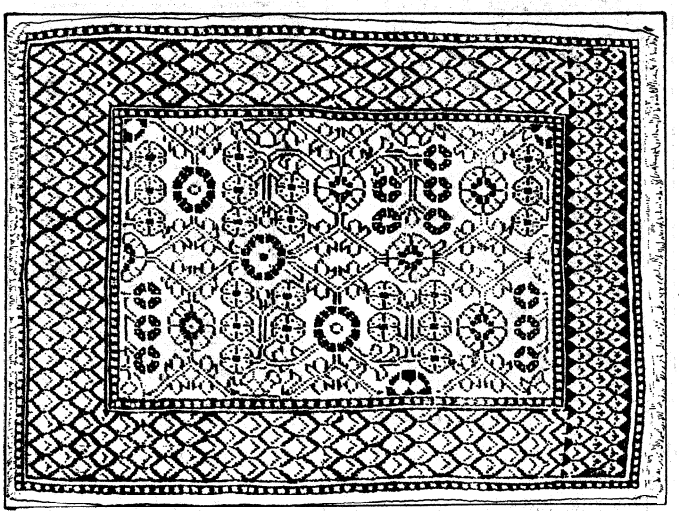


FIG. 38.—KHOTAN CARPET WITH "FIVE BLOSSOM" PATTERN

as "Lotto" rugs (fig. 15). From some unidentified region, perhaps Bergamo. come rugs again on a ground of deep muffled red of wonderful depth and intensity, also focused on small medallions. This type developed in the 17th century into carpets known as Transylvanian (fig. 18), because so many of them have been found in the churches of Transylvania. But they are purely Turkish in feeling and have the Turkish merits of rich and quiet colour and placid designs, aside from prayer panels, vases and conventionalized foliage, ultimately of Persian derivation. Many of these are prayer rugs. The majority are dominated by a fine red but a few use a wool that is now approximately the colour of old parchment.

The 17th century saw the development of another characteristic type, erroneously called Bird rugs (fig. 16) as the highly conventionalized pair of arabesque blossoms on stems enclosing a leaf does suggest a bird. The few rugs that have survived are of serene and quiet beauty, the field is of soft ivory white and all the colours discreet and modest.

The Turkish rugs are distinguished above all things by their rich and harmonious colours and their broad and spacious designs. They have none of the lively and intricate movement of the Persian carpets, none of the adroit differentiation of pattern, none of the fuguelike counterpoint where primary, secondary and tertiary patterns are played against one another in subtle rhythms, dissonances and resolutions, Persian qualities unsurpassed and unapproached in these respects by the weaving of any other region.

The Caucasus.—Fine rugs have been woven in the Caucasus from earliest times, for this region provides every facility for the art. The enormous prestige of Persia, the dominant political and cultural power in this region through many centuries and the magnificent carpets produced at the court furnished models for the more serious Caucasus weavings that were made for the local nobles or khans. But the Caucasus has its own individual character and while it took motives from other sources, like the dragon and phoenix fighting (so common in Persian illuminations), sunburst medallions, latticelike field divisions derived from the Vase carpets and other sources, or repeating lotus forms often in huge scale, all these contributory elements were completely transformed, and were used only as indications or design material to be refashioned. The Caucasus rugs. perhaps because of questions of expense (for the little Caucasus kingdoms could never compete in luxury with sultans or shahs) were of coarser weave, the famous Kuba Dragon carpets being not infrequently less than 80 knots to the square inch, and hence the designs were much simplified; but the taste that controlled these virile and powerful designs was genuine and original and warrants classifying the rugs of this region as one of the principal types.

One of the most famous of the Caucasus weavings, the Dragon carpets, concerning which there has been a heated controversy, seems to hdve come from the town of Kuba, which was one of the great weaving centres. These carpets are of a prodigious scale and furious vigour of design that has no rival in the textile world

(A. U. P.)

Central Asia—As the carpets of western Turkistan are made by nomadic Turcoman tribes living in tents and constantly moving about, it is not to be expected that very old ones can still exist. Probably in fact few go back more than 100 years, though it is almost certain that similar rugs have been made for centuries. Turcoman rugs are easily identified, for they all, excepting the Beluchis, have a dark red colouring and geometric designs. Many of the older pieces are not in reality rugs at all though those intended for hanging in tent doorways have that appearance. Many are just bags used for storage in the tents or on the pack animals. Those called camel bags measure about five by three feet, and the tent or wall bags three by one or more. Saddle bags consist of two squares of about two feet, joined together. There are also long bands about a foot wide and perhaps 60 yards long, which are for wrapping round the large tents. The small squarish rugs and larger ones of about ten by seven feet seem to be later in date and were perhaps made chiefly for sale. The Turcoman carpets (wrongly called Bukhara) have woollen warp, weft and pile, two lines of weft and nearly always the Sehna knot. They are surprisingly well woven for nomads nith none but the most primitive appliances. After the predominant red, the chief colours are blue, white and a natural black that tones to a very pleasant brown. The characteristic design is the octagon—or so-called elephant's foot—arranged in rows and columns, often with diamond-shaped figures in between The doorway hangings—called Tekkes (see fig. 30)—have cross shaped panelling and the smaller pieces often have a rectangular diaper. Woven end webs and tassels are freely used as embellishments. The best classification is on a tribal basis.

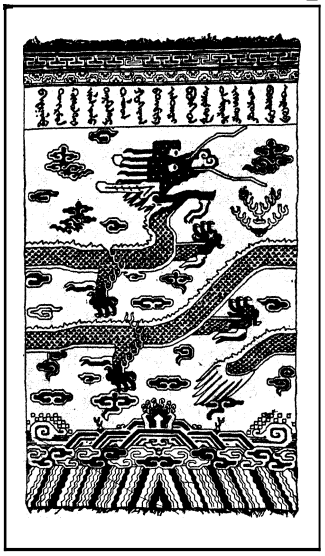


FIG. 39.—PILLAR CARPET. DRAGON DESIGN

Tekke.—These are often very finely woven, sometimes with 400 knots to the square inch. The principal colour is a deep muffled red (fig. 31).

Yomud.—Of medium fineness, mostly with the Ghiordes knot. The chief colour is a purple red, and there is a good deal of white, especially in the border. In the pattern diamonds often displace the usual octagon (see fig. 32). The long tent bands, which have the pattern in pile on a woven ground, belong to this group.

Saryk.—Like the Tekkes but with an almost black-purple or very deep crimson colouring, together with some very prominent white. Not very common.

Ersari.—These are rarely large pieces. The chief colour is a bronn-red; dark green and a little bright yellow are characteristic. The patterns are very varied, with a tendency to zigzags, diagonal lines and spotted effects (see fig. 33).

Afghan.—Mostly large rugs with long pile and a pattern of large octagons almost touching in columns (see fig. 34), and akin to the Ersaris.

Beshiv.—A rare type apparently made near Bukhara, with rich colouring including a lot of yellow, and patterns apparently based on the Persian Many are prayer rugs with a characteristic pointed arch (see fig. 35). Large carpets are more common.

Beluchi—These differ from the other Turcomans in that they have a black weft, and dark purple and red colouring, sometimes

with natural camel-colour and very staring white. The patterns are almost geometrical but the prayer rugs often have tree forms (*see* fig. 36). Most of them come from eastern Persia in the vicinity of Khaf near the Afghan border.

Chinese **Turkistan.**—The earliest rugs of Chinese Turkistan date from the 17th century and mostly have a silk pile and some metal and gilded thread. The patterns are formal floral ones, based on the Persian but with unmistakable Chinese treatment of the detail. The later carpets are loosely woven with the Sehna knot, wool, or more rarely silk pile, and a cotton warp. The 18th century examples have rich but dark colouring, which during the 19th century gets gradually more vivid until at last it becomes excessively crude. There are two important types of design.

Medallion.—These usually have three medallions suggesting in shape a square with well-rounded corners (see fig. 37). One border almost invariably has a conventional Chinese pattern of foam-crested waves. This pattern is mostly called Samarkand in the trade, but the rugs themselves come from Kashgar and Yarkand.

Five Blossom.—These have a floral diaper with characteristic groups of five blossoms (see fig. 38). The colouring is often richly red and orange with a little clear blue.

China.—The rugs of China proper are easily recognized by their characteristic Chinese ornament. They are of coarse texture and are woven with the Sehna knot on a cotton warp: the pile is thick with a very smooth surface. A peculiar feature is the clipping of the pile so as to form a furrow at the contours of the pattern. The prevailing colour is yellow, sometimes intentional but often resulting from the fading of shades of red and orange. Blue and white are also freely used but there is little true red, brown or green.

Some of the carpets have repeating scrolling plant forms. Others have, scattered about, flowers, medallions of frets and the countless symbols that are so familiar in Chinese art. Frets of the Greek type are very common in the border. Pillar carpets are peculiar to China. They are designed (see fig. 39) so that when wrapped round a pillar the edges will fit together and give a continuous pattern, which mostly is a coiling dragon. Many small mats, seat covers and the like are found. The dating of Chinese rugs is an almost impossible task, as patterns have varied very little with time, and internal evidence is almost nonexistent. During the 20th century numbers of large carpets have been made for export.

Morocco.—Large carpets, twice as long as wide, are made in Morocco. They are loosely woven with very bright but mostly faded colours. The field is often cut up into rectangular panels filled with ornament taken directly from Turkish carpets.

Spain.—Carpets seem to have been made in Spain as early as the 14th century. They are made entirely of wool. The knot is tied, or rather twisted, on one warp thread instead of on two, and the weft passes several times after each row of knots. The colours are bright and few in number, little being used but yellow, blue, red and green. The designs fall into two groups, being based either upon oriental models, such as the geometrical Turkish one or upon purely Spanish ornament. The latter type of carpet frequently introduces heraldry. One early type of long rug has shields of arms on a field with a honeycomb pattern introducing plant forms and birds. A common design is a succession of foliated wreaths; another is a diaper of ogee compartments containing the floral device known as the "artichoke." Few knotted pile carpets seem to have been made after the 17th century, but small rugs woven in narrow breadths with a looped pile were common until very recently. They come principally from Alpujarras in the Pyrenees.

England.—The art of making hand-woven carpets in England soon followed their importation from Turkey, though actual specimens of the 16th and 17th centuries are so rare that only about a dozen complete rugs are known. They have a hempen warp and weft and a noollen pile of medium fineness, tied with the Ghiordes knot. The ground is usually green and there are so many shades of the other colours that the whole number of tints is greater than in oriental carpets. The designs may be divided into two groups. In the first are found typical English patterns resembling contemporary embroidery, and often introducing heraldic devices and, fortunately, dates. The earliest known carpet of this type belongs to the earl of Verulam and is dated 1570. Large numbers of pieces of carpet knotting—called at the time "Turkey-work"—were made for covering chairs and stools. As the demand for carpets increased in the 18th century small factories were started at Paddington, Fulham, Moorfields, Exeter and Axminster, and the home production was stimulated by premiums offered by the Society of Arts in 1756. The designers continued to adopt the decoration of the time or to copy eastern carpets. The famous Axminster factory worked on well into the 19th century and then became merged into the Wilton factory, which is still in operation, With the advent of machinery the industry dwindled and almost disappeared until, about 1880, the craft was revived by William Morris. Quite late in the century a successful factory was opened in Donegal and during the 20th century many small rugs have been knotted by handicraft societies, though their products can scarcely compete commercially with the machine or with the oriental rug. (C. E. **TA.**)

THE UNITED STATES

The first carpet factory in the United States was established in 1791 by W. P. Sprague at Philadelphia. From that time the development of carpet-weaving machinery has progressed rapidly, especially in the line of broadlooms. One of Sprague's earliest Axminster carpet designs represented the arms and achievements of the United States. This attracted the attention of Alexander Hamilton, who recommended the imposition of a small duty on imported carpeting, thus initiating the policy of a protective tariff. While in the early days of carpet manufacturing in the United States, looms were imported from Great Britain and the continent, it uas not long before looms were invented and constructed in the different carpet mills which had come into existence in several cities in the United States. The Jacquard pattern device was put into use in the United States shortly after its introduction in Europe. At Medway, Mass., in 1825, a small ingrain carpet mill, owned by Henry S. Burdett and managed by Alexander Wright, was started with hand looms brought- from Scotland. In 1839 Erastus B. Bigelow began experimental work at Lowell, Mass., which resulted in the perfection of the first power loom ever made for weaving carpets. This wove an ingrain type, and was followed by Mr. Bigelow's development of the Brussels power loom in 1848. John Johnson of Halifax, England, undertook tapestry and velvet weaving (*q.v.*) in Newark, N.J., producing the pattern by printing the dyestuff on the individual strands of yarn. In 1876, after several years of research, Halcyon Skinner invented the moquette or spool Axminster at West Farms, N.Y. James Dunlap, in Philadelphia, developed a method of printing tapestry and velvet carpeting in the finished fabric. Imitation Smyrna rugs were made in considerable quantity by many factories during the latter part of the 19th century, the process being of the chenille Axminster type, but double faced. The three-quarter width or 27 in. was the limit of weave in the several types for long periods after invention, but in the closing years of the 19th century a movement to widen the looms began in the United States. The ingrain carpet and Smyrna rugs gradually lost favour, while the tapestry, velvet, Axminster, Wilton and chenille rapidly grew in demand as the processes were perfected and the looms widened. Rugs were first formed by sewing carpet strips together. Later the corners of a border pattern strip were mitred to form the framed design effect. Slowly the necessary changes were made to allow weaving the border patterns in the straight strips and avoid the mitred corners. (See CARPET MANUFACTURE.) To eliminate the seam through the centre of rugs and in the medallion designs, popular at the time, required a wider strip and loom to weave it. Looms nine feet in width followed this trend in tapestry, velvet and Axminster in the early years of the 20th century and Wilton broadlooms followed after many years of experimental work and became popular about 1926. All these weaves are commonly woven up to 15 ft. in width and even wider looms were developed. The chenille weave, developed in Great Britain

in 1839, was not introduced into the United States until 1909 and was not produced in quantity until 1916. It has had a steady growth since because it is the only woven floor covering that can be woven to special order up to 30 ft in width, any reasonable length, any shape. design or colour arrangement and an inch or better in thickness. (X)

France. — There are early records of carpet weavers in France, but nothing is known of their nork until the foundation of the famous Savonnerie factory near Paris in 1626. There many large carpets were made, mostly with flaxen warp and neft and a woollen pile tied with the Ghiordes knot. The designs accord with contemporary French decoration and few if any nere based on oriental carpets. In 182j the factory nas closed and the manufacture transferred to the Gobelins tapestry factory. During the 18th century and afterwards many tapestry-woven carpets were made at Aubusson and in other tapestry factories.

Other Countries. — A few carpets are still in existence that were made in Poland in the 17th century, with floral patterns in light colouring. Loosely woven rugs have been much made by the peasants of Finland. They often have human figures and dates and seem mostly to have formed part of the bridal dowries Kilims are made in the Balkan states and in southern Russia; they resemble the Turkish pieces but have, especially the Russian, more naturalistic floral patterns. Those from Rumania generally include birds in the design.

PRACTICAL CONSIDERATIONS

It is perhaps more important that a carpet for use should be soundly made than beautiful and certainly better that it should be beautiful than that it should accord with any particular scheme of decoration. Oriental carpets. on account of their depth of tone, rarely go badly with other objects. Accordingly when buying, the first thing to ascertain is that the foundation threads are sound and strong and that the pile is not unduly worn anay. If a rug is held up to the light, holes and thin places are often revealed that were quite unnoticed when it lay on the floor. Holes that have been properly repaired are of little consequence. It should be noticed nhether it is of good shape and whether it lies flat on the floor. Few rugs have the sides perfectly parallel but an excessive distortion is unsightly. A rug that is not flat tends to wear badly in the baggy places, but certain good rugs, such as the Shiraz, are rarely quite free from this defect. A guarantee should be asked that the rug has not been chemically treated. as is too often done with the object of effecting a supposed improvement in colour. Such treatment usually results in a hopeless deterioration of the yarns. Undesirable though less destructive, is the process of hot rolling, nhich gives to inferior wool a silky gloss that is only transitory.

The Care of Carpets. — Carpets will give remarkably long service if treated nith proper consideration. Their tno great enemies, apart from the inevitable destructive effect of uear, are moth and damp. The former is best kept at bay by frequent moving or handling and by regular exposure to light and air If rugs must be stored, then inspection at intervals is essential. A carpet in use is rarely in danger. There seems to be a great future for certain chemical applications that render the wool uneatable by moth, but the method appears not fully established. Damp will in time rot the threads and destroy the fabric, but it can be avoided by obvious means. If any mechanical injury is suffered, such as a cut or burn, the damage should be dealt with as soon as possible by a competent repairer, for such lesions get worse very quickly. In ordinary use, quite apart from accident, the ends and sides often tend to wear and fray out, in nhich case the parts should be re-overcast — a very simple operation if done in time. Places in the middle locally worn or damaged can have new knots inserted and even large holes can be restored so as to be almost as good as new, though such work is rather expensive. In carpets of lesser value, instead of new knotting, patches cut from a suitable rug can often be inserted at less cost, and sometimes a serviceable small rug can be made from a larger worn one by cutting auay the bad parts.

From time to time but not more often than necessary carpets should be cleaned and the improvement in their appearance is often astonishing. If there is any doubt as to the stability of the dyes of the carpet, it should be entrusted to one of the many firms who specialize in this kind of work. In many cases, however, surface nashing with a limited supply of hot water and carpet soap applied with a stiff brush may be done at home, though drying the fabric afterwards is often a difficulty. as a clean and airy place must be available for some days at least It is most important to wash out all traces of soap Some of the nen cleaning compounds using irium as a base are superior to soap. In ordinary use carpets are properly kept free from dust by brushing, or by means of a vacuum cleaner, but in all cases where a brush is employed it is most important that it is not used against the lie of the pile. (See also EMBROIDERY; TEXTILES; TAPESTRY.)

(C. E. TA.)

Uses of Carpets. — The carpets so far mentioned have been practically all special productions for a wealthy clientele but at the same time, although few have survived, the common people also had their rugs.

Throughout the near east rugs have from the beginning been for commonest use and an affair of the whole population. This very universality was one of the reasons for their excellence. The traveller Herbert from England. writing in the 17th century, said there was no house too poor but what it was furnished with carpets. From immemorial time they covered the floors of house and tent as nell as mosque and palace, and serred many other uses besides. They made handsome portieres and were sometimes hung on the wall like tapestries. They were a convenient, portable and durable form of uealth. served as tribute money, and were frequently gifts of one state to another. They were used as blankets, canopies and tomb covers. In past times they were also handy for committing and concealing murder. The last caliph of Baghdad (1357) made his tragic exit via a carpet in which he nas rolled up and beaten to death. a not uncommon mode of execution, quite the reverse of Cleopatra's dramatic entrance to the presence of a Caesar (Mark Antony) nhen she stepped out of an unrolled rug Woven nith an apex that could be pointed to Mecca. they served as prayer rugs for an individual, or, given sufficient size and reduplicate prayer panels, they could serve simultaneously for a whole family or some religious fraternity They made excellent saddle covers and carryall bags as nell. These modest rugs had their onn merits. They were closer to the life of the people; the best of them have an air of genuineness and respect for the limits of the craft. On them were lavished loving care. into them nere noven life-protecting symbols which in early times people understood and took seriously — even now the meanings of the more obvious patterns are dimly remembered.

Size and Shape. — Rugs — a term understood to include all carpets for use on the floor — are mostly rectangular, though occasionally pieces are seen made to fit into irregular spaces, and a few round carpets are known, probably woven for tents. The rectangle may vary from a square to a strip at least six times as long as it is wide. A very usual ratio is about three to two. The strips, called runners or *kanara,* made in pairs to go along the sides of a Persian room, are very useful in corridors. A very common size for small rugs is about $6\frac{1}{2}$ ft. by $4\frac{1}{2}$ ft., while large ones may reach 25 ft. in length or occasionally more.

A very common room size for modern carpets is 10 ft. by 14 ft. but not for old carpets which are much narrower in proportion to length, owing primarily to their use in combinations in the oriental house. Some old carpets are nearly three times as long as uide, for example. the famous McCormick Vase carpet non in the Metropolitan museum is 10 ft. by 29 ft. Some of the palace carpets woven in the early 17th centun (especially of the Herat type) are 50 ft. long. There are recently woven fine quality hall carpets in the ministry of foreign affairs in Tehran that are approximately 6 ft. by 125 ft.

The Low School **Rugs** of Persia. — By the end of the 17th century the summit of the rug-neaving art was past. The impoverishment of the court and the general slackening of cultural energy throughout the near east are clearly reflected in the

steady decline of the court art. None the less the conditions out of which this art arose continued to operate in more humble circumstances throughout most of western Asia. The wandering nomads and the settled town dwellers alike continued to design and neave carpets which if Increasingly stereotyped and of steadily diminishing artistic vigour, none the less maintained genuine artistic character until within a few generations ago. They used dye methods that had been developed and tested through centuries Each group stuck to its own characteristic pattern content to maintain the artistic tradition intact with little addition or embellishment. These carpets were not made for a greedy impatient western market and could with oriental respect for time and perfection continue to embody traditional merits of high quality. Most of the indigenous rug weaving centres have been corrupted by western demand and the commercial organization of weaving centres, but these various humble rugs. the so-called Low School type, are frequently of a very high artistic character, beautiful in colour, design, of fine material and excellent technique. They are worthy of the collectors' enthusiasm of the last jo years and deserve a more serious study as works of art than they have received.

The identification of the localities in which these humble rugs were woven is by no means certain. Russian investigators have identified about 40 or 50 weaving centres in the Caucasus but the results are not yet published. Names are attached to rugs frequently in the international markets at Istanbul, Smyrna and Tabriz, and do not fully correspond to the actualities. Different and contrasting rugs are often woven in closely related districts, such as Bijar and Sehna, where similar appearing rugs may be woven in districts far apart. The nomadic wanderings, the forcible transfer of populations several times in the 18th century, tribal intermarriages and many other factors have tended to confuse the type and conceal their true origins. **A** few of the better known types may be briefly designated.

Kashan was noted for its fine textiles as early as the 12th century, and by the 16th it mas producing the sumptuous velvets rivalled by even more sumptuous silks and in the 17th by the silver and gold-threaded rugs called "Polonaise" carpets. The skill and tradition survived and Kashan has produced the finest woven, most elaborately designed, richly coloured rugs of recent times. Their high cost restricted the output and the best of them were finally crowded out of the market.

Joshaghan, 60 mi. northwest of Isfahan, wove the great Vase carpets of the Sefavid period and like Kashan and Tabriz continued fine weaving down to the present day. During the 19th century the most characteristic Joshaghans were distinguished by flower sprays, very precisely drawn. on a field of soft red.

The finest rugs made today come from special looms in Meshed and Birjand which have been especially favoured by court orders. The materials are excellent, the weaving leaves nothing to be desired, the colours are beautifully toned and need no chemical washing as do most contemporary eastern carpets, though the designs still lack the spaciousness, the originality and expressive poner of earlier days.

These less pretentious rugs, the product of tribal nomads or of sedentary tonnfoiks, maintained their standards down to the latter half of the .19th century when their near ruin as art was completed by western commercialism with its insatiable demand for quantity, cheapness and speed.

Western taste also intruded destructively, and European importers began to supply designs with confused or meaningless patterns, and to order shapes and colours that nere in conflict with the oriental tradition. Competition was intensified and the weaver reduced to an animated machine. Aniline dyes, harsh and fugitive, displaced the older, far more costly dyeing processes. Poor wool was cheaper than good, and various processes of chemical washing temporarily concealed the deficiencies and imparted an enticing sheen to the carpet which the unsophisticated thought charming.

However, the more intelligent European importers were aware of the destructiveness of such practices and made real efforts to arrest the deterioration of the craft and to restore something of the old quality, though the factory system was now too well established ever to be displaced. The Persian government made several sporadic attempts to contest commercialization, imposed severe penalties for the use of aniline dyes, but the commercial tide was not so easily checked. In recent years the government, however, has made a much more systematic effort to revive the art, with considerable success. A school of design. under Taherzadeh Behzad in Tehran based its work on faithfully studied 1 jth and 16th century models. Sound methods of dyeing, wool selection and testing are taught and the school graduates go into the various rug producing districts to improve their standards. In various places the original. indigenous methods have been maintained, and particularly in Meshed and Birjand, carpets are woven which for technical competence and in beauty of colour stand comparison with the 17th century weavings. The art of designing great carpets, however, is not so quickly recovered. The tendency to over-elaboration needs to be curbed by a more sympathetic study of the early models with their aristocratic restraint and the fundamental strength of their designs.

The principal weaving centres in the 19th century were Tabriz in the northwest, Joshaghan in central Persia. Kerman and Ravar in the southeast and Meshed in the northeast. These centres have all woven large carpets, Meshed, Kerman and Tabriz utilizing the medallion schemes of early classical time, Joshaghan and some Kerman carpets repeating various interpretations of the garden motive.

The province of Azerbaijan in the extreme northwest of Persia is ideally fitted for rug weaving. Excellent wool, water and dye plants are readily available, and hence it is natural that the region has produced some of the finest rug types. Among the more important are those from Karadar and Karajar, where the weavers remained faithful to the highest ideals until they were no longer producing. The region around Ardabil produced many handsome nomadic rugs difficult to identify. South of Ardabil the principal types have been the so-called Heriz, Gorevan and Serapi carpets that make liberal use of tan and blue and hold to bold and simple patterns.

The Kurdish region in northaest Persia produced many fine medium-sized rugs in thick lustrous wool of fine colours, repeating the designs of other parts of Persia. Curiously enough, in the heart of the Kurdish district from the immediate vicinity of the town of Sehna (now Senandaj) have come finely woven carpets and kilims. The patterns are exquisitely rendered medallions or the *bouté* (the so-called pear or palm leaf motive), with imbrications.

A great rug industry was developed in western Persia in the Sultanabad district. From individual towns come beautifully woven rugs like the Sarouks. nith their ancient medallion pattern; the Sarabandes, nith their repeating *bouté* patterns on a ground of silvery rose, the Ferraghan, with their so-called Herati pattern — an all-over, rather dense design with a light green border on a mordant dye that leaves the pattern in relief. The earlier Ferraghans (two are known. dated at the end of the 18th century) are on fields of dark lustrous blue and a pattern delicately draw-n and clear and open. Later, toward the end of the 19th century, Ferraghans degenerated in colour and material; the pattern became clumsy and crowded.

The Kerman rugs were made of brilliant wool, finely and skilfully woven, and beginning about 1870, they became the most favoured of all the Persian weavings. They are lighter in tone, thanks to the discreet use of light ivory and pale rose, and were particularly adapted to western drawing rooms in the late 19th century, with their over-emphasis on elegance.

From the province of Fars come a large number of semi-nomadic rugs and a few large-scale carpets, reflecting ancient models. The Bahtiari region west of Isfahan turned out a few large double-warp stoutly woven carpets and a few smaller rugs that occasionally attained very great merit. Northeastern Persia from Meshed down to Birjand and Ghayian produced large carpets predominantlv violet or purplish in tone with wide multiple borders and very soft and not too durable wool.

Throughout Persia in the 18th and 19th centuries, probably

about 50 to 100 different types of rugs were woven. Occasionally large carpets of quite individual design, but all with their roots in the classical past, appear to baffle the students seeking for precise classification. Extensive studies are required for their identification and interpretation.

Caucasus — Low School. — The Low School rugs of the Caucasus region are among the most individual and satisfactory. Their patterns are practically all geometrical densely juxtaposed generally without organic connection and without implied movement, but they are clear, ingenious, logical and entirely suitable for floor decoration. The more recent examples seem a little dry in colour but many of them, like the rugs woven by the Kazaks, Suruks and other nomads, are sometimes of flaming brilliance, and the older rugs from Daghestan, Kuba and Shirvan are done in beautifully clear, discreet and well balanced tones.

Kilim or tapestry rugs were woven all over the near east, but the most artistic come from the Caucasus. The Shirvan kilims, with their broad horizontal stripes, have bold and clearly defined motives that are harmoniously assembled by virtue of their perfect colour balance.

A more important type of flat-stitch carpet, embroidered and with a mass of loose threads at the back, which comes from the region of the ancient fortified city of Shemakha, has been improperly called cashmere because of its superficial resemblance to cashmere shawls. The design is most often composed of large, beautifully articulated mosaic tile patterns in rich and sober colour. In design they are descendants of the carpets that so delighted Memlinc and the Van Eycks.

Turkish — LOWSchool. — The Low School rugs of Asia Minor of the 18th and 19th centuries continue the earlier qualities of quiet and sober patterns and luxurious colour. Some of the 18th century weavings still faithfully follow the simple geometrical patterns of the 15th century. But the chief output of the Turkish weavers are prayer rugs, with which the Turks were more lavishly supplied than any other of the faithful. Melas, Konia, Ladik, Kirsher and Sivas all wove handsome carpets, those of Ladik being the most brilliant, both in pattern and colour. The most famous prayer rugs came from the towns of Ghiordes and Kula, mostly of the 18th and 19th centuries, and in the United States, the first passion of the collector. Regions like Smyrna produced a great many utility carpets for the western world.

Knotted-Pile Technique. — The technique used in the earliest extant pile fragments is logically also the most primitive, for the pile yarn is wrapped round only a single warp, the warps being held together by two or more wefts woven the full width in ordinary cloth binding (alternately over and under), after each line of knots. Such a technique was most probably invented among the nomads of the central Asiatic steppes and may well have evolved out of a still more rudimentary weave still practised in the Kerghiz tribes whereby a simulated fleece is made on a straw mat by catching in bits of wool in the course of the plaiting (A. U. Dilley, Rugs and Carpets, p. 1).

The simple pile looping around a single warp had travelled, by the early middle ages, to the east Mediterranean for it is found in pile carpet fragments recovered from the Fustat refuse heaps. A fine example (Musée Arabe, Cairo) bears on a dark blue ground an inscription in white Kufic letters which makes it datable in the late 9th or early 10th century. Not long thereafter the technique was carried into Europe and was used in Germany, at Quedlinburg, at the end of the 12th century, for a hanging illustrating an allegory centred on Mortian's Marriage of Mercury and Philologia (Ackerman, Tapestry, p. 33). Moreover, by the beginning of the 14th century *tapisserie sarrazinoise* is discussed in industrial statutes, and clearly differentiated from both *tapisserie nostre* and haute-lisse (true tapestry). Evidently looped-pile weaving continued in Europe (zbid., pp. 312–313). The same technique was still in use in Spain in the 17th century.

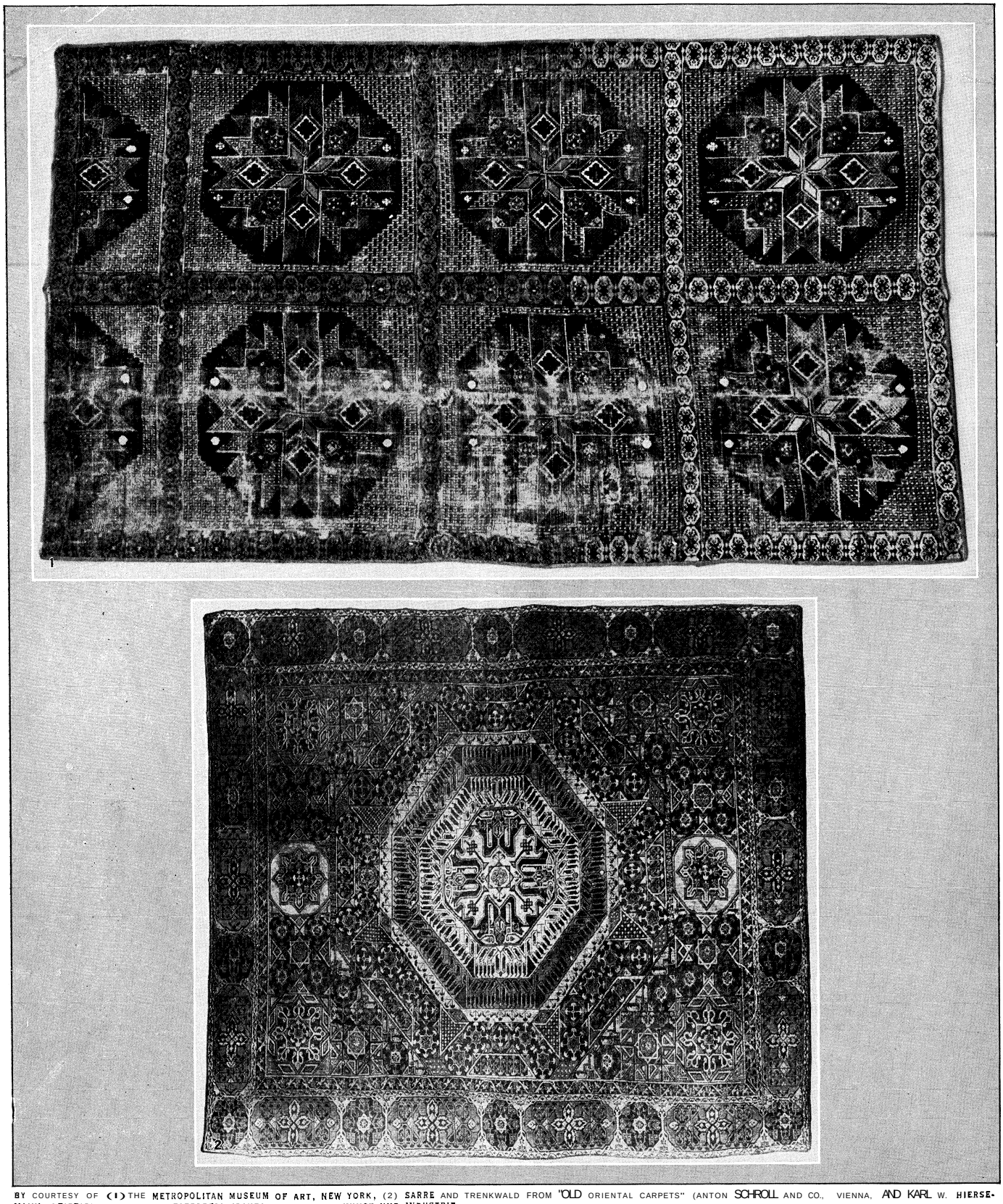
Meanwhile in Egypt and probably other east Mediterranean centres also, two other forms of looped weaving were being developed which made either a potential pile (uncut pile) or actual long-ended pile surface. One of these practised in two variants, was a forerunner of velvet. In this a supplementary weft for the pile is carried on top of regularly spaced foundation wefts (from the fifth to the ninth in general) and passes under a certain number of warps to hold it firm (from three to six overpassed warps, as a rule), then is deeply looped over a single warp, and so repeated; or alternatively, it is deeply looped between two warps. But the second of these loop weaves contains the germ of the development of true rug-knotting form. This, the supplementary weft after passing under a certain number of overpassed warps in the same way (*e.g.*, two), is then floated over a certain number of them (*e.g.*, two or three), and is carried back under the same number of warps. This leaves a cut end at the beginning of the unit (of say seven warps in all), and another in the middle thereof — a coarse version of the knot which came to be known as the Persian knot. The two techniques were used equally for garments and wall hangings but the latter was used also for carpets as is shown by a good-sized specimen in the Metropolitan museum from Antinoe, datable c. A.D. 500–600, with a broad conventional polychrome design (M. Dimand, in Metropolitan Museum Studies, iv, pp. 159–61 [1932–33]).

But the earliest true knotted pile carpets are not in the knot related to this form of looped weaving, but the alternative, so-called Turkish knot, which had been developed by the 14th century at least, as the Ala-ud-Din carpets show. Moreover by the end of the 15th it had penetrated Europe for a fragment of an Annunciation, probably Flemish, possibly French, is in this technique (E. B. Saxe, in Metropolitan Museum Studies, I).

In these fully evolved forms of the technique the pile yarn, instead of being wrapped round a single warp (fig. 1), is knotted round two. These warp threads — most often cotton, but in both Spanish and near eastern nomad rugs sometimes wool, or in some finer qualities, silk — are stretched vertically on a loom (fig. 4), and a length of the pile yarn is tied on every two threads the full width of the loom; then two or more weft threads likewise of any of the materials cited, or of a combination thereof, are cloth woven (alternately over and under), back and forth across the full width, two or more times, and the process is repeated. There are thus three sets of threads involved, each with its specific function: warp, weft, pile. The pile is usually wool but may be silk or cotton, though the last is not desirable except for very small areas where the crisp accent of an unfadeable white is wanted. In the Turkish pile knot (fig. 2) the yarn is passed under one warp, back over two, and back again under the second so that both ends come up together between the two warps on the same side of the overpass loop. In the other type (fig. 3) the yarn passes under one warp, over and back under the next, so that the two ends stand on the surface with one warp between them. The pattern is obtained by changing the colour of the pile yarn. When a row of knots is tied it is beaten down with a heavy malletlike comb against the preceding rows, so that the pile completely conceals on the front both the warp and weft; and when a certain area is woven the pile ends are sheared to an even height, which varies according to the character of the rug from very close to, on some nomad rugs, a depth of about an inch, which produces a shaggy effect.

The fineness of the weave depends on the number of knots to the square inch which varies according to the weight and spacing of the warps and also, though to a lesser extent, of the wefts, and the thickness of the pile yarn. The permissible range is from about 80 to the square inch, used for instance in some of the Kuba Dragon carpets of the late 16th or 17th century, to more than 2,400, found in a fragment of a Mughal (Indian) prayer carpet of the 17th century, obviously an emperor's property (Altman collection, Metropolitan museum, N.Y.). But the most finely woven carpets are not by any means those of greatest artistic or historic importance. Thus, *e.g.*, the beautiful and famous pair of carpets from the mosque of Ardabil, dated by an inscription 1539, have only about 325 to the square inch.

In certain types of pile rugs, both wool and silk, some areas are'brocaded with gold or silver thread, usually cloth woven but with a surface float over several warps (basket-weave) to obtain the maximum richness. In these the weft is carried forward over four of the warp threads and then backwards behind two (see

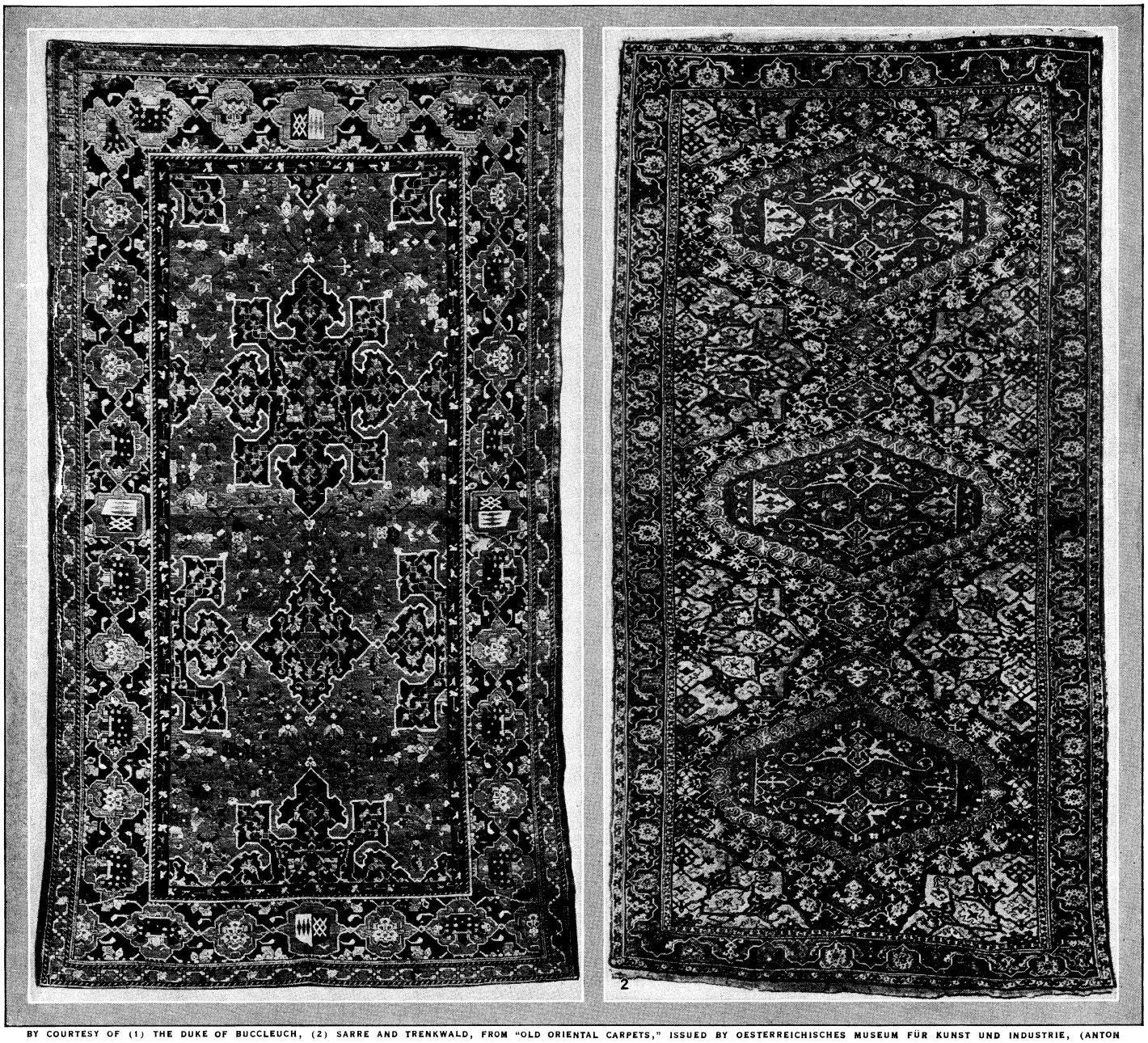


BY COURTESY OF (1) THE METROPOLITAN MUSEUM OF ART, NEW YORK, (2) SARRE AND TRENKWALD FROM "OLD ORIENTAL CARPETS" (ANTON SCHROLL AND CO., VIENNA, AND KARL W. HIERSEMANN, LEIPZIG), ISSUED BY OESTERREICHISCHES MUSEUM FUR KUNST UND INDUSTRIE

SPANISH AND TURKISH RUGS, 15TH-16TH CENTURY

1. Spanish rug, 15th or 16th century. Wool; principal colours: red, yellow, blue
2. Cairene carpet, 16th century. About 10 ft. x 9 ft. 6 in. Wool; the colours are: ground tone, a deep cherry red with patterns in sky-blue and yellowish green

RUGS AND CARPETS



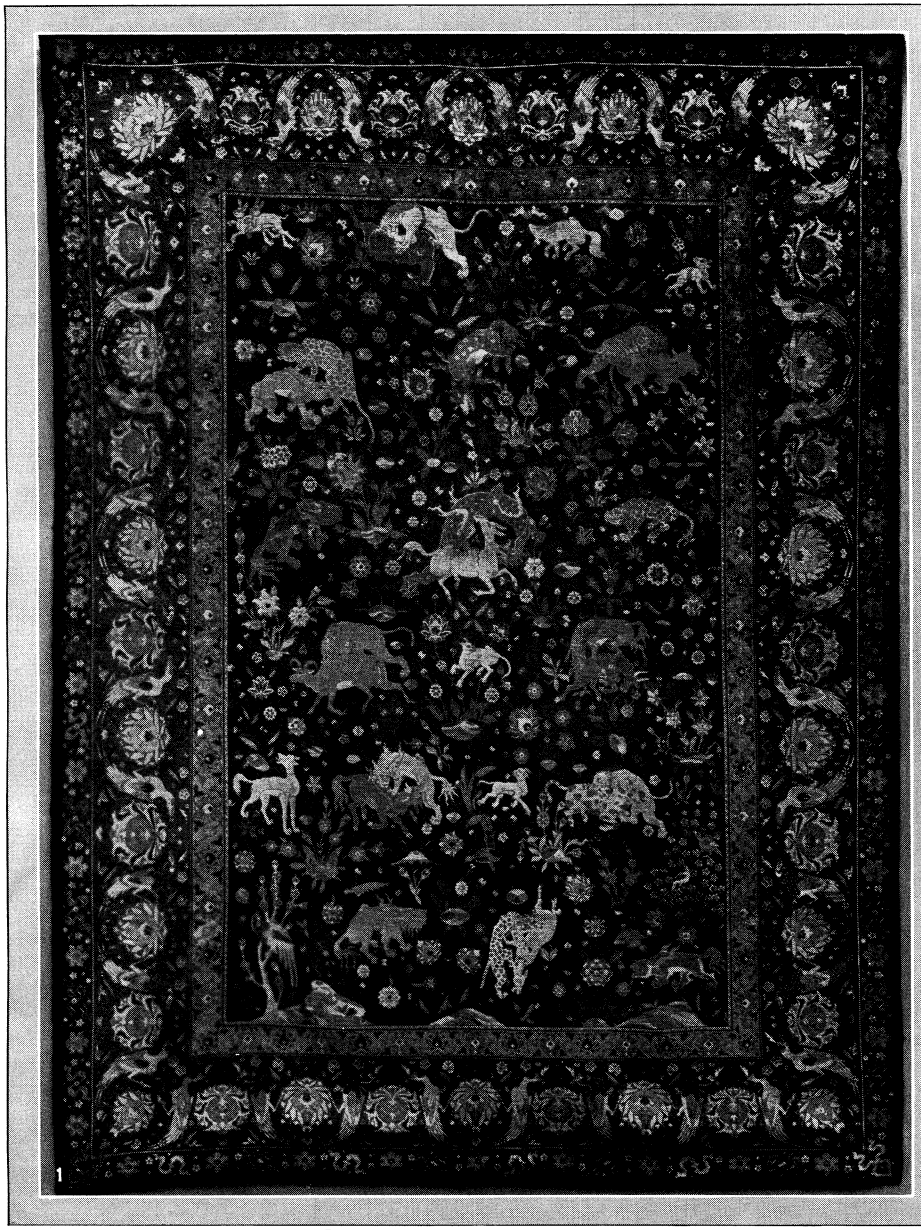
BY COURTESY OF (1) THE DUKE OF BUCCLEUCH, (2) SARRE AND TRENKWALD, FROM "OLD ORIENTAL CARPETS," ISSUED BY OESTERREICHISCHES MUSEUM FÜR KUNST UND INDUSTRIE, (ANTON SCHROLL AND CO., VIENNA, AND KARL W. HIERSEMANN, LEIPZIG)

TURKISH CARPETS, 16TH CENTURY

1. Ushak, with Buccleuch armorial escutcheon and dated 1584. Made in Turkey to British order
2. Ushak carpet, c. 1600. 15 ft. 9 in. x 8 ft. The pattern shows red panels and flattened hexagons, with serrated borders, and floral forms and arabesaues. The colours used are red, light blue, dark blue, yellow, black (brown in places), white and rose

TURKISH COURT CARPET, 16TH CENTURY

Section of Turkish carpet, court manufactory. 16th century. Dimensions of whole, about 18 ft. x 10 ft. The warp is of yellow silk, the weft of dyed red silk, the pile and cotton in seven colours. The pattern, of cartouches and conventionalized flowers and leaves and Chinese cloud bands, gives the effect of graceful movement



PERSIAN AND TURKISH RUGS, 16TH CENTURY

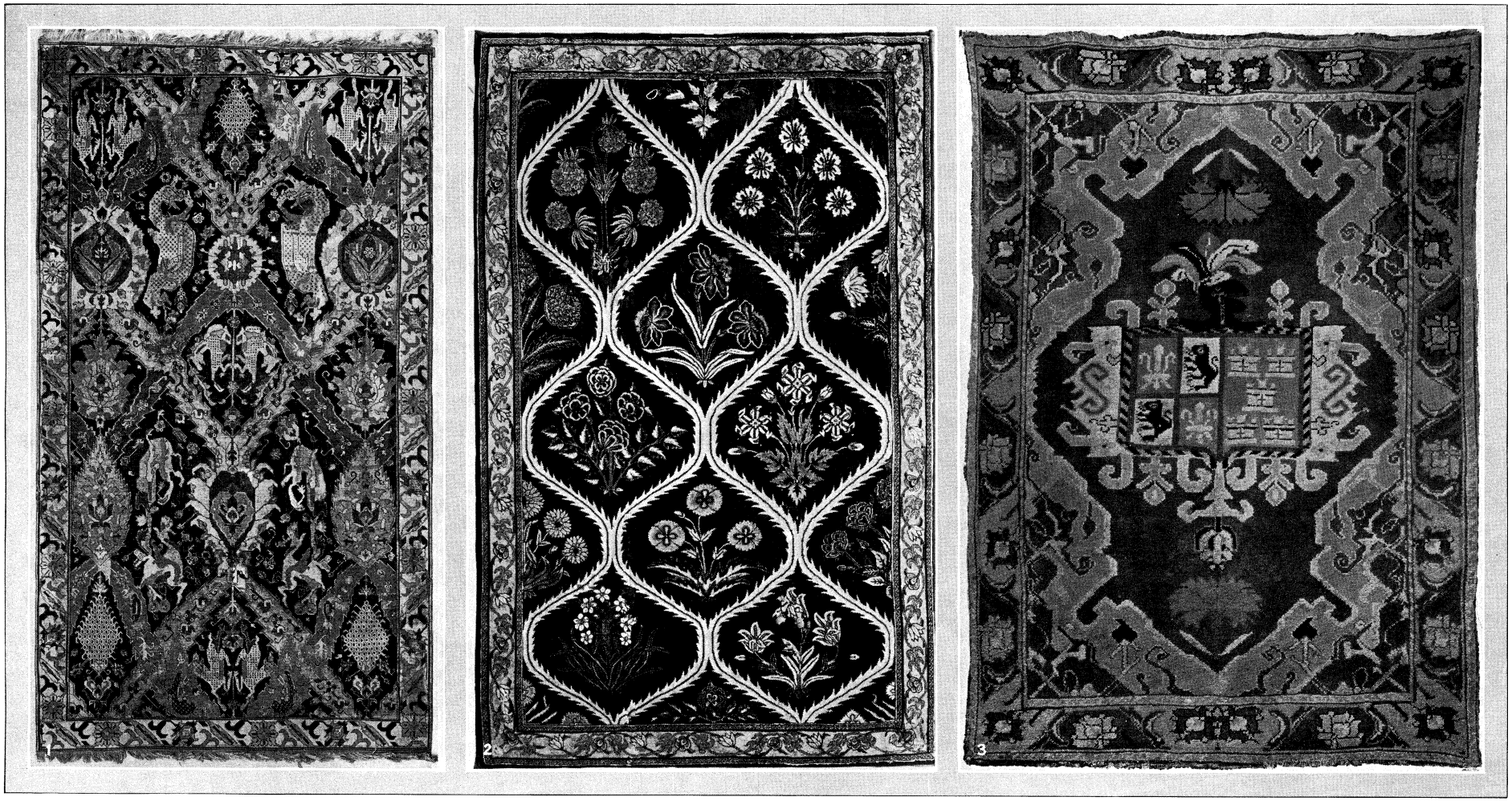
1. Silk rug, showing animal combat, probably Kashan, 2nd half of 16th century. The colour of the inner field is a deep rose-red. The central border is blue-green. The patterns are in yellow, green and tan

2. Turkish rug, court manufactory, 2nd half of 16th century. The foundation colour is a soft red, with green, blue and yellow prevailing in the design, with accents in cotton white

BY COURTESY OF MR. AND MRS. WILSON-FILMER

PERSIAN VASE CARPET, EARLY 17TH CENTURY

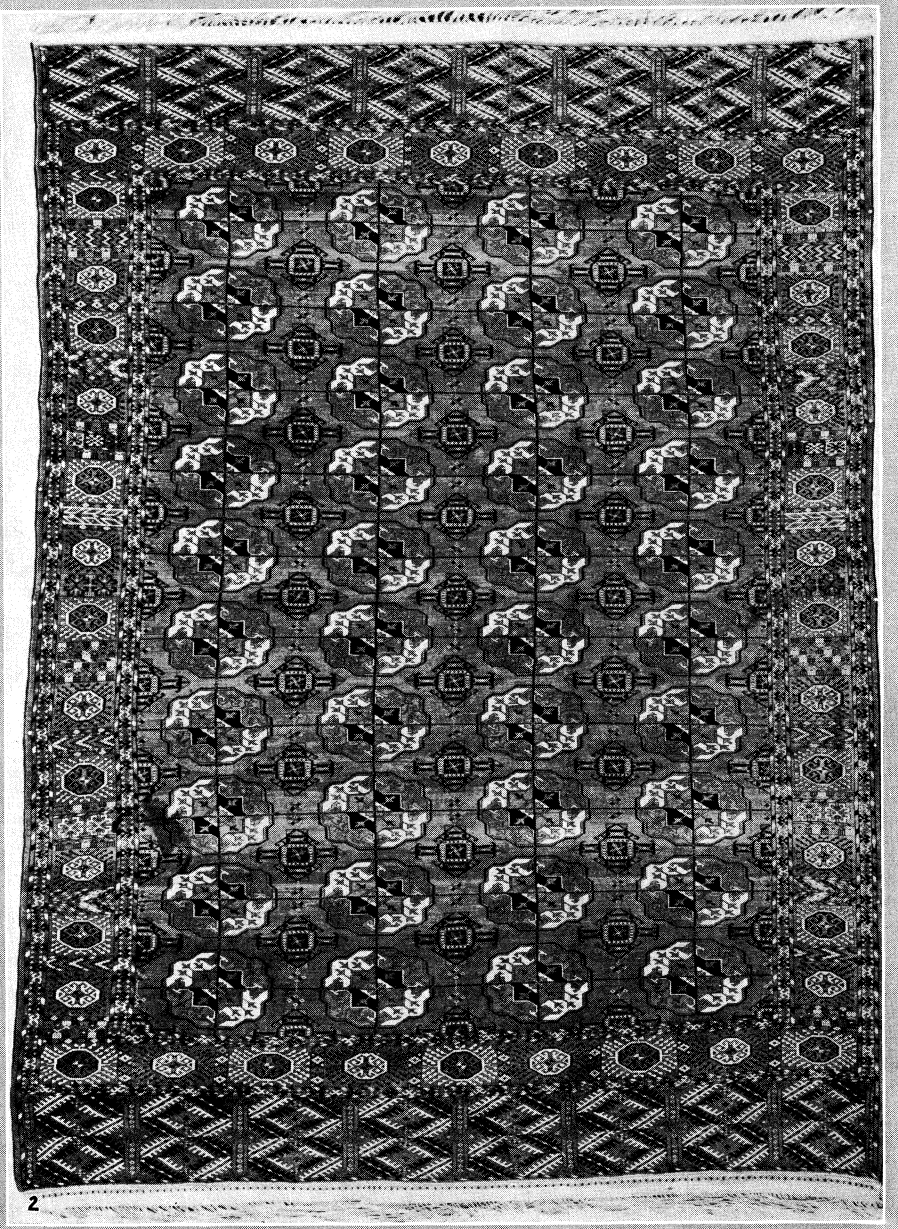
Vase carpet, so-called because of the vases of flowers in the pattern. Court looms of Shah Abbas, probably Joshaghan Ghali



BY COURTESY OF (1, 2) THE DIRECTOR OF THE VICTORIA AND ALBERT MUSEUM, (3) THE SPANISH ART GALLERY, LONDON

THREE CARPETS

1. South Caucasian Dragon carpet, probably woven at Kuba, 17th century. 11 ft. x 6 ft. 4 in., with diamond-shaped compartments in the field, and conventionalized representations of the dragon and phoenix. The colours are brown, white, blue, yellow, red and purple
2. Indian carpet, late 16th or early 17th century. 4 ft. 8 in. x 2 ft. 11 in. This shows a type of pattern exclusive in Indian carpets with the field divided into ogee compartments, each containing naturalistic flowers or floral patterns. The colours are: crimson ground, with the design in yellow; the floral forms are in red, white, rose, blue, green, yellow and purple
3. Spanish carpet, with design derived from Asia Minor models, with Spanish armorial escutcheon for medallion, 18th century



BY COURTESY OF THE DIRECTOR OF THE VICTORIA AND ALBERT MUSEUM

ORIENTAL CARPETS, 18TH AND 19TH CENTURIES

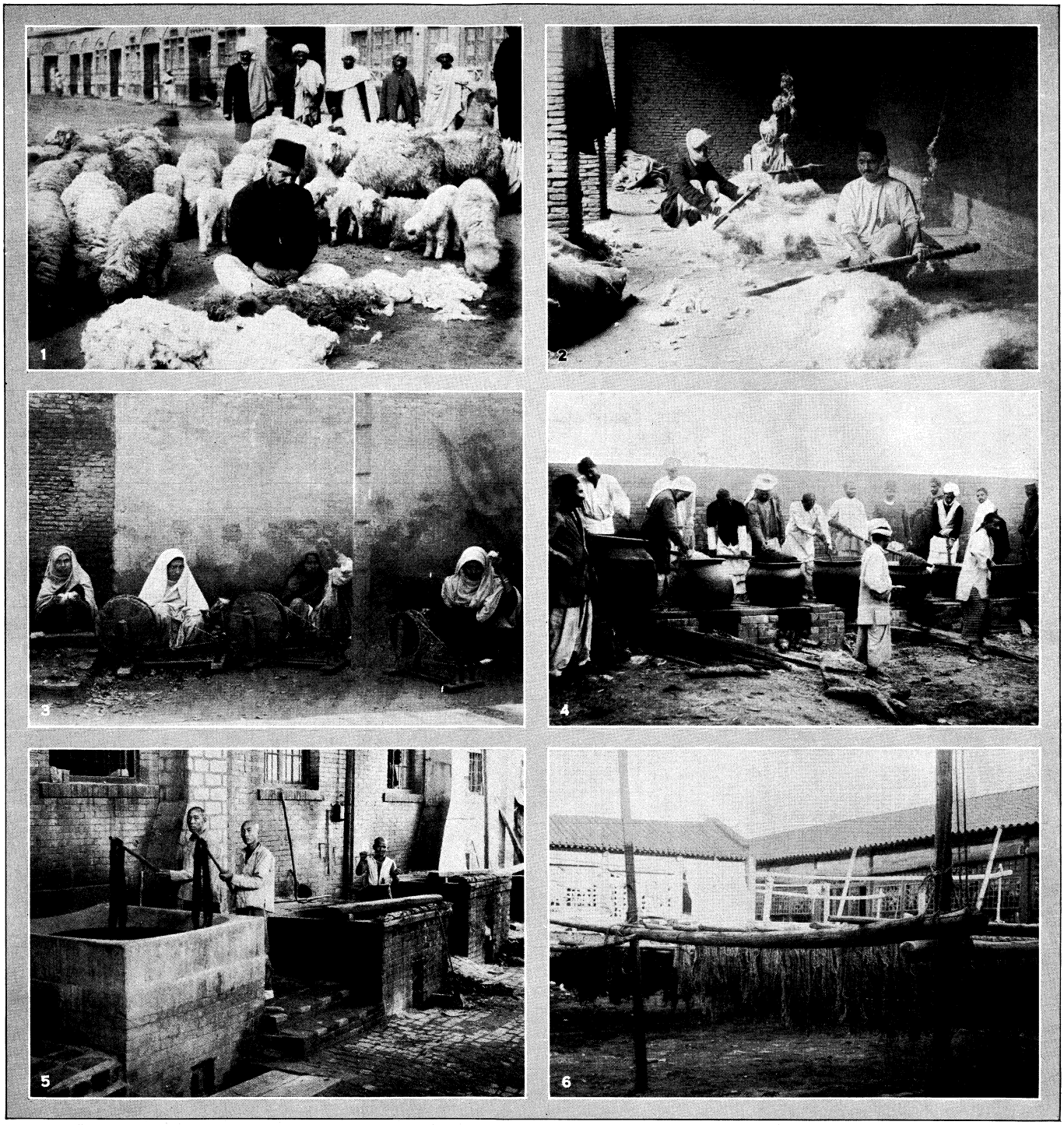
1. Chinese carpet, late 18th century. The colour of the inner field is ivory, with the pattern in blue. The outer border is a deep blue, with the design in ivory and yellow. 11 ft. 8 in. x 8 ft. 4 in. Knotted in woollen pile on a cotton warp

2. Tekke-Turcoman carpet, 19th century, 9 ft. 7 in. x 7 ft. 2 in., made of silky wool. Sometimes erroneously called Bokhara, the carpets are often very finely woven; the principal colour is a deep, glowing crimson

BY COURTESY OF A. SCHROLL AND COMPANY FROM FRIEDRICH SARRE AND HERMAN TRENKWALD, "OLD ORIENTAL CARPETS" (TRANS. BY A. F. KENDRICK, 1926), ISSUED BY THE AUSTRIAN MUSEUM FOR ART AND INDUSTRY, VIENNA

CAUCASIAN CARPET, 17TH CENTURY

So-called Armenian carpet, Caucasus region, end of 17th century. About 11 ft. 6 in. x 6 ft. 6 in. The ten colours are strong in tone; the ground colours, deep-blue, white and red. The warp and weft of white cotton, the knotting is of sheep's wool, with the pile slightly to the right. The pattern of large stems and cartouches includes floral motives angularly conventionalized. The border, narrow in relation to the field, shows leaf-motives and blossoms



BY COURTESY OF (1-4) W. AND J. SLOANE, (5, 6) THE KENT-COSTIKYAN TRADING CO., INC.

PREPARATION OF WOOL FOR CARPETS IN INDIA AND CHINA

1. Old process of clipping wool from the sheep with shears, still practised in India. This scene is in Amritaar, India
2. Carding wool with a bow string, showing how an ancient weapon of war is used for a peaceful purpose, Amritsar
3. The *charkha* or winning-wheel still used to-day by millions of Indian home workers. The spinning-wheel has become a symbol of the principle of the encouragement of home industry preached by Gandhi
4. Dyers dyeing wool for carpets, Amritsar
5. Dye-vats of a large carpet plant, Tientsin, China
6. Drying the dyed wools in large drying-space, Tientsin

RUGS AND CARPETS

BY COURTESY OF JEKYLL'S, LTD., AND KENT-COSTIKYAN, INC.

MAP OF THE PRINCIPAL RUG-WEAVING CENTRES

TURKISH OR **ASIA** MINOR CARPETS: **1.** Bergama. 2. Ghiordes. **3.** Kulah. 4. Ladik. 5. **Melas.** 6. Makri. **7.** Ushak. 8. Konia. 9. Karaman. 10. **Héreké. 11.** Kir-Sher. **12. Mujur. 13.** Sivas. **14.** Yuruk. 15. Tuzla. 16. Kaisariya. **17.** Anatolian. 18. Ak-Hissar. 19. **Sparta.** 20. **Brusa**

CAUCASIAN CARPETS: **1.** Daghestan. **2.** Shirvan. 3. Kabistan. **4.** Derbent. 5. Kuba. 6. Soumak (pileless). **7.** Shemakha. 8. Leshgian. 9. Chichi (Tchechen). 10. Cherkess. **11.** Kazak. **12.** Baku or Khila. 13. **Ghenga. 14.** Karabagh

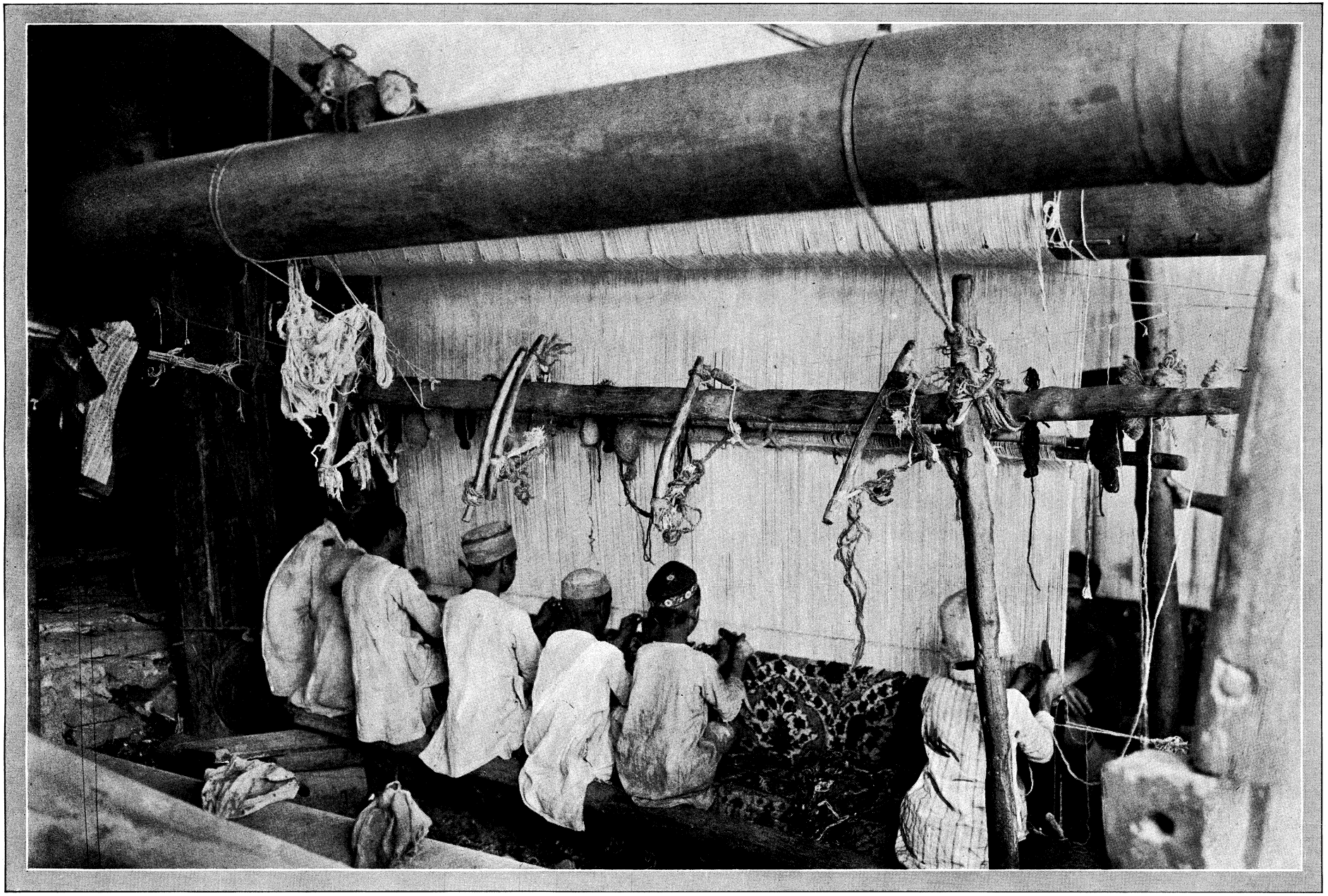
PERSIAN CARPETS: 1. Isfahan. 2. **Herat.** 3. **Khurasan** (a) Kain (b) Birjand (c) Khaf. 4. Meshed. 5. Sabrawar. 6. Kerman. 7. Ravar.

8. Yezd. **3.** Shiraz. **10.** Niriz. **11.** Ferghana. **12** Hamadan. 13. Sarouk. **14.** Kashan. **15.** Joshagan. **16.** Saraband. **17.** Buruj rd. **18.** Suitanabad. 19. Muskabad. **20.** Sehna. **21.** Bijar. 22. Kerrnanshah. **23.** Western Kurdistan. **24.** Persian Kurdistan. **25.** Karaja. **26.** Tabriz. 27. Bakshais. **28.** Gorevan. **29.** Serapi. **30.** Sauj Bulakh. **31.** Herer. **32.** Kara Dagh. **33.** Mosul. **34.** Kultuk. **35.** Mianeh

TURCOMAN CARPETS: **1.** Tekke. **2.** Bukhara. 3. Yornud. **4.** Ersari. **5.** Afghan. 6. Beshir. 7. Salor. **8.** Saryks. 9. Pinde'. **10.** Khiva. **11.** Adraskand. **12.** Baluchi

CHINESE TURKISTAN CARPETS, Middle Asian (Mongolian): **1.** Khotan. 2. Yarkand. **3.** Samarkand. **4.** Kashgar. **5.** Tibetan

INDIAN CARPETS: **1.** Agra. **2.** Lahore. **3.** Arnritsar. **4.** Srinagar. **5.** Kandahar. 6. Jaipur



BY COURTESY OF THE CANADIAN PACIFIC STEAMSHIPS

CARPET-WEAVING

Indian workers at a loom in one of the factories for the manufacture of hand-made carpets at Jaipur, Rajputana, in northern India. Between the two rollers which, with the supporting framework, constitute the loom, are stretched the vertical warp threads. The coloured wools (or silks) are knotted in horizontal rows on the warp threads, the knots being cut to form the pile of the carpet. The weft threads are passed alternately under and over the warp threads, lines of weft alternating with lines of knots. Carpets are known with as few as 15 and as many as 2,400 knots to the square inch, from 60 to 80 knots being considered a moderately fine texture

fig. 6). This gives a kind of herringbone texture at the front and a series of ribs at the back of the fabric. Because a weft looped round the warp threads as described has much less than the usual binding effect, alternate wefts are cloth-woven, but these are concealed in compacting the loop-woven wefts, which are changed in colour according to pattern as in straight tapestry weaving.

Dyes.—Red is most often obtained from madder root *(rubia tinctorum)*. Thus the red of the Noin Ula carpets is madder with the usual alum mordant. The shade which runs through the gamut of reds and pinks to reddish brown and orange varies with the age of the plant, and also other components, including the mordant, the density of the solution and the duration of the immersion. Some reds, however, are obtained from the *coccus ilicis* which breeds on oaks in the near east, related to but not identical with, the cochineal (q v.) (*coccus cacti)* of Mexico. Blues are made from indigo. The yellow of the Noin Cla carpet is rhamnetin, the dye obtained from unripe berries of various bushes of the Rhamus family. The famous saffron (*q.v*) dye. made from the dried stigmas and part of the style of a crocus *(Crocus sativus)* is too expensive to use to any extent. Greens are usually blue plus yellow; violets (only rarely used), red plus blue. Black, when not the natural wool, is done with iron filings in citric acid, a corrosive dye whose destructive effect on wool especially is often conspicuous in old rugs. White is the natural wool, but occasionally when a sharper white is desired, a little cotton is introduced

The time required for weaving rugs has been very greatly exaggerated. They are often spoken of as having required lifetimes, but a careful check made by Heinrich Jacoby *(A Survey of Persian Art,* vol. III, p. 2464) shows that the finest carpets would hardly have taken three years. Even the huge Ardabil carpet, with its 33,000,000 knots. could have been woven, from the preparation of the cartoon through all the processes to its completion, within four years. Great carpets like the Milan Hunting carpet probably only required a year and a half

Another common fallacy concerning rugs is that they were designed to be seen on the floor. This is only partly true; most of them were worked on vertical elements and the designs are traditional and derivative and not very often planned in relation to the destined environment of the carpet Moreover, the great court carpets of the 16th century, for example, were the work of illuminators who were accustomed to think of the book page and a vertical design The designs of the great carpets, nhen seen on the floor from a normal eye height, are compressed and distorted Their full effect comes only when hung nhere they can be viewed so that the eye is nearly equidistant from all points.

Carpets in museums are almost all underlighted. Oriental fabrics were all woven and used in regions of high illumination and their colours are only at their maximum and in proper relation to one another when the illumination is strong.

Design.— Both the pile carpet technique and the flat techniques. whether straight tapestry or the looped Shemakha weaving, permit unlimited variation within the design—in sharp contrast to all shuttle weaving which necessitates regularly recurring repeats But nhile the rug designer thus has unrestricted liberty, needs of the eye and the mind, further defined by habits of tradition and discipline, guide invention. A division into field and border is the basis of all rug design. The border serves, like the cornice on a building or the frame on a picture, to emphasize the limits, isolate the field. concentrate attention on it, and sometimes control the implied movements of the interior pattern. The value of a border had already been recognized by pottery painters in 4000 B.C and is fully developed in rug patterns from Assyrian times on. Its function is so fundamental, logically and psychologically, that it cannot be successfully omitted

The field may be decorated with an all-over pattern, a panel composition. or a medallion system The all-over pattern may be of identical repeats. either juxtaposed or evenly spaced though the latter nhile common on textiles. is rare on carpets; or it may be of varied motives in a unified system, ***e.g***, different plant forms of about the same size and in the same relation to each other, but even in this freest type of design it almost invariably includes bilaterally balanced repetitions which agreeably, almost necessarily reflect the human bilateral equilibrium. The latter type of design is found most typically in formalized representations of the paradise parks or woods which are a feature of Persian palace plans. Another type of allover design appears entirely free but is actually organized on systems of scrolling stems, notably on the east Persian carpets of the 16th–17th centuries.

The value of panel subdivisions for controlling patterns had been discovered by the Upper Palaeolithic period (*c*. 25.000 B.C) in a simple rectangular version. and panel systems have been a basic form of design since 4000 B.C., when pottery painters were already devising varied systems. On carpets the lattice provides the simplest division of the field. often a diagonal lattice as on the embroidered carpet from Noin Ula a scheme that appears on Sassanian capitals and in Coptic tapestries But a characteristic field design of the court carpets of the Shah Abbas period. the so-called Vase carpet, is constructed from the ogee, a motive that becomes prominent in near eastern textile design in the 14th century. Simple rectangular panelling—really a large-scale check—is typical of one style of Spanish rugs of the 15th–16th centuries.

The most frequent medallion composition consists of a central panel of more or less elaborate construction in the centre of the field superimposed on an allover design. but this is also often complemented with corner pieces, which are typically quadrants of the central medallion.

But multipie medallion systems also are developed, either a succession or a chain of medallions on the vertical axis; or two or more forms of medallions alternating in bands, a scheme typical of the Turkish ("Ushak") carpets of the 16th–17th centuries; or systematically spotted medallions which may or may not be interconnected, or may interlock when the scheme logically becomes an elaborate lattice.

Persian carpets of the great period (15th–17th centuries) commonly have multiple design schemes, that is, composition systems on two or more "levels." The simplest is the medallion superimposed on an allover design, but more typical are subtler inventions such as two or three spiral stem systems, sometimes overlarded with large-scale cloud bands, the nhole intertwining and mutually supplementary, but each independently conceived and individually carried to completion. The finer Vase carpets have double or triple ogival lattices set at different intervals ("staggered"), each with its own centre and tangent motives which also serve other functions in the other systems. What at first sight appears to be a great multiplicity of independent motives thus proves on careful exploration to be firmly controlled and logically distributed.

Occasionally stripe systems are used, either vertical or diagonal, but this conception is more natural to shuttle-woven fabrics, and probably, when employed in the free techniques of rug weaving, are imitations of textiles.

The border invariably consists of a minimum of three members: the main band which can vary greatly in width in accordance with both the size of the rug and the elaborateness of the field design, and the guard stripes, a decidedly subordinate band on either side, really the borders of the border These may be the same on both sides or different. But multiple border systems also are quite common, as on one of the Noin Ula carpets, very elaborate schemes having been developed in mosaic floors of the Roman period. Some of the greatest carpets, however. have the simplest border arrangements. while on certain types of commercially produced carpets of the late 19th and early 20th centuries meaninglessly multiple and complex compositions were developed. The court designers of the 16th century developed many beautiful correlations of rhythm and accent between border and field.

Patterns.— Four main classes of motives are used: geometrical, conventional, plant and illustrative The geometrical repertoire is built up from variations and combinations of meanders, polygons. crosses and stars Meanders. chiefly for borders range from the simple serration which is ageless (actually already much used in the Upper Palaeolithic) to fairly complex hooked forms, characteristically the angular "running-wave" or "Greek-key,"

which is also very ancient. Such meanders typically constitute reciprocals, *i.e.,* designs which form the identical shape in the positive and negative areas, and so when executed in contrasted colours can be alternatively interpreted; or differentiated reciprocals, the negative space created by the main motive having a different but destructive form, a type of narrow border well developed in early mediaeval textile design. Little trefoil reciprocals are used for guard stripes in the Caucasus, central Persia (so-called Polonaise) and in India. Chief among the polygons employed are the lozenge and the octagon. The Maltese cross is frequent, and the gamma cross (or swastika) is frequent. The purely geometrical stars are usually based on the cross or the octagon. Many of these motives, which are rudimentary and very ancient, may have originated in basket-weaving and the related reed-mat plaiting, for they are natural to both techniques; but in rug weaving they have survived chiefly in the work of central Asia, Asia Minor and the Caucasus, pile-knotted and flat-woven, uhether tapestry or of the Shemakha type:

One of the principal motives in the 16th and 17th century Persian carpets is the so-called arabesque, an ambiguous term that generally implies an intricate scrolling vine system that in Persian ornamental schemes (12th to 18th centuries) usually terminates in a lilylike blossom of two uneven and asymmetrical members meeting at a narrow acute angle, generally with a rounded lobe on one side underneath, and describing two curves in opposite directions which continue readily into further scroll systems. This highly individual form was well begun in China in the late Chou period (c. 600 B C.), notably on a few bronze mirrors, and is beautifully developed during the Han dynasty (220 B.C.–A.D. 220). It does not appear in Persia, however, until the 12th century (on pottery and architectural stucco ornament), and its intermediate history has not been traced in either country, yet when it does emerge in Persian design the essential forms are so close to those that had been current in the far east more than 1,200 years before, a hiatus and reinvention seem improbable.

Directly traceable to China, on the other hand, are the cloud knot (or 'tchi) and cloud band or ribbon—both begun by the Han period at least and with a continuous history thereafter. The cloud ribbon first appeared in western Asia in Syrian silk design of the 7th century but was sporadic until the 13th century when it was reintroduced as an aftermath of the Mongol invasion and at this time it became associated with the three-ball motive, an astral symbol that goes back to Babylonia of the second millennium B C. and referred to the sun, moon and planet Venus, decisive astral bodies in the aest Asiatic cults. The combination moved from Syrian textile design into Asia Minor textile design with the Ottoman Turkish conquest in the 15th century and became typical of one group of 16th–17th century Turkish carpets.

The cloud band or ribbon, already skilfully used on book covers, manuscript illumination and in architectural faïence, became important on 16th century carpets and was employed with especial elegance and skill by the Persian designers, and perhaps most beautifully in the Turkish court carpets which owed much to Persian inspiration, while the cloud knot or *'tchi,* a feature of the court carpets of the time of Shah Abbas, was continued to the end of the 18th century.

A second major class of conventional motives dominant in a considerable range of carpet designs from Asia Minor to India, the palmettes, are of plant derivation, and are justifiably named in that they originated in Assyrian design as stylizations of the palm, a symbol of the vitalistic power, often, if not always, in relation to the moon. Moreover, many of the almost uncountable variations that developed through the centuries continued to refer directly to the palm. Others. however. also beginning early in the first millennium B.C., derived from the lotus blossom, a complementary figure since it was connected primarily with the fertility repertoire in relation to sun symbolism. Still others involved the symbolically closely related pomegranate, utilizing primarily the fruit while still others presented the general vitalistic emblem, the vine, this last built on the single leaf The forms of all these four main types of palmettes found in the rug designs are directly descended from styles current in textile designs from the 4th century, and are more or less modified by Chinese influences. These patterns in the 16th and early 17th centuries were beautifully and realistically elaborated, and blossoms like the Chinese peony sometimes compete with the more conventional lotus. The lanceolate leaf often associated with palmettes especially in east Persian designs, is also largely conventional.

Outstanding among the more naturalistic plants are the cypress and blossoming fruit tree, typically shown thus combined in Persian designs, still suggesting the ancient meaning of life eternal and resurrection. Willows are especially favoured in the Shah Abbas Vase carpet, as are jasmine flowers, and in Turkish court carpets, tulips. Many minor foliate and floral forms had no specific botanical identification though they give a realistic effect. Naturalistic red or pink roses, as on Karabagh and Kerman rugs from the 18th–19th centuries, are imitated from French patterns or English chintz and had no place in the old Persian repertoire, despite the importance of the rose in Persian poetry life and even economy, and its ancient symbolic importance throughout western Asia as an alternative to the lotus blossom.

In one uidely distributed class of design some of the plant forms grow out of a vase, a residue of an old symbolic complex, a cosmological tree, usually the Tree of Life, sustained by the Water of Life as implied by the "cloud-jar," a design already well developed in Babylon.

Of the illustrated motives, in addition to the naturalistic plants, the most importact are those connected with the garden and the hunt: many small songbirds of which the nightingale meant most to the Persian; the *feng huang* (pheasant) taken over from China and much favoured in the 16th century and occasionally the peacock, which further west in Asia had had considerable symbolic value; the great felines—lions and the semiconventional lion-mask, sometimes used as the centre of a palmette; tigers; cheetahs; bear; fox; deer of numerous species; goats, sometimes picturesquely prancing; or the wild ass, a fleet prey; ferocious looking Chinese dragons and the gentle *kilim,* a fantastic equine likewise imported from China. Fish sometimes swim in pools or streams, or are conventionally paired to suggest an escutcheon in the borders of one type. Huntsmen, usually mounted, are the major human figures, though musicians and angels also occur. (A U.P.)

RUHR, a river of Germany and an industrial region. The Ruhr river is 146 mi. long, an important right-bank tributary of the lower Rhine. It rises on the side of the Winterberg in the Sauerland, at about 2,000 ft. above the sea. It flows north and then west in a deep. well-wooded valley past the town of Arnsberg. Shortly after reaching Neheim it bends southwest, and skirts the southern border of the coal-mining district in a tortuous course that passes Witten, Steele, Kettwig and Mülheim, and joins the Rhine at Ruhrort. The river is navigable from Witten downward, by the aid of 11 locks. Its chief affluents are the Mdhne (right) and Lenne (left). The river has given its name to the largest single industrial area in the world. The Ruhr area comprised about 2,000 sq.mi. and in the 1950s it had a population of more than 5,200,000. Five towns—Essen, Dortmund, Duisburg, Gelsenkirchen and Bochum—each had a population of more than 300,000.

The Ruhr coal field is the second largest in the world. In the 1950s its production was about 92% of the coal output of the German Federal Republic. The Ruhr district also supplied about 90% of western German steel production. Many kinds of chemical industries developed in the area.

Before World War I most of the Lorraine iron and steel works were owned by or closely affiliated with concerns in the Ruhr. The low-grade iron ore of Lorraine went mostly to the blast furnaces of the Ruhr. On the other hand the coke of the Ruhr was needed for the smelting of Lorraine ores.

World War I and After.—The return of Alsace-Lorraine to France and the retirement of Luxembourg from the German customs union reduced Germany's home supply of iron ore by 80%. German coalmasters, however. held the winning hand. Compensation from the German government enabled them to erect new iron and steel works on the Ruhr, which could be run with high-grade Swedish or Spanish ore or with war scrap.

As early as the conference of Spa (1920) when Germany had

fallen short on coal deliveries, the Allies presented Germany with an ultimatum which threatened the occupation of the Ruhr in the case of nonacceptance. Though this extension of the area of occupation was an arbitrary act, the German government gave way, and France began to use this threat of an extension of the occupation as a weapon in the struggle about reparation. When the German government refused the proposals (Jan. 29, 1921) of the Paris conference, they occupied Düsseldorf, Ruhrort and Duisburg, and continued the occupation after Germany had accepted the London ultimatum of May 5, 1921.

On Dec. 26, 1922, the Reparation commission announced that Germany had fallen short on certain deliveries of boards and telegraph poles; a few days later a similar shortcoming in coal deliveries variously estimated at 11% to 15.6% was declared. The Reparation commission concluded that Germany's shortcomings had been "intentional," which permitted the Allied and associated powers to take "such other measures as the respective Governments may determine to be necessary in the circumstances." The French and Belgian governments decided to send a technical mission to the Ruhr, accompanied by a military force.

When the French and Belgian troops entered the Ruhr on Jan. 11, 1923, the German coal syndicate had transferred their seat to Hamburg. The German government issued a protest (Jan. 12, 1923); all reparation payments especially the delivery of coke and coal to France and Belgium ceased. Civil servants and railway officialswere forbidden to obey orders from the occupying powers. The French expelled German officials and heavily fined or imprisoned recalcitrants. They erected a customs frontier, dividing the occupied district from the rest of Germany.

The struggle for the Ruhr completely destroyed German finance and with it German currency. Passive resistance in the long run meant the withdrawal of all workers, starting with the railway men, from such productive and distributive processes as might help the army of occupation. This involved the maintenance of all persons out of work at the public expense. The Ruhr occupation was the deciding factor in the collapse of the mark.

At last the new German government, presided over by Stresemann, gave up passive resistance on Sept. 26. The French government continued to refuse negotiations and strongly supported the separatist movement all over the left bank of the Rhine.

In Nov. 1923, the industrial concerns in the occupied districts negotiated an agreement with the Mission Interalliée de Contrôle des Usines et des Mines (called Micum) with the object of freeing the huge iron and coal stocks which had accumulated, as the French government mould not negotiate with the German government. It demanded the payments of the German coal tax and the coal on the dumps, while the new output could be sold by the works against payment of a duty; the delivery of reparation coal and coke was to be resumed on a percentage basis of the total output. Iron and steel might be sold by the works against payments. The German government acknowledged its obligation to refund the cost of payments of delivery to the industries concerned.

These provisional arrangements paved the nay for a settlement, after British and U.S. pressure had induced the French government to agree to the appointment of the Dawes committee by the Reparation commission.

The nen French government agreed to accept the Dawes plan, to free the prisoners and to leave the Ruhr. The plan was formally signed on Aug. 30. The evacuation of the Ruhr ended on July 31, 1925, when the French troops left Essen and Miilheim. On Aug. 25 Dusseldorf. Duisburg and Ruhrort were given back.

World War II and After. — Much of the Ruhr industrial area was in ruins by the end of World War II, and more than one-third of the coal mines had discontinued operations completely or were heavily damaged. The capture in April 1945 of 325.000 German troops who were trapped in the Ruhr pocket by the U.S. 1st and 9th armies was one of the outstanding successes of the Allied campaign in western Europe (*see* WORLD WAR II).

After the war Great Britain occupied the Ruhr. As a safeguard against the growth of German military and economic power in Europe, the Allies set up the International Authority for the Ruhr on April 28, 1949. The I.A.R. was dissolved after the European Coal and Steel Community treaty — ratified by France, the German Federal Republic, Italy, Belgium, Luxembourg and the Netherlands — came into force on Aug. 10, 1952. (M. Bo.; X.)

RUHRORT, after 1305 a part of Duisburg, formerly in the Prussian Rhine province, west Germany, and after 1945 in North Rhine-Westphalia at the junction of the Ruhr and the Rhine.

Ruhrort is first mentioned in 1379 and obtained civic rights in 1551. Having been in the possession of the counts of La Marck, it passed into that of Brandenburg in 1614. Ruhrort has one of the largest river harbours in the world, and it is the principal shipping port for the coal of the Westphalian coal field. *(See* DUISBURG.)

RUISDAEL (RUYSDAEL, RUIJSDAEL), **JACOB** VAN (c. 1629–1682), Holland's greatest landscape painter, was born at Haarlem about 1629. He was probably the pupil of his father, the frame maker Izack de Gooyer, who later styled himself Ruysdael. There is no truth in the statement that his uncle Salomon van Ruysdael (*q.v.*) influenced his artistic development, let alone was his teacher. The influence of Cornelisz Vroom, another Haarlem landscapist, is often noticeable in his early works of the 1640s; the earliest dated pictures are of 1646. Two years later he became a member of the Guild of St. Luke in Haarlem. Around 1650–52 he traveled extensively in Holland and the neighbouring parts of western Germany (several views of the castle of Bentheim). About 1655 he settled in Amsterdam, of which he became a free citizen in 1659. Meindert Hobbema must have been his pupil before 1660. Ruisdael's name was entered on the list of Amsterdam doctors in 1676, but later his name was deleted. Whether he ever practised as a doctor is not known, but his artistic work was relatively well rewarded. He died in Amsterdam but was buried in Haarlem on March 14, 1682 (the Jacob van Ruisdael who died in 1681 in the almshouse of Haarlem was another painter. the son of Salomon).

The early works of Ruisdael, mostly with motifs from the surroundings of Haarlem, are very accurately drawn and executed. Around 1650 his art developed toward a heroic-pathetic style of well-composed romantic landscapes. Unlike most of the Dutch landscape painters, he did not care for a topographical rendering of special scenes. As few of his pictures are dated after 1655, it is hard to place them in exact chronological order. It seems that the many "Waterfalls," varying a theme by A. van Everdingen (who had been in Sweden), belong to his later period, as do the few townscapes nhich exist. His main motifs are derived from forest scenery ("The Pool in the Wood," Leningrad). Beaches and stormy seas with magnificent clouds had never been painted before with such a power of expression, feeling for atmosphere and space.

The works of Ruisdael are spread over all the great galleries, the National gallery, London, possessing many good examples. I-lis famous paintings also include: "The Jewish Burial Ground" (Dresden and Detroit). based on drawings made at Ouderkerk near Amsterdam; the "View of Haarlem" (Rijksmuseum, Amsterdam); "The Pool" (Berlin and Worcester college, Oxford); "The Wood" (Kunsthistorisches museum, Vienna); two "Views of Egmond" (Philips collection, Eindhoven. and Art gallery, Glasgom); "The Cornfield" (Metropolitan museum, New York); "Mill at Wijk Near Duurstede" (Rijksmuseum, Amsterdam); "The Winter" (Staedel, Frankfurt), "The Burst of Sunshine" ("Le Coup du Soleil," Louvre, Paris). Sometimes, but by no means always, the small figures in his pictures are added by other artists. such as **A.** Van de Velde, Philips Wouwerman and Kicolaes Berchem.

As can be seen from the subjects, Ruisdael's landscape vision had a wide range. His understanding for the beauty and inner life of the landscape is nowhere hampered by the fact that his poetic and romantic vision transformed the simple Dutch scenery sometimes into unnaturalistic but powerful compositions. Moreover, the rendering of the details — the trees, the water and the ground —is full of careful, sensitive observation. There are several fish markets in white. black and grayish colours. and there is a surprising church interior of the Nieuwe Kerk at Amsterdam (marquess of Bute collection; drawing in Print room, Berlin).

See C. Hofstede de Groot, ***Catalogue*** of ***Dutch painters (1912)***; *J.*

Rosenberg, Jacob *van* Ruisdael (1928). (H. K. GN.)

RUISLIP-NORTHWOOD, an urban district (1904) in the parliamentary division of the same name, Middlesex, Eng., 16 mi. W.N.W. of London. Pop. (1961) 72.541. The manor of Ruislip was in French possession from Norman times for about 200 years. The district contains the former villages of Ruislip, nith the priory and parish church of St. Martin containing 15th-century mural paintings, and 17th-century almshouses opposite the Elizabethan manor farm; Northwood, with the ancient grange now used for community purposes; and Eastcote, nith the Elizabethan Eastcote house, in timbered grounds, that was acquired by the council in 1936, and Haydon hall dating from *c.* 1700. Nearly 600 ac. of woodland was originally part of the great forest of Middlesex and is now part of London's green belt. Close to Park wood is the playground known as the Ruislip lido including a lake covering 46 ac. Tile and brickmaking were carried on from the 14th century until comparatively recent times and forestry was a major industry until the 19th century. In South Ruislip are factories making organs, metallic films, precision and electrical instruments, etc.. and a large milk-bottling depot.

RUIZ, JUAN (*c.* 1283–*c.* 1350), Spanish poet, became archpriest of Hita. It may be inferred from his writings that he was not an exemplary priest, and one of the copies of his poems states he was imprisoned by order of Gil Albornoz, archbishop of Toledo. He finished his *Libro* de *buen amor* in 1343, while in jail. and he was no longer archpriest of Hita in Jan. 1351; it is assumed that he died shortly before. Ruiz had a considerable knowledge of colloquial (and perhaps of literary) Arabic; he knen by heart the *Disticha* of Dionysius Cato, and admits his indebtedness to Ovid and to the *De Amore* ascribed to Pamphilus; his references to Blanchefleur, to Tristan and to Yseult, indicate an acquaintance with French literature, and he utilizes the *fabliaux* with remarkable deftness; lastly, he adapts fables and apologues from Aesop, from Pedro Alfonso's *Disciplina clericalis,* and from mediaeval bestiaries. All these heterogeneous materials are fused in the substance of his versified autobiography, into which he intercalates devout songs, parodies of epic or forensic formulae, and lyrical digressions on every aspect of life. Ruiz. in fact. offers a complete picture of picaresque society in Spain during the early 14th century. From his Don Furón is derived the hungry gentleman in *Lazarillo* de *Tormes,* in Don Melón and Doña Endrina he anticipates Calisto and Melibea in the *Celestina,* and Celestina herself is developed from Ruiz' Trotaconventos. Moreover. Ruiz was justly proud of his metrical innovations. The *Libro de buen amor* is mainly written in the *cuaderna via* modelled on the French alexandrine, but he imparts to the measure a variety and rapidity previously unknown in Spanish. (J. F.-K.)

RUIZ DE ALARCÓN (Y MENDOZA), JUAN (*c.* 1581–1639), greatest Mexican writer of the colonial era and principal dramatist of early 17th-century Spain after Lope de Vega and Tirso de Molina, was born at Mexico City and educated there and, after 1600. at Salamanca. Spain. Having returned home in 1608 to practise law, he re-emigrated definitively to Spain in 1613 and began to write. A spinal deformity savagely ridiculed by his literary contemporaries isolated him from society and was thus perhaps as responsible as his colonial origin for the atypical character of his work, with its formal polish (with 20 published plays, he is the least prolific major Spanish dramatist) and ethical bias. His finest works are La *verdad sospechosa* (adapted by Corneille as Le *menteur)* and Las *paredes* oyen. He died at Madrid on Aug. 4, 1639.

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RUIZ ZORRILLA, MANUEL (1834–1895), Spanish politician, born at Burgo de Osma. Deputy in 1856, he soon attracted notice among the most advanced Progressists and Democrats. After the military movement in Madrid of June 22, 1866, he had to flee to France, returning only at the revolution of 1868. In 1569 he became minister of grace and justice under Serrano: elected president of the House of Deputies in 1870, he seconded Prim in offering the throne to Amadeus of Savoy In 1871 he formed a cabinet. and continued to be the king's chief councillor until his abdication (Feb. 1873), when Ruiz Zorrilla advocated a republic. On the restoration of Alphonso XII (1875), he went to France. where for nearly 18 years he was the soul of the republican conspiracies. He was eventually allowed to return to Spain and died at Burgos on June 13, 1895.

RULE OF THE ROAD: see TRAFFIC REGULATIONS.

RULE OF THE ROAD AT SEA. The present article is a summary of the regulations that came into force on Jan. 1. 1954, following the International Conference on Safety of Life at Sea, 1948. The regulations apply to all vessels on the high seas. A "power-driven" vessel means any vessel propelled by machinery. When under sail only she is considered a sailing vessel and under sail and power is considered a power-driven vessel. The rules for seaplanes apply when they are water-borne. Vessels and seaplanes are "under way" when not at anchor, moored or aground.

Lights and Shapes.—The word "visible" when applied to lights means visible on a dark night with a clear atmosphere. The rules concerning lights must be complied with in all weathers from sunset to sunrise. No other lights which might be mistaken for the prescribed lights, impair their visibility or interfere with the keeping of a proper lookout must be exhibited. Shapes shall be not less than two feet in diameter.

Power-Driven Vessels Under Way.—(1) *Masthead light:* in the fore part of the vessel a white light visible over an arc of 225°, *i.e.,* from right ahead to 22½° abaft the beam on either side for five miles; (2) a second white light of similar character either forward or abaft the above light (not compulsory for vessels less than 150 ft in length or when towing). These two lights must be in line with the keel, one 15 ft. higher than the other. The horizontal distance between them must be at least three times the vertical distance. The lower light shall not be less than 20 ft. above the hull. (3) *Side lights:* (*a*) on the starboard side a green light clearly visible over an arc of 112½°, *i.e.,* from right ahead to 22½° abaft the beam for two miles; (*b*) on the port side a similar red light. These side lights must be fitted with screens projecting three feet forward of the light. (4) *Seaplanes:* (a) in the fore part amidships a white light visible over an arc of 220°, *i* e., from right ahead to 20° abaft the beam on either side for three miles; (b) on the starboard wing tip a green light visible from right ahead to 20° abaft the beam for two miles; (*c*) on the port wing tip a similar red light. (5) Stern *light:* (*a*) vessels under way shall carry at their stern a white light visible over an arc of 135°, *i.e.,* from right astern to 67½° on each side for two miles; (b) small vessels unable to carry this light must have ready an electric torch or lighted lantern to show to an overtaking vessel; (*c*) a seaplane shall carry a white light on her tail visible over an arc of 140°, *i.e.,* from right astern to 70° on each side for two miles.

Towing Lights — (1) (a) A power-driven vessel towing or pushing another or seaplane shall carry in addition to her side lights two white masthead lights vertically, not less than six feet apart; if the tow exceeds 600 ft. an additional white light to be carried six feet above or below them; (*b*) a stem light or a white light abaft the funnel on aftermast for the tow to steer by. (2) A seaplane towing in addition to her under way lights. shall show a second white light six feet above or below the forward white light.

Not *Under* Control —(1) A power-driven vessel shall carry in lieu of the masthead lights, where best seen, two red lights vertically, not less than six feet apart and visible all round for two miles. By day, the red lights shall be replaced by two black balls. (2) A seaplane may carry, where best seen, two red lights vertically. not less than three feet apart, visible all round for two miles. (3) A vessel working telegraph cables, navigation marks, surveying or on underwater operations and unable to manoeuvre shall carry in lieu of masthead lights three lights vertically, thus—red, white, red—visible all round for two miles. By day, similarly placed. she shall carry three shapes vertically, the highest and lowest globular in shape and red in colour, the middle diamond in shape and white. (4) Vessels and seaplanes not under control shall only carry side lights when making way through the water.

Sailing vessels under *way,* vessels and seaplanes towed shall carry the same lights as prescribed for a power-driven vessel or seaplane but not the masthead lights. Small vessels unable to fix the *side*

lights must have them ready for immediate display on nearing another vessel.

Power-Driven Vessels of Less Than 40 Tons.— (I) In the fore part, not less than nine feet above the gunwale, a white light constructed and screened as a masthead light visible for three miles. *(2)* Side lights constructed and screened as described above visible for one mile, or a combined lantern showing green and red lights from ahead to 22½° abaft the beam on their respective sides. Small power-driven boats may carry the white light lower than nine feet but it must be higher than the side lights.

Vessels of less than 20 tons under oars or sails if without side lights shall carry a lantern fitted with a green and red light visible for one mile. *Rowing boats under oars or sails* shall show a white light from an electric torch or lantern in time to prevent collision.

Pzlot Vessels.— (I) Sailing pilot vessels under way on station shall carry a white all-round light at the masthead visible for three miles and exhibit a flare-up light at intervals not exceeding ten minutes, and also show their side lights on the approach of or to other vessels. *(2)* Power-driven vessels on station duty under way shall carry the above lights and flares and eight feet below the white masthead light a red light visible all round for three miles and side lights. *(3)* When on station duty at anchor, pilot vessels will exhibit the above lights and anchor lights but not side lights. (4) When not on station duty, they shall carry the same lights as other vessels of their class and tonnage.

Anchor Lights and Shapes.—(1) Vessels less than 150 ft. in length shall carry forward a white light showing all round for two miles. *(2)* If 150 ft. or more, the above light not less than 20 ft. above the hull, and at the stem at least 1*j* ft. lower than the forward light. another such light. both to be visible all round for three miles. *(3)* Between sunrise and sunset every vessel at anchor shall carry forward one black hall. (4) Working telegraph cables, navigation marks. surveying or on underwater operations, a vessel at anchor shall carry the lights and shapes previously described for such vessels and also anchor lights. *(5)* A vessel aground shall carry by night anchor lights and the two red lights prescribed for a vessel not under control; by day three black balls, vertically not less than six feet apart. *(6)* Seaplanes less than 150 ft. long, a white light visible all round for two miles. If more than 150 ft., a white light forward and one aft. each visible all round for three miles. If more than 150 ft. in span, a white light on each side to indicate the maximum span. visible all round for one mile. If aground, they shall carry anchor lights and may carry t o red lights vertically three feet apart, visible all round.

Fishing Vessels.— (I) When not fishing they shall show the lights and shapes for similar vessels of their tonnage. When fishing only the prescribed lights and shapes must be shown visible for two miles. *(2)* With trolling (towing) lines: as for a power-driven or sailing vessel under way. *(3)* With nets or lines (not trolling') extending less than 500 ft. into the seaway, an all-round white light and on the approach of or to another vessel, another white light six feet below it and at least ten feet horizontally from it in the direction of their gear. By day, display a basket. which must; if at anchor, be shown in the direction from the anchor ball toward the gear. If the gear extends more than *joo* ft.. three white lights in a vertical triangle. three feet apart, visible all round. Side lights must be shown only when making way through the water. By day, a basket must be shown close to the stern not less than ten feet above the rail: also, conspicuously, one black conical shape apex upward. At anchor with gear out they shall show the basket to approaching vessels in the direction from the anchor ball toward the gear. *(4) (a)* A power-driven vessel trawling shall carry in lieu of the masthead light, a tricoloured lantern showing a white light from right ahead to 22½° on each bow and green and red lights showing from 22½° on each bow to 22½° abaft the beam on the starboard and port sides respectively, and not less than 6 nor more than 12 ft. below the lantern a white all-round light and also a stem light; *(b)* sailing vessels trawling shall carry a white light showing all round and on approach of or to another vessel show a white flare-up light; (cj by day, vessels trawling shall display a basket in a conspicuous position. (5) Fishing vessels may in addition to the above lights show a flare-up light in order to attract attention, and use working lights. *(6)* Vessels fishing at anchor shall show anchor lights and shapes and an additional white light six feet below the forward anchor light and ten feet horizontally from it, in the direction of the gear. (7) *(a)* If a vessel when fishing becomes fast by her gear to an obstruction, she shall in daytime haul down the basket and show the shape required for a vessel at anchor, by night show anchor lights; (b) in bad visibility whether by day or night sound the signal for a vessel not under control which signal shall also be used on the approach of another vessel in good visibility.

Special Lights and Signals.— (I) Vessels and seaplanes may, to attract attention, show a flare-up light or use detonating sound signals which cannot be mistaken for any signal authorized elsewhere. *(2)* Ships of war, convoys and merchant ships may operate station or signal lights or recognition signals adopted by shipowners, duly authorized by their respective governments.

Vessels under sail and power in daytime shall display one black conical shape. point upward. carried forward.

Fog *signals* by whistle, siren, foghorn and bell. A "short blast" means one of one second; a "prolonged blast", one of four to six seconds. Signals prescribed shall be given by vessels: if power-driven, on the whistle; if sailing vessels, on the fog horn; if towed, on the whistle or fog horn.

In fog and restricted visibility, by day or night, the following signals shall be used. (1) Power-driven vessel making way: every two minutes a prolonged blast. *(2)* Stopped and not making way: every two minutes two prolonged blasts with one second between them. *(3)* Sailing vessel under way: every minute, on the starboard tack one blast; port tack two blasts; wind abaft the beam, three blasts. *(4)* A vessel anchored shall ring her bell rapidly for five seconds every minute. If more than *3jo* ft. in length: sound the bell forward, and aft sound a gong or similar instrument. She may also sound to approaching vessels, one short, one prolonged and one short in succession. (5) Towing or unable to manoeuvre: one prolonged and two short in succession every minute. (6) The last vessel of a tow: one prolonged and three short in succession every minute, after the towing vessels signal. (7) Vessel aground: three strokes on the bell immediately before and after ringing the bell as prescribed in (4). (8) Vessels less than *20* tons, rowing boats and seaplanes: an efficient sound signal every minute. (9) \-essels fishing of *20* tons upward: a blast followed by ringing the bell every minute.

Speed in Fog.— (1) Every vessel or seaplane shall in conditions of restricted visibility go at a moderate speed. *(2)* A power-driven vessel hearing, apparently forward of her beam, the fog signal of a vessel the position of which is not ascertained shall, circumstances permitting, stop her engines and navigate with caution until danger of collision is over

Steering and Sailing Rules.— Sailing vessels approaching one another with risk of collision shall take action as follows. (1) A vessel running iree shall keep out of the way of the vessel close-hauled. *(2) A* vessel close-hauled on the port tack shall give way to the vessel close-hauled on the starboard tack (3) When both are running iree with the wind on different sides, the vessel with the wind on the port side shall keep clear of the other. (4) When both are running free with the wind on the same side, the vessel to windward shall keep clear of the one to leeward. (5) The vessel with the wind aft shall keep clear of the other, vessel.

Power-Driven Vessels.— (1) When meeting end on or nearly end on with risk of collision, each shall alter course to starboard so that they pass port to port. This applies only to cases when by day each vessel sees the masts of the other in a line or nearly so with her own and by night to cases in which each vessel is in such a position as to see both the side lights of the other. For these purposes a seaplane shall be included as a power-driven vessel. *(2)* When two power-driven vessels are crossing so as to involve risk of collision, the vessel which has the other on her starboard side shall yield the right of way.

Power-Driven and ***Sailing*** *Vessels.— (I)* When risk of collision is involved the power-driven vessel shall keep out of the way of the sailing vessel. (2) A seaplane shall in general keep well clear of all vessels and avoid impeding their navigation. However, where risk of collision exists she shall comply with these rules.

General.— (1) Where by these rules one of two vessels is to keep out of the way of the other, the other shall keep her course and speed. When from any cause the latter vessel finds herself so close that collision cannot be avoided by the action of the giving-way vessel alone, she also shall take action as will best aid to avert collision. (2) Every vessel which is directed by these rules to keep out of the way of another vessel shall. if the circumstances of the case admit, avoid crossing ahead of the other. (3) Every power-driven vessel shall, on approaching another vessel which she is directed by these rules to keep clear of, if necessary slacken her speed, stop or reverse.

Vessels overtaking shall keep out oi the way of the overtaken vessel. An overtaking vessel is one coming up with another from any direction more than 22½° abaft her beam, *i.e.*, a position from which by night she would be unable to see the side lights of the vessel she is overtaking and no subsequent alteration of the bearing between them shall make the overtaking vessel a crossing vessel within the meaning of these rules or relieve her of the duty of keeping clear until she is finally past and clear. If the overtaking vessel is doubtful whether she is forward or abaft this direction from the other vessel, she shall assume that she is an overtaking vessel and keep clear.

Narrow Channels.—(1) Every power-driven vessel proceeding along the course of the channel shall, when it is safe and practicable. keep to that side of the fairway or mid-channel which lies on the starboard side of such vessel. (2) A power-driven vessel nearing a bend in a channel when another vessel approaching from the other direction cannot be seen shall give a prolonged blast when within one-half mile of the bend, which signal shall be answered by a similar blast by any approaching power-driven vessel within hearing around the bend. The bend shall be rounded with alertness and caution.

All vessels not engaged *in* fishing shall keep out of the way of vessels fishing with nets, lines or trawls. This rule shall not give to any vessel engaged in fishing the right of obstructing a fairway used by vessels other than fishing vessels.

Navigational Dangers and Proper Precautions.—Due regard shall be had to all dangers of navigation and collision and special circumstances, including the limitations oi the craft involved. which may render a departure irom the rules necessary in order to avoid immediate danger. Nothing in these rules shall exonerate any vessrl, owner, master or crew thereof from the consequences of any neglect to carry lights or signals or to keep a proper lookout or of the neglect of any precaution required by the ordinary practice of seamen or by the special circumstances of the case.

Sound Signals *for Vessels in Sight of One Another.*—(1) When vessels are in sight of one another. a power-driven vessel in taking any course authorized or required by these rules shall indicate that course by the following signals: one short blast to mean "I am altering my course to starboard"; two short blasts, "I am altering my coursr to port"; three short blasts, "My engines are going astern." (2) A power-driven vessel which is the stand-on vessel finding herself in doubt through the keep-out vessel not taking sufficient action to avert collision may indicate such doubt by giving at least five short and rapid blasts on the whistle. but this does not relirve her of any obligation under these rules or of her duty to indicate any action taken under them of giving the appropriate sound signals laid down under (1).

Reservation *of* Rules *for Harbours and* Inland *Navigation.*—Nothing in these rules shall interirre with the operation of a special rule dilly made hy local authority relative to the navigation of any harbour, river or inland water, including a reserved seaplane area.

Distress **Signals.**—Vessels and seaplanes in distress and requiring assistance from other vessels or the shore shall use or display the following signals either together or separately: (1) a gun or other explosion signal fired at intervals of about a minute: (2) a continuous sounding with any fog-signal appa-atus; (3) rockets or shells throwing red stars fired one at a time at short intervals; (4) a signal made by radiotelegraphy or by anv other signalling method consisting of the group SOS in the Morse code; (5) a signal sent by radiotelephony consisting of the spoken word "Mayday"; (6) the international code signal of distress SC: (7) a square flag having above or below it a ball or anything resembling a ball; (8) flames on the vessel (as from a burning tar barrel, etc.); (9) a rocket parachute flare showing a red light. (L. F. H.)

RULES OF **ORDER,** as the term is ordinarily used in the United States, embodies the generally accepted rules, precedents and practices commonly employed in the government of deliberative assemblies. Its function is to maintain decorum. ascertain the will of the majority, preserve the rights of the minority and facilitate the orderly and harmonious transaction of the business of the assembly. While it had its origin in the early British parliaments. the modern system of general parliamentary law is. in many respects, at wide variance with the current systems of procedure of both the English parliament and the U.S. congress. These legislative systems are designed for bicameral bodies. generally with paid memberships. meeting in continuous session. requiring a majority for a quorum and delegating their duties largely to committees. Their special requirements and the constantly increasing pressure of their business have produced highly complex and remarkably efficient systems peculiar to their respective bodies but which are as a whole unsuited to the needs of the ordinary assembly. As a result there has been simultaneously developed through years of experiment and practice a simpler system of procedure adapted to the wants of deliberative assemblies generally and which, though variously interpreted in minor details by different writers, is now in the main ctandardized and authoritatively established.

Organization.-Assemblies convene with the implied understanding that they will be conducted and governed in accordance with these fundamental principles. The routine ordinarily followed in the preliminary organization of an assembly includes the call to order by any of those present with a request for nominations for temporary chairman, The temporary chairman having been elected and having taken the chair, a temporary secretary is chosen and those addressing the chairman are recognized to explain and discuss the purposes of the meeting. If the assembly has convened for a single session only or is in the nature of a mass meeting a presiding officer and recording officer will suffice. If permanent organization is contemplated a committee is usually appointed to draft a constitution and bylaws and on the adoption of its report, with or without amendments, the assembly proceeds to the election of the permanent officers thus authorized. In a permanent organization such officers commonly consist of a presiding officer known as the president. chairman. speaker or moderator: a vice-presiding officer; a recording officer, known as the secretary or clerk. who keeps the records. attends to the clerical work of the organization and in the absence of the presiding ofiicers calls for the selection of a temporary president; a treasurer or bursar who receives and disburses its funds; and a sergeant at arms who preserves order and carries out the wishes of the assembly through the presiding officer.

It is the duty of the presiding officer to call the assembly to order at the appointed time. cause the journal or minutes of the preceding meeting to be read. call up the business of the assembly in the order provided by its rules and conduct its proceedings in accordance with parliamentary law. He is especially charged with the responsibility of ascertaining the presence of a quorum. the minimum number of members prescribed by the rules of the assembly as competent to transact business. In legislative assemblies a quorum is presumed to be present unless the question is raised. but where the bylaws of an ordinary assembly require a quorum it devolves upon the presiding officer to ascertain that a quorum is present before proceeding with business.

Motions.—The will of an assembly is determined and expressed by its action on proposals submitted for its consideration in the fcrm of motions or resolutions offered by members recognized for that purpose. In order to make a motion a member must rise and address the chair and secure recognition. If the motion is in order and is seconded by another member it is "stated" by the presiding officer and is then subject to the action of the assembly. A second is not required in legislative assemblies but is requisite under general parliamentary law. Motions may be classified as main or principal motions, introducing a proposition; and secondary or ancillary motions. designed to affect the pending main motion or its consideration. A main motion is in order only when there is no other business before the assembly, and yields in precedence to all other questions. Secondary motions may be subdivided into subsidiary. incidental and privileged.

Subsidiary motions are applicable to other motions for the purpose of modifying the main question or affecting its consideration and disposition. They have precedence of the motion to which applied but yield to privileged and incidental motions. They take precedence among themselves in the following order: to lay on the table; for the previous question; to close or extend dehate: to postpone to a day certain; to commit. recommit and refer; to amend; and to postpone indefinitely.

Motion to Lily on the Table.—The motion to lay on the table is in effect a motion to suspend consideration of the question and, if agreed to, also suspends consideration of all pending questions relating to the motion to which applied until such time as the assembly may determine to take it from the table for further consideration. The motion is not debatable and may not be amended, postponed. committed. divided or reconsidered.

Motion for the Previous Question.—The purpose of the motion for the previous question is to close debate peremptorily and bring the assembly to an immediate vote on the pending question. It may be ordered on a single question. a group of questions or any part of a pending question, as on an amendment. It precludes both debate and amendment and requires a majority vote only for passage. It yields to the motion to table. to the question of consideration and to privileged and incidental motions and may

be reconsidered, but takes precedence of motions to postpone, amend and commit.

Motion to Close or Extend Debate.—The motion is not admitted in either house of the U.S. congress when not sitting as committee of the whole but is in order under general parliamentary law and insofar as applicable is subject to the rules governing the previous question.

Motion to Postpone to a Day Certain.—This applies to the main motion and its pending amendments and is debatable only as to the advisability of the postponement proposed, and does not open to debate the subject matter of the motion to which applied. It is subject to amendment and reconsideration, to privileged and incidental motions, to motions for the previous question and to lay on the table but has precedence of all other subsidiary motions.

Motion to Commit, Recommit and Refer.—The motions to commit, recommit and refer are practically equivalent and provide for reference of the pending proposition to a committee. While the motion to recommit ordinarily applies to the whole subject including pending amendments, it may apply to certain features only. It may be amended as by adding instructions to the committee as to time and manner of report. Debate on the motion is limited to the question of reference and instructions. It takes precedence of motions to amend and indefinitely postpone but yields to other subsidiary motions and to all incidental and privileged motions. It may be tabled or postponed with the main question but no subsidiary motions except the motions to amend and for the previous question may be applied separately. It is subject to reconsideration at any time before the committee begins consideration of the question submitted to it but after that time the subject matter may only be reclaimed by a motion to discharge the committee

Motion to Amend.—Changes in the text or terms of the proposition require a second and must be reduced to writing if requested by the chairman. There is no limit to the number of amendments which may be proposed and new amendments may be offered as rapidly as the pending amendment is disposed of. Amendments in the second degree. that is. amendments to amendments, are admissible but amendments in the third degree. that is amendments to amendments to amendments, are not in order. Only four amendments in the first and second degrees may be pending simultaneously. as follous: (1) amendment; (2) amendment to the amendment; (3) substitute for the amendment (*i.e.*, when it is desired to replace the entire pending amendment); and (4) amendment to the substitute. The amendment must, of course, be offered first and the substitute before the amendment to the substitute. but otherwise there is no rule governing the order in which the four amendments may be presented. They must. however. be voted on in the following order: first, amendments to the amendment; second. amendments to the substitute; third. the substitute; and last, the amendment. Debate on an amendment is in order only when the main motion is debatable, and is then limited to the proposed modification. An amendment which has been rejected may not be offered the second time in identical form, and no amendment may be proposed reversing the operation of an amendment previously adopted. Motions to amend will not be entertained unless germane or relevant to the main question, and no proposition different from that under consideration will be admitted under guise of amendment. This motion yields to all privileged, incidental and subsidiary motions except indefinite postponement. It is subject to amendment, to the operation of the previous question and to reconsideration. and when laid on the table carries with it the proposition proposed to be amended. Likewise, nhen the main question is laid on the table, postponed or recommitted, all pending amendments accompany it. The motion to amend is not applicable to the motion to lay on the table or for the previous question, to adjourn or to suspend the rules.

Motion to Postpone Indefinitely.—The motion to postpone indefinitely provides for final adverse disposition for the session and amounts to summary rejection. It is debatable and opens to debate the question to which applied but is subject to no subsidiary motion except the motion for the previous question.

Incidental Motions.—Incidental motions include questions arising incidentally in the consideration of other questions and decided before disposition of the one to which they are incident. They have no relative rank and merely take precedence of the pending question in the consideration of which they have arisen. All are undebatable with the exception of appeal. They comprise motions to suspend the rules, withdraw motions, read papers, raise the question of consideration, questions of order and appeal, reconsider, take up out of order, determine method of procedure, divide pending questions and questions relating to nominations.

The motion temporarily to suspend the rules may not be debated or reconsidered and is not subject to the application of any subsidiary motion. The vote required to pass the motion is ordinarily fixed by the rules of the assembly and in the absence of such provision is two-thirds of those present and voting.

Withdrawal or modification of a motion after it has been "stated" by the presiding officer is usually effected by unanimous consent but in event of objection by any member must be submitted to the assembly. Consent of the seconder is not required but if .modified the seconder may withdraw the second. When applied to the main motion it includes all adhering motions but when applied to amendments or adhering motions the main question is not affected. The reading of papers on which a vote is to be taken may be demanded by any member as a matter of right. Papers on which a vote is not required are usually read by unanimous consent but if objection is made the question must be submitted to the assembly.

The question of whether the assembly desires to take up a proposition regularly presented for its consideration may be tested by raising the question of consideration, which may be moved at any time before actual consideration commences and does not require a second. It is not in order after debate begins or after a subsidiary motion has been applied. When the question is properly raised the assembly may by a two-thirds adverse vote decline to take up any business it prefers not to consider.

Points of **Order** may be made while another has the floor, and when the question concerns the use of unparliamentary language the member so called to order must be seated pending disposition of the matter. The question must be raised at the time the proceeding giving rise to the objection occurs and will not be entertained after the assembly has passed to other business. If the point of order is overruled the member resumes the floor but if the objection is sustained he may proceed only by consent of the assembly. Debate on questions of order is for the information of the chair and may be closed by the presiding officer at any time. Any member may appeal from a decision by the chair and such appeal is debatable unless arising out of an undebatable question.

The motion to reconsider must be made by one who voted with the prevailing side but may be seconded by any member. It is only in order on the day or the next calendar day after the vote proposed to be reconsidered is taken. The motion is of the highest privilege and map be entered for record on the minutes nhile another has the floor, but cannot be called up for consideration until the pending question is disposed of, nhen it takes precedence of all new business. If applied to a debatable question it reopens the entire subject to debate. The motion may not be amended, committed or indefinitely postponed and requires a majority vote for passage. If agreed to, the motion reopens the entire question for further action as if there had been no final decision. The motion to take up out of order is merely another form of the motion to suspend the rules and requires a two-thirds vote for enactment. It is not amendable and debate is limited to the specific question presented.

A motion to divide the question is in order where the pending question includes propositions so distinct that, one being taken away, a substantive proposition will remain. Such motions are applicable to main questions and their amendments only and no subsidiary motion except the motion to amend is admitted. The rules of the U.S. house of representatives provide that any member may demand the division of a question as a matter of right, but under general parliamentary procedure the question must be submitted to the vote of the assembly.

Nominations do not require a second. Where the rules of an assembly fail to provide a method of nomination a motion for such provision is in order. The motion to close nominations is subject to none of the subsidiary motions save the motion to amend, and is decided by a two-thirds vote.

Privileged Motions relate to the needs and interests of the assembly and its members in matters of such urgent importance as to supersede temporarily pending business. They take precedence of all other motions and may be offered while other questions are pending. In this class of motions is the motion to fix the time to which to adjourn, to adjourn, to take a recess. raising questions of privilege and the call for the orders of the day, all of which are undebatable.

Other motions variously referred to as supplementary, miscellaneous and unclassified are the motions to take from the table, to. discharge a committee. to accept the report of a committee, to rescind, to repeal, to annul, to expunge and to permit a member to resume the floor after having been called to order for words spoken in debate.

Rules for Debate. — In order to debate a question, a member must rise and address the chair and be recognized by the presiding officer for that purpose. The presiding officer should first recognize the mover of a proposition or the member of a committee presenting a report and should endeavour to alternate recognitions between those favouring and those opposing a question. It is also customary, though not necessarily incumbent upon the chair, to permit the proponent of a proposition to close debate. A member may speak but once on the same question at the same stage of the proceedings if others desire recognition, but is entitled to speak on the main question and on each amendment as presented. Under general parliamentary procedure a member securing the floor may speak without limit and this practice still obtains in the U.S. senate, but the house of representatives by rule limits speakers to one hour in the house and to five minutes in the committee of the whole. Most assemblies and all legislative bodies provide a limit for debate and in conventions it is customary to adopt a rule at the opening session limiting debate to a specified number of minutes. In debate a member must confine himself to the question under consideration, must avoid personalities and must not arraign motives. Members should be silent and respectful while another has the floor and in questioning the speaker should first address the chair, who will in turn inquire if the speaker desires to yield. Where the presiding officer is a member of the assembly he has the right to debate and to participate in the proceedings but should call another to the chair before taking the floor and should not resume it again until the pending question has been decided.

Voting. — Voting may be by ballot; by division, that is a rising vote; viva voce, that is by acclamation, the presiding officer deciding by the volume of voices; by show of hands; by tellers. the members passing between tellers appointed from opposite sides to count them as they pass through; and by yeas and nays, the clerk calling the roll and recording each vote as given. If there is doubt as to the result of a viva voce vote any member may request a division and the presiding officer thereupon proceeds to take a rising vote. A member may change his vote at any time prior to announcement of the result. Only members in attendance may vote and voting by proxy is never permissible unless by operation of law.

A tie vote defeats an affirmative motion. The presiding officer if a member of the assembly votes to break a tie but not to make one.

Committees. — Much of the work of assemblies and especially of legislative bodies is transacted by committees. The committee system provides for a better division of labour and for a more detailed consideration than the assembly as a whole is ordinarily prepared to give. Committees are classified as standing committees with fixed terms of office and rendering continuous service; and special committees serving temporarily and assigned to limited service. In the absence of a rule making other provision, committees are selected by the assembly. Frequently the chair is authorized to appoint committees. Or selection may be made by ballot, by resolution or by designation in motions of reference. If no chairman is designated the member first named acts as chairman until the committee elects a chairman. As far as applicable the rules of the assembly govern its committees. The chairman of the committee submits its report to the assembly and unless it is of elementary character is required to present it in writing. Members who do not concur in the report may submit minority views over their signatures. When called up for consideration in the assembly such minority report is read in connection with the majority report unless there is objection. in which event the question of reading the minority views is submitted without debate to the vote of the assembly.

The committee of the whole consists of the entire assembly acting as a general committee. In legislative assemblies it affords greater freedom of consideration but in nonlegal bodies is rarely used.

Parliamentary Practice. — Use of motions to effect a purpose in the assembly or its committees when applicable may be summarized as follows: The body may protect itself against business which it does not wish to consider by invoking the motion to lay on the table, by raising the question of consideration or by voting to postpone indefinitely. If it is desired to suppress debate, the motion to limit debate and the demand for the previous question are available. Modification of a proposition may be secured through amendment or reference to a committee with or without instructions. Action may be deferred by postponement to a day certain, by providing a special order or by the motion to table. A question may be brought up a second time for consideration in the assembly by voting to take from the table, by reconsideration or by the motion to rescind, repeal or annul.

(C. CA.)

RULHIERE (or RULHIÈRES), **CLAUDE CARLOMAN DE** (1735–1791), French poet and historian, was born at Bondy, near Paris, on June 12, 1734. He served Marshal Richelieu in the Hanoverian campaign of 1757, and during his government at Bordeaux in 1758. At St. Petersburg (Leningrad) where he was sent as secretary of legation, he witnessed the revolution which seated Catherine II on the throne. In 1773 Rulhiitre became secretary to the future Louis XVIII; in 1787 he was admitted to the academy. He lived chiefly at Paris, where he held an appointment in the foreign office.

Rulhiitre died at Bondy on Jan. 30, 1791. He befriended J. J. Rousseau in his old age.

Rulhière's historical works include *Histoire de l'anarchie de Pologne* (4 vols., 1807), edit. P. C. F. Danon, and *Éclaircissements historiques sur les causes de la révocation de l'edit de Nantes* (2 vols, *1788).*

RULLUS, PUBLIUS SERVILIUS, a Roman tribune of the people in 64 B.C., well known as the proposer of one of the most far-reaching agrarian laws brought forward in Roman history. This law provided for the establishment of a commission of ten, empowered to purchase land in Italy for distribution amongst the poorer citizens and for the foundation of colonies. The commission was to be invested with praetorian powers. and Pompey, then in the East, was excluded by a provision that personal attendance was necessary to election. In fact, the commission as a whole was intended to act as a counterpoise to his power. There were provisions for the purchase of further land by the sale of recently conquered territory and the use of the revenues from Pompey's provinces. The places to which colonies were to be sent were not specified, so that the commissioners would be able to sell wherever they pleased, and it was left to them to decide what was public or private property. Cicero delivered four speeches against the bill, of which three are extant. It was not greeted with enthusiasm and was dropped before the voting. The whole affair was obviously a political move, probably engineered by Caesar, his object being to make the democratic leaders the rulers of the state. Although Caesar could hardly have expected the bill to pass, the aristocratic party would be saddled with the odium of rejecting a popular measure, and the people themselves would be more ready to welcome a proposal by Caesar himself, an expectation fulfilled by the passing of the *lex Julia* in 59, whereby Caesar at least partly succeeded where Rullus had failed.

See the orations of *Cicero* De *lege agraria,* with the introduction in

G. Long's edition, and the same author's *Decline of the Roman Republic,* iii, p. 241; Mommsen, *Hist. of Rome,* bk. v, ch. 5.

RUM or ROUM, an indefinite term in use among Muslims at different dates for Europeans generally and for the Byzantine empire in particular. At one time it was used for the Seljuk empire in Asia Minor and now for Greeks inhabiting Ottoman territory (Arab. *ar-Rūm*).

When the Arabs met the Byzantine Greeks, these latter called themselves Romaioi, or Romans; so the Arabs called the people "the Rūm" as a race-name (already in Qur. xxx, 1), their territory "the land of the Rūm," and the Mediterranean "the Sea of the Rūm."

Later, inasmuch as Muslim contact with the Byzantine Greeks was in Asia Minor, the term Rūm became fixed there geographically and remained even after the conquest by the Seljuk Turks, so that their territory was called the land of the Seljuks of Riim.

RUM is a spirit obtained by distillation of the fermented products of sugar cane. Although it is produced in most sugar-growing countries of the world (United States: Cuba, Australia and South Africa) for local consumption, the world demand for rum is mainly supplied by the West Indies, where it originated. Types of rum are legion, for they depend upon the quality of the ingredients, upon methods of fermentation and distillation and upon subsequent treatment and maturation.

The manufacture of rum was developed in the British West Indies in the 17th century, soon after the settlement of the islands. After Columbus had discovered Cuba in 1492 the Spaniards introduced sugar cane there, whence it spread to the other West Indian islands; the sugar industry has been paramount ever since. In Barbados, rum was certainly produced as early as 1647, 23 years after the island's settlement: and probably earlier. At first it was known as "kill-devill"; three years later it mas referred to as "rumbullion" and by 1667 it was called simply rum.

Rum is made out of either pure cane sugar or, more frequently, molasses. The main territories that produce rum for export are Barbados, Trinidad. Jamaica and British Guiana; Puerto Rico and Cuba also export considerable quantities to the United States. Most of the other West Indian islands produce rum in small quantities. Where the sugar industry is undeveloped, pure sugar cane juice is used rather than molasses. Rum can be made, however (as in the United States and Germany), from imported molasses.

Molasses, the commonest ingredient for fermentation. is the treacly residue left after sugar crystals have been crushed from sugar canes; sometimes skimmings from the purer cane juice are also added. Fermentation can be of either the Demerara or the Jamaican type. In the Demerara method either sugar cane or molasses is prepared into a liquid known as the "wash," and diluted to a low specific gravity (1.060); usually a little sulfuric acid is added to assist the saccharomyces, or alcohol yeasts. and sometimes also a small quantity of ammonium sulfate, as food for the yeast. The fermentation thus encouraged is completed in 48 hours. This method produces a high alcohol yield but a low ester content; thus the spirit is comparatively lacking in bouquet, although it is sometimes subsequently flavoured.

In the Jamaican method, the fermentation lasts for about 10 or 12 days with a wash of between 1.078 and 1.096 specific gravity. Apart from introducing into the wash some of the waste, known as dunder, from a previous distillation, no special encouragement is given to the alcohol yeasts; it is thus possible for esters to develop more easily and this is one of the origins of the distinctive flavour possessed by Jamaican rum. Certain special Jamaican rums have such a high ester content that they are used exclusively for blending.

The flavour of a rum also is affected by the distillation method. Two methods are available: the pot still and the continuous still. In the first: a single distillation is insufficient for it produces a spirit too weak for consumption; a second distillation is necessary to bring the spirit to the required strength. In the alternative method the spirit can be brought to any strength in one "burning"; it is thus far more economical. As the separation of alcohol from water can be very quick and almost complete in the continuous still, the spirit so produced has less flavour (and is less heavy) than that produced by the pot still. A third of the stills in British Guiana and all those in Jamaica are pot stills. while the remainder of the stills in British Guiana and all those in Barbados and Trinidad are continuous.

After the rum has been distilled it is colourless, but it will pick up colour from the casks in which it is stored (no rum less than three years old may be sold). It may be further coloured with caramel or burnt sugar to suit public taste.

In Cuba the distilled spirit is purified by passing through charcoal so as to obtain a flavourless alcohol, which is later flavoured independently; it has a characteristic taste, the rum flavour being weak. U.S. rum is mostly heavy-bodied; it develops an excellent aroma when aged. (C. C. H. F.)

RUMANIA or RŎMANIA, a nation of southeast Europe to the north of the Balkan peninsula. Its area within the boundaries established after World War I covered 113.889 sq.mi., with a population of 18,025,237 in 1930. In 1940 Rumania lost about a quarter of its territory. The present area of the country is 91,699 sq.mi. and the population (1960 est.) 18,403,414.

RUMANIA AFTER WORLD WAR II AND THE PEACE TREATY OF 1947

PHYSICAL FEATURES

Rumania is a land of great contrasts and contains within its boundaries examples of most of the physiographical regions characteristic of the European continent. Of the total area (1947 boundaries), mountains occupy 26%, hills 39% and plains 35%.

The Carpathians form the predominant feature of Rumania. They run in a great arc from the junction of the Hungarian and U.S.S.R. frontiers in the north. in the districts of Maramures and Bukovina, to the junction of the Yugoslav and Bulgarian frontiers in the south. Within the arc lie the related Bihorului mountains, forming the core of Transylvania and distinguishing it from the plains of Hungary. These great ranges of alpine-fold mountains, which run in a continuous zone from the Danube river at Bratislava in Czechoslovakia to the Danube at the gorge of the Iron Gate in Rumania, forrn a link betn-een the Alps proper and the Balkan ranges of Yugoslavia and Bulgaria.

In Rumania the mountains are characterized mainly by their penetrability. The rivers, which drain entirely toward the Danube, by cutting back into the numerous upland basins (*e.g.,* that of Brasov) provide routes linking the hills and plains on either side. Most of the summits are remarkably uniform in height, and the formation of what is almost a plain has resulted in gently rounded plateaus, forming the *plaiu* (way) or high alpine meadows above the deep forest-shrouded upper valleys. Sharp mountain peaks, such as those of the Fagaras mountains, are more the exception than the rule. One Danube tributary, the Olt, has, by cutting a narrow gorge: succeeded in crossing from the Transylvanian to the Walachian side of the Carpathians. Apart from the Olt, the other tributaries that drain southward to the Danube are the Jiu, the

Dambovita on which stands the capital Bucharest (Bucuresti) and the Ialomita. The eastern slopes of the Carpathians drain into the Siret (with its tributary, the Bistrita) and the Prut which join the Danube a little above its delta. The interior basins of Transylvania, together with the inner slopes of the Carpathians and the Bihorului mountains, are drained westward by a complicated network of headstreams which feed the Tisza (Tisa) and two of its major tributaries, the Somes and the Mures. One other river, the Timis, makes its way independently of the Tisza reaching the Danube at Belgrade.

Two crystalline massifs, composed mainly of granite and schist, form the northern and southern ends of the Carpathians in Rumania. They are, in the north, that of Bukovina-Maramures running northwest to southeast with summits usually reaching from 5,400 ft. to 6,400 ft. (Pietros is 7,568 ft.); in the south that of Banat-Transylvania, generally known as the Transylvanian Alps, running east-west and reaching over 7,400 ft. at many points. The highest peak in Rumania is Negoi (8,346 ft.) in the Fagaras mountains. Between these two terminal bastions, and linking them, is a somewhat lower north-south group, the Moldavian Carpathians, in which the so-called Flysch (folded and fractured sandstones, etc.) predominates. Along the inner edge of the ranges there are numerous examples of volcanic intrusions; *e.g.*, the rocks forming the Caliman mountains in Maramures. The Bihorului mountains (about 6,000 ft.) are composed of both crystalline and volcanic rocks and show the rounded characteristic of the Rumanian ranges.

Within the arc of the Carpathians and abutting against the hard core of the Bihorului mountains lie the Tertiary rocks of the Transylvanian basin, a much-folded upland basin of sandstones and clays eroded into a country of hilly relief by the mountain-fed streams, the soft banks of which are much given to landslides. The outer edge of the mountain belt is ringed by the sub-Carpathian foothill zone bordering Moldavia and Walachia. The latter is subdivided into two smaller divisions by the Olt river, Oltenia to the west, Mutenia to the east. The foothills, composed of folded sedimentary rocks which provide the famous oil-bearing strata, afford one of the most verdant regions of the whole country.

The general accessibility of the Carpathians, which are crossed by numerous passes provided usually by low cols between the gently rounded mountain summits and often approached by upland basins, provides a contrast to the alpine-fold mountains elsewhere. In Rumania the mountains are not only crossed at many points, but actually form a well-populated region; with Transylvania they formed the cradle and refuge of the Rumanian nation above the tides of conquest that swept back and forth along the Danube plains and across the plains of northern Europe.

The most important passes—those followed by railway lines—are: (1) the Caransebes corridor leading from Timisoara to Orsova at the Iron Gate by way of the Porta Orientalis; this is an alternative to the Orient Express route; (2) the Olt gorge and the Red Tower (Turnu Rosu) pass leading from Oltenia to Transylvania; (3) the Predeal pass (3,445 ft.) linking Brasov with Ploesti and Bucharest, joining Muntenia (Greater Walachia) and Transylvania—the Orient Express route; (4) the Ghimes pass linking lower Moldavia and Transylvania and (5) the Bargau pass (3,940 ft.) linking Jassy (Iasi) in northern Moldavia and Chernovtsky (Cernauti), U.S.S.R. (a Rumanian city until 1940), with northern Transylvania.

The lowlands of Walachia and Moldavia consist in reality of plateaus of various elevations composed of horizontal or slightly tilted sedimentary strata of the Tertiary period, overlaid by a covering of recent deposits. These recent deposits, particularly in Moldavia, consist largely of the wind-borne loess, from which the rich black earth, or chemozem, soils are derived. The plateaus are crossed by the rivers descending from the Carpathian mountains. These streams are often deeply entrenched into the general level and are usually dry in the late summer when acute droughts are common. The Danube itself flows in a broad flood plain known as the Balta, characterized by numerous swamps and abandoned arms of the river, between bluffs marking the edge of the plateaus and the edge of the sub-Balkan platform of Bulgaria.

The Dobruja (Dobrogea), a unique region forming part of the sub-Balkan platform, consists of a core of folded crystalline rocks which are exposed in the northern hills (up to 1,300 ft.), but mainly concealed by a layer of chalk and recent deposits of loess. Dry valleys resembling the wadies of northern Africa dissect this hill region, which by its northward projection accounts for the diversion of the Danube in its lower course.

Climate.—Because Rumania is one of the more southerly European countries—the 45° N. parallel dissects the Danube delta—it is to be expected that it would experience high temperatures and much sunshine in summer. Atlantic influences, however, are remote (Bucharest is 26° E.). A great diurnal and seasonal range of temperature and a continental distribution of precipitation (with a marked early summer maximum) are characteristic of the whole country. The marked variations of relief have a great effect on climate; the plains of Moldavia and Walachia are essentially steppelike with less than 20 in. of rainfall a year, cold winters and hot summers, while the Carpathian foothills have enough rainfall to support verdant forests and enjoy slightly more temperate conditions. The Carpathian zone receives a much greater precipitation than the other highland districts of the country, and is much cooler. It has some of the heaviest snowfalls of Europe. Transylvania, although higher and mountain-fringed like the Hungarian basin, has a noticeably harsher climate than the other hill regions, and is not so suited to the ripening of maize and the warmer fruits.

The year is divided into three seasons—winter, summer and autumn. The winters are long, often with much snow, and unpleasant when the northeast wind (the *crivat*) brings severe conditions from the Russian steppes. Summer can be of tropical intensity; a feature of this season is the southwest wind (the *austru*) which sometimes brings oppressive weather. Late summer is occasionally accompanied, especially in the Moldavian and Walachian plains, by severe drought; if this is combined with excessively low winter temperatures it produces famine conditions like those that arose in 1947. Autumn is the most temperate and enjoyable season of the year.

Data for Bucharest taken from a representative year illustrate these general conditions: with a mean annual range of temperature between 26.6° F. (January) and 71.6° F. (July), Bucharest recorded absolute extremes of −11.2° F. and 102.2° F. There were 78 days with frost and an equal number with tropical heat; one-third of the days were cloudless, one-third partly overcast and one-third sunless.

Fauna.—In its fauna, Walachia has far more affinity to the lands lying south of the Danube than to Transylvania, although several species of *Claudilia*, once regarded as exclusively Transylvanian, are found south of the Carpathians. Moldavia and the Baragan steppe resemble the Russian prairies in their variety of molluscs and the lower kinds of mammals. More than 40 species of fresh-water mussels (Unionidae) have been observed in the Rumanian rivers. The lakes of the Dobruja likewise abound in molluscs—parent forms, in many cases, of species which reappear greatly modified, in the Black sea. Insect life is somewhat less remarkable; but besides a distinctive genus of Orthoptera (*Jaquetia* hospodar), there are several kinds of weevils (Curculionidae) said to be peculiar to Rumania. Birds are numerous, including four varieties of crows, five of warblers, seven of woodpeckers, eight of buntings, four of falcons and five of eagles, while among the hosts of waterfowl which inhabit the marshes of the Danube are nine varieties of ducks and four of rails. Roe deer, foxes and wolves find shelter in the forests, where bears are not uncommon. Chamois frequent the loftiest and most inaccessible peaks.

(G. W. S.)

HISTORY

The early history of the lands which constitute modern Rumania, down to the end of the period of Roman domination, is traced in the article DACIA. Roman rule in Dacia lasted for 163 years. The legions were finally withdrawn south of the Danube in 271 A.D. by the emperor Aurelian. From the 3rd to the 12th century wave after wave of barbarian invaders from the east passed over the undefended country—first came the Goths and

Gepidae, then Slavs, followed by the Avars (*q.v.*), and in the second half of the 7th century by the Bulgars. The Bulgarian domination. lasting for two centuries, allowed a rudimentary civic life to take shape, and it was the Bulgars who, after the conversion of their tsar Boris in 864, brought Christianity in its eastern form to the ancestors of the Rumanians, building on earlier Latin foundations (see *Religion* below.) At the end of the 9th century the Bulgars were overcome by the Magyars; later came a brief incursion by the now almost vanished Petchenegs and Cumans (*qq.v.*).

One school of historians maintains that the Daco-Roman population north of the Danube was obliterated during these invasions and that the Rumanians of today are descended from Vlach tribes south of the river who pushed northward in the early 13th century. The Rumanian view, supported by linguistic and other evidence is that the Roman withdrawal affected only the military and official classes, while the body of the Daco-Roman inhabitants were driven by the invaders into the Carpathians, becoming the Vlachs of Transylvania. The Macedo-Romans south of the Danube, later knonn as Kutso-Vlachs, similarly sought shelter in the Pindus mountains. The controversy is considered in the article VLACHS.

Transylvania, regarded by Rumanians as the cradle of their nation. was conquered in the 11th century by King Stephen of Hungary, but all records of its early inhabitants were destroyed in the Mongol invasion of that country in 1241. The authentic history of the Vlachs does not begin until the end of the 13th century, when they are found establishing themselves south of the Carpathians in two distinct groups, one settling in the area later known as Walachia (called Muntenia by the chroniclers) and the other to the east in Moldavia. The incoming Vlachs fused with a population that already contained a Vlach element, but consisted mainly of Slavs and Tatars with an admixture of Petchenegs and Cumans.

The two regions thus colonized became the principalities of Walachia and Moldavia, whose annals remain distinct until 1774, but can thereafter be combined in one narrative. the Turkish administration being uniform. In 1859 the two principalities were formally united under the name of Rumania. The historical narrative which follows is therefore arranged under four headings, *Walachia, Moldavia, The Danubian Principalities* and *Rumania.*

WALACHIA

Tradition, embodied in a local chronicle of the 16th century entitled "History of the Ruman land since the arrival of the Rumans" (*Istoria tierei Românesci decându au descălicati Românii*) gives 1290 as the date of the founding of the Walachian state, asserting that in that year a voivode (prince) of Fagaras in southern Transylvania crossed the mountains with a body of followers and established himself at Campulung in the foothills, moving later to Curtea de Arges. The name given for this first leader. Radu Negru (Ralph the Black), is probably a confusion with that of a later Walachian voivode, but the southward movement at that period of Vlach peoples from the mountains to the Danubian plain can be affirmed with certainty. Walachia itself was known to its own people as Muntenia, land of the mountains, after their former home. Historians who deny the continuity of Daco-Roman (Vlach) settlement in Transylvania have to postulate a northnard migration of Vlachs from across the Danube to the Carpathians at the beginning of the 13th century to account for the indisputable southward movement at its close. The seeking of a new home in the south was due to the consolidation of Hungarian feudal power in Transylvania and of the feudal system, to the arrival of German settlers and to the growing proselytizing zeal of the Hungarian kings as faithful servants of the papacy. The Vlachs, since the introduction of organized Christianity under Bulgarian influence, had belonged to the Eastern Orthodox Church, taking the Byzantine side against Rome in the schism of 1054, though later some of their leaders came under Roman influence. (*See* also *Religion* below.)

The new principality remained at first under the domination of Hungary, but the voivode Bassarab defeated the Hungarian king Charles Robert in 1330 and secured independence. Vladislav (*c.* 1360–74), although again defeating the Hungarians. accepted a form of Hungarian suzerainty in return for investiture by Louis the Great, Charles Robert's successor, with the banat (frontier province) of Severin and the duchy of Omlas.

The early days of the principality were conditioned by the struggle against Hungary, but with the reign of Mircea the Old (1386–1418) a new period began, that of the struggle against the Turks. The first voivodes of Walachia, in search of help against Hungary, had contracted matrimonial and military alliances with the two Slav states south of the Danube, Bulgaria and Serbia, but both empires were already at the point of extinction at the hands of the Turks. Tradition recounts that a Walachian contingent helped the Serbs at the battle of Kosovo in 1389; it is a fact that the sultan followed up his victory by invading Walachia, which first appears in 1391 as a tributary of the Sublime Porte. The final overthrow of Bulgaria in 1393 left Walachia open to further Turkish advance but Mircea succeeded in holding the invaders back on the Danube marshes in 1394, and in the following year made an alliance with Hungary. The joint Christian forces, which included French and Burgundian contingents. were defeated in 1396 at the battle of Nicopolis (Nikopoli). Mircea had thrown over an earlier alliance with Poland in order to secure one with Hungary; accordingly the Poles, taking advantage of the defeat at Nicopolis, intrigued for his deposition and replaced him by his son Vlad, who accepted Polish suzerainty. Mircea later returned, re-established, and for a time increased, his power by exploiting the quarrels between the sons of the sultan Bayazid. In 1417, however, Walachia was forced to capitulate to Turkey under Sultan Mohammed II, though its dynasty, territory and Christian religion were left intact. Mircea died a year later.

Early Years of Turkish Rule.—After Mircea's death, Walachia, convulsed by internal struggles, could take no active part against the Turks, but they were for a time again driven back by the Hungarians under the brilliant John Hunyadi (*q.v.*), a Rumanian by race though enrolled in the Hungarian nobility. He deposed one of the weak Walachian voivodes and nominated Vlad IT.'—who in 1456 acknowledged Hungary as suzerain—a man whose unbelievable cruelties earned him the name of "the Impaler" (Tepes). Vlad (1455–62 and 1476–77) was able briefly to defy the Turks; with his death, resistance crumbled rapidly, Walachian voivodes succeeding one another after very short reigns.

The instability of the throne was in part due to the mixture of the hereditary and elective principles in the system of succession; the council of boyars (nobles), which came under Turkish rule to be known as the divan by analogy with the Turkish institution of that name, chose the prince from legitimate and illegitimate heirs of his dead predecessor.

The only voivode of the 16th century deserving mention is Neagu Bassarab (1512–1521), who founded cathedrals at Curtea de Arges (*q.v.*) and at Targoviste, which had become the Walachian capital. and endowed monasteries in Walachia, besides making noble contributions to Mount Athos. The patriarch of Constantinople honoured the dedication of the Arges monastery with his presence.

Neagu's son and successor was imprisoned by the Turks who proceeded to nominate Turkish governors in the towns and villages of Walachia. The Walachians resisted desperately. They elected Radu, a kinsman of Neagu, as voivode and defeated the Turkish commander Mahmud Bey with Hungarian help at Grumatz in 1522. The continuance and extension of Turkish control became inevitable, however, after the crushing defeat of Hungary in 1526 at the battle of Mohacs.

Walachia thereafter became a line of communication for Turkish expeditions against Hungary and Transylvania. The voivode Alexander, who succeeded in 1591, actually farmed out his possessions to his Turkish supporters, and it seemed that Walachia must succumb to direct Ottoman rule.

Michael **the Brave, 1593–1601.**—The Turkish advance was once more to be halted. though for the last time, under a new voivode, Michael, son of Petrusko, ban of Craiova. He secured the deposition of Alexander and his own election by raising a loan at Constantinople of 400,000 ducats to make the customary presents to the Porte and was supported by Sigismund Bathory (*q.v.*), prince of Transylvania, and by the English ambassador at Con-

stantinople, Edward Barton. Michael was to prove a thorn in the flesh to the Turks, but was much criticized for making Walachia once more subject to Hungarian princes in return for their help. In concert with the Moldavian voivode Aaron, Michael organized a massacre of Turkish guards and settlers (Nov. 1594) and with the support given by Bathory in return for the acknowledgment of his suzerainty proceeded to invade Turkish territory, taking Ruschuk, Silistra and other places on the right bank of the Danube. A simultaneous invasion of Walachia by a large Turkish and Tatar host mas defeated at the battle of Mantin (1595). The sultan next sent Sinan Pasha the Renegade to invade Walachia with 100,000 men. Michael withdrew to the mountains, but with aid from Bathory and a Transylvanian contingent resumed the offensive and stormed Bucharest, pursuing the main body of Sinan's forces to the Danube. In 1597 the sultan, wearied with these defeats. reinvested Michael for life.

Walachia's subjection to Hungary was not permanent. On the abdication of Sigismund Bathory, Michael, with the support of the emperor Rudolf II, attacked and defeated his successor Andreas Bathory in Oct. 1599 and had himself proclaimed prince of Transylvania, being acknowledged by the emperor as his lieutenant and having his position ratified by the diet. The Vlach peasant population of Transylvania was encouraged to revolt against the Magyars by having an overlord of their own race, but Michael, whose support in Walachia rested on the boyars, helped the Magyar nobility to suppress the peasant rising. Despite this the Magyars distrusted Michael, both as a despised Vlach and as a Habsburg agent, and he found his position in Transylvania insecure while Moldavia remained as a centre for Magyar and Polish intrigue. In May 1600 he invaded that principality, deposed the voivode and without waiting for the emperor's sanction had himself proclaimed "prince of all Ungro-Vlachia, of Transylvania and of Moldavia."

Though Rudolf confirmed Michael in his appointment he grew suspicious of his vassal's progress and determined to undermine his position. The imperial commissioner, Gen. George Basta, was instructed to give support to the disaffected Magyar element in Transylvania, and Michael was driven out by a successful revolt. At the same time the Poles invaded Moldavia, and restored the unseated voivode, while Walachia itself was also attacked. Michael appealed to the emperor, who restored him to favour, and in conjunction with Basta he defeated the Transylvanian forces at Goroslau in 1601. Basta, however, jealous of Michael's returning prosperity, procured his murder almost immediately after their joint victory.

Michael the Brave (Mihai Viteazul) is the leading Rumanian national hero, partly because it was he who made the last stand before the era of Turkish and Greek domination, but chiefly because for the first time since Dacian days he brought all the Rumanians, scattered in three principalities, under one rule, thus weaving the stuff of the national dream which was not to become reality until 1918.

The Period of Greek Penetration, 1634–1711.—After Michael's death Radu Serban of the Bassarab dynasty was appointed voivode of Walachia by the emperor's wish, but was deposed by the Turks in 1611. A succession of insignificant puppet princes followed him, the Greek element becoming increasingly apparent. There was a temporary rally in the second quarter of the 17th century under Matthias Bassarab, who succeeded in holding the throne for 22 years—warding off repeated attacks from his rival Basil the Wolf of Moldavia—and did much for the arts and the endowment of churches. He founded a printing press at the Govora monastery which issued a compendium of canon law, *Pravila sea mica,* the first Rumanian book to be printed in the principalities (Gospels in Rumanian had been printed in the preceding century by the Protestants in Transylvania).

The successor of Matthias, Constantine Serban, was the last Bassarab to rule in Walachia. On his death the Turks, who in 1698 moved the capital to Bucharest—at a safer distance from the Transylvanian frontier—began to exercise a more direct influence over the ruling families. who were now frequently of Greek origin. Serban Cantacuzino (1678–88), the first important Greek voivode, was an able man; forced to assist the Turks at the siege of Vienna, he opened up secret communications with the emperor, who granted him a diploma creating him a count of the empire and recognizing his descent from the imperial house of Cantacuzino. In 1688, the year of Serban's death, the first Rumanian Bible was printed.

Serban's successor was his nephew Constantine Brancovan (Brancoveanu), descended on his mother's side from the Bassarabs, who pursued a policy of cautious balancing between the Porte, the emperor, Poland and the rapidly westward-thrusting Russia. Brancovan sent congratulations to Peter the Great on his victory at Poltava and asked for help for the Christian cause. Finally falling a victim to intrigues, Brancovan was deposed and executed at Constantinople in 1714.

The Phanariot Regime, 1714–1821.—At the beginning of the 18th century Turkish power was in obvious decline and the strength of Austria and Russia growing. Alarmed by the intrigues of Brancovan of Walachia and Cantemir of Moldavia with Vienna and Moscow, the Porte decided to exercise direct control over the principalities. Instead of reducing them to mere pashaliks, however, the Turks employed Greeks from the Phanar district of Constantinople as their agents. The new princes, or hospodars, insecure of tenure, had to extract the maximum from the country in the minimum of time—the average duration of a reign was only two and a half years—and thus the word Phanariot has come to stand for bribery, exaction and corruption, though the hospodars themselves were often men of culture and intelligence.

Under this oppressive regime many peasants emigrated; in 1741 there were 147,000 peasant families in Walachia, but four years later their number was reduced by half. In the face of this, the enlightened hospodar Constantine Mavrocordato decreed the abolition of serfdom in 1747, but after numerous rises and falls from favour he was finally imprisoned in 1763 after efforts at reform had proved abortive.

The tide of Ottoman domination was now ebbing fast under Russian pressure; after defeating the Turks at Hotin in 1769, Russian troops occupied both principalities, the bishops and clergy taking an oath to the empress Catherine. At Focsani in 1772 Catherine demanded that the Porte recognize the independence of Walachia and Moldavia under Russian guarantee, but she was deterred by Austrian opposition, and temporarily satiated by the partition of Poland.

MOLDAVIA

Moldavia took shape in circumstances similar to those of its sister state but somewhat later: according to chronicles, more plentiful than those dealing with Walachia, Dragos, founder of the principality, emigrated southward with his followers from Maramures in the northern Carpathians (the dates given vary from 1299 to 1342). An independent state first emerged about 1349 under Bogdan. One of the early voivodes, Peter Musat (1375–90) was a member of the Bassarab family of Walachia and. in pursuance of the interests of his kinsman, Mircea the Old, recognized the suzerainty of the king of Poland whose sister he married. From this period date Poland's ambitions to control the new state, which had hardly emancipated itself from Hungarian tutelage. The first important voivode, Alexander the Good (1401–35), acknowledged Polish overlordship and laid the foundations of organized life in the principality. Civil war reigned among Alexander's successors, but a new era in Moldavian history opened with the reign of his grandson Stephen the Great (1457–1504), who was to prove one of the greatest champions of Christendom against the Turks. Patriotic and religious. Stephen was doubly affected by the fall of Constantinople four years before his accession; the cutting of the trade route through the Bosphorus was disastrous for the commerce of the principalities and the desecration of St. Sophia was a blow to Christian feeling. Stephen's whole reign was devoted to the attempt to rally the west against the infidel; he appealed for help to Poland. Hungary and Venice as well as to the pope Sixtus IV, who gave him the title "athlete of Christ."

Stephen inflicted a crushing defeat on the Turks at Rahova in 1475, and again repelled them the following year. Poland and Hungary, however, never gave him the solid support for which he

had hoped; in 1484 the Turks captured his key fortresses of Chilia and Akkerman (later Belgorod-Dnestrovski), and the following year burned the Moldavian capital Suceava. Once again Stephen rallied and defeated the Turks in 1486 at Scheia near Roman. As early as 1484, after the loss of his fortresses, he had been compelled to do public homage to King Casimir IV of Poland, but in 1499 he was able to draw up a treaty on equal terms. Poland, however, once again failed to honour its pledge to give help. On his deathbed Stephen, realizing the hopelessness of securing united action from Christendom; advised his son to submit to the Turks if they would respect the framework of church and state.

Stephen encouraged the arts, gave generous grants of monastic lands and built more than 40 stone churches. and the great monastery of Putna. Stephen's son Bogdan III, the "one-eyed" (1504–17), at feud with Poland over Pokutia, which his father had annexed, and lacking support from the already shaken Hungary, was forced in 1513 to pay annual tribute to the sultan while securing guarantees for the Christian religion and Moldavian institutions. In the anarchy following on the battle of Mohacs a strange figure ascended the Moldavian throne. Peter Rares (1527–38 and 1541–46), an illegitimate son of Stephen. Allying himself with the Turks. he made war on the imperial forces in Transylvania and on Poland, attempting to recover the lost Pokutia. Later he allied himself with the emperor against Poland and the sultan, but was defeated and deposed in 1538. In 1541 he returned to the throne with Turkish help, but concluded a secret treaty with the emperor against the Turks. His successors could no longer oppose Turkish power.

Turkish Penetration — Peter's son actually accepted Islam; the sultan strengthened his hold on Moldavia by occupying a series of fortresses and increased the tribute. From the middle of the 16th century each aspirant to the illoldavian throne had to buy the consent of the Porte. and the may was thus open to adventurers. The most dramatic was Jacob Basiliscus Heraclides who seized Moldavia from the voivode Alexander Lapusneanu with Turkish support. A Greek by birth, he had travelled over Europe and had become the friend of Philipp Melanchthon; he attempted to found an educational system in Moldavia, but his heavy taxation led to revolt and he was assassinated in 1563. Under the restored Lapusneanu and under Bogdan IV (1568–72), Moldavia relapsed into obscurity. Bogdan's successor John the Terrible (1572–74), provoked by the Porte's demand for increased tribute, rose against the oppressor, but was defeated and slain in 1574. Moldavia did not rally until the victories of Michaei the Brave at the turn of the century when it was actually inccrpcrated for a year in Michael's Great Dacian realm. After Michael's murder, the Poles again asserted supremacy, but the Porte resumed its domination in 1618. No voivode of any importance occupied the throne untii Basil the Wolf (1634–53), a brave soldier of Albanian origin. He might have achieved success against the Turks. bdt chose instead to attack his neighbour Walachia. coveting its throne. He married one of his daughters to Timothy. son of the celebrated Ukrainian hetman (general) Bogdan Chmielnicki and raided Walachia with the help of his son-in-law, but mas routed by the veteran Matthias Bassarab. He was overthrown by a conspiracy of Moldavian boyars, and after his death Greek influence became paramount. One of the Greek hospodars. Demetrius Cantemir, attempted to exchange Turkish for Russian sovereignty, and proving unsuccessful went into exile in St. Petersburg. He was a scholar whose *Descriptio Moldaviae* is a valuable historical source.

The Phanariot regime in Moldavia is generally reckoned from the reign of Nicholas Mavrocordato. Cantemir's successor; it was similar to that in Walachia, and indeed the hospodars were frequently shifted by the Turks from one throne to the other. Moldavia was perhaps more prosperous than Walachia at this period and had a considerable export trade in timber, salt, wine and foodstuffs.

THE DANUBIAN PRINCIPALITIES

The treaty of Kuchuk Kainarji which ended the Russo-Turkish war in 1774 altered the situation in both Walachia and Moldavia. Russia restored the principalities which it had occupied, to the sultan (Moldavia. however, Iost its northern tip, Bukovina, which Austria. profiting by the situation, annexed) on conditions which included provisions favourable to the territories themselves. The tribute was to be reduced. and the agents of Walachia and Moldavia at the Porte were to have diplomatic status; Russia was accorded a virtual protectorate. In view of Turkish attempts to evade fulfilment of the treaty. Russia secured a more precise definition of its rights in the convention of Ainali-Kavak (1779) and strengthened its position in 1782 by appointing a consul in Bucharest. Austria countered by dispatching an "agent" Ignaz Rajcevic, whose *Osservazioni storiche intorno la Valachia* (1788) is one of the best sources for the period. In the Russo-Turkish fighting which broke out again in 1787 the principalities once more provided battlefields, and Prince Potemkin made his headquarters at Jassy (Iasi). In 1791, when peace was imminent, a group of Walachian boyars, fearing the effects of renewed Ottoman rule, addressed an appeal to Austria and Russia which, though it achieved no results, is of interest as an early sign of the awakening of national feeling. The boyars asked for the ending of Phanariot rule, the return of native princes and the creation of a national army. By the peace of Jassy (1792) Russia had to evacuate the principalities, the Dniester (Dnestr) being recognized as its frontier, and the privileges of the principalities accorded in earlier treaties were confirmed. In defiance of treaties the Porte continued to change the hospodars almost yearly, until in 1802 the Russians obtained a fresh convention under which every prince was to hold office for at least seven years and could not be dispossessed without Russian consent.

The two new hospodars were strongly under Russian influence. Constantine Ypsilanti of Walachia, encouraged by the convention, refused some Turkish requisitions, acted as intermediary between the Serbs and Russia in the Serb revolt of 1804 and tried to embroil the French and the Porte. Napoleon's envoy at Bucharest denounced both hospodars as traitors and influenced the Porte's decision to dethrone them in 1806 without consulting Russia. Russia occupied the principalities and the Turks declared war in Dec. 1806; Moldavia and Walachia had become pauns in the intrigues betneen the tsar, the Porte and Napoleon. The Russian occupation. which lasted six years, reduced the country to a desert; produce was carried off, the coinage debased and labour requisitioning was enforced by the deportation of recalcitrants to Siberia. The Christian populations exchanged hope and confidence in a liberator for a profound suspicion and fear of Russia which remained rooted in Rumanian minds.

Russia's design to incorporate the principalities in its empire was frustrated by the peace of Bucharest (1812), but it secured the cession of southeastern Moldavia, known as Bessarabia (q *v.*). The two hospodars who were appointed after the peace in 1812, Ion Caragea in Walachia and Scarlat Callimachi in Moldavia were masters of extortion. The former increased the taxation eightfold, partly by creating 4,000 new boyars. Both were strongly Greek in feeling. and were supported by some of the boyars, who. disappointed in Russia, dreamed of a new Graeco-Rumanian Byzantium. Caragea was in secret relations with the Greek revolutionary movement, Philike Hetairia, which was being fostered at Odessa under Russian auspices. The way was thus prepared for the adventure of Alexander Ypsilanti, son of the Walachian hospodar Constantine and *azde-de-camp* of the tsar, who marched into Moldavia at the head of the Hetairists in 1821. He received the support of the Moldavian hospodar Michael Sutu (Sutzu), but the boyars were hostile in Moldavia and still more so in Walachia where a national popular movement led by Tudor Vladimirescu (q *v*) turned not against the Turks but against the Phanariots. Turkish troops which invaded to crush Ypsilanti were not finally withdrawn until 1824 The Turks, anxious to divide the Rumanians from the Greeks, thought it wise to heed the former's demands and the Rumanians took advantage of this to secure a number of reforms in the national interest. The retorms included the promulgation of laws in Rumanian and the appointment of native princes, the first of whom were Ion Sturdza in Moldavia and Gregory Ghica in Walachia. Ghica's family, though of Albanian extraction and settled at the Phanar, was entirely rumanized.

Both princes were anti-Greek and unacceptable to the Russians; Sturdza was accused of subversive tendencies because he cherished plans for constitutional reform, including an elected assembly.

Kiselev and the "Règlement Organique". — Russia and Turkey resumed relations in 1825 and by the convention of Akkerman signed by them in 1826 the privileges of the principalities were once more confirmed, and Russia was again allowed a voice in elections to the two thrones. On the outbreak of hostilities between Russia and Turkey again in 1828, Russia once more occupied Walachia and Moldavia. The peace of Adrianople in 1829 left them still tributary to the sultan, but wholly under Russian protection. The two hospodars were thenceforth elected for life.

Russia secured a continuation of its occupation by making evacuation conditional on the payment of an impossibly high indemnity by Turkey. The occupation, which. had again been exceedingly onerous during the war, became more enlightened after the signing of the treaty. a change which was largely due to the Russian administrator, Count Pavel Kiselev. The boyars, under Kiselev's supervision, drew up a constitution known as the *Règlement organique,* promulgated in Walachia in 1831 and in Moldavia in 1832. It was wholly oligarchic in character, but was an advance in that legislative and administrative powers were vested in a native elected body. The economic provisions of the *Règlement,* however, deepened the cleavage between the boyars and the peasant class and were censured by Kiselev. The *Règlement* was ratified by the Porte in 1834, whereupon Russia withdrew its troops.

The National Movement and 1848.—The new hospodars, Alexander Ghica (1834–42) in Walachia and Michael Sturdza in Moldavia, a-ere, however, strongly under Russian influence. Ghica's successor George Bibescu (1842–48) had been educated in Paris and was influenced by the new spirit of romantic nationalism. In agreement with Sturdza he removed the fiscal barriers between the principalities. Meanwhile a new generation of Rumanians was growing up, educated in Paris or looking to France for inspiration; these came rapidly to the front in the great crisis of 1848 which in the principalities took a form partly national and partly social. The national movements in Moldavia and Walachia were spurred on by the dramatic upsurge among the downtrodden Rumanian peasants of Transylvania, which culminated in the "field of liberty" demonstrations at Blaj in May 1848. Sturdza in Moldavia proved able to quell popular agitation; Bibescu, although he had some sympathy with the movement, lacked courage to lead it and fled, leaving in power a provisional government largely controlled by Ion C. Bratianu (*q.v.*), first head of the great Liberal family which for so long dominated Rumanian politics. The Turks, under Russian pressure, were forced to put down the new movement; joint Russo-Turkish military intervention restored the *Règlement organique.* The Balta-Liman convention of 1849 laid down that the hospodars should again be appointed for seven years only; the assemblies.were replaced by so-called *divans ad hoc.* Gregory Alexander Ghica was appointed hospodar in Moldavia, and Barbu Stirbey, brother of George Bibescu, in Walachia.

Crimean War and Treaty of Paris. — Russian troops did not evacuate the principalities until 1851, and during the Crimean War they were occupied in turn by Russia and Austria. Although they suffered severely, the Austrian occupation brought material benefits and opportunities of contact with the west. The treaty of Paris (1856) placed the principalities with their existing privileges under the collective guarantee of the contracting powers, thus ending the Russian protectorate, though retaining the suzerainty of the Porte. The Russian frontier was withdrawn from the mouths of the Danube by the return of a strip of southern Bessarabia to Moldavia. The existing statutes were revised in 1857 by a European commission with a Turkish member meeting at Bucharest, assisted by two *divans ad hoc* called together by the Porte.

Union of the Principalities. — The divans voted unanimously for autonomy, union of the principalities under the name of Rumania, a foreign hereditary prince and neutrality. The divans were dissolved by the Porte in Jan. 1858 and in August the convention of Paris accepted their decisions with modifications. There were still to be two princes and two assemblies, but a central commission at Focsani was to prepare measures of joint concern. The two assemblies, meeting at Jassy and Bucharest respectively, then elected a single prince in the person of Alexander Cuza (*q.v.*) on Jan. 17, 1859. The de *facto* union of Rumania was thus accomplished.

RUMANIA

A new conference met in Paris to discuss the situation and in 1861 the election of Prince Cuza was ratified by the powers and the Porte. In Feb. 1862 a single ministry and a single assembly replaced the divans and central commission. Cuza, in May 1864, promulgated by plebiscite a new constitution providing for a senate as well as an assembly and extending the franchise to all citizens, with the reservation of a cumulative voting power for property. An important agrarian law of the same year emancipated the peasantry from forced labour. Prince Cuza's agrarian and educational reforms were progressive, but his methods of enforcement were despotic. He alienated the boyars by abolishing forced labour, and the clergy by confiscating monastic estates (see *Religion* below), while the agrarian reform was not radical enough to satisfy the peasantry.

In Feb. 1866 Cuza was compelled to abdicate and the principalities by referendum elected as prince, almost unanimously, Charles (*see* CAROL I), second son of Prince Charles Anthony of Hohenzollern-Sigmaringen, the candidate of Ion Bratianu, who had secured the veiled support of Napoleon III. The new prince reached Bucharest on May 22, 1866, and in July took the oath to a new constitution modelled on the Belgian charter of 1831, which provided for upper and lower houses and gave the prince an unconditional veto on all legislation. Turkish assent was secured in October; Prince Charles was recognized as hereditary ruler and was allowed to maintain an army of 30,000 men.

Internal Politics, 1866–75.—Prince Charles's policy was to avoid all political adventures and to give Rumania a sound administration. The internal situation was at first unsettled; ten governments held office in five years. The dominant figure was the Liberal leader Ion Bratianu.

In 1869 Prince Charles paid a series of state visits to consolidate his position, and married Princess Elizabeth of Neuwied, the poetess later known as Carmen Sylva, who earned great popularity in her adopted country. Prince Charles was a Roman Catholic and his wife a Protestant. but he agreed to bring up his successor in the Eastern Orthodox faith.

Tension arose between the German prince and his pro-French politicians on the outbreak of the Franco-German War in 1870 and there was an abortive attempt to overthrow him in a revolutionary outbreak at Ploesti. Anti-German feelings were increased by a scandal in the new Rumanian railways; the German contractor failed to honour the coupons of the bonds, mainly held by influential Germans. and the Prussian government attempted to coerce the Rumanian government into payment. Indignation in Rumania culminated in a mob attack on the German colony in Bucharest in March 1871, and Prince Charles contemplated abdication. 4 Conservative government formed under Lascar Catargiu succeeded in restoring order, however. and retained office for five years. After another crisis threatening Prince Charles, the Liberals again took office in 1876 and Bratianu became premier; he enjoyed almost absolute power for the next 12 years.

The Russo-Turkish War, 1877–78, and the Treaty of Berlin. — Domestic problems were temporarily eclipsed by the reopening of the Eastern Question in 1877. Russia rejected Rumania's offer of co-operation on equal terms against Turkey and threatened occupation. On April 16, 1877, Rumania signed a secret convention allowing free passage to the Russian armies, while the tsar promised to respect Rumanian territory. The Russians crossed the Rumanian frontier in April, and on May 11 Rumania declared war on Turkey. Rumanian troops contributed materially to the joint victory at Plevna in September, which left the Russian army free to march on Constantinople. Nonetheless Russia refused to admit Rumanian representatives to the peace negotiations at Adrianople rind later at San Stefano. The Russians insisted on the handing back of southern Bessarabia which had been restored

to Moldavia after the Crimean War, and despite bitter Rumanian protests this provision was incorporated in the treaty of Berlin; Rumania received an alternative outlet to the mouths of the Danube in northern Dobruja, a territory with little or no Rumanian population, the possession of which later caused discord with Bulgaria.

The treaty recognized Rumanian independence and guaranteed absolute freedom of worship without loss of political rights. The latter article (44) caused indignation in the country and could not be implemented without constitutional revision. Article 7 of the 1866 constitution stated that "only Christians can become citizens of Rumania," thus excluding Jews from civic rights. Jews had not been numerous in the principalities until the early 19th century, but their influx after the treaty of Adrianople had caused the safeguard to be put into the constitution. Under pressure from the poners, article 7 was finally repealed.

Independence of Rumania: the Kingdom.—The independence of Rumania was recognized by Italy in Dec. 1879 and by Great Britain. France and Germany in Feb. 1880. Prince Charles, having no children, regulated the succession in 1880 in favour of his nephew Prince Ferdinand of Hohenzollern, and the idea of making Rumania a kingdom was mooted. The Liberal government, accused by the Conservatives of republican tendencies. itself took the initiative in proclaiming the kingdom. This action was hastened by the general fear of revolution consequent on the assassination of Tsar Alexander II. Charles was crowned king on May 22, 1881, and secured the immediate recognition of the powers.

Internal Politics, 1878–1912.—Since 1876 Bratianu had exercised almost dictatorial power. His Liberals stood for the rapid development of a strong middle class able to control the Jews, and were mainly Francophil. The Conservatives were divided into the old boyar group, which tended to look to Russia, and the so-called Young Conservatives, the Junimists, led by Petre Carp, who had studied in Germany rather than France and favoured the Central Powers. Bratianu retired after electoral defeat in 1888, and died three years later. Thereafter various Conservative and Junimist administrations held office, the Liberals under Sturdza returning to power in 1895.

The country was in considerable financial difficulties and there was much discontent, particularly in the countryside where the peasants, though emancipated in 1864, were forced by poverty into the hands of Jewish moneylenders. A serious peasant rising in 1907, stimulated by the Russian upheaval of 1905, attacked first the Jews and then the large landowners. The Conservative ministry had to resign and it was a Liberal government which restored order. In 1909 the Liberal leader Sturdza resigned and was succeeded by Ionel Bratianu, eldest son of the great statesman, who continued to base his policy on the expansion of the urban middle class. though some of his younger colleagues concentrated on the agrarian problem. The Conservatives under Carp came to power again in 1911, but were violently attacked by the Liberals and a group of Conservative dissidents formed after the peasant rising under Take Jonescu. Under the pressure of foreign events the cabinet was reconstituted in 1912 with Titu Maiorescu as prime minister and Jonescu as minister of the interior. In Jan. 1914 Ionel Bratianu succeeded Maiorescu and formed a Liberal administration; together with the party theorist Constantine Stere, a Bessarabian boyar who had been banished to Siberia for his radical views, he worked out a program of agrarian reform.

Foreign Affairs, 1878–1912.—The foreign political situation remained comparatively calm between the treaty of Berlin and the outbreak of the Balkan wars, though Rumania's relations with its neighbours could not be cordial. Bulgaria, a traditional friend, was embittered by the loss of northern Dobruja; against Russia the Rumanians were incensed by the forced retrocession of southern Bessarabia. The resentment aroused against Austria at the end of the 18th century by its seizure of Bukovina, the first home of the Moldavian principality and repository of its chief artistic and ecclesiastical treasures, had died down, but ill feeling was aroused by the commercial treaty of 1875, which Rumania considered unfair, and was intensified by Austria's insistence on having a delegate on the Danube commission, though the commission's writ only ran from Galati (Galatz) to Orsova and did not reach Austrian soil. The oppressed Rumanians of Transylvania had been increasingly conscious of grievance against Hungary since 1848 and their feelings were shared in Rumania. With Greece there mas a constantly reviving dispute in which Bulgaria was also involved, concerning the status of the Vlach (*q.v.*) communities in Macedonia over which Rumania claimed the rights of a protector; this caused a diplomatic rupture between Rumania and Greece from 1905 to 1911.

King Charles had a natural and pronounced preference for the Central Powers, and in this he was supported by Ion Bratianu, whose fear and dislike of Russia after the treaty of Berlin outweighed his Francophilia. It was Bratianu, with Sturdza as foreign minister, who signed the secret treaty of 1883 with Austria and Germany. The treaty. remaining a close secret, was formally renewed under a Conservative administration in 1892. It was, however, the first signatory, Sturdza, leader of the Liberals since 1893, who was most active in support of the claims of the Transylvanian Rumanians against Hungary. The Bosnian crisis of 1908 alarmed Rumania because it showed that Austria was prepared to further the fortunes of Bulgaria in order to destroy Serbia. Ionel Bratianu, however, on succeeding Sturdza in 1909, remained faithful to the secret treaty.

First Balkan War, 1912.—The outbreak of war between the Balkan league and Turkey in 1912 found the Conservatives in office. Rumania's sympathies were at first uncertain; the secret Serbo-Bulgarian military convention of March 13, 1912, had provided against a possible Rumanian attack. The rapid success of the Bulgarians caused Rumania to abandon its original profession of disinterestedness and to stake a claim. Rumania intimated to Bulgaria that in the event of a partition of European Turkey it would, in the interests of the balance of power in the Balkans, require a frontier rectification in the Dobruja. Danev, president of the Bulgarian house of deputies, returning through Bucharest from a visit to Vienna and Budapest, offered only minor frontier rectifications, excluding Silistra, which was the kernel of Rumania's claims. He did, however, consider the renunciation of Bulgaria's claim to northern Dobruja and the giving of a guarantee for the Vlachs of Macedonia. No agreement was reached in Bucharest or in London in Jan. 1913. The case was finally submitted for arbitration to the conference of St. Petersburg (May 1917) which assigned Silistra to Rumania. Bulgaria regarded the concession as excessive and Rumania no longer looked on it as a satisfactory price for neutrality.

Second Balkan War, 1913.—Bulgaria's attack on its allies in July 1913 mas used by Rumania as a pretext for intervention. The Rumanian army, 500.000 strong and commanded by the crown prince, crossed the frontier (July 10), occupied southern Dobruja and advanced on Sofia. Negotiations were immediately opened at Bucharest, where an armistice was signed on July 31, 1913, between Rumania, Serbia, Greece and Bulgaria. By the treaty of Bucharest, signed on Aug. 10, Rumania obtained southern Dobruja mhich it had already occupied.

Rumania's position mas now precarious in view of the growing tension between Vienna and St. Petersburg. The king renewed the secret treaty with the Central Powers at the beginning of 1914 and Austria made great efforts to win Rumanian friendship, but popular sentiment ran the other way. The feeling of kinship with Transylvania grew steadily among the younger generation, while Austria's continued diplomatic support of Bulgaria aroused resentment. The growing feeling of the need for a policy covering the interests of the entire Rumanian nation, within and without the national frontiers, led to a new inclination toward Russia. Though Russia held Moldavian Bessarabia, Austro-Hungary, as arbitrator of the destinies of the much more highly developed Rumanian communities in Transylvania, was the greater obstacle to the realization of dreams of unity. The visit to St. Petersburg of Prince Ferdinand. heir to the throne, in March 1914 and of the tsar to Constanta in June, did not bring about a definite change of policy, however.

Rumania and World War I.—On the outbreak of war in 1914 Ionel Bratianu and his Liberal party were in office. The poli-

ticians were divided in their views, not along party lines, and Rumania at first maintained armed neutrality, though tempted by the Central Powers with the promise of the return of Bessarabia and by the Allies with the offer of Transylvania. Grief at the country's failure to honour the secret alliance hastened King Charles's death in Oct. 1914. His successor Ferdinand had married Marie of Edinburgh, granddaughter of Queen Victoria and of Alexander II, stronger in character than her husband and a staunch lover of England and Russia. Her influence, Allied promises, and alarm at the extent of German victories finally brought Rumania into the war. By a treaty of Aug. 17, 1916, Great Britain, France, Russia and Italy guaranteed Rumania the Banat, Transylvania, the Hungarian plain up to the Tisza (Theiss) river and Bukovina as far as the Prut river. Rumania declared war on Austria-Hungary on Aug. 22; its troops at once crossed the passes into Transylvania, but were expelled by mid-November. Bucharest was occupied by the Central Powers on Dec. 6, 1916. The king and his ministers and parliament had already retired to Jassy and were followed by the army, which reorganized in Moldavia under the shelter of the Russian forces. The Russian Revolution of Feb. 1917 led to the collapse of the front and left the German Field Marshal August von Mackensen free to throw all his forces against the Rumanian army, which was rendered incapable of further resistance after a prolonged stand at Marasesti in August. After the October revolution the Russian army disintegrated into pillaging bands, hostilities were suspended and an armistice was concluded on Dec. 6. 1917.

During this period the parliament in exile at Jassy was busy with projects of agrarian and electoral reform. Bratianu had already been considering these topics in 1914, and in Dec. 1916 he made a coalition with Take Jonescu and his dissident Conservatives, who had been concerned with the peasant question since the 1907 rising. The effects of the Russian Revolution in the Ukraine and Bessarabia (*q.v.*), where the peasants had appropriated the land, made the question urgent. King Ferdinand was personally concerned and induced the Conservatives to agree to a project of radical expropriation, which was passed in July 1917.

The Treaty of Bucharest. — After Bratianu resigned on Feb. 9, 1918, Gen. Alexandru Averescu was charged with the peace negotiations at Buftea, near Bucharest. The Dobruja was ceded as far as the Danube, Bulgaria taking over the southern half which it had lost in 1913, while the Central Powers administered the northern half conjointly. Rumania was to have a trade route to the Black sea via Constanta. The frontier of Hungary was advanced in the Carpathians. The Central Powers secured such terms on the Danube, in the Rumanian oilfields and over the railways. as would have placed Rumania in a state of economic slavery to them for many years. Averescu's cabinet hesitated to sign and resigned on March 12 in favour of the pro-German Alexandru Marghiloman ministry, which signed the treaty at Bucharest on May 7, 1918.

Marghiloman's ministry struggled against almost unsurmountable difficulties throughout the succeeding months. The Central Powers forced the Banque Générale to issue 2,500,000,000 lei in paper money. This disorganized the finance of the kingdom, while economic ruin was ensured by the forced export of sheep and cattle, the cutting down of forests and the dismantling of factories. The population meanwhile was starving, and the morale of the working class was being perverted by revolutionary propaganda.

On Nov. 8, 1918, when the defeat of the Central Powers was assured, the king called to power General Coanda, who repealed all laws introduced by the Marghiloman ministry and decreed universal, obligatory and secret suffrage for all male voters over 21 years of age. War was declared again on Nov. 9. The king re-entered Bucharest (Nov. 30) after the German troops had evacuated Rumania under the terms of the Armistice. Bratianu again became prime minister on Dec. 14.

GREATER RUMANIA

The dream of greater Rumania was realized, but it was no easy task to unite provinces which had been under the domination of different alien states. Bessarabia (*q.v.*) was already incorporated in the old kingdom, having abandoned an earlier idea of autonomy. Its council voted for unconditional union on Dec. 9, 1918. The incorporation of Transylvania (*q.v.*) followed in virtue of a resolution passed by a Rumanian assembly at Alba Julia on Dec. 1, and that of Bukovina (*q.v.*) on Nov. 28. The government had to carry on difficult diplomatic negotiations for the recognition by the Allies of the new frontiers. Those fixed by the agreement of Aug. 1916 were drawn back in places to give the Hungarians a part of the hinterland of Oradea Mare, and the Yugoslavs the western half of the Banat. A line of demarcation was fixed in Hungary, and Rumanian troops occupied the country up to this line, pending final settlement by treaty. In March 1919 a further neutral zone was established and Rumania was given the right of occupying it. Bela Kun's Communist government which then came into power in Hungary started a campaign as a result of which the Rumanians advanced to the Tisza river, where they were stopped by the Allies on May 9. On July 22 Kun started a new offensive, but the Rumanian army defeated his troops, crossed the Tisza — despite the interdiction of the Allies — and occupied Budapest on Aug. 4. There they remained, in the face of numerous protests, until Nov. 14. The treaties of St. Germain and Trianon recognized as Rumanian the predominantly Rumanian territories of the old dual monarchy, and the treaty of Neuilly sanctioned Rumanian possession of southern Dobruja.

Domestic Politics, 1919–1930. — The political scene was transformed after 1918; the old Conservative party was swept away because of its pro-German policy and the impoverishment of its chief supporters, the boyars. The Liberals became the party of the business and professional classes, while the peasants, who gained new status through the land reform, founded a party of their own in the old kingdom headed by Ion Mihalache. More radical elements came in from Transylvania, notably the National Popular party headed by Iuliu Maniu and Alexandru Vaida-Voevod. The Socialists were not influential as more than 80% of the population of Rumania were peasants; in the old kingdom the Socialists were mainly Marxist and supported the Russian Revolution, but in Transylvania they looked to the west.

The new parties had their chance as early as Dec. 1919 in a coalition cabinet headed by Vaida-Voevod, the Bratianu government having resigned in protest against the minorities clause of the treaty of Trianon (article 60), but their tenure of office was short. General fear of Communist propaganda and the alarm of the landowners at the proposed expropriation led to the government's resignation in March 1920 and the return of a new People's party containing many former Conservatives, led by General Averescu, hero of two wars.

He secured the able Take Jonescu as minister of foreign affairs. The general, despite personal sympathy with the peasants, had to take strong measures to restore order. A revolutionary movement was breaking out on the Dniester and securing support among extremists in the old kingdom, and social tension reached a climax in the general strike of Oct. 1920. The failure of the strike split the Rumanian socialist movement. The more moderate leaders were imprisoned, and the Communists, who had kept underground, gained the upper hand. They voted for the affiliation of the party with the Comintern at a congress in May 1921, whereupon 70 leaders were arrested.' The Social Democrats thereafter kept separate, and the Communist party was outlawed in 1924.

Meanwhile Averescu had to put through the promised land reform. The bill was introduced in the spring of 1921 by the minister of agriculture, Constantin Garoflid, himself a large landowner. After impassioned controversy, expropriation was put through on the lines agreed in July 1917, estates being limited to 500 ha. in the old kingdom, and to much smaller areas in Bessarabia and Bukovina. The peasants were not wholly satisfied; the holdings allotted were often unduly small and there was no adequate arrangement for the granting of credits for the purchase of seed and tools.

The Liberals came to power at the beginning of 1922, remaining in office with one short break until 1928. Bratianu dominated

the scene until his death in 1927 and thus had the satisfaction of being in office for the coronation of King Ferdinand as sovereign of united Rumania at Alba Julia on Oct. 15, 1922.

A new constitution was adopted in March 1923 based on that of 1866 but with the addition of manhood suffrage. The Jews were given citizenship rights, but their inflow in large numbers after World War I provoked violent hostility. In the financial sphere the Liberal government pushed through the difficult policy of coupling industrialization with the exclusion as far as possible of foreign capital, which bore heavily on the peasants who had to pay for it by export duties. The chief cause of Liberal unpopularity, however, was the centralization of administration. All the new provinces, even including backward Bessarabia, had hoped for a measure of autonomy, and this feeling was strongest in Transylvania where bitter hostility was aroused by the arrival of officials from the old kingdom. The minorities problem was to prove troublesome to all Rumanian administrations in the years following World War I, and none succeeded in finding a solution.

Bratianu proceeded in 1926 to push through an electoral law giving great advantages to the party in power at election time. By this law those who secured 40% or more of the votes were given half the seats in the chamber, plus a share in the remainder in proportion to the number of votes obtained. When a ministry fell as a result of an adverse vote in the chamber, the king could call on the leader of the next largest party to form a cabinet and hold elections. Until 1937 no party in charge ever failed to secure the necessary 40%. The Liberal party's popularity was slowly waning at the end of 1925, and in the face of growing discontent King Ferdinand again called on General Averescu to form a cabinet. His party, with some peasant support, secured four-fifths of the seats in the chamber in the elections of March 1926, largely because of successful pressure at the polls. Though the Liberals only had 16 deputies it was clear that the new administration governed largely with their support. Meanwhile the opposition was greatly strengthened by the fusion, in Oct. 1926, of Maniu's National Popular party with Mihalache's Peasant group to form the National Peasant party, which was to represent the majority of the Rumanian people. Averescu resigned in June 1927 and Bratianu was again returned; the newly formed National Peasant party, despite universal popularity, polled only 20% of the votes in the obviously manipulated elections.

The political situation was complicated by the dynastic position. In Dec. 1925 Crown Prince Carol had left Rumania, renouncing all his rights in favour of his young son Michael. In view of King Ferdinand's precarious health a council of regency was formed in Jan. 1926 consisting of the patriarch Miron Cristea, the president of the supreme court Gheorghe Buzdugan, and the king's second son, Prince Nicholas.

King Ferdinand died on July 20, 1927, and Bratianu died in November of the same year. The Liberal party, thus weakened, was faced with an economic crisis and peasant demonstrations. The regency council in May 1928 entrusted Maniu with forming a cabinet and holding elections: his National Peasant party was returned with a majority of more than 75%. The new government abolished censorship and martial law, mitigated the police regime, promised concessions to the minorities and in June 1929 introduced, to the great satisfaction of the Transylvanians, an administrative reform bill aiming at extensive decentralization. The peasants were helped by the repeal of the export duties; cooperatives were encouraged and free sale of land allowed, a measure which unfortunately led to an increase of the rural proletariat rather than to a consolidation of prosperous peasant holdings as had been intended. The economic situation was greatly eased by the entry, at last allowed, of foreign capital.

Foreign Policy, 1920–1937.—Rumania's foreign policy after Trianon was necessarily based on an endeavour to maintain the status quo and to protect itself against aggression. Rumania mas from the first a consistent member of the League of Nations, but built up a careful system of regional pacts to buttress collective security. The first such pact was concluded with Poland in March 1921, when Take Jonescu and Prince Eustachy Sapieha signed a treaty providing for mutual assistance in the event of unprovoked attack on the eastern frontier. Both countries were threatened by the U.S.S.R., which had not recognized Rumania's right to Bessarabia and seemed little satisfied with Poland's possession of its former Ukrainian and Byelorussian territories.

Take Jonescu had hoped to form a Baltic-Aegean bloc to act as a buffer between Germany and the U.S.S.R., but had to be content with joining the little entente (*q.v.*) system. An agreement with Czechoslovakia for mutual protection against Hungary was signed in April 1921 and with Yugoslavia for similar protection against Hungary and Bulgaria in June. He sought further to cement Balkan friendships by dynastic alliances. Marriages were concluded between Crown Prince Carol and Princess Helen of Greece (March 10, 1921), between his elder sister Princess Elizabeth and the crown prince of Greece (Feb. 1921) and between Princess Marie and King Alexander of Yugoslavia (June 6, 1922).

General Averescu, in his 1926–27 administration, extended Rumania's system of pacts to include its "Latin sisters." A treaty of alliance and nonaggression was signed with France in June 1926 and another in September of that year with Italy. The Italians, after long hesitation, recognized the incorporation of Bessarabia in Rumania in March 1927. Relations with the U.S.S.R. remained in a state of tension; during 1924 the Soviet Union kept up continuous agitation and threats of war, even setting up a three-day Communist republic at Tatar Bunar in southern Bessarabia. A conference held in Vienna in April 1924 between Rumanian and Soviet representatives led to no results. The situation was eased when Nicolae Titulescu became foreign minister in 1927. In 1933 both countries signed the convention of London defining the aggressor, and with the U.S.S.R.'s entry into the League in 1934 and the exchange of letters between Titulescu and Maxim Litvinov later that year it was hoped that the Bessarabian question was settled. Rumania entered into diplomatic relations with the U.S.S.R. in 1934, but the Bessarabian question remained open and was raised again by the Russians after Titulescu had been dropped from the Rumanian cabinet in 1936.

Agreement with Bulgaria, resentful at the loss of southern Dobruja to Rumania and at the inclusion of parts of Macedonia in Yugoslavia and Greece, proved out of reach; nonetheless, the Balkan pact, signed in 1934 between Rumania, Yugoslavia, Turkey and Greece, was left open to Bulgaria.

Rumania under King Carol.—Maniu, dissatisfied with the regency, arranged for the return of Carol from exile with the agreement of all the major parties. Carol was proclaimed king on June 9, 1930, his son Michael becoming crown prince (grand voivode). Conflict soon arose between the king and Maniu, who had exacted a promise that Carol would leave his Jewish mistress Magda Lupescu abroad if he resumed the throne and would seek reconciliation with Queen Helen. On the king's breaking this promise Maniu resigned the prime ministry in Oct. 1930, though his party remained in power under Gheorghe Mironescu. King Carol was from the first determined to secure absolute power and to break up the old political parties. Maniu's resignation and the world economic crisis helped to bring down the National Peasants in 1931. After Mironescu's resignation the foreign minister Titulescu attempted to form a cabinet, and on his failure the king appointed one of his own choice headed by his former tutor Nicolae Jorga. The elections of June 1931 gave the government a majority of 291 seats out of 387, but it resigned a year later. The National Peasants had a brief return to power and it fell to Vaida-Voevod to deal with the serious Communist-inspired railway strike at Grivita in Feb. 1933, but the party, split through King Carol's intrigues, could no longer keep itself in power. The Liberal opposition was also split; the leaders Ionel Bratianu and his brother Vintila a-ere dead and the third brother Constantin (Dinu) had not their grip over the party, while their nephew Gheorghe was on the king's side. Nevertheless the Liberals returned to power in 1933 under an anti-Carol leader Ion Duca.

Rise of the Iron Guard.—The king mas helped in his disruption of the older parties by the rise of a new group of fascist type which was taking shape in Moldavia, feeding on endemic Rumanian anti-Semitism and the economic crisis. The leader, a young man named Corneliu Zelea Codreanu, first called his group

the legion of the archangel Michael; later it had many names, the best known being the Iron Guard. Priests, officers and students flocked to Codreanu's standard; the party had a mystical appeal and its leaders wore the trappings of romance. Its slogan was the Christian and racial renovation of Rumania: in foreign affairs it opposed co-operation with France, the U.S.S.R. or the League of Nations and sympathized with Germany and Italy and later with Francisco Franco in Spain; at home it tempted the peasants with the slogan omul *si* pogonul—"one man, one acre."

The Iron Guard gained its first four seats in parliament in 1932; its policy of violence, which had already been demonstrated by the murder of the prefect of Jassy, was carried forward by the assassination of the prime minister Duca, on Dec. 30, 1933, a month after he had assumed office. Unlike the neighbouring Balkan states Rumania had not in modern times been prone to political murders and the country was profoundly shocked. The new Liberal premier Gheorghe Tatarescu proscribed the Iron Guard, but reappearing under another name—*Totul Pentru Tara* (everything for the fatherland)—it succeeded in securing Titulescu's removal from the foreign ministry in Aug. 1936.

In the 1937 elections, presided over by Tatarescu, the government for the first time failed to secure the necessary 40% of the votes. It was highly unpopular, and the opposition was unexpectedly consolidated by the conclusion of an electoral pact between the National Peasants and the Iron Guard, which led to much criticism of Maniu. The Guard secured 16% of the votes. King Carol, alarmed at this success and not wishing to have Codreanu as a rival dictator, dropped his earlier policy of covert support and called on the elderly Transylvanian poet Octavian Goga, leader of the right wing anti-Semitic National Christian party, to form a government. After a few weeks of violent anti-Semitic action, at which the British and French ministers protested, Goga was dismissed by King Carol, who then proclaimed a personal dictatorship. A new constitution of corporative type was published on Feb. 20, 1938, and "accepted" in a plebiscite. The patriarch Miron Cristea was made prime minister with Tatarescu as his deputy. In April Codreanu and other guardists were sentenced to ten years' imprisonment. The guard replied with a renewed terror campaign, and in November King Carol, returning from a post-Munich visit to the western capitals, had Codreanu and 13 of his followers "shot while trying to escape."

On Dec. 16 the king founded a monopoly party, the National Renaissance Front, to support his government, and announced certain concessions to the minorities, who accordingly joined the front. Miron Cristea, the patriarch and prime minister, died in March 1939 and was succeeded by Armand Calinescu, minister of the interior in the former government. Elections on a corporative basis were held in June, the electorate under the new constitution being 2,000,000 compared with 4,500,000 in 1937. The senate was designed to include old parliamentarians, and the leading political figures, Maniu and Mihalache of the National Peasant party and Dinu Bratianu, head of the National Liberals who disapproved of the Tatarescu faction, automatically became members. They refused, however, to take the oath to the new constitution, and were suspended. Women could vote and, for the first time in Rumanian history, stand as candidates, but only for the senate. The Iron Guard continued to foment unrest during the summer of 1939 with German backing and on Sept. 20 murdered the prime minister, Calinescu; after the brief premiership of Gen. Gheorghe Argesanu, who was able to secure some degree of public order, Constantin Argetoianu became prime minister for two months and was then succeeded by Tatarescu.

Foreign Policy, 1938–39.—The anschluss and the Munich agreement overthrew the whole system of Rumanian foreign policy. Relations with Italy were already embittered through Rumania's adopting sanctions at the League's bidding during the Abyssinian war, and the pact with Italy had lapsed in 1936. Rumania had been ready to fulfil its obligations under the little entente and to come to the aid of Czechoslovakia during the Munich crisis, even secretly agreeing to allow Soviet troops to cross its territory. The Polish alliance stood, even after Munich, but Rumania refused Poland's offer of a slice of Czechoslovak territory in Ruthenia in Oct. 1938. Confidence in the west had been shaken by Munich, and in March 1939 a trade treaty was signed with Germany designed to put the whole of Rumania's economic life at German disposal. The new foreign minister, Grigore Gafencu, made a last attempt to seek support in the west, securing a Franco-British guarantee of Rumanian territorial integrity on April 13, 1939. Rumania's only real hope, however, lay in German-Soviet antagonism, and that was shattered by the Ribbentrop-Molotov pact in August.

World War II.—The invasion and dismemberment of Poland in Sept. 1939 found Rumania powerless to help its ally; Rumania declared neutrality on Sept. 4. The collapse of France in the summer of 1940 removed the last prop of Rumanian morale; nonetheless, King Carol made efforts to put the army on a war footing and announced that the country's frontiers would be defended at any cost. Under German pressure the foreign minister, Grigore Gafencu, was forced to resign and was succeeded by the strongly pro-German Ion Gigurtu. On June 21 the king agreed to turn the National Renaissance Front into a still more totalitarian national party which included Iron Guardists, under Horia Sima, released on German orders.

The first blow fell on June 27 when in agreement with Germany the U.S.S.R. occupied not only Bessarabia, but northern Bukovina, which had never been in Russian possession. Rumania was forced to accept, renounced the British guarantee on July 2 and on July 4 appointed a new pro-German cabinet with Gigurtu as prime minister and Horia Sima as minister of culture. On July 16 Germany was "invited" to send a military mission. Hungary now had to be conciliated; on Aug. 30 Germany and Italy imposed the Vienna award whereby Hungary was to be given northern Transylvania, an especially bitter blow to Rumanian patriotism. The people wished to fight and looked for a lead to Maniu, the grand old man of Transylvania. While he hesitated the Iron Guard. despite their pro-German attitude, led the national protest and demanded the abdication of King Carol, who was made the scapegoat. The king left on Sept. 6 with Magda Lupescu, leaving his 19-year-old son Michael on the throne as Mihai I. Before his departure he entrusted power to a general, Ion Antonescu, who formed a government consisting largely of Iron Guardists, with Horia Sima as vice-premier. The constitution was suspended and Antonescu given full powers. Meanwhile Bulgaria, with German support, had been agitating for the return of southern Dobruja; the agreement for its cession was signed at Craiova the day after Carol's departure. Rumania lost about 3,500,000 subjects to the U.S.S.R., 2,400,000 to Hungary and 360,000 to Bulgaria. There were rumours that Germany intended also to separate the Banat (*q.v.*) from Rumania, but in the end that territory was merely accorded semiautonomy under the large local German minority. Germany and Italy guaranteed rump Rumania. Rumania was declared a "national legionary state" on Sept. 15 and joined the Tripartite pact on Nov. 23.

German troops had been pouring into the country since September, but as the Germans had decided to reduce Rumania to complete subservience by playing off the Iron Guard against Antonescu, the Wehrmacht stood by when the guardists staged a St. Bartholomew's night on Nov. 28 in which 64 prominent members of the old regime were assassinated, including Jorga and the peasant leader Virgil Madgearu. Antonescu now secured German support in putting down the Guard, which staged a more serious rising at the end of Jan. 1941 under the leadership of Sima, vice-premier in Antonescu's cabinet, and Ion Codreanu, father of Corneliu. The revolt was finally suppressed with about 6,000 casualties; Sima escaped. The new administration formed at the end of January was mainly military, all guardists being excluded. Some 500,000 German troops were in the country by February, and on Feb. 10 Great Britain broke off diplomatic relations. Antonescu refused to join Adolf Hitler in smashing Rumania's ally Yugoslavia in April 1941, but the country was behind him in entering the war against the U.S.S.R. as Germany's ally on June 22. Great Britain declared war on Rumania on Dec. 7 and on Dec. 12 Rumania declared war on the United States. Rumania's recovery of Bessarabia in the summer of 1941 was

highly popular in the country, but the opposition leaders underground, in particular Maniu, strongly disapproved of the army crossing the Dniestr into Soviet territory in 1942 and of the organization of a new Rumanian province beyond the river known as Transnistria. The nation, however, did not become thoroughly war-weary until the disastrous casualty lists came in from Stalingrad.

The Communist Regime.— Although Rumania had not had a parliamentary government since 1938, the chief political parties had kept their organizations intact; the National Peasants under Maniu and the Liberals under Dinu Bratianu formed a rallying point for popular discontent with the fruits of Antonescu's pro-Axis policy, and undertook secret negotiations with the Allies during 1943. The traditional parties were supported in the desire for an armistice by the pro-Soviet left-wing groups, the Social Democrats under Titel Petrescu and the Communists under Lucretiu Patrascanu. The Communists, whose organization had long been illegal, were relatively few in number in 1944; they had no war record of partisan activity to give them prestige and few of the leaders were of Rumanian origin, the majority being Russian-trained Jews, Ukrainians or Hungarians. The party gained reinforcement in its lower ranks after 1941 from among the leaderless and disillusioned Guardists, ready for any violence. In the spring of 1944 these four parties agreed to form a national bloc to bring the country out of the war.

The coup d'état of Aug. 23, 1944, which overthrew Antonescu and brought Rumania into the war against Germany, was largely the work of King Michael himself, supported by the National Peasants and Liberals, but the Social Democrats and Communists were given representation out of proportion to their numbers in the first postarmistice administration. The armistice was signed in Moscow on Sept. 12. Soviet troops having been in occupation of Rumania since the end of August. The peace treaty subsequently provided for their remaining until after the conclusion of the Austrian treaty, a period which would ensure their presence while Rumania was being remodelled on the Soviet pattern. The Russians had prepared during the war a division of indoctrinated Rumanian prisoners named after the hero of 1821, Tudor Vladimirescu; these marched into Rumania beside the Red army.

Until elections could be held, three short-lived governments of a mainly military character took office, the first two headed by Gen. Constantin Sanatescu (1885–1947), and the third by the chief of staff Nicolae Radescu (1874–1953), an open anti-communist. The Soviet deputy foreign minister. Andrei Vishinsky, went in person to Bucharest to insist on Radescu's removal and the installation as premier of Petru Groza, head of a splinter left-wing country party known as the Ploughmen's Front which, though not forming part of the national bloc, had been included under Soviet pressure in the last Sanatescu administration.

The Groza government, which took office in March 1945, excluded the National Peasants and Liberals and proved highly unpopular. In August of that year the Potsdam conference proposed the resumption of diplomatic relations with Rumania provided that the government mas "recognized and democratic." The U.S.S R immediately resumed relations, but Great Britain and the United States refrained on the ground of the unrepresentative nature of the administration. King Michael then appealed to the three powers who, meeting in Moscow in Dec. 1945, advised that a government, broadened by the inclusion of a National Peasant and a Liberal member, should hold elections.

The 1923 constitution had been restored after the armistice, but before the elections a law aas passed abolishing the senate. The government bloc announced that it had polled 71% of the votes in the elections held on Nov. 19, 1946. The Communists secured the key portfolios in the new government, excepting that of foreign affairs which was given to Tatarescu, and split the Social Democrats, the bulk of the party remaining aloof under its leader Petrescu. who was later imprisoned. The elections were followed by a wave of arrests of former prominent politicians and their followers, including Maniu himself (Antonescu was shot as a war criminal in 1946). The National Peasant party, which had the allegiance of the majority of Rumanians. was declared illegal in Aug. 1947 and Maniu himself tried and condemned to life imprisonment on Nov. 11. (He died in prison in 1952.) Evidence given at the trial was used as a pretext for removing Tatarescu from the ministry of foreign affairs. Ana Pauker, a Moscow-trained Jewess, taking his place.

In Dec. 1947 King Michael was forced to abdicate. In Feb. 1948 the remnant of the Social Democrats under Lothar Radaceanu (d. 1955) merged with the Communists to form the Rumanian Workers' party (Partidul Muncitoresc Roman) which, together with the Ploughmen's Front and the Hungarian People's union, presented a single list as a People's Democratic Front in the ensuing elections. The front claimed 405 out of 414 seats in the grand national assembly elected on March 28. A constitution of Soviet type was adopted in April and the Rumanian People's republic proclaimed, uith Constantin Parhon as first president. The Communist party purged itself by 18% during 1949; by the middle of 1950, after the admission of new members, the total membership was put at 720,000. The wartime Communist leader Lucretiu Patrascanu, dismissed from the ministry of justice and arrested in Feb. 1948, was tried and executed in 1954. In May 1952 three leading communist ministers, among them Ana Pauker, were purged. Gheorghe Gheorghiu-Dej then became premier, Groza retiring to the presidency vacated by Parhon. A revised constitution, still closer to that of the U.S.S.R., was adopted on Sept. 24 and a new assembly elected on Nov. 30. On Oct. 3, 1955, Gheorghiu-Dej abandoned the premiership to Chivu Stoica, himself reverting to the first secretaryship of the Rumanian Workers' party. By the end of 1955 the party had 595,398 members and 56.583 candidates.

By the peace treaty, ratified on Sept. 15, 1947, the cession of Bessarabia and northern Bukovina to the U.S.S.R. and of southern Dobruja to Bulgaria was confirmed; in exchange the Vienna award was cancelled and northern Transylvania restored by Hungary.

The Rumanian People's republic now had no independent foreign policy. A treaty of friendship, collaboration and mutual assistance was signed with the U.S.S.R. on Feb. 4, 1948, and Rumania later entered into the network of alliances with different people's republics. On May 14, 1955, in Warsaw, Rumania joined a treaty of mutual assistance concluded by the U.S.S.R. with its seven European satellite states. **A** united command for the eight armed forces was created. (B. BR.)

POPULATION

The total population fluctuated with the various territorial changes which Rumania underwent. In 1914, before the addition of Transylvania and Bessarabia, the figure was 7,600,000; at the 1930 census the population was 18,025,237; in 1940, before incurring the losses arising out of the Vienna award and the Soviet and Bulgarian seizures (see History, above), it was estimated at 19,930,000; the 1948 census, reflecting the eventual peace settlements, with Bessarabia and northern Bukovina remaining in Soviet hands, southern Dobruja under Bulgaria but the former Hungarian frontier restored, gave a total of 15,872,624 inhabitants. The 1956 census revealed a population of 17,489,450 (190.7 per sq.mi.). The population was distributed among the various historic provinces as follows: Muntenia (the most densely settled region), 31.4%; Transylvania, 21.6%; Moldavia, 16.4%; Oltenia, 13.8% and 16.8% shared by the border provinces of Crisana, Banat, Maramures, Bukovina and Dobruja.

The country's area before World War I was 50,715 sq.mi. (131,353 sq.km.) and after it 113,918 sq.mi. (295,049 sq km.). By losing Bessarabia (17,151 sq.mi.), northern Bukovina (2,096 sq.mi.) and southern Dobruja (2,970 sq.mi.) Rumania was reduced to 91,699 sq.mi. (237,500 sq.km.).

The rural character of much of Rumania's population is illustrated by the fact that according to the 1956 census only 31.3% of the total lived in urban centres. Rumania is essentially a nation of peasants. The largest town, the greatest manufacturing centre and the capital of the country, is Bucharest (*q.v.*).

The two next largest towns, Kishinev (Chisinau) (190,000 in 1956) and Chernovtsy (Cernauti) (142,000 in 1956) became part of the U.S.S.R. Next to Bucharest in size in 1956 was Cluj (Kolozsvar), the important route centre in Transylvania. Six

other towns had reached the 100,000 mark by 1956—Timisoara, Brasov, Ploesti, Iasi (Jassy), Arad and Braila. The expulsions of Germans, Magyars and Jews changed the ethnic composition of the urban population, but detailed figures of the changes are'not available. The big increase in Bucharest is partly accounted for by changes in administrative boundaries. (See Table I.)

TABLE I. —Cities in Rumania, 1900–56

Town	1900 (est.)	1930 (census)	1939 (est)	1948 (census)	1956 (census)
Bucharest	300,000	631,288	648,162	1,041,807	1,222,874
Cluj	46,670	96,866	100,272	117,915	154,723
Timisoara	53,033	91,866	89,872	111,987	142,257
Brasov	34,511	56,234	61,827	82,984	123,834
Ploesti	50,000	77,325	77,376	95,632	114,544
Jassy	80,000	102,595	104,471	94,075	112,977
Arad	53,903	77,225	75,725	87,000	106,460
Braila	60,000	68,310	68,561	95,514	102,500
Oradea Mare	47,018	82,355	80,872	82,282	98,950
Galatz	66,000	101,148	102,232	80,411	95,646

Not only did the total population of the country decrease as a result of the territorial losses, but the ethnic composition was considerably modified between 1920 and 1948. In 1920, 70% of the total population were Rumanians; according to the 1956 census, they formed 86% of the total. In 1956, there were 1,589,543 Magyars (9.1% of the total); the actual number was only slightly less than in 1920, the post-1945 expulsions from Transylvania having been suspended later. The third largest element in 1920, the Jews, had then numbered 900,000; in 1956, there were only 144.236, as they had suffered considerably under the Iron Guard and Antonescu regimes—though less severely than the Jews of Poland and Germany—and many of the survivors emigrated to Israel. The fourth largest group, the Germans, declined from 792,000 in 1920 to 382.400 in 1956; they were affected by the wartime schemes of repatriation to Germany and by deportations to the U.S.S.R. in the period immediately after 1944. The Slavonic group in 1920 was large and included 792,000 Ukrainians and Russians in Bessarabia; 440,000 Poles. Czechs and Ruthenians in Bukovina and Maramures; and 290,000 Bulgars in the Dobruja. The Slavs were much reduced by the Soviet and Bulgarian acquisitions of territory. and the 1956 census recorded their combined total as 135,352. Finally, smaller ethnic groups, such as Turks, Greeks. Albanians, Armenians and gypsies, numbered 217,-211 persons in 1956.

It is generally accepted that the Rumanians are partly the descendants of Roman merchants and veterans who settled in Dacia, even as far north as the modern Polish border, before and after the campaign of Trajan. and partly of the native Dacians. Archaeological and historical evidence shows that there was a long and thorough period of penetration of the Carpathians by Roman commerce and after the Roman withdrawal the various established Roman elements remained in the country.

The very word *batran* in Rumanian, meaning "old," is derived from the Latin veteranus and the word biserica (church) indicates the western origin of Christianity in these parts (*biserica* = basilica) and so the western connections with Italy and the Roman culture. The Rumanian physical type, in many cases, seems more definitely Latin than the Italian and the language is in many respects closer to Latin than is Italian. Slavonic elements are clear in some of the prevalent types but it is by no means the preponderant influence.

The Magyars are found for the most part in the towns of Transylvania. By training, education and tradition they associate themselves more happily with the German elements than with the Rumanian and they take only a small part in the agricultural development of the land. They are industrious but in the past were regarded as politically unreliable since they were encouraged by their fellow Magyars in Hungary to oppose in every way the rule under which they lived. A branch of the Magyars known as Szeklers were military colonists planted by the kings of Hungary to guard the frontier passes at the head of the Mures and Olt rivers. A Hungarian autonomous region, with its centre at Targu Mures, was established in 1952.

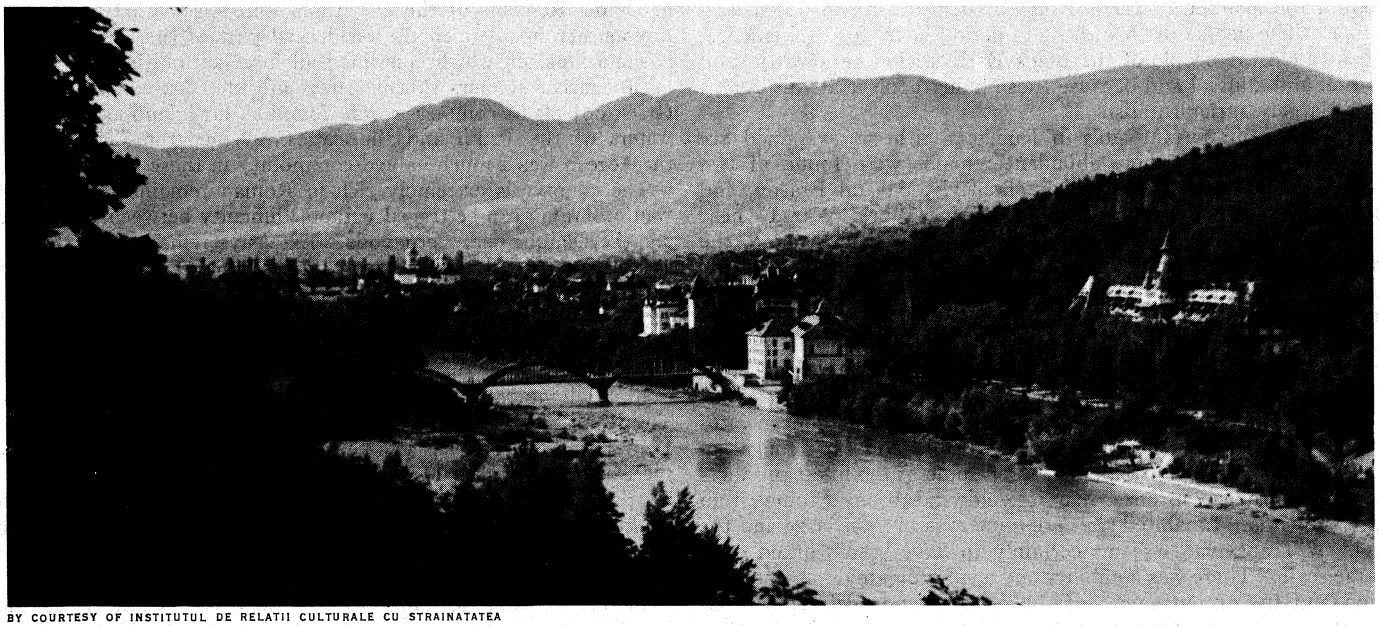
Germans settled in Rumania from time to time for various reasons. The earliest were knights and their companies, perhaps crusaders, in the 12th century, who were persuaded by the Hungarians to settle in towns that commanded the main passes of the Carpathians and so prevent inroads of barbarians into Europe. Gradually they developed their settlements and in 1224 their position and independence were recognized. Alsatians and Saxons together with some groups from the Rhineland were settled in these early times. Until 1944 they still lived an exclusive and separate life, largely with their own institutions and local government. They are mainly of the Lutheran religion. It is remarkable to see in their churches the one hint of the orient, which they were brought there to combat, in the shape of fine Turkish carpets of the 16th century, survivals of the period when the Turks overran the Transylvanian plateau but left the German settlements still independent. They formed a very useful element in the state and, if rather an isolated enclave in a foreign land, yet were loyal subjects of whatever regime controlled them. The Germans of the Banat are of ,a different type. They colonized the waste plains of this fertile region in the 18th century and are mostly Rhinelanders and Alsatians. Their activities are almost entirely agricultural and their wealth and industry is considerable.

(G. W. S.; X.)

Religion. — The great majority of Rumanians belong to the Orthodox Eastern Church (*q.v.*). No firm evidence of the first coming of Christianity to their ancestors survives, but the fact that most of the basic words of church observance in the Rumanian language are of Latin origin suggests that the first missionaries belonged to the Church of Rome. Dacia was separated from the empire before the conversion of Constantine, but the Daco-Romans later had contact with their kinsmen in Moesia south of the Danube. The beginnings of Christian life were submerged in the barbarian invasions, and an organized church was not founded until the 9th century, when the Bulgarians, then masters of the former Dacia, became Christian and introduced to the province the Slavonic alphabet and liturgy that they had received from SS. Cyril and Methodius. This Slavonic rite. maintained in the Rumanian Church until the 17th century, helped to keep the Ilach Christians in Transylvania apart from their neighbours, so that, unlike the strongly propapal Hungarians, they followed eastern Christendom against the papacy in the schism of 1054. When the principalities of Moldavia and Walachia took shape in the 14th century the people were staunchly Orthodox and attached to their Slavonic rite, though some of the early princes, intermarrying with Poles and Hungarians. temporarily took the Roman Catholic side. Orthodox bishoprics were at once founded in the new states, depending at first on the Bulgarian Church and later on the patriarchate of Constantinople but having a large measure of autonomy. (See also CYRIL AND METHODIUS, SAINTS.)

In Transylvania Orthodoxy was oppressed, not being one of the four "received religions" and the Orthodox bishop there was dependent on the Walachian metropolitan. Hence the title of the Rumanian primate — mitropolit Ungro-Vlahia si exarhul *plaiurilor* (metropolitan of Ungro-Walachia and exarch of the mountains [*i.e*, the Carpathians]). The Moldavian and Walachian princes and boyars were exceptionally generous in their endowments to monasteries; in order to protect them in the unsettled conditions under Turkish rule the practice arose of dedicating them to one of the patriarchates of the east or to the Holy Places. This led to an infiltration of Greek monks. As the source of Slavonic teaching dried up and the village priests knew no Greek, Rumanian gradually became the liturgical language in the 17th century, particularly in the villages. The first Gospels in Rumanian were printed in Transylvania in 1561 under Protestant influence, and the first Rumanian Bible appeared in 1688. The work of Rumanian printers was helped in Moldavia by the metropolitan of Kiev, Peter Mogila, himself of Moldavian origin and one of the leading theologians of the Eastern Church. In Phanariot times, from the 18th century onward, Greek influence spread rapidly, the bishops frequently being Greek and the liturgy being celebrated in Greek in the richer churches.

With the union of the principalities in 1859 the churches of Walachia and Moldavia were united and anti-Greek reaction had full swing. In 1863 the dedicated monasteries, whose lands cov-



BY COURTESY OF INSTITUTUL DE RELATII CULTURALE CU STRAINATATEA

SPA AND RESORT TOWN OF CALIMANESTI AT THE FOOT OF THE CARPATHIAN MOUNTAINS ON THE RIVER OLT

ered more than one-fifth of the area of the new state and most of whose revenues left the country, were expropriated, and the use of Greek in all churches and monasteries was forbidden. In 1865 an autonomous Church of Rumania was set up, which in 1872 was given an organic statute, and shortly after Rumania had been proclaimed a kingdom (1881) the Orthodox Church was declared autocephalous and arranged to consecrate its own holy chrism instead of procuring it from Constantinople. The oecumenical patriarch protested, fearing that complete ecclesiastical independence in Rumania would lead to an undue growth of Russian influence, but finally agreed.

With the formation of greater Rumania in 1918 the Orthodox Church received many new adherents. In Transylvania there was only one Orthodox bishopric, at Sibiu, which had been granted autonomy in 1869 after former dependence on the Church of Serbia. The majority of Transylvanian Orthodox, soon after the province had come under direct Habsburg rule, had signed an act of union with Rome in Oct. 1698, whereby they kept their own rite but acknowledged the Holy See's jurisdiction. .The Orthodox had suffered severe disabilities under Calvinist control and looked on the union as a way of escape. In Bukovina, which had been Austrian since 1775, the people remained Orthodox and had had their own metropolitanate at Czernowitz since 1873. In Bessarabia, the majority of the people were Orthodox and had been under the jurisdiction of the Russian Holy Synod. All these churches united after 1918, and in 1925 the enlarged Church of Rumania was elevated to a patriarchate with the consent of Constantinople, the first patriarch being a Transylvanian, Miron Cristea. With the collapse of the Russian Church in the Revolution the Rumanian Church, with 13,000,000 members, became a leading force in the Orthodox world and took the initiative in many matters of general ecclesiastical interest. In 1936 it recognized Anglican orders

The old kingdom of Rumania had been relatively homogeneous in religion, but the new provinces brought in a big influx of other denominations. More than 3,000,000 owed allegiance to Rome in 1930, half being Uniates from Transylvania, all of whom were Rumanian by race. and the other half Latin Catholics, mainly Hungarians of Transylvania and Swabians of the Banat. Many of the Hungarians were Calvinist or Unitarian, while the Saxons of Transylvania were Lutheran. In Bukovina and Bessarabia there were many Jews, and in the latter province and in Dobruja there were Moslem Turks.

Under the constitution of 1923 the Orthodox Church and the Uniate Church of Transylvania were declared Rumanian churches, the former being dominant and the latter having precedence over all other denominations. Liberty of conscience was established, but the Jews, the Baptists and other sects suffered under considerable disabilities. A concordat with the Vatican was concluded in 1929. Under the Antonescu regime a decree on the recognition of cults was issued (Sept. 12, 1940) suppressing a number of sects and putting restrictions on Jeuish worship.

After the armistice of Sept. 23, 1944, relations between the churches of Rumania and the U.S.S.R.. interrupted since 1918, were resumed. The second patriarch of Rumania, Nicodim, died in Jan. 1948 and was succeeded in June by a young bishop, Justinian. Government nominees did not cease to vote for the patriarch or for the bishops now that the government was officially atheist. The Communist constitution of April 1948 removed the special privileges of the Orthodox Church. Laws on religion and education in Aug. 1948 ended all church control in schools and laid down that all denominations must submit a statute before being allowed to function. Under the Orthodox Church statute, 1949, several of the old dioceses were suppressed.

In Oct. 1948 the Uniates of Transylvania were reincorporated in the Orthodox Church and their five bishops were arrested. By 1952 the Roman Catholic Church had not secured approval for a statute. The concordat with the Vatican was denounced on July 17, 1948, and the five Latin-rite bishops put under arrest. The Lutherans, Calvinists and Unitarians secured approval for their respective statutes and the Baptists formed a federation with the other neo-Protestant sects. The different Jewish sects were also amalgamated into a federation of the Mosaic cult, and the Moslems were put under the muftiate in Constanta. All these recognized religions expressed full loyalty to the Communist government. Apart from the Catholic hierarchy many priests of the Orthodox Church and of other denominations were imprisoned.

(B. BR.)

ANTIQUITIES AND EARLY SETTLEMENT

Rumania is rich in antiquities of all periods from the Neolithic to the Roman but no scientific archaeological work can be said to have been done before 1900 when G. Tocilescu published the results of his surveys of Roman Dacia. Excavation by Rumanians did not begin before 1914.

The Neolithic period is hard to distinguish from the Chalcolithic but in general it is abundantly clear that Rumania in the first half of the third millennium B.C. formed part of a homogeneous region in which Bulgaria, Thrace, Thessaly and the Ukraine as far north as Kiev were included. This culture is distinguished by a

remarkable painted pottery of high artistic quality in design and shape. The people of this area and period have, for convenience. been called the people of the Black Earth region because the soil is rich and alluvial and because those living upon it at this period were largely agriculturalists.

The most important sites in Rumania hitherto examined are Cucuteni near Iasi where abundant remains were found of two periods of this culture, Erosd in Transylvania and Brasov, and some sites (excavated by Germans during World War I) near Cernavoda on the Danube. The culture so revealed is one of the most remarkable that developed in Europe in the early prehistoric period. It is thought by some to have oriental affinities with regions as far afield as Turkistan and Honan in China, where remarkably similar pottery is found. In any case the Black Earth culture came to an abrupt end about 2000 B.C. and was replaced by a culture coming from the northeast, whose people had war weapons.

The Bronze Age that ensued develops rapidly and concentrates mainly in the western half of Transylvania and the Hungarian plains. It is of great artistic merit and some of the finest products of the European Bronze Age in gold and bronze come from Transylvania. Inhabited sites are numerous but not large and the gold of Transylvania seems certainly to have been worked on a large scale. There was a nobility and a subordinate or serf population and the accoutrement of the nobility and their gold ornaments and plate form an outstanding feature of the civilization they represented. The *floruit* of this Bronze Age seems to have been about the 15th century B.C. and the Hungarian plain seems to have been the breeding place for movements that extended far and wide. Bronze swords of Danubian type from these regions are found during the 14th and 13th centuries B.C. penetrating, perhaps more as signs of invasion than as elements of trade, as far afield as Mycenae, Egypt. Cyprus and Crete. The makers of the swords seem to have been the peoples who were gradually pressing down southward into the Mediterranean and who subsequently were responsible for the northernization of the Minoan world. Their gold may have reached the wealthy cities of the Mycenaean mainland. Certainly they were in close touch with Troy and Anatolia.

Toward the close of the second millennium before Christ the Bronze Age culture of Rumania was modified by external influences and at the dawn of the Mediterranean Iron Age, Italy played a preponderant part in the commerce of the Carpatho-Danubian regions. Villanovan culture from north Italy sent its wares (particularly its fine bronze work), far and wide into Transylvania and western influences predominated. Rumania proper is almost out of touch with the Hallstatt Iron Age and its Bronze Age does not end until the 8th century when devastating invasions from Scpthia entered from the northeast. Scythian graves are found in three large areas—in north Hungary, in south Transylvania and in Walachia. They are never rich and they indicate the intrusion of large bodies of well-armed warriors who for a time controlled the country. They were. however, soon absorbed by the native population. But the wealth and prosperity of Rumania was checked, and never really recovered until Roman times.

Hellenic penetration was marked but never very effective and the Daco-Getic peoples of Rumania were never Hellenized as were the Balkan Thracians. But of the Greek period there are many archaeological evidences. The important Milesian settlement of Histria near the Danube mouth on a lagoon island facing the modern village of Karanasuf has been uell excavated Over 150 inscriptions illustrate the life over many centuries of this remote Hellenic tonn. The wealth of the inhabitants, as is evident from two large and important inscriptions of the Roman period, had at all times come from the fishing in the delta, over which the Histrians had immemorial rights.

Kallatis, an old Dorian settlement on the site of the modern Mangalia in the Dobruja, was partly excavated. Inscriptions there indicate that the population was strongly Dorian and that the city. with others along that coast, was largely subject to the Thraco-Scythian kings of the interior. Kallatis was evidently one of the great grain-exporting emporiums of the Black sea. Constanta has been identified as the ancient Tomi, the place of exile of Ovid. Remains of the city walls were discovered across the promontory upon which the residential part of the town is built. A small museum which contained all local antiquities was looted by Bulgarian soldiers during 1917 and the contents dispersed. Greek objects of commerce were found as far inland as the headwaters of the Pruth and the Arges. Wine from Thasos and the Aegean was a much valued commodity in these regions.

The country is extremely rich in Roman remains. The great wall of Trajan can be traced without difficulty between Constanta and the Danube near Cernavoda. Extensive remains of Axiopolis at its western end can be seen on the Danube, and excavations were carried out there. The most impressive of all the Roman monuments is the Tropaeum Trajani at Adamklissi. It stands in a wild and desolate region in the rolling steppeland between the Danube river and Constanta with much of its sculptured decoration still lying round the massive concrete core which survives. The Roman town of Ulmetum midway between Harsova on the Danube and the coast has also been explored and excavated. Along the Danube the traces of Trajan's campaigns are numerous. The inscription recording his construction of the road along the south bank near the Iron Gate is still visible in the cliff face near the island of Ada Kalesi. Some of the piles of the bridge he built across the Danube still survive.

In Transylvania inscriptions are found as far north as the Polish border and elements of the various fortifications built at different periods can be made out. At the village of Verespatak, near Cluj considerable traces of Roman gold mining are to be seen and a series of important inscribed wax tablets was found there, bearing record to the manner and method by which the mines were worked. Of the Dacians who opposed the Romans there is much evidence but the archaeological discoveries are not of the first importance. The site of Sarmisegetusa has been identified in the mountains a little south of Deva in Hunedoara. It is a powerfully fortified hill city and was the metropolis of the Dacians.

Post-Roman remains of the time before the Rumanians came under the influence of Byzantium are rare, and little or nothing is known about the country at this time. The great gold treasure of Petroasa, however, which was transported to Moscow during World War I, is certainly of Hunnish or semioriental origin. It consists of two superb chalices of pure gold, inset with large garnets and with handles shaped like panthers, a large necklet of the same material, several large gold ewers elaborately chased and some superb toraues.

Byzantine remains are not of importance until the 14th century when the Byzantine church and monastery of Curtea de Arges mas built. The frescoes there rank as the finest and oldest Byzantine works of art in the country.

A special architectural style grew up after this, particularly in Moldavia, based upon the Byzantine, but of a very marked character and of great beauty. It flourished mostly in the 16th and early 17th centuries. The Church of Trei Erarchi (Three Saints) at Iasi. founded in 1639, is one of the finest examples. The style of architecture so evolved is purely Rumanian and owes little or nothing to Greek or Slavonic tradition in matters of decoration, though the structure is in essence Byzantine. Byzantine traditions in painting dominated the artists of the churches and monasteries down to the 18th century. (S. CA.)

EDUCATION

Elementary education in Rumania, both before and after World War II, was described officially as free and compulsory. The remark of the old Rumanian academician, I. Simionescu, describing pre-1939 conditions, remains apposite: "In reality. it is not so free as one would think. because the committees charge a fee for each child: it is not compulsory because the state budget never allows for the setting up of enough schools to accommodate all the children of school age."

A national educational system was a comparatively late development in Rumania, partly because of the lack of a literary form of the language; a system began to take shape in the 19th century but development was most rapid after World War I. In regard to

the state-provided schools, in the year 1937–38, 120,516 children were said to be in attendance at infant schools, 2,358,059 at primary schools, 164,603 at secondary schools; the numbers at private schools were much smaller, being respectively 8,922 (infant). 133,184 (primary) and 35,922 (secondary). By 1950, the numbers attending approximately 14,000 primary schools were 2,079,357, secondary schools 365,310.

In 1952, Rumania possessed four universities, the same number as in 1939, that at Cernauti (founded in 1875), noted as a centre of Germanization, having been lost to the U.S.S.R. and replaced in 1945 by a new foundation at Timisoara. The other three are at Bucharest (founded 1864), Iasi (1860) and Cluj (1872). The university of Cluj was formerly a Magyar institution. but after its nationalization in 1919 had both Rumanian and Hungarian colleges. The superior learned society, the Academia Romana of Bucharest, was founded in 1866 by C. A. Rosetti.

The Communists paid a great deal of attention to the problem of providing an adequate elementary education for the Rumanian people. Their great interest lay in complete control of the young mind and the implantation therein of their particular political beliefs, and the exclusion of other concepts, interpretations of history and so forth that tended formerly to influence the nation in the direction of western thought. Political instruction, in fact, became compulsory at each stage of education. Education was rendered completely secular in 1948, with the abolition of private schools, of religious teaching in school hours and of all the religious orders.

The other great concern of the party was the provision of skilled personnel to carry through the ambitious program of industrial development envisaged in the five-year plan. Four colleges of engineering were founded at Bucharest, Timisoara, Craiova and Iasi. In 1951 there were in all 11 institutions of higher education with about 57,000 students.

The comparatively recent emergence of Rumania as a political entity together with the continuing instability of frontiers and of internal politics are factors which tended to exaggerate the lack of economic balance. Resources were exploited rather than husbanded, the more so as German economic imperialism began to dominate the scene in the 1930s. During World War II the Rumanian oil resources and surplus grains were of supreme importance to the German war machine. After the Soviet occupation in 1944, Germany's position was taken by the U.S.S.R.. and Rumanian industries, especially oil, mining, timber, textiles and heavy industries were at the disposal of the Soviet Union. The transfer to the U.S.S.R. of German assets in Rumanian industries and commerce was made law by a Rumanian decree of April 1946. Thus, for example, the largest iron and steel concern, Resita, passed to the Soviet Union and the Soviet State Insurance company took over German assets in Rumanian insurance. Other foreign assets passed to the Soviet Union; *e.g.,* the Hungarian holdings (amounting to 62% of the total) which accounted for about three-fourths of the total Rumanian output. Special Soviet-Rumanian or "Sovrom" joint-stock companies, with the Soviet Union as the controlling partner, were set up to exploit these assets, and became dominating features of the Rumanian economv.

On Sept. 18, 1954, an agreement was signed for the "sale and transfer" to Rumania of the Soviet share in 12 joint-stock companies; it provided that the Soviet share would be "reimbursed by Rumania on favourable terms, in instalments over a number of years." Nevertheless, four "Sovroms" continued to function. namely, *Sovromasigurare* (insurance). *Sovromfilm, Sovromcuartit* (uranium ore) and—the most important of all because it controlled the largest oil industry in Europe outside Russia—*Sovrom*-petrol. The Soviet shares of *Sovrompetrol* were transferred to Rumania on Dec. 13. 1955, and those of *Sovromcuartit* on Oct. 22, 1956.

In Jan. 1949, Rumania joined the Moscow Council for Mutual Economic Aid, and the annual trade agreements signed in Moscow, as well as the first five-year plan (1951–55), all contributed to the further development of the new trend in the Rumanian economy. Pronouncements by the Rumanian Communist leaders confirmed that the trend toward closer integration with the U.S.S.R. was continuing undiminished.

Rumania follo ed closely the pattern of economic reform set after 1944 throughout the Soviet-dominated sphere of Europe.

In agriculture, the road to collectivization had already been prepared by the land reform of 1945, and collectivization itself put into operation fully after the 1949 reform. After 1947, privately owned industry, commerce and finance, and western types of trade-union organization, social welfare and cultural activities were gradually destroyed by Communist reforms. By 1952, industry, transport and communications were the property of the state, controlled directly by it or by the various Sovrom companies.

In June 1948, a law was passed nationalizing the subsoil rights, industry, banking, insurance, mining, transport and telecommunication undertakings. This was followed immediately by the establishment of a supreme State Planning commission and the reorganization of the existing industrial boards into state industrial centres for each industrial group.

A survey of industry and housing was carried out in Nov. 1948. The yearly plans of economic rehabilitation which covered development from July 1947 to Dec. 1950 eventually culminated in the first five-year plan, for 1951–55. The lack of coal as a source of power to supplement the oil and wood supplies, and the existence of a considerable hydroelectric potential, encouraged the planners to undertake a special ten-year electrification plan for 1950–60.

The cumulative effects of such planning were to be noticed in the continuing scarcity of food and other consumer goods. Rationing was carried out according to the Communist interpretation of political and economic "usefulness" of various classes of consumer. The cost of living increased enormously after 1944.

Agriculture.— Farming and forestry continue to be of great economic importance. In 1948 more than 75% of the total population was still engaged in rural pursuits.

The farming areas fall into several natural regions: (1) the Carpathians are given over mainly to forestry, but are noted for the old-established summer pastures—the *plaiu*—above the timber line. Under settled conditions, transhumance—the seasonal migrations of men and animals—was also practised by the peasants of the Danubian plains who sought out the hill pastures of northern Dobruja. The mountain sheep pastures are the basis of the home wool production which is usually enough to provide for the manufacture of the coarse woollen garments worn by the Rumanian peasants. The Carpathian settlements are of the characteristic line type, often strung out for five or six miles along the valleys; the houses have high-pitched roofs and thick carved beams. (2) Transylvania, an upland, hilly country with a harsh climate and forest, has mixed farming, producing the cooler grains. oats and rye, and much cattle and other livestock. (3) The piedmont zone

TABLE II.—*Agricultural Production*
(In *ooos* of metric tons)

verdant country with mixed farming, vineyards, plain orchards, groves of walnut trees and market gardens. (5) The Moldavian and Walachian plains slope gradually down to the Danube, and are steppelike and in part even semiarid. This is the region of concentrated settlement, of extensive farming, of occasional famine and outbreaks of pellagra, of large-scale wheat production, maize, sunflowers, rape, soya, tobacco, cotton and hemp. The largest areas of oilseed and industrial fibre production were lost when Bessarabia was annexed by the U.S.S.R. (6) The Danube flood plain produces a certain amount of rice. The lower Danube, in the shallows and lagoons below Giurgiu and in the delta itself, has an important fishing industry, specializing in carp, sturgeon, the black caviare from sturgeon, crayfish, etc.

The principal categories of land utilization are as follows (in thousand hectares, 1948): arable, 9,751; forests, 6,705; pastures, 2,820; meadows, 1,696; farmyards, 618; vineyards, 227 and orchards, 221. (See Tables II and III.)

Land Reform.—As in other countries of eastern Europe, the rapid growth of the peasant population, the survival of feudal systems of tenure and servitude, and the new demands for export foodstuffs arising from the industrialization of western Europe, combined to produce in Rumania in the latter part of the 19th century an acute agrarian problem.

After the emancipation of the peasants in 1864, they were granted from time to time allotments from crown lands, but such grants were never sufficient to satisfy the general land hunger. Distribution was equally unsatisfactory in the case of Bessarabia under the Russian and Transylvania under the Austro-Hungarian empire, but the Bukovinan peasants had been more fortunate in obtaining possession of a considerable share of the land. In 1920 an expropriation law was passed for Bessarabia, which was rapidly followed by similar laws for the old kingdom (1921) and for Transylvania and the Bukovina (also 1921), whereby provision was made for the total expropriation of absentee landlords, foreigners, mortmain estates and for partial expropriation of large landed properties. By the end of 1927 about 16,500 estates totalling 6,055,863 ha. had been broken up; of this land reserve 3,421,000 ha. had been handed to 1,368,978 poor or landless peasants, but 590,100 peasants were still without land.

Under the Communist regime, two further land reform acts were passed, that of March 22, 1945, mainly concerned with the expropriation of private properties in excess of 50 ha. and the properties of certain categories of individuals, such as Germans, war criminals, etc., and that of March 2, 1949, when the remaining property of 15,000 larger landowners was confiscated. The 1945 act was followed by the distribution of land to the landless and the poorer small landholders; but the whole aim of the Communist reforms was to replace the old system by one not of peasant ownership but one of collective farming on the Stalinist model. The liquidation of the kulak (*chiabur* in Rumanian), or larger peasant farmer, went hand in hand with the development of collective farms. The large estates of the past and the small peasant holdings still in existence were being gradually converted into the large state farms and collectives, the *sovkhozy* and the *kolkhozy,* which were the ultimate objectives of the Communist agrarian policy.

TABLE IV.—*Number of Holdings of a Given Area as a Percentage of Total Number**

Area (ha.)	1907	1941	1948
0–½	0.34	12.0	7.3
½–1	0.93	9.3	9.5
1–3	7.31	33.0	35.9
3–5	17.16	10.2	23.3
5–10	14.55	19.5	17.8
10–20	8.89	5.1	4.7
20–50			
More than 50	51.02	0.7	0.4

The 1907 figures apply to the old kingdom; the 1941 and 1948 figures exclude northern Transylvania; but although covering the same regions the 1941 figures apply to some 2,300,000 holdings covering more than 10,000,000 ha. 'three-quarters of which was arable land, while the 1948 figures apply to 2,600,000 holdings covering 17,000,000 ha., less than half of which was arable. The table does, however, serve as a guide to the process of "parcellation" prior to the commencement of the collectivization drive.

However, by Jan. 1, 1954, the private farmers still owned 83% of the agricultural land.

The forests of the Carpathian ranges and foothills, of the Transylvanian uplands and of the better-watered lowlands provide Rumania with one of its most valuable resources. In 1938, about 10% of the country's workers were connected with forestry, and timber exports were the third most important after oil and grain. It provides an important source of fuel, supplementing the oil supply and the scanty coal resources. Associated industries, such as furniture-making, pulp and paper, and cellulose are to be found at a number of suitably located centres such as Stalin (Brasov), Busteni, Bacau and Timisoara.

Industry.—The oil-bearing strata are found in a crescent-shaped belt running along the edge of the Carpathian foothills zone in Muntenia and Moldavia. Even before oil became the leading industry, this belt was one of the most populous in Rumania, and many peasants supplied seasonal labour to the oil producers. The chief producing regions are Bacau, Buzau, Prahova and Dambovita. Most of the refineries are situated in Ploesti, the oil capital, from which pipelines go to Constanta and Reni, in Soviet territory. The last-named was the former pipeline Ploesti-Giurgiu, dismantled and rebuilt by the Russians in Oct. 1945–Feb. 1946.

Natural gasoline had been used locally, but it was not until 1854 that the extraction of petroleum began on a commercial scale. Production increased steadily, except during World War I, until a peak of 8,700,000 tons (3.5% of the world production) was reached in 1936. Lack of technical skill and equipment held up production after World War II, although prospecting and drilling were carried out with increasing vigour especially after the five-year plan started in 1951.

BY COURTESY OF INSTITUTUL DE RELATII CULTURALE CU STRAINATATEA

REFINERY AT PLOESTI, CENTRE OF THE RUMANIAN PETROLEUM INDUSTRY

In addition to oil, Rumania possesses the largest source of natural gas in Europe, with a production in 1947 of 1,176,000,000 cu.m. This methane gas, found near Medias, Copsa Mica and Sarmasel in the Transylvanian basin, is widely used for lighting and heating purposes.

Rumania has no large resources of coal and iron, and heavy industry was therefore on a restricted scale. The most important coal field is in Oltenia, in the upper Jiu valley in the southern Carpathians centring on Petrosani, producing anthracite and lignite. The hard coal, some of which is suitable for coking, is found toward the western end of the Carpathians in the Anina-Resita area of the Banat. Other fields of brown coal are found in the foothills in Muntenia (Filipesti), Transylvania and Moldavia (Comanesti).

The deposits of iron ore, mainly limonite (47% to 54% iron)

and siderite (28% to 35%), are small and are found chiefly in the vicinity of the metallurgical centres of Resita and Hunedoara. Imported scrap was also a vital necessity. The centres of heavy industry are Bucharest (machinery, machine tools, agricultural

TABLE V.—*Industrial Production*

(In 000s of metric tons, electricity in 000,000s of kw hr, gas in 000,000s of cum)

	1938	1947	1950	1954	1955 (Plan)	1955 (Actual)	1960 (Plan)
Coal	299	163	300	350	8,533	6,200	11,800
Lignite	2,500	2,105	3,600	5,150			
Crude petroleum	6,610	3,810	5,000	9,800	10,000	10,515	13,500
Gas, natural	300	...	2,000	3,700	3,900	3,900	10,100
Electricity	1,148	1,511*	2,100	3,700	4,700	4,300	8,000
Pig iron	133	90	320	432	800	575	1,150
Steel	284	183	555	627	1,250	765	1,700
Manganese ore	60	...	93	...	...	390	546
Cement	532	422	657	1,600	2,860	2,000	3,600
Sulphuric acid	43.9	30	51.6	73.6	143	92.0	210

*1948.

equipment, locomotives, railway cars, pipes, etc.); Resita (iron and steel, armaments); Hunedoara (iron and steel) and Brasov (tractors, aircraft, armaments, machinery, locomotives, etc.). Under the five-year plan, a new steel centre was set up at Campia Turzii near Cluj.

In 1948, as part of the Communist plan for nationalizing industry, the mining of precious and nonferrous metals was put in charge of a state centre, with divisional headquarters at Bai Mare, northern Transylvania, and Brad, in the Bihor mountains of central Transylvania. The first district has gold, silver and lead mines as well as processing and refining plants, the second possesses gold, silver. lead, zinc, bauxite and mercury mines, with plants for processing, refining and distilling, and for the manufacture of chemicals.

Rumania was normally self-sufficient in lead, but needed to supplement zinc supplies by imports from Poland. Gold production in 1947 was 71,728 fine troy ounces, Rumania ranking with Sweden as one of the leading producers in Europe. Bauxite production was never on a large scale, and aluminum production was on an experimental basis, at least until 1939. Other products are mica, chrome and manganese.

The Tertiary rocks of the Transylvanian basin and the foothills of the Carpathians in Oltenia and Moldavia contain vast reserves of salt; extraction is carried on at Ocnele Mari on the Olt Slanic in the Prahova valley, and Targu Ocna.

Communications.— Compared with those of western Europe, transport and communication standards are low. Up to the 1950s political and economic conditions had prevented a great development of roads and railways; the former were few indeed, and the oxcart and unmetalled track were a more familiar sight than the motorcar and surfaced highway; most railways were single track, nith the exception of certain sections of the Orient Express route, notably from Bucharest to Brasov, and parts of the Bucharest-Braila line.

The Germans attempted during World War II to improve certain road and rail communications in order to make Rumanian resources, petroleum, minerals and timber, more easily accessible; to enlarge facilities on the Danube at minor ports to relieve congestion at the bigger centres; and to aid the flow of military traffic across the Danube into Bulgaria. In the period after 1945 similar operations were undertaken with the difference that trade was now directed not toward Germany and the western European countries but mainly toward the U.S.S.R. and the other Soviet bloc countries. The new railways were extended into the Jiu coal field and into the forests of the Moldavian Carpathians.

The Danube is navigable throughout its whole length in Rumania, but there are two distinct sectors for traffic—seagoing vessels of 2,000 to 3.000 tons go upstream as far as Braila and Galatz, and river vessels ply on the rest. Heavy-draught shipping does not enter the Danube but docks at Constanta, as the Sulina bar needs constant dredging to maintain a depth of water of 22–23 ft. In the Iron Gate gorge, between Turnu Severin and Orsova, specially skilled pilots and smaller tows of barges are required to navigate the reefs and rapids, but below Calafat the current is slight. Ice blocks the river during about three winters out of every four, the blockage lasting sometimes from mid-December to March; occasionally late summer droughts close the Danube for a period in the autumn.

The Danube river has a steep bank on the Bulgarian side but on the left bank below the Iron Gate gorge the flood plain, with its marshes and lagoons. is several miles wide. The railway bridge carrying the Bucharest-Constanta line across the Danube at Cernavoda is $7\frac{1}{3}$ mi. in length. A new road and railway bridge, between Giurgiu and Ruse. Bulg., was inaugurated in June 1954. Another project, the Danube–Black sea canal, first publicized in 1949, was reported to have been begun soon after but in Aug. 1953 work on it had stopped. This new waterway would save the long detour of the delta and the Sulina bar by linking Cernavoda to a point a short distance north of Constanta on the Black sea coast. (See also DANUBE.)

Traffic remained at a very low ebb between 1945 and 1948, but increased subsequently with the development of trade between the Soviet-bloc countries. The goods carried consist mainly of Soviet iron ore destined for Czechoslovakia, Hungarian bauxite and Rumanian timber, oil and cement for the U.S.S.R.

The ports have tended to specialize according to their hinterland and harbour facilities. Thus Constanta is the chief oil port, Braila is the chief grain port, and Galatz, besides being the main port of entry and principal naval base, handles most of the timber which is floated down the Siret or comes by rail from Bukovina and Moldavia.

The length of Rumanian railways was estimated in 1949 at 7,363 mi.. and that of roads at 43.163 mi., including 1,150 mi, modernized. The number of telephones was estimated at 140,000 in 1953, and that of wireless receiving sets at 226,000 in 1949.

Finance.— The economic and political conditions peculiar to Rumania have been nowhere more apparent than in the financial sphere. Although the country possesses considerable man power and natural resources, a certain lack of balance and an emphasis on exploitation rather than conservation always characterized the country's economy.

During the 1930s, the financial situation was dominated by the sharp drop in world agricultural prices, and the mounting foreign debt which by 1935 had risen to 80% of the total national debt of 139,000,000,000 lei. A temporary improvement was more than offset by the deterioration caused by general rearmament in the late 1930s.

After 1945, and before reparations payments were reduced by the U.S.S.R., a serious degree of inflation resulted. Two currency reforms ensued. the first in Aug. 1947 nhen 20,000 old units were made exchangeable for one new leu, and the second in Jan. 1952. The latter pegged the Rumanian currency officially to the Soviet rouble, and one new leu was exchanged for 37 old ones. After the 1947 reform the exchange rate for the leu (plural lei) nas fixed at U.S. $1 = 150 lei. On Jan. 28, 1952, new rates were fixed: 1.50 lei to the rouble, 6 lei to the U.S. dollar and 16.80 lei to the pound sterling.

In carrying out these reforms, not only was Rumanian economy made entirely dependent upon that of the U.S.S.R.. but class warfare inside Rumania was furthered. Private financial power was destroyed. and the independent farmer, craftsman, manufacturer and professional man was reduced to a position of complete dependence upon the state. At the same time, the real value of wages was not increased; scarcities and rationing were the order of the day. The most Rumanian banks were dissolved in Aug. 1948, and a few months later the National Bank of Rumania was transformed into the Bank of the Rumanian People's Republic.

TABLE VI.—*Budget Estimates*

(In 000,000s of lei)

	1951*	1952	1953	1954	1955	1956
Revenue	433,900	32,108	38,510	40,838	44,405	45,431
Expenditure	429,900	30,608	37,510	39,838	43,005	44,431
Investments†	176,800	16.101	18,539	17,000	25,400	26,144

*In old lei.
†Part of budget expenditure, extracted from that figure.

DEFENSE

After 1945, Rumania formed an integral part of the Soviet defense system in eastern Europe. The country was occupied by a large Red army force until the signing of the peace treaty in 1947, and certain numbers were maintained there subsequently.

BY COURTESY OF INSTITUTUL DE RELATII CULTURALE CU STRAINATATEA

WINDMILLS IN THE DELTA OF THE DANUBE RIVER AT THE BLACK SEA

The ne Rumanian army was rebuilt around the three divisions of Rumanian prisoners of war who had been trained in the U.S.S.R. and crossed the frontier as liberators alongside the Soviet troops.

The peace treaty laid down that the Rumanian armed forces should be restricted to the following: (1) land forces (including frontier guards) of up to 120,000 men; (2) antiaircraft artillery with 5.000 men; (3) an air force with 150 aircraft. of which not more than 100 might be for combat, and a personnel of 8,000 and (4) a navy of up to 15,000 tons and 5,000 men.

By 1955 the total numbers under arms including security forces had risen to about 400,000 or more than three times the peace treaty level. In addition, Soviet forces occupied certain positions in Rumania.

Rumania continued to keep small naval forces in the Black sea and on the Danube. (G. W. S.; X.)

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RUMANIAN LANGUAGE, one of the Romance languages (*q.v.*), in the main is derived from the Latin of the province of Dacia, which roughly corresponds to modern Rumania. Four principal dialects may be distinguished: (1) Daco-Rumanian, or Rumanian par excellence, spoken by about 18.000.000 persons in modern Rumania, the Banat (Yugoslavia), and in some villages of Bulgaria and Hungary near the Rumanian border, that is, mostly on the left bank of the Danube; (2) Macedo-Rumanian, or Arumenian, spoken by some 350,000 persons scattered in various regions of the Balkan peninsula (Thessaly, Epirus, Albania, Macedonia, Bulgaria); (3) Megleno-Rumanian, or hleglenitic, spoken by a few thousand persons northwest of Salonika; (4) Istro-Rumanian, spoken by a few thousand persons on the Istrian peninsula around Monte Maggiore

Although these dialects are sufficiently different from one another to make communication difficult if not impossible, they may all be classified together because of their similarity in structure.

Dacia was conquered by the Romans during the reign of Trajan in hard-fought campaigns of A.D. 101 and 105–107; it was named after the vanquished Dacians, of whom little is known. The inhabitants were virtually exterminated, and the province was colonized by settlers from all parts of the empire, especially Syria and Asia Minor, who romanized the land. It should be noted that in this romanization of Dacia the substratum population had a small part. if any. But only 170 years later, between 271 and 274, the old province of Dacia north of the Danube was abandoned under the emperor Aurelian, who established a new Dacia Ripuaria south of the Danube at the expense of Moesia and Thrace. Eventually the region became part of the Eastern empire and was the battleground and the gateway into the empire for successive Germanic tribes and nations moving southward and westward from the Baltic countries. From the early 7th century, this part of the Romance-speaking world has remained cut off from the remainder by intrusions of Slavonic peoples (the Slovenes to Pannonia, that is, Hungary and eastern Austria, the Serbs and Croats to the northwestern Balkans).

Linguists are faced with the paradox that in the older Dacia (abandoned by the Romans in 271) Latin speech was preserved, whereas in the newer Dacia Ripuaria south of the Danube (which remained much longer in Roman hands) Slavonic dialects are spoken. Unfortunately, the social and ethnic history of the area during the dark ages is too little known to provide a good explanation. As far as the Romance language of Rumania is concerned, linguists seeking a reason for its presence have proposed two principal theories: (a) Latin speech was continued throughout the ages in Rumania; indeed, the withdrawal of the Romans under Aurelian to regions south of the Danube was not complete, and later non-Romance-speaking invaders were absorbed, at least linguistically, by the tenacious colonists; (b) the retreat of the Romans under Xurelian was indeed total, but Romance-speaking people later recrossed the Danube when onrushing Slavs forced them out of their homes. Some of them moved into other regions, where they planted the various dispersed Rumanian dialects now lying outside of Rumania proper. Since the first report of Neo-Latin speech in Rumania dates only from the 13th century and since the first Rumanian text available stems from the early 16th century, the

belief in remigration and noncontinuity of speech seems confirmed. But this is an *argumentum ex silentio* and therefore not conclusive.

The truth lies probably between these extremes: the Aurelian withdrawal was not complete. and a remigration did occur after the 6th century. Some linguists are eager to prove not only an uninterrupted continuity of Romance speech in Rumania but also an ethnic continuity which would make Rumanians the true descendants of the Romans, a notion dear to the heart of many patriots. Linguistic continuity. however, is not dependent on ethnic or local continuity. In the absence of other proofs, therefore, a Romance language in Rumania is no proof of the ethnic Roman-ness of modern Rumanians.

The historical development of the Rumanian language from Latin is quite regular, that is to say, the operation of the rules of phonemic development and substitution (the so-called sound laws) is not greatly disturbed by other factors. One of the most important such interferences is analogy, which restores paradigmatic orderliness that the strict obeisance to sound laws is apt to obliterate. Consequently, in view of the small part played by analogical leveling in Rumanian, it is from the descriptive point of view, and for the learner, a somewhat irregular language.

The following are the most important changes and features of Rumanian linguistic history. (For earliest developments from Latin *see* ROMANCE LANGUAGES)

Phonology.— As in other Romance languages, Latin *ē* and *ĭ* coincide as *e: credo* > *cred, lĭgo* > *leg.* Unlike most others. but like Sardinian. Corsican and Dalmatian. Rumanian continued the distinction between Latin *ō* and *ŭ: cōco* > *coc, fŭrcam* > *furcă.* The other Latin vowels have the same proto-Romance developments as they had in other Romance languages. Latin *-ct-* > *-pt-, -ks-(-x-)* > *-ps-, -gn-* > *-mn-: ŏcto* > *opt, coxam* > *coapsă, cognatum* > *cumnat.* A similar labialization changes *-qu-* and *-gu-* to *p* and *b: aquam* > *apă, linguam* > *limbă;* but before front vowels they become *ts* and *dz: quinque* > *cinci, sanguinem* > *sânge.* Rumanian has two high mid vowels, spelled *ă* and *â* or *î*, the first from Latin *a* in unstressed position. the second from *a* before nasal consonant: *carbonem* > *cărbune, aqua* > *apă, canto* > *cânt.* When stressed *e* or *o* is followed by a syllable containing *e* or *a (d)*, diphthongization occurs (through metaphony): *nigram* > *neagră* (but *nigrum* > *negru*), *mollem* > *moale.* Dental and velar consonants if followed by front vowels are palatalized: *diem* > *zi* [*dzi*]; *caelum* > *cer* [*tšer*]; *terram* > *ţeară, ţară* [*tseara, tsarə*]; *gelu* > *ger* [džer]. Intervocalic *-l-* rhotacizes: *solem* > *soare.*

Morphology and Syntax.— The noun has: (a) one singular and one plural form without article *(domn, domni* [masc.]; *soare, sori* [masc.]; *casă, case* [fem.]; *carte, cărţi* [fem.]); (b) two singular and two plural forms with the article (direct case, *domnul, soarele, casa, cartea; domnii, sorii, casele, cărţile;* oblique case: *domnului, soarelui, casei, cărţii; domnilor, sorilor, caselor, cărţilor*), where the forms of the article are derived from *illu, ille, illa, illi, illae, illui* (classical dative *illi), illaei (illi),* and *illorum,* respectively. Note that the article in Rumanian is postposited. A number of nouns have different gender in the singular and plural: *câmp* (masc.); *câmpuri* (fem.). The infinitive of the verb is shortened, a *cântà* < *cantare,* but the long form *cântare* serves as a verbal noun. The future is formed by means of *uolēre* (classical *uelle*) "to wish" followed by the infinitive: *voiu cântà* or *cântà-voiu* "I shall *(cf.* 'will') sing"; an alternative way is a form of *a avea* (< habēre) + să + subjunctive: *am să cânt;* in the latter case the auxiliary verb may be used in an invariable form *o: o să cânt.* (Similar formations exist also in Albanian, Bulgarian, Greek and Serbian. which induced some linguists to postulate a general Balkan linguistic area.) Characteristics of syntax are: the repetition of the personal pronoun in nonsubject case forms—*pe mine nu m'a văzut* "(me) he hasn't seen me": the replacement (not obligatory) of the infinitive direct object by a subjunctive construction (also Albanian, Greek, Bulgarian, Serbian)—*vreau să spun* "I should like to say"; the replacement of the possessive pronoun (when the possessor is not emphasized) by the dative of the personal pronoun — mi-ai *luat cartea* "you took me the book" = "you took my book" (not uncommon in other Romance languages. especially Italian and Portuguese); the use of the preposition *pe* with the direct object if this is a person — am *vdzut pe vecinul nostru* "I have seen our neighbor" *(cf.* the use of *a* in such cases in Spanish).

Vocabulary.— Among words of Latin origin in Rumanian there are a number which do not occur in other, especially the western, Romance languages. This is, of course, due to the isolation of Rumanian. (One hundred and twenty such words, or 6% of the total Romance lexicon, have been counted — but such counts must, for a variety of reasons, be taken with reservations) It is only natural that Rumanian should contain many loanwords from non-Latin languages, especially Slavonic, but also from Turkish, Hungarian, Albanian, depending on the geographic location of a given dialect and the cultural prestige or propagating power of the donor language at a given time. On the whole, the number of Latin words in the dictionary is smaller than that of the others all together, even smaller than that of Slavonic words alone. But in a count of frequency of occurrence the percentage of Latin would be much higher.

The Rumanian literary language is based mainly on the Daco-Rumanian dialect of Walachia. It assumed importance only at the end of the 18th and the beginning of the 19th centuries. Before that all literary output was dialectal. With the literary language came also, for a time, a purist movement favoring the exclusion of all non-Romance words; this, of course. could only have crippled the language. The change-over from Cyrillic to Latin nriting and the establishment of a more etymological orthography, advocated about the same time, were successful.

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RUMANIAN LITERATURE. The nritten literature in Rumanian is paralleled by a rich folklore, lyric. epic, dramatic and didactic, nhich has continued till modern times. The lyric poetry consists of *doine* (love songs songs expressing an undefined longing). *bocete* (dirges), *colinde* (carols) *cântece* (lyrics) The epic genre is represented by ballads in verse *(ccintece bătrâneşti)* and by folk tales in prose. The dramatic genre has its representatives in mystery plays, scenes of the nativity. new year plays (*Vicleim, Irozi*). The didactic literature shows a great richness in proverbs, riddles, satiric songs.

The geographical position of Rumania enabled its folklore to mediate the transfer of folklore themes from the Balkans to the east (Ukraine. Russia). The religious homogeneity of the region, situated between Byzantium and Kiev. favoured. on the other hand, the circulation all over this area of the literature written or printed in the Rumanian principalities Western influence reached the Rumanian lands through Hungary, Transylvania and Poland, uhen the first political organizations were founded, east and south of the Carpathian range, in the 12th–14th centuries. In the next centuries the Reformation prompted the first translation of church literature from Slavonic into Rumanian (1 jth century) Up to the 17th century. Church Slavonic was the language of the church and of the chanceries. In 1600 Prince Michael of Walachia issued. in Alba Iulia. Transylvania, the first state paper in Rumanian. In the 18th century the autochthonous ruling princes were replaced by Greek rulers from Constantinople (in Moldavia in 1711, in Walachia in 1714), and for more than a century the culture of the principalities was mainly Greek, Rumanian and Slavonic playing a secondary role. As after the fall of Constantinople and the disappearance of the Slavonic states south of the Danube, the Rumanian principalities became the haven of the Slavo-Byzantine culture so in the 17th and 18th centuries they became the centre of Greek Orthodox culture, which spread from there over all Orthodox countries. The French Revolution and the ideas of the romantic movement shook off the domination of the Phanariotes and, under uestern influences, began the national revival.

The development of Rumanian literature may be divided into four periods: (1) from the first Rumanian texts, written in the 1 jth century and preserved in copies of the 16th century, to the Phan-

ariote period; the activity of this period is crowned by the translation of the whole Bible (1688); (a) the 18th century up to the national movement of Tudor Vladimirescu (1821); (3) the national renaissance under western influences, from 1820 to World War I: (4) the national unity and the literary integration.

The Old Period. — The oldest translations from Slavonic are Rumanian interlinear verses or interpolations in religious texts of the 15th century From the same period date the so-called rhotacizing texts. preserved in copies of the 16th century, written in Maramureş (northern Transylvania), under the impetus of the Hussite movement. or according to another opinion under the influence of the Reformation. Such texts are: *The* Psalter of *Şcheia,* The Psalter of Voronef, The Acts of the Apostles. Their characteristic feature is the change of intervocalic *n* into *r* in words of Latin origin (bire for bine < Lat. *bene*).

The printing press was introduced in Walachia in the first years of the 16th century from Venice. On this press was printed in 1508. in Tbrgoviste, a Slavonic liturgical book. Toward the end of the century a certain Deacon Coresi moved from Tbrgoviste to Braşov and printed, in 1560–61, a translation of the Gospels. Of a Rumanian Lutheran catechism. printed in 1544, no copy has so far been found. Coresi. assisted by local clergy, revised. completed and printed the existing translations. Among those printed are found. the *Acts of* the Apostles (Lucrul Apostolesc, 1563); Sermons and Book of Prayers (*Tâlcul Evangheliilor şi* Molitvenic, 1564); Psalters (1568, 1570); Interpretation of the Gospels (Evnnghelie *cu învăţătură,* 1581). Coresi's prints enhanced the spreading of the Rumanian language in the churches of the three principalities Other centres which supported this movement by their printing activity were: *Sas-Sebeş* (produced probably Coresi's *Slavo-Rumanian* Psalter, 1577); Alba Iulia (Evanghelia *cu învăţătură,* 1641; The Gospels, 1579); *Orăştie* (Palia, printed in 1582 for the Calvinist Rumanians).

This activity, enhanced by the ferment of the Reformation in Transylvania, continued in the 17th century. In 1648 there appeared in Alba Iulia the Gospels translated by the metropolitan Simion Stefan (*Noul* Testament dela *Bălgrad*), a version collated with the Greek, Latin and Slavonic texts. The first Rumanian book printed with Latin characters is a Calvinist hymnbook of 1570.

The religious literature printed in the first half of the 17th century in Walachia and Moldavia came partly as a reaction to this activity stirred up by the Reformation. South of the Carpathians, in Walachia. the most important centres in which books were printed are. Câmpulung (*Învăţături* preste *toate zilele,* 1642); Govora (*Pravila,* 1640; Evanghelie *învăţătoare,* 1642); Mănăstirea Dealului (Evanghelze *învăţătoare,* 1644); Tbrgoviste (*Mystirio* sau *Sacrament,* 1651; *Îndreptarea Legii,* 1652 = Nomokanon); Râmnicu-Vâlcea (Antologhion, 170j); Bucharest (Bucureşti) (Cheia *Înţelesului,* 1678); Buzău (*Octoih,* 1700); Snagov (Carte sau *lumină,* 1699).

In Moldavia, whose monasteries were centres of theological studies, the reaction against the Reformation found its expression in the metropolitan Varlaam's Reply (1645) to the Calvinist catechism printed in Alba Iulia (1642). In 1643 Varlaam published in Jassy (Iaşi) *Cartea Românească* de *învăţătura* ("Sermons"). In 1646 was printed in Jassy the *Pravila lui* Vasile *Lupu* ("Laws of Vasile Lupu, Prince of Moldavia"). The Walachian *Pravila lui* Matei *Basarab* (1652) incorporated in its texts also the Moldavian code of 1646. This collection of canonical and civil laws remained in force, with some additions, up to the middle of the 19th century.

The Moldavian metropolitan Dosoftei, a great scholar and theologian, published in 1673 in Uniejów (Uniev). Pol., where he was in exile, the first book of poetry, The *Rhymed* Psalter. In 1679 he translated the liturgy from the Greek. At this time the Orthodox see of Kiev was occupied by Peter Movila or Mogila (*q.v.*), a countryman of the two former hierarchs. At his request, Vasile Lupu convoked in Jassy the last pan-Orthodox synod, 1642, to counteract Roman Catholic propaganda. The Confessio Orthodoxa, drawn up in that synod. remained the dogmatic charter of all Orthodox churches. A Rumanian translation from Greek by Radu Greceanu (*Pravoslavnica Mărturisire*) was printed in Buzău.

Toward the end of the 17th century the monastery of Snagov. near Bucharest, became the centre of a pan-Orthodox literary activity, and on the initiative of a monk, Antim Ivireanu, books were printed not only in Rumanian but also in Greek, Slavonic and Arabic. A Rumanian printer, Mihai Stefan, introduced the press into the Caucasus where he printed the first Georgian books: The Gospels (1709) and The Georgian *Liturgy* (1710).

The religious literature, common to all three principalities, reached its climax with the edition of the complete Bible (1688) translated from the Septuagint by Radu and Şerban Greceanu. This Bible was the basis for all successive translations. With the fall of the principalities under the Phanariote rule begins the downfall of Rumanian culture.

Early historiography is represented by Slavonic annals and commemorative tables of the monasteries (*Letopiseţul* dela *Bistriţa,* 1359–1506). It reached its climax with the humanist historiographers of 17th-century Moldavia. The Italian Rinascimento, through the Polish humanism, finds its expression in the slogan of Grigore Ureche. the father of Moldavian historiography: "We descend from Rome. and our language is made of Latin words." This creed will be echoed through the following centuries. Miron Costîn (1633–91), a student of Polish schools, who also wrote in Polish a chronicle of Moldavia and composed a poem on the history of his country, is the leader of this historiography. He took up the thread of the history of Moldavia where it was left by his predecessor G. Ureche (*Letopiseţul Tării Moldovei 1359–1595*), and continued its tale (1595–1661). Costîn's son, Niculae Costîn. amplified the chronicle of his father; Ion Neculce carried it forward up till 1743. He is a pioneer in folklore with his collection of legends (*Ocsamă* de *cuvinte*) The learned Demetrius Cantemir (q v), prince of Moldavia. wrote in Latin the history of the Rumanians (1698), which was translated into Rumanian in 1710 (Hronicul *Românо-Moldo-Vlahilor*). His Latin Descriptio *Moldaviae* (1716) was translated into Russian (1786), German (1769), Greek (1819) and Rumanian (1825). He took his place among the western historiographers, as member of the Academy of Berlin and as a knight of the Roman empire, with his Hzstoria *incrementorum* atque decre*mentorum* aulae othomanicae (1715–16), translated into French. (1743), German (1745) and English (1734–35 and 1756) by the care of his son Antioch, Russian ambassador in London.

A special place among the Moldavian historians is occupied by the great polyglot Spatharius Niculae Milescu who wrote theological, historical and travel works. As envoy of Tsar Alexius Mikhailovich he undertook a journey across Siberia to China. (His description of this journey was published by J. F. Baddeley, Russia, Mongolia, China, 1919).

The Walachian chroniclers are less original and more personal. Stoica Ludescu compiled from earlier annals a History of Walachia up to 1688. He was chronicler of the Cantacuzinos. Radu Popescu wrote a history of the rulers of Walachia (Cronica *Ţării Românești*) from the point of view of a boyar party headed by the Băleanu family. Radu Greceanu carried the history of Walachia up to 1714, when Constantin Brâncoveanu (Brancovan), his four sons and his son-in-law were beheaded in the market place of Constantinople. The *stolnic* (steward) Constantin Cantacuzino, a student of the University of Padua, the political mentor and the cultural patron of his country, wrote a history of Walachia (*Istoria Ţării Românești,* c. 1710).

The profane literature is represented by numerous translations from Greek or Slavonic of historical or apocryphal books. The last category was uritten mainly under the influence of the Bogomils. **A** collection of such texts is contained in the Codex Sturdzanus. Many Byzantine and oriental popular books found their way into the Rumanian literature. Fiore di *virtù* was translated, in the 16th century, from Italian. The most important didactic works of this period are the Teachings (*Învăţăturile*) of the prince Neagoe Basarab, written in Church Slavonic in the 16th century and translated into Rumanian c. 1654. This is a treatise on policy based on Christian morals.

The 18th Century. — The Phanariotes counted among them some well-meaning rulers who patronized Christian culture in the Rumanian principalities. However, politically and economically this period presents a sad picture of social oppression and deca-

dence. A rich profane and apocryphal literature circulated in numerous manuscripts (*Erotocritul, Fiziologul, Istoria lui Archir, Viaţa lui Esop, Halimaua,* etc.); the printing presses of the monastic centres continued to produce beautiful books, but there was no progress in comparison with the past. A great number of liturgical books were printed in all three principalities. In Moldavia a new cultural centre arose at Rădăuţi where there appeared a *Cataaasier* (1744) and a *Ceasoslov* (1745). The achievements of the century are the *Minei* ("The Lives of the Saints") (1776–80) published in Râmnicu-Vâlcea. and the *Minei* (1807–15), each in 12 volumes. published in the monastery of Neamţul. The richness and lucidity of the language, as well as their execution, put these publications alongside the Bible of 1688.

In 1700 a minority of Rumanians of Transylvania joined the Church of Rome with a view to obtaining protection from Vienna against the Hungarians. The disciples of the theological schools of Rome and Vienna amplified the ideas of the Latin origin taken from the Moldavian chroniclers and from the church books in Walachia This ferment. however, was not favourable for literary creation. The representatives of the Latinist school of Blaj, the cultural centre of the Uniate Rumanians, were zealous scholars and great patriots.

Samuil Micu-Clain (1774–1806) wrote *Istoria . . . Românilor* (Buda. 1806) according to western standards and, in collaboration with Gheorghe Sincai (1753–1816), the author of the *Hronica Românilor* (1807), he published the first Rumanian grammar, *Elementa linguae daco-romanae sive valachicae* (1780). The third scholar of Blaj. Petru Maior (1755–1821), fought for the introduction of the Latin alphabet with his *Orthographia romana sive latino-valachica* (1819) and wrote *Istoria pentru începutul Românilor t ?Ðachia* (1812). A collective work of this school is the *Lesicon românesc-latinesc-unguresc-nemţesc* (182 *j*). Many religious books completed the arduous task of these apostles of Latinity. The bishop Ioan Bobb published (1812) Thomas & Kempis' *Imitatio Chrzsti* in a translation by Samuil Clain, who also revised the Bible of 1688 and published it in Blaj (1795).

Lyric poetry was cultivated, toward the end of the century, by Anacreontic love songs of Alecu Văcărescu (1796), one of the writers of the gifted Văcărescu family. His father Ienăchiţă (1720–96?) wrote the first grammar in Rumanian: *Observaţii sau bdgdri de seamd asupra regulilor şi orânduielilor gramaticii româneşti* (1787): his son Iancu (1786–1863) overshadowed his predecessors by his poems, published only in 1848. The lyric tradition was carried on in Walachia by B. P. Mumuleanu *(Rost de poesii,* 1820; *Caracteruri,* 1825), who wrote under the influence of Alphonse de Lamartine, Edward Young and neo-Greek poetry; by Vasile Cbrlova and others. In Moldavia this early versification is represented by Costachi Conachi and Enache Kogălniceanu who versifies historical events.

Epic verse was tried by Ion Budai-Deleanu who wrote a satirical epos *Ţiganiada* (1812), in which the heroes are gypsies. Vasile Aaron (1770–1822) sang, in 10.000 verses, the Passion (*Patima şi moartea Domnului Isus Christos,* 180*j*), an imitation of Milton's *Paradise Lost;* he also wrote *Piram şi Tisbe* (1807), inspired by Ovid's *Metamorphoses.* I. Barac (1779–1848) produced the epic *Risipirea Ierusalimului* (1821), *Arghir şi Elena* (1800) and translated from Homer and Ovid. Foreign plays were adapted and produced in Greek and in Rumanian: Molière. Corneille, Kotzebue, Metastasio *(Ahilefs la Schiro,* 1797), Schiller and also Shakespeare's *Hamlet* in a translation from German by Barac.

Anton Pann (1797–1854) popularized religious and profane folk literature and edited church service books with musical notations. His *Povestea vorbii* (1847–53) is an interpretation of proverbs connected by popular tales.

This period closes with the annexation of Bukovina (1774) by Austria and of Bessarabia (1812) by Russia. These events brought about translations of law codes in Russia and Austria. Also in the principalities law codes were compiled, in Moldavia in 1833 and in Walachia in 1780 and 1817.

The National Renaissance. — The landmark of this period was the rising of Tudor Vladimirescu (1821) and the return of national rulers. Romanticism carried forward the falling wave of the Latinist movement. In the second half of the 19th century a sober literary criticism, whose origins were in German philosophy and in French culture, inaugurated modern literature.

The Transylvanian Latinism crossed the Carpathians and had some beneficial effects on the Hellenized culture of Walachia. Gheorghe Lazar (1799–1823) came as teacher to St. Sava's college in Bucharest and Rumanized the teaching. One of his pupils, I. Eliade Rădulescu (1802–72), developed a prodigious literary activity and exercised a great influence on the literary development. In 1828 he founded the political newspaper *Curierul Românesc,* followed, in 1836. by a literary supplement *Curierul de ambe sexe.* His works include translations from Byron and Lamartine, but he was a pioneer of Italian influence. He founded the Societatea Filarmonică (1833), which afterward created the National theatre in Bucharest, and was the first president of the Rumanian academy (Societatea Academic: Română, 1866).

The Societatea Pentru Cultură (1862) in Bukovina called the Latinist Aron Pumnul (1818–66) from Blaj to Cernăuţi (Czernowitz), where he had among his pupils the greatest Rumanian poet of the 19th century, Mihail (Michail) Eminescu (*q.v.*). He published the *Lepturariu rumînesc* (4 vol., Vienna, 1862–64). The historian Simion Bărnuţiu (1808–64), who pronounced the speech of liberation on the Field of Freedom in Blaj (1848) took refuge to Jassy, where he taught in the university and created a school of lawyers and economists.

Gheorghe Asachi (1788–1869) represented the Italian influence in Moldavia; he created the historical short story, wrote verses in Rumanian and in Italian and founded the periodical *Albina Românească* (1828), with a literary supplement, *Alăuta Românească.*

A galaxy of poets enriched the romantic heritage. The Bessarabian A. Donici. in collaboration with C. Negruzzi. translated from Russian the satires and fables of his countryman Antioch Cantemir; another Bessarabian. C. Stamate, wrote under the influence of French and Russian romantics and translated from Thomas Moore and Sir Walter Scott. Andrei Mureşanu, the author of the revolutionary hymn *Deşteaptă-te, Române,* translated from Young. The Macedo-Rumanian D. Bolintineanu versified historical legends. The outstanding literary personality among them is Grigore Alexandrescu (1812–85). who wrote *Poezii* (1832), *Meditaţii* (1863), fables and satires under the influence of Boileau, Lamartine and La Fontaine. and translated from Voltaire and from Byron. Western romanticism penetrated through translations from French, Italian and German. *Robinson Crusoe* was translated twice about 1830. The learned boyar D. Golescu travelled through western Europe and recorded his experiences in *Însemnare a călătoriei mele* (1826).

The national historian of this heroic period was N. Bălcescu (1819–59), the author of *Românii sub Mihai Viteazul; Puterea armată şi arta militară* and of other historical and literary works. He edited the periodical *Magazinul istoric pentru Dacia* (1845–47). Modern historiography mas inaugurated by Mihai Kogălniceanu (1817–91), who was the leading statesman in the newly organized monarchy under Alexander Cuza (1859–66) and Charles I (1866–1914). He produced the first edition of the old chronicles *(Letopiseţele Moldovei,* 1845–52) and edited the historical review *Arhiva românească* (1840) apd the literary magazine *Dacia Literară* (1840), which marks the beginning of the traditionalist trend in literature. Alecu Russo (1819–59), another leader of 1848, enriched the letters with his biblical poem in prose, *Cântarea României.*

The second half of the century was dominated by Vasile Alecsandri (1821–90) and Mihail Eminescu (1850–89). Alecsandri's rich literary heritage comprises poetry *(Doine şi lăcrimioare,* 1853; *Suvenire şi Mărgăritarele,* 1856). prose *(Buchetiera din Florenţa; Călătorie în Africa)* and plays (*Fântâna Blanduziei; Ovidiu; Despot Vodă*). Helped by A. Russo, he revealed treasures of folklore by publishing *Balade* (1852–53) and *Poezii populare* (1866).

Eminescu, the philosophical lyric poet, created modern Rumanian poetry *(Poezii,* 1884). His genius was influenced by Hindu thought and German philosophy (Schopenhauer), but he remained deeply rooted in the ancestral tradition. He raised poetry to heights not since surpassed, and remained the guiding star of the whole cultural

life. His heritage includes also short stories and political and philosophical essays.

Free from any outside influence, Ion Creangă (1837–89), a peasant by origin from the eastern Carpathians, wrote folk tales and *Amintiri din copilărie* ("Recollections from Childhood"). They are a sincere reflection in the mirror of a literary genius, of unassuming artistry, of the village life and of the peasant mind.

The literary critic under whose aegis literary creation developed up into the first decade of the 20th century was the statesman and eclectic philosopher Titu Maiorescu (1840–1917). He founded in Jassy (1863) the literary circle Junimea, which represented a reaction against form without content in art, and repudiated the extremism of the Latinist school. Its periodical *Convorbiri Literare* (1867) continued to appear till World War II.

C. Negruzzi (1808–69) excelled in prose, especially with his historical short story *Alexandru Lăpuşneanu* under Walter Scott's influence. The archaeologist A. Odobescu (1834–95) created the historical novel (*Mihnea Vodă,* 1858; *Doamna Chiajna,* 1860), but his artistic talent was revealed in *Pseudokinegetikos* (1874), an archaeological mosaic of high aesthetic emotions. I. Ghica (1816–97), the first Rumanian diplomatic representative in London, attempted the same genre in his *Convorbiri economice* (1879) and *Amintiri* (1890). In his short stories Ion Slavici (1848–1915) described the moral conflicts of village life. I. Popovici-Bănăţeanu (1860–93) wrote about the life of the tradesmen in the Banat (*Nuvele,* 1909). N. Gane translated Dante's *Inferno* and wrote short stories (*Domniţa Ruxandra*). The translation of Dante's *Divina Commedia* was undertaken by Gheorghe Coşbuc (1866–1918), the bard of rustic life (*Balade şi Idile,* 1898; *Fire de tort,* 1896; *Cântece de vitejie,* 1904). Eminescu's follower in lyric pessimism, Alexandru Vlahuţă (1858–1919), wrote a masterly description of the Rumanian landscape (*România pitorească,* 1903).

The greatest writer of this period is I. L. Caragiale (1852–1912) who created the social comedy (*O scrisoare pierdută; O naopte furtunoasă; D'ale Carnavalului; Conul Leonida faţă cu reacţiunea*); he also wrote a realistic drama (*Năpasta*), delightful *Moments and Sketches* and short stories of high aesthetic value. With caustic humour and sparkling irony he presented a society in transition from orientalism to occidentalism.

Outside the influence of Junimea, sometimes opposed to its ideology, stood: the creator of the historical national drama Barbu Delavrancea (1858–1918), with his historical trilogy *Apus de soare* ("Sunset"), *Luceafărul* ("The Evening Star"), *Viforul* ("The Storm"), and a number of short stories; the historian-philologist B. P. Hasdeu (1836–1907), with a rich literary activity (*Răzvan şi Vidra,* 1867, a historical drama in verse); and the neoclassicist Duiliu Zamfirescu (1858–1922), whose cycle of novels *Neamul Comăreştilor* described the family life of the old country gentry.

The folklore and the numerous manuscripts of folk literature found their collectors and interpreters in A. M. Marienescu (1859), Urban Iarnik and Andrei Bârseanu in Transylvania; S. F. Marian in Bukovina (1873); G. D. Teodorescu in Walachia (1885); T. T. Burada in Dobruja (1880); and G. Tocilescu (1900). P. Ispirescu's fairy tales, *Basmele Românilor,* emulate those of Creangă. Moses Gaster, the pioneer in research into Rumanian folklore and folk literature, continued his activity in London. I. A. Zanne published *Proverbele Românilor* (9 vol., 1895–1901); A. Gorovei collected the riddles, *Cimiliturile Românilor* (1898).

The traditionalist movement of Dacia Literară was continued in the 20th century by a galaxy of writers whose organ was *Sămănătorul* (1901). The poets S. O. Iosif (1875–1913) and D. Anghel (1872–1914) brought the perfection of their graceful verses in their conjoint creation (*Legenda Funigeilor,* 1907). P. Cerna (1881–1913) attempted with success the philosophical lyric inaugurated by Eminescu. But the poet of this generation was the vigorous national bard of Transylvania, Octavian Goga (1879–1938), whose first volume of poems appeared in 1905.

The prose writers found their inspiration in village life and in history. E. Gârleanu (1878–1914) described the patriarchal life (*Bătrânii*); C. Hogaş (1847–1916) pictured the magic landscapes of his Moldavian mountains (*Pe drumuri de munte; In munţii Neamţului*); A. Sandu-Aldea (d. 1927) described peasant life in the plain of the Bărăgan and in the Danube delta.

A parallel movement to that of *Sămănătorul,* with its romantic background, was that of the periodical *Viaţa Românească* (1906) of Jassy. Its ideology, labelled *poporanism* on the pattern of the Russian populism, had a social and political background. The Russian influence found its way through the literary critic C. Dobrogeanu-Gherea, a disciple of H. Taine and Karl Marx. The aesthete of the group was G. Ibrăileanu, author of the psychological novel *Adela.* The social critic was the Bessarabian C. Stere.

Western modernism penetrated under its various aspects. Symbolism found a great supporter in the learned philologist and gifted writer O. Densusianu (1873–1938), who founded the periodical *Viaţa Nouă* (1905). The poets I. Minulescu (1881–), author of *Romanţe pentru mai târziu* (1908) and of *De vorbă cu mine însumi* (1914), and G. Bacovia (1881–), who wrote *Plumb* (1916), compared favourably with any western symbolist. Impressionism found a worshipper in E. Lovinescu, author of a *History of Contemporary Literature* (4 vol., 1926–28). Outside these schools, N. Davidescu, after publishing a volume of poems (1910), translated Oscar Wilde's *Parables,* produced several volumes of lyric poems and an epic one, *Cântecul omului* ("The Song of the Man"). Cincinat Pavelescu (1872–) was the troubadour of the madrigal and romance. A. Macedonski (1854–1920) ostentatiously opposed his exotic modernism of French origin to the academic discipline of Junimea as well as to the rustic traditionalism of *Sămănătorul;* he also wrote verses in French, as did others of his generation—Julia Hasdeu and Elena Văcărescu. Carmen Sylva (Elizabeth), wife of Charles I, wrote in German and in Rumanian; in the following period Queen Marie, wife of Ferdinand, wrote in English and in Rumanian. Panait Istrati wrote also in French; A. Busuioceanu, the art historian, became a Spanish poet during World War II.

Between World Wars I and II.—In the period of national unity, the novel entered into competition with lyric poetry. Attempts at introducing the novel go back as far as 1863, when N. Filimon (1819–65) produced a social fresco of his period in *Ciocoii vechi şi ciocoii noui* ("Old and New Upstarts"); but only after 1918 did the novel come into the foreground. Liviu Rebreanu described the peasant's thirst for soil and independence in his novel *Ion* (1920); he presented his suffering and his struggle for freedom in the novel of epic breadth, *Răscoala* (1932); in *Crăişorul Horia* (1929) he described the peasant revolution of 1784 in Transylvania; among his psychological novels *Ciuleandră* (1927) is a fascinating clinical description, but the most powerful novel, inspired by Rumanian participation in World War I, is *Pădurea spânzuraţilor* ("The Forest of the Hanged"; 1922), translated into all European languages.

World War I also inspired Cezar Petrescu (1892–) who wrote, among other novels, *Scrisorile unui răzeş* (1922) and *Întunecare* (1927). In his novel *Roşu, Galben şi Albastru,* the symbolist I. Minulescu gave a picture of life under German occupation. The lyric novelist Ionel Teodoreanu (d. 1954) described the melancholy disappearance of the patriarchal life (*La Medeleni,* 1926–27; *Turnul Mileni,* 1928). Victor Ion Popa found the subjects of his novels in village life (*Velerim şi Lerim, Doamne,* 1932; *Sfârleaza cu Fofează*); he also wrote the biography of the pioneer in aviation Aurel Vlaicu (1939) and enriched the theatre with exquisite plays (*Muşcata din fereastră*). E. Bucuţa (1887–), in his *Fuga lui Şefki* (1926), and G. Mihăescu (1894–), in *Rusoaica* (1933) and *Donna Alba* (1935), described the exotic life of the borderlands. Mircea Eliade brought an Indian atmosphere into one of his novels, *Maitreyi* (1933). Matei Luca Caragiale, the son of I. L. Caragiale, in his short-lived literary career produced a refined piece of art with his *Craii de Curtea Veche.*

Gala Galaction (1879–) translated the Bible (1938), in collaboration with Vasile Radu, and wrote mystical prose (*Bisericuţa din Răzoare,* 1914) and novels with biblical subjects (*Roxana,* 1930). Hortensia Papadat-Bengescu is a psychological analyst (*Concert din Muzică de Bach,* 1927). Life in the suburbs of Bucharest found its interpreter in the novelist G. M. Zamfirescu (d. 1939). Humorous prose found able representatives in D. D. Pătrăşcanu (1872–1937) who wittily described political life (*Can-*

didat fără naroc) ; in Damian Stanoiu, the caricaturist of monastic life; in Gheorghe Brăescu. who found his material in military life.

The link with the older generation was assured by two prose writers. I. A. Brătescu-Voinești (1868–1946?) was the kind-hearted representative of the landed gentry, whose stories are mainly centred round the defeated inadaptables in life. Mihail Sadoveanu (1880–1961), whose talent reached maturity between World Wars I and II, tried the historical novel under the influence of Henryk Sienkiewicz (*Șoimii, Frații Jderi, Zodia Cancerului*), but his art was revealed in landscape descriptions and hunting scenes. The Transylvanian writer I. Agârbiceanu (1892–) carried on Slavici's tradition, presenting in his novels and short stories the village and the middle class of his province against a religious background (Dela bard, 1906; *Arhanghelii,* 1914; *În pragul vieții*). He was one of the founders of the Transylvanian periodical *Luceafărul* (1902).

The scholars and philosophers took part in the literary movement of the period as critics and writers. The classical archaeologist Vasile Pârvan (d. 1927), commemorating the sacrificed generation of World War I. wrote Parentalia, inspired by Thucydides. The prodigious historian and cultural animator. Nicolae Iorga (Nicholas Jorga, *q.v.;* 1871–1940), edited *Sămănătorul,* founded several literary periodicals and wrote literary criticism, poetry, numerous plays and travel descriptions. The geographer S. Mehedinfi (Soveja) edited Convorbiri *Literare* and wrote village stories (Oameni dela munte). The philosopher I. Rădulescu-Motru exercised a great influence on intellectual life with some of his works (*Personalismul* energetic, 1927). Lucian Blaga (1895–) is the philosophic essayist (*Filosofia stilului,* 1924; *Etnografie și artă,* 1926) as well as the poet of the generation. He began as a lyric poet (*Poemele luminii,* 1919) under the influence of western expressionism, and developed a philosophical system based on the traditional way of life interpreted as a cosmic mystery (*Trilogia cunoașteri,* 1931–34). His poetic dramas express his philosophic thinking (*Meșterul Manole,* 1927; *Cruciada copiilor,* 1930; Avram Zancu, 1934).

Literary criticism counted among its best representatives the aesthetician M. Dragomirescu, editor of the Convorbiri *Critice;* D. Caracostea. the analyst of Eminescu; G. Bogdan-Duică, the literary historian; A. Busuioceanu. the art historian; and Paul Zarifopol (*Pentru arta literară,* 1934).

The national and the private theatres offered great opportunities for playwrights. Rumanian plays and translations, old and new plays, held the stage. A. Davila's historical drama in verse *Vlaicu Vodă* (1922), Victor Eftimiu's *Cocoșul negru* (1913), M. Sorbul's *Letopiseții* (1914) and *Patima roșie* (1916), Caton Theodorian's *Bujorești,* C. Ciprian's *Omul cu mârțoaga* and Ion Sân-Giorgiu's *Masca* (1922) are among the best.

Lyric poetry was the most cultivated in modern Rumanian literature. Schools and periodicals were numerous indeed (*cf.* Mario Roques, *La poésie roumaine contemporaine,* Taylorian lecture, Oxford, 1934). Nichifor Crainic, the leader of the literary magazine *Gândirea* (1920), represented the religious traditionalist tendency (*Darurile pământului,* 1920); I. Pillat developed under the influence of the French and German lyric and sang the beauty of his native landscape (*Pe Argeș în sus; Satul meu*); V. Voiculescu was a profound mystic poet (*Întrezăriri,* 1940); Adrian Maniu produced the play *Meșterul* (1922) and wrote refined verses inspired by the rustic landscape. The poems of the mathematician I. Barbu evoke the geometric forms of the crystal (*Joc secund,* 1930). Dragoș Protopopescu, the translator of Shakespeare, is an original poet and talented essayist on English literature.

The poet who, after Eminescu, created a new lyric poetry was Tudor Arghezi (1880–). In his poems the language acquires an unexpected expressiveness and magic harmony. His prose (*Cartea cu jucării,* 1935; *Ochii Maicii Domnului,* 1931, *Cimitirul Buna Vestire,* 1936) and his verses (Cuvinte *potrivite,* 1927; *Flori de mucegai,* 1931; *Versuri* de *seară,* 1935) set a new landmark in the development of Rumanian letters.

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(G. Ns.)

RUMELIA, a general name formerly used by the Turks to denote their possessions in the Balkan peninsula (Turkish *Rumeli,* the land of the Romans, *i* e., Byzantines). Before 1908 it comprised the vilayets of Istanbul (European part), Edirne, Salonika, Kosovo. hlonastir, Scutari (Usküdar) and Ioánnina (Janina), in addition to the provinces of Eastern Rumelia (now the southern part of Bulgaria between the Balkans and the Rhodopes) and Bosnia and Hercegovina. Eastern Rumelia (capital Philippopolis or Plovdiv) became. by the Berlin treaty of 1878, an autonomous province within the Turkish (Ottoman) empire, but proclaimed its unity with Bulgaria on Sept. 18, 1885 (*see* BULGARIA). Turkish territory in Europe is now known as Trakya (Thrace).

(N. Tu.; S. Er.; E. Tu.)

RUMEX, a genus of the buckwheat family to which belong the well-known weeds known as dock and sorrel (*qq.v.*).

RUMFORD, COUNT VON: see THOMPSON, SIR BENJAMIN.

RUMI: see JALAL-UD-DIN RUMI.

RUMINANT. A very important group of mammals, the Ruminantia constitute one of the three suborders of the artiodactyls (*q.v*). the even-toed hoofed mammals. Hoofs. cud chewing and a diet of grasses or foliage are the most obvious characteristics of this suborder, which includes not only cattle, sheep and goats but also the diverse types of antelopes, giraffes, deer and chevrotains.

Although most of these animals possess either horns or antlers, all have been derived from hornless ancestors and a few, such as the musk deer of central and eastern Asia, have never developed them

Apart from the horns which vary strikingly in shape and construction· not only from family to family but from species to species, the ruminants are a homogeneous group; perhaps the most eccentric member is the long-necked giraffe. and even this is linked with the more normal types by the okapi, an animal belonging to the giraffe family but with a shorter neck and shorter limbs than the true giraffes. In the wild state ruminants, like all hoofed mammals. seek safety from their carnivorous enemies in flight, using their antlers or horns as weapons of defense only if driven to bay. Swiftest of all are the deer, antelopes and gazelles, while the goats and mountain sheep have a marvelous power of rapidly scaling steep heights to which few carnivores can follow them.

It is therefore among the ruminants that there is found a more perfect adaptation to a fugitive life than among any other of the larger mammals. The skeletal and muscular systems of the ruminant together form a perfectly constructed running mechanism; their digestive system is also elaborately planned so that they may hastily snatch a meal in some favourable grazing ground and store the food temporarily in a special compartment of the stomach until they have found a refuge where they can masticate and digest it at leisure.

Limbs and Feet.—In the skeleton, the proportions of the limbs and the structure of the feet are particularly noteworthy. As in all running animals the lower leg and foot are very long compared with the upper segment of each limb; this insures a long stride and at the same time a swift one. The surfaces of the joints are grooved and keeled like pulley wheels, permitting free motion forward and backward but limiting the motion in all other directions. Joints of this type are quite strong, and are admirably adapted for swift locomotion over a smooth surface, though less efficient on rough ground.

The feet are constructed on the artiodactyl plan; in each foot no more than two of the ancestral five toes are used, the rest being either lost or reduced to vestiges. The animal steps lightly on the tip of these two remaining toes, the short terminal segments of which are encased by the hoofs. The upper segments (metapo-

dials) of each toe, fused into a single strong bone (termed the cannon bone), are in contrast very long so that the joints corresponding to the human wrist and ankle are raised high above the ground and are consequently often regarded as elbow and knee. On account of the shortness of the upper segments of the limbs, corresponding to the human upper arm and thigh, the true elbow and knee joints of the ruminant are close against its body, enclosed within the skin of the trunk.

Dentition. — Quite as distinctive as the foot of a ruminant is its skull. and especially its dentition. It will have been noticed how a sheep, when it feeds, seems not so much to bite off the grass as to tear it off by quickly jerking its head. This is because the front teeth in the upper jam are replaced by a horny pad, while those of the lower jaw are directed forward and simply press the grass tightly against this pad on closure of the mouth; when the head is jerked sideways the grass is cut through by the sharp edges of the lower front teeth. It is also a matter of common observation that in chewing its food a ruminant swings its lower jaw to the side: it usually swings it first a number of times to one side and then, reversing the direction, about an equal number of times to the other side, so that the grinding teeth on both sides of the mouth are used in turn. These grinding or "cheek teeth" are admirably adapted for triturating hard grasses and coarse foliage. Viewed from the side, they appear to be made up of a number of columns, but looked at from the grinding surface they are seen to have a crown pattern of four crescents or Vs, sometimes complicated by little additional folds. Each crescent is enclosed by a border of enamel which. as it is a very hard substance, prevents the tooth from wearing down too quickly. Also, as the enamel does not wear down at the same rate as the softer substance within, the surface of the crown is almay rough and therefore all the more effective as a grinding mechanism. The great height of the crown also insures that the tooth will last out the animal's lifetime before it is quite ground away. Similar devices are characteristic of the molar teeth of all herbivorous mammals, a matter of considerable importance since most grasses contain a great deal of silica, which causes hard wear to the tooth.

In those ruminants that feed on soft leaves rather than on grasses, the cheek teeth are much shorter than in the exclusively graminivorous types and have a less complex crown pattern. However high the grinding teeth, the mandible of a ruminant is a slender bone, slung somewhat loosely onto the skull, and the joint between mandible and skull is shaped so as to permit great freedom of movement in grinding.

Digestive Processes. — The following account of the process of rumination is an abbreviation of that given by T. H. Huxley in his *Anatomy of* Vertebrated *Animals*. A ruminant does not masticate its food on first taking it into its mouth but swallows it hastily, well mixed with saliva. Only when its appetite is satisfied does it stop grazing and seek a place of safety where it can lie down and "chew the cud" at leisure. If we closely observe a cow which has just lain down in a field after a period of grazing, its body inclined to one side. we notice that after an interval of quiescence a sudden spasm, rather resembling a hiccough, passes over the animal's flanks; and that at the same time something is quickly forced up the gullet into the mouth. This is a bolus of grass nhich, rendered sodden by the fluids in the stomach, is now returned to be masticated by the grinding teeth. This process is repeated until most of the grass which was originally cropped has been reduced to pulp.

A ruminant's stomach is divided into four compartments. When the food is first hastily swallowed it passes no further than the first and second of these; on second swallowing, it passes along a groove in the roof of the second, directly into the third compartment; chemical digestion takes place in the fourth compartment, which alone has gastric glands in its malls for secretion of digestive jucies.

Horns. — Four main types of horn construction are found among the ruminants.

1. The antlers of deer. These are usually found in the male deer only, but in the reindeer they are present in both sexes. They grow out from the frontal bones of the skull as solid processes which rapidly reach their full size. At first they are covered by soft and hairy skin. Then a circular ridge called the burr appears at a short distance from the base of the antler and divides the latter into pedicel on the skull side of the burr, and beam on the far side.

The circulation in the beam then gradually dwindles, and the skin dies and peels off, leaving exposed the dead bone beneath it. Absorption and sloughing take place at the extremity of the pedicel, beam and burr are shed. and the end of the pedicel scabs over. Fresh skin gradually grows up under the scab so that the pedicel becomes once more smooth and hairy. The antlers are shed and grown anew every year, usually adding additional branches each time. (See DEER.)

2. In the bovine ruminants the bony core formed by the frontal bone is covered by a horny sheath. The core itself is hollow, instead of solid as in the deer. The horny sheath is never shed but persists throughout life and grows with the growth of the core. This type of horn is never branched but may be curved, spirally twisted or compressed; it is often present in both sexes. (See SHEEP; GOAT; ANTELOPE; etc.)

3. In the giraffes (*q.v.*) the horn cores are covered with soft and hairy skin and are never shed.

4. In the North American pronghorn, *Antilocapra,* there is a permanent, unbranched horn core enclosed in a horny sheath as in the Bovidae, but this sheath is forked and furthermore is shed yearly after the rutting season since the development of a new sheath pushes the old one off. (See PRONGHORN.)

These four types of horn are characteristic of the five families into which existing ruminants are classified: the Cervidae or deer; the Giraffidae or giraffe and okapi; the Bovidae or oxen, sheep, goats, antelopes, etc.; the Antilocapridae, solely represented by the North American pronghorn; and the Tragulidae, the chevrotains (*q.v.*), which have no horns or antlers.

Many other forms are extinct. The earliest fossil forms were small with no antlers but a pair of long slender tusks in the upper jaw like those of the musk deer. From such as these were derived not only the modern families but several families now extinct; among them the Lagomerycidae, Amphimerycidae, etc.

See also ARTIODACTYLA and articles on the separate families and genera.

See W. H. Flower and R. Lydehker, *Introduction to the Study of Mammals, Living and Extinct* (1891); W B. *Scott, History of Land Mammals in the Western Hemisphere* (1937). (H. S. P.; X.)

RUMMY (RUM, RHUM, ROMME), the most generally known of all card games and, with its many variants including canasta (*q.v.*) and gin rummy, the most widely played, especially in the United States, where a 1957 survey showed canasta first, rummy itself sixth and gin rummy tenth in popularity among card games. The original version, introduced early in the 20th century, was called conquian *(see* COON-CAN) from the Spanish *con quién* "with whom." The English gave it its lasting name by calling it rum (queer) poker.

Though there are no official rules, the following procedure of the basic game is common to most variants.

From two to six may play, using a standard deck of 52 cards with or without jokers. Cards rank: K (high), Q, J, 10, 9. . . . A (lon). Cards are dealt face down one at a time, clockwise beginning uith the player on dealer's left. For two players, ten cards are dealt to each; for three or four, seven; for five or six, six. The remainder of the deck, the stock, is placed face down; top card of the stock is faced to start the talon or discard pile.

The common goal of all rummy games is to build sets or melds such as three or four of a kind (as four 6s, three 8s) or sequences of three or more cards of the same suit (♠J-10-9-8, etc.). A joker may represent any needed card.

Each player, at his turn, draws the top card of the stock or of the discard pile and may then face upon the table any meld or melds of three cards or more, and may also lay off any cards from his hand that match his own or another player's exposed melds. He must then discard one card face up on the discard pile (except that on the turn when he goes out, no discard is needed).

The deal is won by the first player who goes out (melds or lays off all his cards). Melding an entire hand at one turn is called going rummy and is paid double.

The winner of each deal collects from each of the other players the index value of the cards each holds unmelded (even if matched up). Face cards count 10 each; aces 1 or 11 as previously agreed; jokers, if used, count 15.

Game ends when any player reaches a predetermined score (as plus 100 points) or after an agreed number of deals.

When stock is exhausted, play ends and the hand with the lowest count wins. In some games, each player is permitted an additional turn to take or refuse the top card of the talon.

500 Rum.—This version is also called pinochle rummy; variations include Michigan rum, Oklahoma, Persian rummy and canasta. From two to eight may play. With five players or more, two full packs shuffled together are used. When two play, each is dealt 13 cards; with three or more, 7 cards are dealt to each.

At his turn, each player draws the top card of the stock or any card in the discard pile provided that: (1) he melds such card at once and (2) he puts into his hand (to meld immediately or not, as he pleases) all cards lying above the one he has drawn.

Layoffs are the same as in rummy, except that each player keeps before him the cards he has melded. When the deal ends, each player receives credit for the index value of his melds, minus the index value of all cards remaining in his hand. Aces count 15 if left in hand or if melded as a group of aces; they count but 1 if melded A-2-3.

When any player has scored 500 or more the game ends. There is no bonus for winning the game.

Persian Rummy.—Four play as partners, using one pack plus four jokers which count 20 points and may be melded only in groups of jokers. Aces count 15 and may be used only as A-K-Q or as a group of aces, not as A-2-3. If all four cards of a rank are melded at once, the value of the meld is doubled. When a player has melded all his cards. the deal ends and his side scores a bonus of 25 points. After stock is exhausted, the discard pile is drawn from until no player is able to make a meld with the exposed card of the discard pile.

Two deals constitute a game. The partnership with the higher total wins the difference between the scores, plus a game bonus of 50.

Knock Rummy.—Any player, at his turn and after drawing and discarding, may knock (lay down his entire hand) and declare the total value of his unmatched cards. He does so when he believes he has the lowest total unmatched (not part of a meld). If his assumption is correct, he collects from each opponent the difference in the counts. If another hand is lower than the knocker, the low hand wins from all and collects an extra penalty of 10 points from the knocker. (Some play that the knocker must pay double.) If a player ties for low, he collects the winnings and the knocker neither pays nor collects. If two or more other players tie for low, they divide the winnings.

Gin Rummy.—First introduced in New York in 1909, this game became a nation-wide fad in the U.S. in 1941 after scoring changes were made. Two play; each is dealt ten cards face down, one at a time, beginning with nondealer. The remainder of the pack, placed face down, forms the stock. The top card of the stock is turned up beside the stock to form the first up card.

Nondealer may take the up card or refuse it; if he refuses, dealer has the same option. If both refuse, nondealer draws the top card of the stock. Thereafter, each player in turn takes either the up card or the top card of the stock, then discards one card face up on the up card pile.

Object of play is to form melds as in rummy. Cards that do not form part of a meld are called unmatched. After drawing, a player may knock (go down) if his unmatched cards (less one discard) total 10 or less. Face cards count 10, aces 1, other cards their index value. Upon knocking, a player faces his 10 cards arranged in sets and with unmatched cards to one side, then discards his 11th card. If all his cards are matched, he is gin and he receives, in addition to the index value of his opponent's unmatched cards, a bonus of 25 points.

Opponent of the knocker may lay off any of his unmatched cards upon the knocker's sets, thereby reducing his count. If the knocker has the lower count unmatched, he wins the difference. Should his opponent remain with an equal or lesser count, he has undercut the knocker and receives the difference (if any) plus a bonus of 25 points, but the knocker cannot be undercut if he has gone gin. When only two cards remain in stock and neither player has knocked, the deal is called off with no score.

First to reach 100 points wins the game and receives a 100-point bonus. Each player then adds to his score 25 points for each hand he has won, called a box. If the loser failed to score. the game is a shutout or schneider and the winner's total score is doubled. (R. L. FY.)

RUMPF (RUMPHIUS), **GEORG EBERHARD** (1628–1702), German-Dutch naturalist and explorer, was a pioneer in the study of tropical floras and laid the foundation of knowledge of the vegetation and fauna of Amboina and other islands of the Malay archipelago. Born in May or June 1628 at Hanau, Ger., he was educated in the same city. He entered in 1652 the service of the Dutch East India company and arrived in Amboina, Indon., the next year. In 1657 he was transferred to civilian service and in 1660 became a merchant. About that time he started the systematic studies of the flora and fauna of Amboina which he pursued all the rest of his life under tragic circumstances. In 1670 he became blind but continued his work with such help as he could get. Fire destroyed all of his illustrations and some of his manuscripts in 1687, but his courage was undaunted, and he brought his work to completion in 1690. The manuscripts of six volumes sent to Europe were lost when the ship was sunk by the French, and the work mas reconstructed from the copy of the manuscript in Batavia, Indon. He completed his lifework a few months before his death on Jan. 15, 1702. His *Amboinsche Kruidboek*, or *Herbarium Amboinense*, 6 vol. (1741–55), with the *Auctuarium* (1755), became a standard work.

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RUNCIMAN OF DOXFORD, WALTER RUNCIMAN, 1ST VISCOUNT (1870–1949), British parliamentarian, who held many posts in Liberal governments, was born at South Shields, Durham, Eng.. on Nov. 19, 1870. He was educated at Trinity college, Cambridge. In 1899 he was elected to the house of commons for Oldham, Lancashire, but he was defeated in the following year by Winston Churchill. He later sat in the house of commons for Demsbury. Yorkshire, 1902–18; for Swansea, west, Glamorgan, Wales, 1924–29; and for St. Ives, Cornwall, 1929–37. After 1931 he sat as a Liberal National. His first post in the Liberal government was parliamentary secretary to the local government board, 1905–07. He was also financial secretary to the treasury, 1907–08, and president of the board of education, 1908–11, and of the board of agriculture, 1911–14. He served as president of the board of trade, 1914–16, and again in the National government, 1931–37. In 1937 he was created a viscount. In 1938 he went to Czechoslovakia as head of a mission which tried to persuade the Czechs to accept the claims of the Sudeten Germans. He was lord president of the council, 1938–39. He died at Doxford, Northumberland, Nov. 14, 1949.

RUNCORN, a market town, river port and urban district in the Runcorn parliamentary division of Cheshire, Eng., on the southern shore of the Mersey, 16 mi. N.N.E. of Chester by road. Pop. (1951) 23,931. Area 4.6 sq.mi. It is on the Bridgewater canal (1773), which descends there into the Mersey by a flight of locks; it is also on the Manchester ship canal and is a subport of Manchester. with extensive wharfage and warehouse accommodation. Exports include coal, salt and pitch; there is also a large traffic in potters' materials. It is connected with Widnes by a railway and a transporter bridge, which in 1956 was about to be replaced by an archetype high-level road bridge. The town possesses shipbuilding yards. iron foundries, rope works, tanneries and large alkali and heavy chemical works. On a rock which formerly jutted into the Mersey, Aethelfleda erected a castle in 916. The ferry is noticed in a 12th-century charter.

RUNDALE, the name of a form of occupation of land, somewhat resembling the English common-field system. The land is divided into discontinuous plots and cultivated and occupied by a number of tenants to whom it is leased jointly. The system was common in Ireland, especially in the western counties. In Scotland, where the system also existed, it was termed runrig.

RUNDI (BARUNDI, WARUNDI), an east African people of the Interlacustrine Bantu group who inhabit the southern portion of the Belgian trust territory of Ruanda-Urundi. The Rundi, who number about 2,000,000, resemble very closely their northern neighbours, the Ruanda, in language, traditional culture and modern economic and political conditions. Legend links the kingships of the two countries through common ancestry.

The traditional Rundi state, however, was somewhat more loosely organized than that of the Ruanda. Whereas among the latter political and military authority was mainly in the hands of appointees of the *Mwami,* among the Rundi princes of the blood ruled together as a kind of oligarchy, each having authority over a district. The over-all authority of the *Mwami* was frequently challenged by his fellow princes and civil wars were commoner than in Ruanda.

See E. M. Albert, "Socio-Political Organization and Receptivity to Change: Some Differences Between Ruanda and Urundi," *Sthwest. J. Anthrop.,* vol. 16 (1960). (L. A. Fs.)

RUNDSTEDT, (KARL RUDOLF) GERD VON (1875–1953), German army officer, leading field commander in World War II, was born at Aschersleben, near Magdeburg, on Dec. 12, 1875, of a noble Prussian family. He was chief of staff of an army corps in World War I and assisted in reorganizing the Turkish general staff. Later he mas active in the secret German rearmament and on his retirement in Oct. 1938 was the senior German field commander. Recalled to active duty before the outbreak of war in 1939, he commanded army groups in the Polish, French and Russian campaigns and became a field marshal.

Coming into conflict with Hitler on the conduct of the Russian campaign, Rundstedt was relieved of command in 1941. but was soon restored to favour and appointed commander in chief west, with headquarters near Paris; there he prepared the defenses against the Allied invasion. He was replaced by Giinther von Kluge in early July 1944, but again became commander in chief west in September and directed the Ardennes counteroffensive. He mas captured by U.S. troops in May 1945 but was later released because of ill-health. He died in Hanover on Feb. 24. 1953. Rundstedt regarded Hitler and his methods with contempt but never permitted conspiracy against him in his own staff.

Rundstedt's biography, *Von Rundstedt, the Soldier and the Man* (1952), was written by his chief of staff, Gen. Giinther von Blumentritt. (P. N. T.)

RUNE, a character of an alphabet used for the oldest form of Germanic writing. This form of writing was in use in the Scandinavian north in the 3rd century, and in remote districts of Sweden almost down to modern times. *(See* also ALPHABET.)

During the first centuries of their vogue, runes consisted of 24 letters: the so-called older or all-Germanic runic staves (fig. 1).

f u th a r k g w h n i j e p R s t b e m l ng o d

FIG. 1.— ALL-GERMANIC RUNIC STAVES

Their peculiar forms appear first in inscriptions found all over Europe from Rumania and western Russia to the east of France and Friesland, but in greatest number in England and Scandinavia. Runes. which were derived from a subalpine script. differ from it radically in their arrangement, as may be seen from some inscriptions that use the runic staves in their entirety, the most important being the Kylver stone in Gothland (5th century), the Vadstena *braktea* from Ostergotland. Sweden (fig. 2), the Charnay clasp from eastern France and the Thames sword from southern England. Moreover every rune had its special name and these names are known through the oral traditions recorded in Anglo-Saxon manuscripts. The 24 runes were divided into three groups

BY COURTESY OF KUNGL. VITTERHETS HISTORIE OCH ANTIKVITETS AKADEMIEN, STOCKHOLM

FIG. 2.—VADSTENA BRAKTEA

of eight each, each group coming later to be called in Scandinavian an *ætt,* a word which probably meant "number of eight." The runic staves, at least at a later period, were called *futhark,* after their initial letters.

As regards sound values, it may be mentioned that *th* was pronounced approximately as in the English *thing;* d like *th* in the English *this; g* had a sound corresponding to g in German *sagen; b* in the same way, therefore corresponding t *b* in the Spanish *Habana; ng* like *ng* in *England;* and *R,* when final, almost like *s* in the English *is.*

Origin.—The oldest extant decipherable runic writings whose origin is at all certain were discovered at the bogland in southwestern Denmark, at Vi-mose in Fyn and at Torsbjaerg in Schleswig. Most archaeologists date the first-mentioned from the middle of the 3rd century, the second from the 4th. The inscriptions are few in number and brief. Those which can be deciphered contain one or two names of men. These earliest finds of runes in Denmark were supplemented by a whole series of others from the 4th. 5th and 6th centuries—inscriptions on single objects, arms, ornaments and more especially gold *brakteas.* Archaeological research establishes the fact that southwestern Denmark was really the cradle of the knowledge of runes, whence the use of runes spread to Norway and Sweden. It has been ascertained, moreover, that from Schleswig it made its way in the 5th century along the southern coast of the North sea to England and the continent.

If then. Schleswig and Fyn are the original home of the runes in northern and western Europe, the next question is: did the runes originate in Denmark or were they imported from elsewhere? It has been established that a number of runes which are contemporaneous with the oldest of those found in the Danish bogland have been discovered along a line of country passing through Pomerania, Brandenburg, Volhgnia and Rumania. Moreover, these discoveries include archaic objects the primary forms of which do not hail from western Europe but are found in southeastern Europe, on the northern coast of the Black sea and along the lower Danube and in Carinthia. From this fact, and also from the close agreement of the forms of the letters in these texts, especially the Negau helmets, with those of the subalpine alphabets of northern Italy, and the agreement in date (*c.* 250 B.C.), the conclusion was drawn simultaneously by a number of scholars that the runes came to Scandinavia from central Europe and that the script itself was of subalpine origin. It is certain that runes were known and used among the Goths in the first half of the 4th century. In the 3rd and 4th centuries there is no trace of the existence of runes in the western Teutonic world, *i.e.,* southwest of the line Schleswig, Berlin, Bucharest.

Ludwig Wimmer made it clear that they are derived ultimately from a Mediterranean form of alphabet that had its origins in a Western Greek type. The runes have the same signs for the vowels *a,* e, *o,* as the Greek and Latin alphabets; the runes for f, *h* and *r* derive from the Italic alphabets. Since quite a number of runes (as *a, i, b, t, m* and *n)* may be traced typographically to the Greek and Latin alphabets and as it undoubtedly would be natural to seek the source of the runes in a single alphabet, Wimmer sought to trace all the runes back to Latin. In so seeking, however, he was forced into assumptions and deductions which must be regarded as improbable and irrational.

In 1928 the Norwegian, C. J. S. Marstrander, showed that the runes derive from a subalpine Northern Etruscan alphabet which was in use in the eastern Alps among Prae-Italic tribes, and it was from these that the Teutons, probably the Marcornanni who lived in Bohemia, developed the runes. Certain runes are more easily and naturally explained in the light of Marstrander's paper than in that of any other interpretation that has been put for-

ward. Archaeological and chronological facts are not difficult to reconcile with Marstrander's hypothesis, which is now widely accepted.

Actually Marstrander had been anticipated by Hempl, Skeat, C. D. Buck and others. The resemblance between subalpine and runic scripts is great. But it is not the mere similarity that is decisive; the important facts are that the oldest-known Germanic inscription is in a subalpine alphabet, and that the oldest runic texts appear at the eastern end of the Alps, not in Germany or Scandinavia.

The close relationship between the runes and cursive handwriting—the ordinary handwriting used in everyday life—indicates that the art of writing did not come to the Goths by the way of scholarship. Some individual Goths (*e.g.*, mercenaries) from the northwestern coast of the Black sea, in the course of visits to the Roman provinces learned Greek and Latin and the Greek and Latin forms of writing used in state edicts and in private life. In addition, they acquired an imperfect acquaintance with the lapidary and uncial style which was the basis for the ordinary cursive handwriting, wherefore some forms of the better style occasionally appear. Such a Goth, or several such Goths working together, undertook to write out the Gothic language on the basis of the knowledge of Latin and Greek writing thus acquired, and these efforts influenced the runic stave.

Like the letters of the classic alphabets, runes soon came to be used for purposes of magic, a use which continued for a long time. But that the chief purpose of the runes was to give the spoken language a fixed form is demonstrated at an early date by the fact that both Ulfilas and those who used the Old English alphabets drew upon runes when the Greek or Latin scripts failed them. Removed from the sphere of classical culture, runic writing soon came to be used chiefly for inscriptions: it was carved or cut on wood, metal or stone. In the process the individual letters began to undergo a certain kind of symmetrical stylization which gave them a substantially different appearance from that of their prototypes, and at the same time the runes came to be put in an order entirely different from that of the classic alphabets.

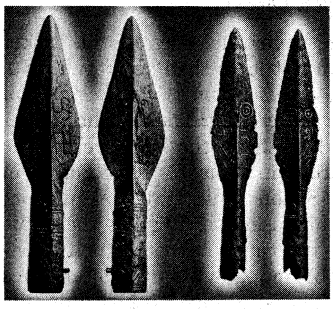


FIG. 3.— SPEARHEADS FOUND NEAR BREST, U.S.S.R.

From the Danubian region knowledge of runes soon spread to distant corners of the great dominion which the Goths established in the 3rd and 4th centuries between the Black sea and the Baltic. From the middle of the 3rd century have been found runic inscriptions on single objects in Gothland, Denmark and Norway.

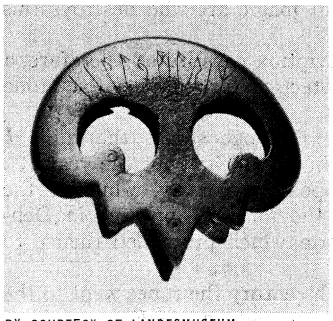
Runes have been used by the unscrupulous to trick the credulous and the superstitious. Forgeries, sometimes used to victimize the patriotic or as sport for pranksters, have turned up even in North America. The Kensington stone, which was found in Minnesota, contains writing that is 1,000 years out of style. Viking swords, found in southern Ontario and once held to support the Kensington case, are now known to have been "planted."

SPREAD AND DEVELOPMENT

Between the Black sea and the Baltic runic letters have been found from the same period, such as those on the spearheads from Brest (fig. 3); their reading, dialect and interpretation are disputed.

Of the same period are certain Scandinavian runes, among them the Thorsbjaerg chape (metal mounting for scabbard) from Schleswig (fig. 4), which bears the inscription *owlthuthewaR niwajmariR;* these are probably the names of two men *WulthuthewaR* and *NiujamariR,* both names being of the familiar old Germanic binominal compound type, but other interpretations have been advanced.

It has already been pointed out that Schleswig and Fyn constituted a cradle for the runes during the Roman period and the earlier portion of the migration era (A.D. 250–450). There are many signs that runic writing was brought there from the Black sea by the Heruli, a people who played an important part in the history of that period and who seem to have had their origin in Denmark. Schleswig in those early days and until well into the middle ages was of primary importance for the intercommunication and exchange of merchandise between the Baltic regions on the one side and western and southern Europe of the other. In particular, Schleswig had long been the traffic route from the Rhineland and England up to the Scandinavian north.



BY COURTESY OF LANDESMUSEUM

FIG. 4.—THORSBJAERG CHAPE

A remarkable runic inscription found in Schleswig is that on a golden horn from Gallehus (fig. 5), which dates from the beginning of the 5th century. It reads: ek *hlewagastiR holtijaR horna tawido,* "THlewagast from Holt made the horn." There are altogether about a dozen inscriptions on portable objects, also inscriptions of the older type as well as about 40 runic brakteas dating from between the 3rd and 6th centuries, which were found in Danish soil.

At a very early period (sometime in the 3rd century) runic writing had spread from Denmark into Korway. There as early as the 4th century the custom had begun of equipping stone monuments with runic inscriptions. One of the finest and longest inscriptions is that of the Tune stone from southeastern Norway (see fig. 6).

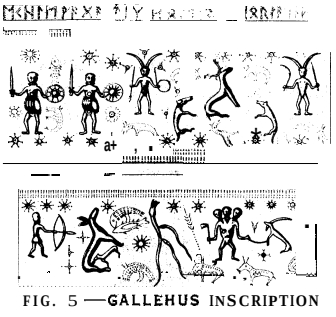


FIG. 5 —GALLEHUS INSCRIPTION

It would seem to date from the earlier half of the 5th century and reads: (*wiwa*)*R* (?) *wodu*-ride staina (satido) *thrijoR dohtriR da*(*i*)*lidun arbija si*(*bi*)-*josteR arbijano,* ek *wiwaR* after *woduride wita*(*n*)*dahalaiban* wo-*rahto*(*runoR*), which perhaps may be translated "Viv (?) raised this stone to Vodurid. Three daughters shared the inheritance as nearest of kin among his survivors. But I. Viv, engraved the runes to my master (=bread-giver, cf. the English lord) Vodurid."

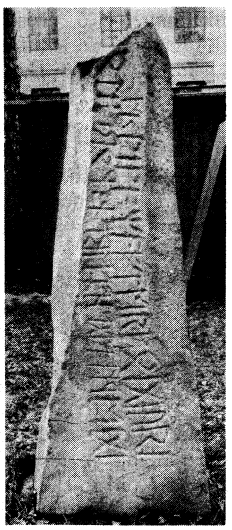


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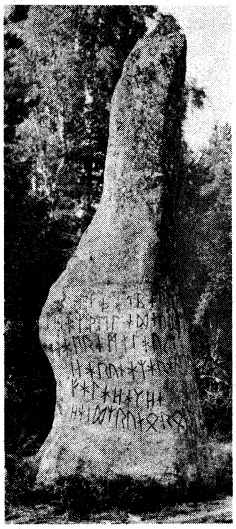
FIG. 6.— TUNESTONE

In Norway the older runic staves had a relatively aide vogue; from the period AD. 250 to A D 800 there are extant, in addition to 10 brakteas with runic inscriptions, about 50 inscriptions, mostly on standing stones or stones inserted in tumuli but also on portable objects.

The runes moved from southwestern Denmark also up the Baltic. The island of Gothland, ancient centre for trade and intercourse in northern Europe, became also a region in which the older runic staves continued to be written throughout the entire period, though not to such an extent as in Norway. The runic inscriptions have been found more sparsely on the mainland of Sweden—in Uppland, Sodermanland and Östergötland. They are more frequent in Västergötland. In all, about 20 runic inscriptions from the migration period have been found in Sweden, as well as few runic brakteas. Of special note among them are the late (7th century) inscriptions from the most western parts of Blekinge which show a continuation of the development of the runic letters that had taken place in southwestern Norway, so

rich in runes, during the early and middle periods of the migration era. Probably these inscriptions also came from Norwegian immigrants. The best-preserved specimen is the Bjorketorp stone (fig. 7) which has its place in a fine stone setting and bears inscriptions on both its sides: *uthArAbAsbA* ("ruin-bringing prophecy") and *hAid runo ronu fAlAhAk hAd(e)rA ginarunAR ArAgeu hAerAmAl-AusR uti AR welAdAude sAR thAt bArutR,* "This is the secret meaning of the runes; I hid here power-runes, undisturbed by evil witchcraft. In exile shall he die by means of magic art who destroys this monument."



BY COURTESY OF KUNGL. VITTERHETS HISTORIE OCH ANTIKVITETS AKADEMIEN, STOCKHOLM

FIG. 7.—BJORKETORP STONE

This inscription constitutes, therefore, a magical protection for the very fine stone setting.

Of these Blekinge stones the runic *k* has the form ᛉ which about the year 500 was developed in Norway, while at the same time the form ᚳ appeared in Denmark, a form which proceeded thence to England.

In the 5th century the runes went to the Germanic continent and to England from southwestern Denmark. On the continent, where the runic *k* retains its original form, there have been found inscriotions from the Rhine province, Hesse, Nassau, Thuringen, Wiirttemberg, Bavaria, Austria, as well as in Charnay, the old Burgundian kingdom in eastern France in what is now the *département* of Saône et Loire. These inscriptions are few and, like the Danish ones, all inscribed on portable objects, and they are quite short. They are all held to belong to the period A.D. 450–550. As an illustration may be cited the inscription on the clasp from Freilaubersheim in Rhenish Hesse (fig. 8): *boso wraet run-ath (i) k dalina godd(a),* "Boso wrote the runes —to thee, Dallina, he gave (the clasp)."

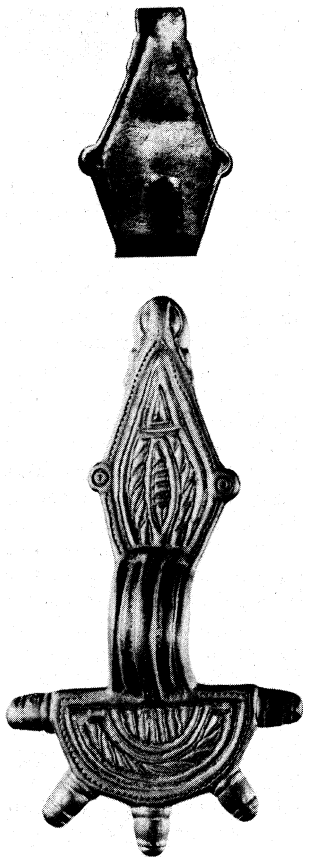


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FIG. 8.— FREILAUBERSHEIM BROOCH

England. — If knowledge and use of runes constituted merely a brief episode on the western Germanic continent, it flourished for five centuries in England. Anglo-Saxon rune staves like continental Germanic have two cross-strokes in the letter *h* and differ from it in the form of the k; they differ from the Scandinavian and eastern Germanic, as well as from the continental Germanic runes with their 24 letters, in that new letters were created to render the most important novelties in the rich Anglo-Friese vowel system. Later new consonant letters were added.

Beginning of this development of the system of letters had already been effected on the south portion of the coast of the North sea in Friesland, uhere there are inscriptions belonging to the end of the 5th century and to the 6th with new runic letters for a- and o-sounds In England there developed a runic stave of 28 letters (fig. 9), which in the 9th century increased to 33.

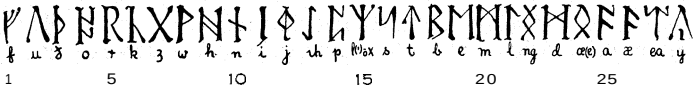

FIG. 9.— EARLY ANGLO-SAXON RUNES

In England are extant about 50 runic inscriptions upon portable objects and standing stones (stone crosses). Among the most remarkable and best preserved are those carved on a casket made of whalebone (Frank's casket, fig. 10). The inscriptions, with illustrations from Biblical history and Roman and Germanic legends, cover the sides of the casket and the lid and are held to be from not later than about A.D. 650. The inscription on one side reads: *hronæs ban fisk flodu ahof on jergenberig warth gasrik grorn thær on greut giswom,* "The whalebone (is this). The flood threw the fish on the firm rock. The monster (?) was stranded on the stone in agony." Reproduced in fig. 11 is the later 33-letter Anglo-Saxon runic stave taken from Cod. Cotton. Otho B. 10 (British museum); it gives the runic names of oldest date. In England the runes persisted for the entire Anglo-Saxon period. Remarkable monuments from later times are the two runic crosses from Bewcastle and Ruthwell on the Scottish border. Because of the tradition kept alive in England from ancient times and the fact that the names borrowed by Ulfilas from the runes to render Gothic letters are indicated in a manuscript (not, indeed, in their original forms) preserved in the National museum at Vienna, it is possible to reconstruct approximately the name which every runic letter seems to have borne from the commencement. Later traditions handed down in Scandinavia are also of value, although the later peculiarly northern runic staves contained only 16 letters and the names of 8 letters therefore have been lost. In the first column below are Anglo-Saxon names of runic letters; in the second, Scandinavian; in the third Gothic reconstructed:

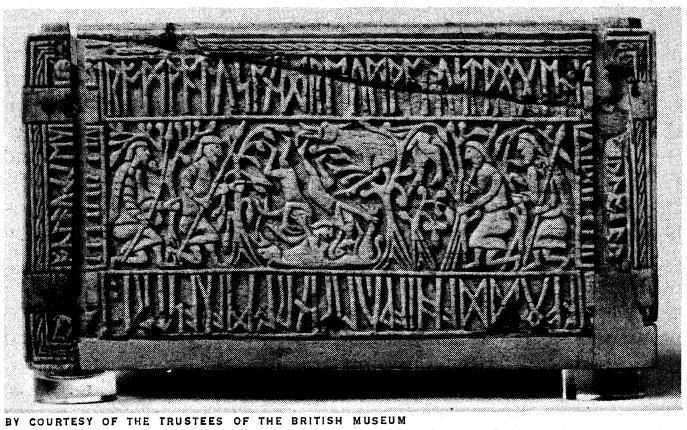

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FIG. 10.— FRANK'S CASKET

f	*feh,*	money	*fé, fa*	goods	*faihu* (read fehu)
u	*úr*	aurochs	*úrr*	aurochs	*urus*
th	thorn	thorn	*thurs*	giant	*thauris*
a	*ós*	god	*óss*	god	*ansus*
r	*rád*	ride	*reið*	journey	*raida*
k	*cán*	torch	kaun	ab oil	kazm ?
g	*geofu*	gift			giba
w	wynn	joy			*winja*
h	*hægl*	hail	*hagl*	hail	*hagl*
n	*nied*	need	*nauð*	need	*nauths*
i	*is*	ice	*íss*	ice	eis
j	*géar*	year	aar	year, harvest	*jer*
e	ddh = *éow*	yew tree	*ýr*	small fir, bow	*eiws*
p	*peorð*	?			*pairthra*
z	*eolhs*	?	*elgr*	elk	*algs*
s	*sygil*	sun	sol	sun	sauil
t	*tír*	honour	*tyr*	god	*teiws*
b	beorc	birch	biarkan	birch seed	bairkan
e	eoh	horse			aihos
m	*man*	human being	*maðr*	human being	*manna*
l	*lagu*	water, sea	legr	liquid	*lagus*
—	*Ing*	a hero			*Iggws*
o	*éðel*	inheritance			*othal*
d	*dæg*	day			*dags*

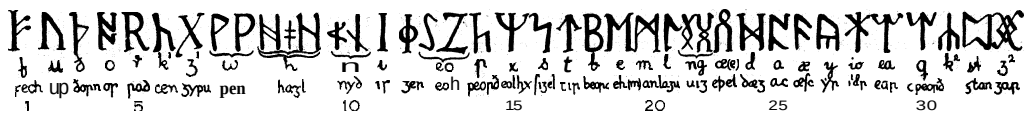


FIG. 11.—LATER ANGLO-SAXON RUNES

Thus the great modification of the Germanic sound system caused by vowel mutation, by breaking and by other sound changes during the migration period resulted in a considerable enlargement of the runic alphabet in England.

Scandinavia.— In Scandinavia it is curious to note the same linguistic development, the Germanic sound shift, produced a result directly opposite to that in England: the number of the runes was reduced from 24 to 16 although the Scandinavian stock of sounds reached 30 or 40 during the later migration period. The explanation of this would seem to lie in the fact that, while the original 24 runes covered adequately the old Germanic sounds, it became the habit later, as the result of the increase in the sound system, to represent different sounds by the same rune. This brought about a simpler alphabet: when a single runic letter could be used to render several sounds, many of the old letters became superfluous. Simultaneously the formation of many of the runes was simplified. This twofold reduction of numbers and forms began in Scandinavia as far back as the 6th century, and at the beginning of the Viking era this had resulted in a special

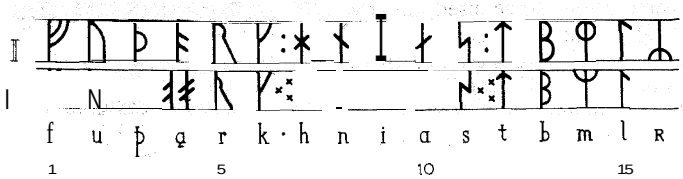


FIG. 12.— DANISH RUNES

16-letter Scandinavian alphabet. This alphabet appears in two distinct forms—Danish (fig. 12) and Swedish-Norwegian (fig. 13). Danish was used also in southwestern Sweden.

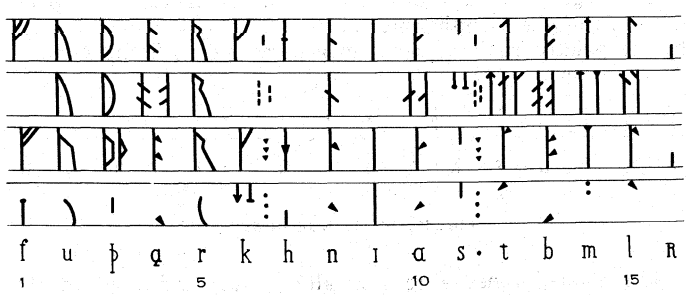
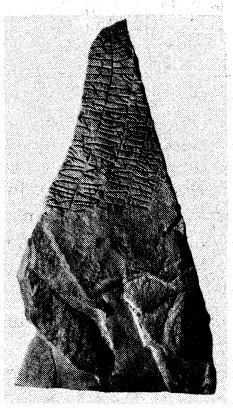


FIG. 13.— SWEDISH-NORWEGIAN RUNES

In Denmark runes seem to have been little used after the close of the 6th century, and the form of the runic *k*, as well as other details, indicates that it was through an impulse from Norway or Sweden that runes came into use again in Denmark at the close of the 8th century.



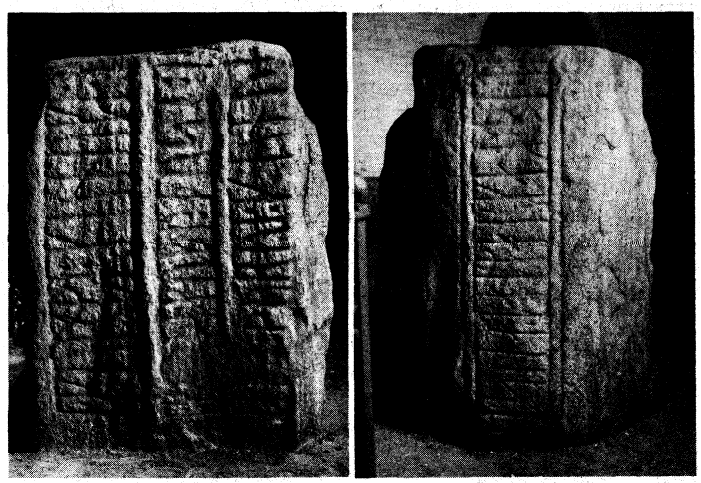
BY COURTESY OF "DANMARKS RUNEINDSKRIFTER," DENMARK

FIG. 14.— HELNAESSTONE

There are extant about 200 inscriptions upon standing stones. as well as a few upon portable objects. Most of these inscriptions date from between A.D. 800 and the middle of the 11th century. Despite their laconic and often stereotyped wording they are among the most remarkable, both as regards style and matter that have been found in Scandinavia. They give the names of several hundred men and women who lived in Denmark during this important period, from members of the royal house down to the lower grades of society, and they provide data for visualizing the life of the people and of individuals in war and peace.

The runic monuments which date from the beginning of this period are few in number. One of the oldest and most remarkable inscriptions with runes of the later period is the Helnæs stone at Fyn (fig. 14): *rhuulfR sati stain nuRa kuthi aft kuthumut bruthur sunu sin turuknathu (haliR uti) ouaiR fathi.* If it were written in a more adequate phonetic alphabet, *e.g.,* the Early Norwegian Icelandic alphabet which includes ð, this inscription would have run: *"HrólfR setti stein, NóRa goði, aft Guðmund brod urusunu sinn drunknadu haliR uti. ÁveiR fáði,"* "Rolf raised this stone, priest and chieftain of the Helnæs dwellers, in memory of his brother's son, Gudmund. The men were drowned at sea. Aveir wrote (the runes)."

From the earlier half of the 10th century the smaller of the two famous Royal stones of Jallinge in Jutland (fig. 15): *kurmR kunu(n)kR karthi ku(m)bl thusi aft thurui kunu sina tanmarkaR but,* "King Gorm made this monument in memory of his wife, Tyra: he (Gorm) who improved Denmark."



BY COURTESY OF "DANMARKS RUNEINDSKRIFTER" DENMARK

FIG. 15.— EARLIER JÄLLINGE STONE

The great majority of Denmark's 200 runic stones date, however, from the end of the 10th and the beginning of the 11th centuries. It was the period when the Vikings' raids on England were renewed, resulting at last in the conquest of the country by the Danish king, Sven Twybeard, who is mentioned in two of the runic inscriptions, and Canute the Great. The relations between Denmark and England are reflected in the history of the runic inscriptions inasmuch as it was probably due to influence by the Anglo-Saxon runes that the Danish alphabet then began to be enlarged by so-called pointed runes.

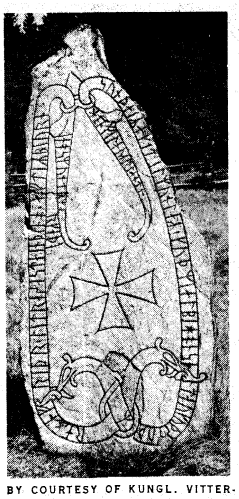
From Denmark the Danish runes spread about A.D. 1000 to Sweden uhere runic inscriptions on standing stones became more numerous than anywhere else. There are known in Sweden about 2.400 runic inscriptions, chiefly from the 11th century and the beginning of the 12th, the majority of them written in Danish runes. No fewer than half of them belong to the central region of the kingdom, Uppland. These monuments make it possible to follow the upward course of the Danish runes through Sweden from Skåne and Vastergotland to the southern part of Norrland, and it may be noted that the inscriptions in the south are, on an average, of earlier date than those in the north. The custom of erecting runic stones was not long-lived anywhere. Generally speaking, it was abandoned whenever a region became definitely Christianized and controlled by the Roman Catholic Church, but it seems to have had a vigorous final revival during the missionary period. The course of the spread of Christianity throughout Sweden during the 11th century—beginning in the south and proceeding to the north—is therefore traceable in a special way in the appearance of the runic stones.

From the beginning runic stones were erected for the most part in village graveyards, and one principal reason for giving up the

custom of erecting them must have been that with the spread of Christianity the dead had to be buried in the cemetery adjoining the parish church, often at a distance from the home. Thereby monuments lost much of their interest for the survivors. In Uppland, more especially, the runic inscriptions were accompanied by cleverly executed ornamental design. the patterns of which were taken from woodcuts—the art of woodcuts having been highly developed during the migration and Viking periods. Not merely the runes themselves but also these ornamental designs needed craftsmanship, and therefore, many runic inscriptions are executed by expert craftsmen.

The oldest and most remarkable (c. AD. 1025–1050) of these Uppland professional writers of runes was Asmund. He is probably identical with Osmundus, who is mentioned by the Bremen ecclesiastical historian. Adam. Osmundus was one of the Englishmen of Scandinavian origin who prepared the way in Sweden for the conquest of Christianity. Other talented masters of the art were Fot and Öpir. Asmund's stones record the names of a number of Swedes who took part in Canute the Great's conquest of England. On the Ängeby stone (fig. 16), one of Asmund's inscriptions reads as follows: *rahnjrithr lit risa stain thina aftiR biurn sun thaiRa kitilmuntaR. kuth hialbi hans ant aukuths muthiR. lzon fil a uirlanti. in osmuntr markathi,* "Ragnfrid had this stone erected in memory of Bjorn, her and Kattilmund's son. God and God's Mother help his soul! He fell in Estland. But Asmund engraved (the stone)."

When the reduction of the runic alphabet from 24 letters to 16 came about, the simplifying of the individual letters was carried furthest in the Swedish-Norwegian runes. These are to be found in Gothland, in eastern Gotaland, in. Svealand and in Norway, dating from the beginning of the Viking era, about A.D. 800. They were displaced on monuments by the Danish runes in the beginning of the 11th century in Sweden, but many circumstances indicate that even after this period they were used for more private purposes. Comparatively few runic monuments have Swedish-Norwegian runes on them but among these few must be mentioned the largest and most original of all, the Rok stone (fig. 17). The top and the four sides are covered with runes. The older forms of runes are also used together with ditierent kinds of secret writing.



BY COURTESY OF KUNGL. VITTERHETS HISTORIE OCH ANTIKVITETS AKADEMIEN, STOCKHOLM

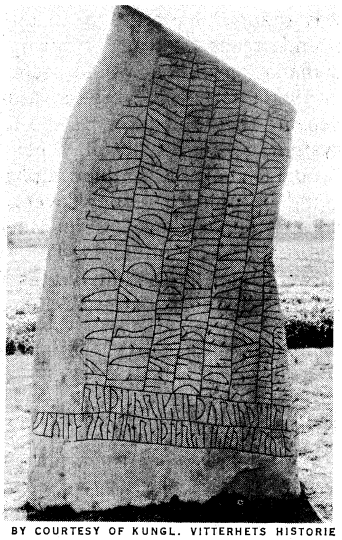
FIG. 16.—ÄNGEBY STONE

The stone was erected by a father in memory of his son and the inscriptions would seem to have in some degree magical purpose: to wreak vengeance on the son's slayers. The beginning of the inscription reads: *aft uamuth stonta runaR thaR in uarin fathi fathiR aft jaikion sunu,* "In memory of Vämod stand these runes. And Varin, the father, made them in memory of his son, overtaken by death."

The Swedish-Norwegian runes take an original form in Sweden. From the start they are characterized by a great reduction in the length of the cross strokes. In order to reduce as much as possible the length of the stroke whether written or incised, the vertical strokes were done away with as far as possible.

Thus came into existence the Halsinge runes (fig. 18), named after the region of Halsingland in which they have been found inscribed on a number of runic stones dating from the 11th century. They were known and used, however, in the central region of Sweden adjoining Lake Mälar, where likely they were invented. The Halsinge runes are a kind of runic shorthand and they give a clear indication that runes were widely used not merely on monuments but for all kinds of announcements: legal provisions, contracts, genealogies and poems. The abbreviated form of the Halsinge runes is clearly due to the need of saving time, trouble and material.

In Norway there appeared in the 11th century a peculiar mixture of Swedish-Xorwegian and Danish runes, which later led to an extension of the 16-letter alphabet to one better adapted to the northern sound system—the pointed runes. The Danes probably got the idea from England at the close of the 10th century. The Anglo-Saxon rune for y was a *u* inside which an *i* was written. This rune was used in Denmark beiore the year A.D. 1000. and after this model there was constructed out of the *i* a special letter for *e* and out of the *k* a special letter for g. These new letters are used generally in the Danish runes during the 11th century, although not consistently. When the Danish and Swedish-Norwegian alphabet came to be blended during the 11th century in Norway, it nould seem that toward the close of the century means were found to employ the wealth of letters thus aroduced to form a systematic representation of all the sounds in the language. The Latin alphabet, nhich had come into use with the introduction of Christianity, must have been of service in the construction of this radical improvement of the runes as symbols for sounds. Thus came into existence the completed pointed runic alphabet (fig. 19).



BY COURTESY OF KUNGL. VITTERHETS HISTORIE OCH ANTIKVITETS AKADEMIEN, STOCKHOLM

FIG. 17.—RÖK STONE (FRONT)

Only in Gothland was the completed runic stave used to any great extent for inscriptions on moruments. But here and there in other parts of Scandinavia are to be found single monuments with inscriptions on them in the pointed runes. In Gothland there are about 250 standing stones adjacent to the churches and also out in the country parts, and the custom of raising such monuments persisted until much later. Gothland, moreover, had to begin with its own pointed runic alphabet built up on the basis of the Danish runes alone. This was displaced later by the pointed runic alphabet in general use in Scandinavia.

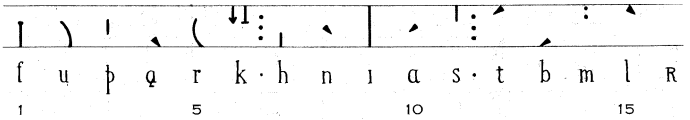


FIG. 18.—HÄLSINGE RUNES

The pointed runes were generally known and used in the whole of the Scandinavian North throughout the middle ages as the writing of cultured laymen. They were mainly used for private

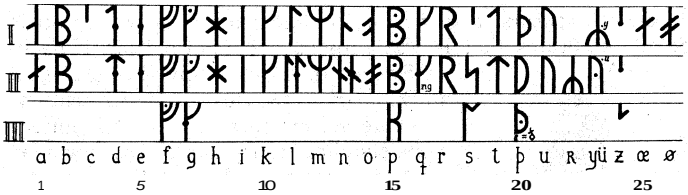


FIG. 19.— COMPLETEDPOINTED RUNIC ALPHABET

records. A Danish legal manuscript, *Codex runicus,* written in runes. dates from the end of the 13th century. There is extant, too, a prayer book of later date. which is evidently intended also for a layman not familiar with Latin. St. Bridget, who was a member of a Swedish family of nobles, spells Swedish. when she comes to acquire the use of the Latin alphabet, in the way in nhich she learned as a child nith runic letters.

There is evidence of the use of runes in Gothland as late as the 17th century.

Runes were kept up longer than elsewhere in outlying Swedish regions like Dalarna and Harjedalen where they were used for

making occasional notes down to modern times.

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RUNEBERG, JOHAN LUDVIG (1804–1877), the greatest Finnish poet, whose works expressed the patriotic spirit of his countrymen and also, because they were written in Swedish, exercised great influence on Swedish literature. The son of a sea captain, he was born at Jakobstad (Pietarsaari), on the Gulf of Bothnia, on Feb. 5, 1804, when Finland was still under Swedish rule. He studied at Åbo (Turku) university, graduating in 1827, but his academic career was interrupted by the need to earn a living, and he became a private tutor on an estate in Saarijarvi. At the university he had been inspired by romantic nationalism; in the heart of the Finnish countryside he learned to know and love Finland's landscape and people and heard at firsthand some of the stories of the heroic past which were to be the themes of his best work. He returned to the university, which had moved to Helsinki, in 1830 and became clerk to the council and (1831) lecturer in Latin language and literature. In the same year he married Fredrika Tengstrom, niece of the archbishop of Finland, and received a gold medal from the Swedish academy for his verse romance of Finnish life, Grafven *i* Perho. In 1837 he moved to Borgå (Porvoo), where he was lecturer in classics until 1857 and rector of the college, 1847–50. He continued to live there until his death, on May 6, 1877. For the last 13 years of his life he was partly paralyzed and unable to write.

Runeberg's first book of poems appeared in 1830 and showed the direction of his gifts in their freshness, vigour and sympathy with the Finnish peasant. His two idylls. Elgskyttarne ("Elk Hunters," 1832) and Hanna (1836), won him a place in Swedish literature second only to Esaias Tegnér. In 1844 he published Kung *Fjalar* (Eng. trans., 1904), a noble cycle of unrhymed verse romances derived from old Scandinavian legends. His *Fänrik Ståls* Sagner (2 series. 1848 and 1860; Eng. trans., The Songs *of* Ensign Stal, 1925), patriotic poems describing the war of independence (1808) as experienced by an old soldier, made a tremendous impression. and the first. "Vårt land," became the Finnish national anthem. Other works include Nadeschda (1841), a popular epic based on Russian folklore; a classical tragedy in verse, *Kungarne på* Salamis (1863); and two later volumes of poems, which, u-ith the 1830 volume, made up the collected poems (1830–43).

Runeberg's work shows the influence of classical literature and of Goethe in its high-mindedness and purity of form. His originality consists in his power to combine this classicism with romantic feeling and the realism which distinguishes his understanding of peasant life and character.

Runeberg's Samlade Arbeten were published in eight volumes, with a study by C. G. Estlander (1899–1902). Publication of his Samlade *Skrifter*, with extensive commentary; began in 1933.

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RUNNIMEDE or (RUNNYMEDE), a meadow on the south bank of the river Thames, Eng., in the parish of Egham, Surrey. It is celebrated as the scene of the granting of Magna Carta by King John on June 19, 1215. A tradition that the scene was Magna Carta, or Charter, island. higher up the river, probably arose about 1834, when G. S. Harcourt erected on it a castellated cottage in which he placed a stone tablet bearing an inscription to the effect that the charter was sealed there.

Runnimede was presented to the nation by Lady Fairhaven in 1929.

RUNNING. The most primitive form of athletic exercise considered as a sport, running has been popular from the earliest times, and the simple footrace (dromos) run straight away from starting point to goal or once over the course of the stadium (a little over 200 yd.) formed an event in the Greek Olympic pentathlon (*q.v.*) or quintuple contest. There was also the race once over the course and return (diaulos) and the dolichos, a long race run many times (often as many as 12; *i.e.*, about $2\frac{3}{4}$ mi.) up and down the stadium. There was also the dromos *hopliton*, a short race for warriors wearing full armour and carrying sword and shield. Except in the warriors' race, the Greek runners were naked, save occasionally for a pair of light shoes. No records of the times returned have been handed down, but the contests must have been severe since the ancient Olympic chronicles preserve the memory of several men who fell dead at the end of the long course. According to Virgil (Aeneid, v, 286 et seq.) running was practised in circus exhibitions in ancient Italy.

The best runners in the middle ages were most often found among the couriers maintained by potentates and municipalities. The Persian couriers of the Turkish sultans often ran from Constantinople to Adrianople and back, a distance of about 220 mi., in two days and nights. In districts of India and Africa not traversed by railways runners were often employed to carry the mails.

In all parts of Great Britain track, road and cross-country running have been popular forms of recreation for many centuries. Practically all the modern sprint records are held by Americans, while many of those for the middle distances stand to the credit of European athletes.

Modern running is divided into three classes: sprinting, middle-distance and long-distance running.

Sprinting. — Sprinting consists of running over short distances with a full and continuous burst of speed, the chief distances being 100 yd., 220 yd. and 440 yd., and the corresponding metric distances. Distances up to and including 220 yd. are called dashes in the United States. The course for sprint races, when run in the open air, is marked off in lanes for the individual runners. In the modern style of sprinting the result often depends upon the start.

The old method of dropping a handkerchief was the worst way to give the starting signal since the muscles react slowly to the impression of sight, less so to those of touch and most quickly to those of sound, a difference of $\frac{1}{25}$ sec. in reaction amounting to more than 1 ft. in a run of 100 yd. All modern foot races therefore are started by the report of a pistol. Until 1887 all classes of foot runners began their races from a standing position. In that year Charles H. Sherrill, Jr., of Yale university, demonstrated an entirely new method known as the crouch, this method of starting became universal in a short time.

Experiments made with an electrical timing apparatus of his own invention by A. V. Hill of the University of London brought to light many interesting points in connection with the physiological processes involved in severe muscular exercise in man. Hill's experiments indicated that from 90% to 95% of the effort made by a sprinter traveling at top speed is expended in overcoming the frictional resistance of his own muscles. The force exerted by the first-class sprinter at maximum speed is equal to from 80% to 90% of his body weight; in running 100 yd. he does sufficient uork to lift himself from 240 ft. to 270 ft. into the air. He will bring into play approximately 8 h.p. and attain his maximum speed at 60 or 70 yd. from the start, when he may be traveling as fast as 24 m.p.h. Approximately 1 sec. is lost in the starting process. After the 70-pd. mark is reached the runner begins to lose speed through fatigue occasioned by the rapid appearance of lactic acid in the muscles, as much as $\frac{1}{8}$ oz. of such acid being secreted in the muscle substance every second. In the course of a 200-pd. race the speed drops as much as 15% between 70 yd. and 190 yd.

Athletes of the United States and the British Commonwealth have thoroughly dominated sprint events since the inception of

the modern Olympic games in 1896. The 100-yd. and 220-yd. distances (and their metric equivalents, 100 m. and 200 m.) have been the special province of U.S. athletes, among them Bernie Wefers, Archie Hahn, Charlie Paddock, Frank Wykoff, Eddie Tolan, Jesse Owens, Mel Patton, Barney Ewell, Andy Stanfield, Bobby Morrow and Dave Sime. Though his records were later broken, Owens is still regarded as the finest sprinter of all time. His career was climaxed in 1936 when he won the 100 m. and 200 m. at the Olympic games in Berlin. At one time Owens held alone or shared the world's records for all sprint distances recognized by the International Amateur Athletic federation. Owens' times of 9.4 sec. for 100 yd., 10.2 sec. for 100 m.. 20.3 sec. for 220 yd. and 200 m. compare favourably with the latest record list.

All important international races at 400 m. and 440 yd. are run on an elliptical track, each runner being provided with his own lane, to which he must keep throughout the race. The starts are staggered so that each runner will traverse the full distance. As a result. the competitors have no exact knowledge of their respective positions until they have completed the final turn and are within 50 yd. of the finish line. Great emphasis is therefore placed on an athlete's ability to judge his speed as well as upon his speed and endurance.

First of the modern 400-m. stars was Eric Liddell of Great Britain, who lowered the world's record to 47.6 sec. at the 1924 Olympic games. William Carr (1932 Olympic champion). Archie Williams (1936 Olympic champion) and Grover Klemmer of the U.S. took turns lowering the mark until Klemmer ran 46 sec. in 1941. Ben Eastman of the U.S. held the 440-yd. mark at 46.4 sec. until 1946, when the great trio from Jamaica, Herb McKenley, Arthur Wint and V. G. Rhoden, began their assault on the records. McKenley moved the 440-yd. mark to 46 sec. in 1948 and it remained there until Jim Lea of the U.S. ran 45.8 sec. in 1956. Rhoden (1952 Olympic champion) did 45.8 sec. for 400 m. in 1950; this was the record until Lou Jones of the U.S. ran 45.4 sec. in 1955 and then 45 2 sec. in 1956. Glenn Davis of the U S. lowered the 440-yd. record to 45.7 sec. in 1958.

Middle-Distance Running. — This comprises distances ranging from 600 yd. through 2,000 m., with the most popular races being at 880 yd. (or 800 m.) and 1 mi. (or 1,500 m.). The mile is the classic distance for all British and U.S. runners, and for years interest centred in the attempts of man to run the distance under four minutes. This feat was finally achieved on May 6, 1954, by an English medical student, Roger Bannister, who did 3 min. 59.4 sec. in a duel meet at Oxford university. A month later. John Landy of Australia reduced the record to 3 min 58 0 sec. In 1958 another Australian, Herb Elliott, ran 3 min. 54.5 sec. at Dublin, Ire.

In both the 880-yd. and mile distances, strategy and tactics play a far more important role than they do in the sprints. Countless theories have been advanced as to the proper way to run each race, but runners usually fall into one of two classes: pace-setters. who try to finish all opposition with an early rush, and kick-runners, who prefer to follow the leader and use their greater finishing speed to win in the stretch. All other things being equal, the latter runner usually prevails, as in the classic race between Landy and Bannister for the British Empire crown in Aug. 1954. Landy set the pace for the first three laps and more, but Bannister won in 3 min. 58.8 sec.

U.S. and British runners won all the Olympic 800-m. (880 yd.) titles from 1896 through 1956, some of the great stars being Douglas Lowe, Thomas Hampson and Sydney Wooderson of England and John Woodruff, Mal Whitfield, Arnold Sowell and Thomas Courtney of the C.S. After 1939, however, the world's record was held by European continentals, Rudolf Harbig of Germany running 1 min. 46.6 sec. in 1939 and Roger Moens of Belgium clocking 1 min. 45.7 sec. in 1955. The 880-yd. record in 1960 was 1 min. 46.8 sec., set by Courtney in 1957.

The Mile.—Of all track-and-field events, the mile and 1,500 m. have been the most international, with Olympic champions and world's record holders coming from Great Britain, the Gnited States, France, Italy, New Zealand, Finland, Sweden, Australia, Ireland and even Luxembourg.

The most memorable names in mile history have been those of Walter George, Paavo Nurmi. Glenn Cunningham, Jack Lovelock. Gunder Haegg, Sydney Wooderson and, of course, Bannister, Landy and Elliott, Ken Wood, Derek Ibbotson and Jim Bailey. (See Table I.)

George was an English professional star of the late 19th century who set a time pattern for miles that is still employed. This consists of a fast first quarter-miie, when the runner is still fresh; a slower second quarter; a still slower third quarter; and then as fast a final quarter as possible. In 1886 George ran the mile in 4 min. 12.75 sec., and no amateur broke that mark until Norman Taber of the U.S. shaded it with 4 min. 12.6 sec. in 1915.

TABLE I.—*Comparative Records of Great Mile Runners*

Quarter	George (Eng.) 1886	Haegg (Swed.) 1945	Bannister (Eng.) May 1954	Landy* (Austr.) June 1951	Bannister Aug. 1954
	(sec.)	(sec.)	(sec.)	(sec.)	(sec.)
1st 440	58.5	56.6	57.5	58.5†	58.8
2nd 440	63.25	61.9	60.7	60.2†	60.6
3rd 440	66.0	61.2	62.3	58.5†	59.3
4th 440	65.0	61.7	58.9	60.7†	60.1
Mile	4:12.75	4:01.4	3:59.4	3:58.0‡	3:58.8

* Land~face mas on a 400-m. track, therefore intermediate times are only approximated. †Approximate time. ‡Actual time, 3:57.9.

It was Nurmi with his theory of evenly paced quarters who brought the mark down to 4 min. 10.4 sec. in 1923, and another eight years passed before Jules Ladoumègue of France broke the 4 min. 10 sec. barrier with a time of 4 min. 9.2 sec. Around this time, Cunningham began his long career in the U.S., while Lovelock came out of New Zealand to break Ladoumègue's record with 4 min. 7.6 sec. in 1933. There ensued a series of thrilling duels between Cunningham and Lovelock, climaxed by the latter's 3 min. 47.8 sec. victory in the 1,500-m. race at the 1936 Olympic games. Meanwhile, Cunningham had reclaimed the mile record with his 4 min. 6.8 sec. race in 1934 and he later ran 4 min. 4.4 sec. in a specially paced indoor race. Wooderson then did 4 min. 6.4 sec. in 1937, and this time held up until the advent of Haegg.

With Sweden neutral during World War II, Haegg had an opportunity denied his contemporaries from other nations. The most picturesque miler of them all, with his fluid running style, Haegg ran the mile record down to 4 min. 1.4 sec. by 1945 in stiff competition with his countryman Arne Andersson. Both were disqualified from amateur racing while still in their prime and immediately retired.

Haegg's record remained in the books until Bannister's immortal race, but once the English star smashed the 4-min. barrier, such times became almost commonplace. Within two years after Bannister's race, the following also dipped under 4 min. for the mile: Chris Chathaway, Ibbotson and Brian Hewson of England; Laszlo Tábori and István Rózsavölheyi of Hungary; Gunnar Nielsen of Denmark; Landy, Bailey and Merv Lincoln of Australia; and Ron Delany of Ireland. Rózsavölheyi set the 1,500-m. mark at 3 min. 40.6 sec. in 1956, but it was Delany who triumphed at that distance in the 1956 Olympics, setting a meet record of 3 min. 41.2 sec. Elliott lowered the 1,500-m. record to 3 min. 36.0 sec. in 1958.

Long-Distance Running. — This includes all flat races from 3,000 m. upward. as well as steeplechasing, road and cross-country running. Among the great distance runners have been Alfred Shrubb of England, Hannes Kolehmainen and Nurmi of Finland, Haegg of Sweden and Emil Zatopek of Czechoslovakia, but by 1957, most of their records had been broken by a new crop of stars headed by Sandor Iharos and Tábori of Hungary, Gordon Pirie of England and Vladimir Kuts of the U.S.S.R. Before World War II, a premium was placed on simple endurance, an economical running style and the ability to judge pace. Nurmi, who ran with effortless ease and a stopwatch on his wrist, exemplified this style and, in his prime, held all the world's records from 1,500 m, to the one for distance covered in one hour (11 mi. 1,648 yd.)

Kolehmainen and Nurmi initiated the Finnish domination of distance running which lasted from 1912 through 1946, or until Zatopek appeared on the scene. The rule of the "Flying Finns"

ended dramatically in the 1948 Olympic games when Zatopek won the 10,000-m. race in record time. The Czech army officer also placed second in the 5.000 m. with a running style that was the complete antithesis of Nurmi's—a driving, tortuous churning of legs and body, an alternation of fast sprints with steady running and an apparently complete unconcern with pace. Zatopek's success at London was mild compared to his grand slam at Helsinki four years later when he won the 5,000 m., 10,000 m. and the marathon, all in record time.

The years between the 1952 and 1956 Olympics saw one distance record after another fall to Iharos, Táborí, Pirie and Kuts and, at Melbourne, it was Kuts, a Russian naval officer who fell heir to Zatopek's crown when he won the 5,000 m. and 10,000 m. These are the banner events of distance running, though in England and the United States they are usually translated into the 3 mi. and 6 mi., respectively.

Another popular event is the marathon (26 mi. 385 yd.), which, uniike the other two, is run for the most part on the open road. Most races of 10 mi. and over are run on the road and here endurance is the prime requisite.

Steeplechasing.—Originally only a cross-country run over a course plentifully provided with natural obstacles, the modern steeplechase takes place partly on the grass and mainly on the cinder track of the athletic field. A water jump must be included, in addition to which there are four flights of hurdles 3 ft. in height. The championship distance in England is 2 mi.; in the U.S. and at the Olympic games 3,000 m. The U.S. won Olympic steeplechases in 1900 and 1904 at 2.500 m., Great Britain taking two other races at 3,200 m. and 4,000 m.; the distance was stabilized at 3,000 m. in 1920.

Cross-Country Running.—This had its inception with the founding of the Crick run at Rugby school in 1837, followed by many other famous schools that also held annual cross-country races. About 30 years later the Thames Hare and Hounds held cross-country runs and races as a winter sport, and in a few years many other clubs were formed throughout England. Many amateur athletes use this winter sport, often formerly termed paperchasing, as a means of keeping fit and developing stamina for track athletics. English championships over the senior distance of 10 mi. were first held in 1876. The famous Midlands club, Birchfield Harriers. won many of these events thereafter. The number of runners in this event increased from 33 in the first race to 450 by mid-20th century.

In England races are limited for juniors (18 to under 21 years) to 6 mi. and for youths (over 16 to under 18) to 3 mi. The first international race was held in 1898 between England and France and an international championship was instituted in 1903 between England, Ireland. Scotland and Wales. In 1907 France first competed, followed by Belgium in 1923, while Italy, Luxembourg, Spain and Switzerland also competed in 1929.

The sport is also popular in the U.S. The championship distance in that country is 10,000 m.; intercollegiate titles are decided at distances of 4 mi. and 5 mi. Formerly included on the Olympic program, cross-country mas dropped after the 1924 games as not suitable for summer competition.

Relay Racing.—This form of competition has long been practised in the U.S. and has become popular throughout the world. Relay races are usually run by four men, each going a quarter of the distance. From 1911 to 1926 only one relay race was included in the English championships. This was really a medley race in which four men ran 880, 220, 220 and 440 yd., respectively. In the U.S. this race is known as the sprint medley relay and is included in most relay carnivals. England abandoned the event in 1927 and substituted two other relay races, a 440 yd. (4 × 110) and a mile (4 × 440).

The U.S. national championship relays, conducted by the Amateur Athletic union, are at distances of 440 yd. (4 X 110), mile (4 × 440), and $1\frac{7}{8}$ mi. (440, 220. 880, mi.). U.S. indoor championships are held at distances of 1 mi. (4 × 440) and 2 mi. (4 × 880).

This method of racing was started in the United States about 1890, on the model of the Massachusetts firemen's "bean-pot" race. The old method was for the men running the second quarter of the course each to take over a small flag from the first man as he arrived, before departing on their own stage of the race, at the end of which they, in their turn, handed on their flags to the awaiting next runners. The flags, however, were considered cumbersome, and for a time it was sufficient for the outgoing runner to touch or be touched by his predecessor. Nowadays a hollow cylinder of wood, constituting a baton, is carried and must be exchanged between lines drawn at right angles to the side of the track 10 yd. or 10 m. on each side of the starting line for each leg of the relay.

The growth of relay racing stems from the University of Pennsylvania, where in 1893, a relay race was included on a track program for the first time. Pennsylvania raced a team from Princeton university that year and again in 1894.

In 1895 a number of eastern U.S. colleges were invited to compete in a first annual Pennsylvania Relay carnival. By the early 1960s, more than 3,000 athletes participated annually in this two-day event.

For Olympic records in running, see OLYMPIC GAMES. See also TRACK AND FIELD SPORTS.

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(F. A. M. W.; SY. S.; E. J. G.)

RUNNING WATER. Water flowing down slopes contributes more than any other external agent to the sculpture of the surface forms of the land. As it flows from higher to lower levels, the potential energy it possesses because of its height above sea level is changed into energy of motion. Most of its work is done in the channels of streams and consists principally of the transportation of weathered rock material toward the sea or toward the enclosed depressions into which the local streams of arid regions flow. Part of this rock waste is transported in solution. Although it often constitutes an appreciable fraction of the load carried by a stream, dissolved matter is mechanically a part of the water and affects its physical behaviour only by making it slightly denser and more viscous. The far larger part of the loads of streams consists of undissolved fragments, to which the water transfers a part of its momentum.

RUODLIEB, a romance in Latin verse by an unknown German poet who flourished about 1030; he was almost certainly a monk of the Bavarian abbey of Tegernsee. The poem is one of the earliest German romances of knightly adventure. and its picture of feudal manners gives it value as a historical document.

RUPEE (Hindustani *rupiya*, from Sanskrit *rupya*), the standard monetary unit of India. Pakistan, Ceylon and, up to 1952. of Burma, each country's rupee being distinct from that of the others and each being referred to by its own country's name; *e.g.*, Indian rupee. Pakistani rupee.

The Indian Rupee.—A silver coin of 175 gr. troy, called tanka, approximating the rupee, was struck by the Muslim rulers of Delhi in the 13th century. but the rupee itself, of 179 gr.. was introduced by Sher Shah in 1542. The English followed various indigenous standards. until in 1835 the silver rupee of 180 gr. (11/12 fine) was made the standard coin throughout British India. Down to 1873 the gold value of the rupee was 2s. (*i.e.*, Rs. 10 = £1); but. after 1873, because of the depreciation of silver. the exchange rate of the rupee in terms of gold currencies fell and at one time sank as low as 1*s*. Realizing the unsuitability of the silver standard, the government brought it to an end in 1893 by closing the mints for the free coinage of silver.

At the turn of the century. the government decided to introduce a gold standard with gold currency under which. nevertheless. the rupee was to continue as the standard monetary unit and would be unlimited legal tender at the rate of Rs. 15 to an English sovereign. But a different currency system, viz.. the gold exchange standard. came to be adopted. While the internal currency consisted predominantly of silver rupees and currency notes (convertible into rupee coins), for external transactions the rupee was linked to gold currencies through a fixed rate of exchange with sterling. The mechanism of this system consisted in the sale by the govern-

ment of rupee drafts (called council bills) in London and of sterling drafts (reverse council bills) in India at rates within the range of 1*s*. $4\frac{1}{8}$*d*. to 1s. $3\frac{29}{32}$d. This system worked well till conditions created mainly by World War I led to its breakdown in 1917. Owing to a rise in the price of silver the rupee ceased to be a token coin in that year; the fixed rate of exchange had therefore to be abandoned, and the rate of exchange for the rupee moved according to the price of silver.

In 1920 an attempt was made to restore the gold exchange standard, this time at a higher rate (R. 1 = as. gold): but it had to be given up after a few months. There followed then a period of "free" or "floating" exchanges. In 1925–26. the whole monetary system was examined by a royal commission (the Hilton-Young commission) which made three main recommendations: (1) the establishment of a gold bullion standard in place of the prewar gold exchange standard; (2) the setting up of a reserve bank for the unified control of currency and credit; and (3) the stabilization of the ratio of exchange at 1*s*. 6d. The government accepted these recommendations and initiated the necessary legislation. The bill relating to the setting up of the reserve bank had, however, to be dropped because of strong opposition to certain provisions. The Currency bill. which sought to fix the ratio of exchange at 1s. 6*d*., was the subject of bitter controversy, academic and business opinion in the country favouring the prewar rate of 1*s*. 4*d*. It finally passed the legislature (as act iv of 1927) and took effect from April 1, 192;. Subsequently, in Sept. 1931, when Great Britain left the gold standard and the government of India decided to continue the link with sterling, the rupee came on the sterling exchange standard.

In 1935, the reserve bank of India was established; it took over from the government the functions of issuing currency and maintaining the exchange rate; for note-issue, instead of the existing rigid fiduciary system, the elastic proportional reserve system was adopted: not less than 40% of the total note-issue must be covered by gold or sterling securities, and the balance issued against rupee coin, government of India rupee securities, eligible bills of exchange, etc.

Among the developments which occurred in Indian currency and exchange during World War II, two were of great importance. First. a comprehensive exchange control! parallel to that adopted by the U.K. and other members of the sterling area, was imposed on the outbreak of war. Secondly, while, because of exchange control and large export surpluses, the rate of exchange ceased to be a problem, there arose another, that of inflation. Under the sterling exchange standard, sterling tendered to the reserve bank was automatically exchangeable into rupees at the fixed rate of 1*s*. 6d. So, in exchange for sterling paid and accumulated in the form of sterling balances in London, rupee finance was made available for the huge war expenditure incurred. This led to a large increase in currency circulation and to serious inflation.

After World War II India's membership in the International Monetary fund brought about a fundamental change in its monetary standard. The par value of the rupee was expressed in terms of gold so that its external value became independent of sterling. Accordingly, in April 1947, the Reserve Bank act was amended so that now the bank was required to buy and sell foreign exchange (not sterling only as previously) at rates to be determined by the central government, with due regard to India's obligations to the I.M.F. This standard may be called the I.M.F. or gold parity standard. In 1948 the provisions regarding currency reserves were also modified by substituting "foreign securities" for "sterling securities" for the purpose of the 40% reserve ratio. However, in actual practice, as a member of the sterling area, India keeps a very large part of its foreign exchange reserves in sterling assets.

In Sept. 1949, uhen sterling was devalued, India decided to devalue the rupee to the same extent so that the value of the rupee in terms of sterling remained unchanged at 1s. 6*d*., the par value being 2.88 gr. of fine gold (or 21 U.S. cents).

Silver rupees mere withdrawn during World War II, one-rupee notes and nickel rupees taking their place. There are 16 annas to a rupee. 4 pice or *paisas* to an anna. and 3 pies to a *paisa*. It was decided to decimalize the coinage in 1957 with a rupee divided into 100 *naya paisas*. Large sums of money are expressed in lakhs (Rs. 100,000) and crores (Rs. 100 lakhs).

The **Pakistani** Rupee.—The state bank of Pakistan has the sole right of note-issue; a proportional reserve system similar to that in India is in force. The monetary standard is also similar. Up to Sept. 1949 the Pakistani rupee was equal to the Indian rupee. but when, in that month, sterling was devalued the Pakistani rupee was the only sterling area currency which was not devalued with it so that Pak. R. 1 became equal to about 2*s*. ad. (sterling), and Pak. Rs. 100 became equal to Ind. Rs. 144. However, on Aug. 1, 1955, it was devalued to the same level as sterling and once again Pak. R. 1 became equal to Ind. R. 1 and to 1s. 6d. sterling. Subdivisions of the Pakistani rupee are annas, pice and pies.

The Ceylon Rupee.—From 1869 to 1941 the Indian rupee was Ceylon's monetary unit. In 1941, by a currency ordinance. Ceylon adopted the rupee exchange standard which was operated by the board of commissioners of currency. The rate of exchange was fixed at Ceylon R. 1 = Ind. R. 1. Currency was issued by the board on a 100%-reserve basis. In Sept. 1949, after the devaluation of the Indian rupee (and by that fact of the Ceylon rupee), the Ceylon rupee was given a value independent of the Indian rupee. However, the par value chosen was the same as that of the Indian rupee (Ceylon R. 1 = 2.88 grains of fine gold). In 1950 the central bank of Ceylon was established. It was granted the monopoly of note-issue. No minimum reserve ratio was laid down, the amount of notes issued being left to the discretion of the bank. The only condition laid down in this connection was that the reserves should be "adequate to meet any foreseeable deficit in the balance of payments." In regard to the par value of the rupee, the bank was empowered to make recommendations to the minister of finance for any change that it considered necessary; the actual change, however, was to be made by an act of the Ceylon parliament, having due regard to Ceylon's obligations to the I.M.F. The Ceylon rupee is divided into 100 cents.

See Report of Royal *Commission* on Indian Currency and Finaace, Vol. I report, Vols. II–VI appendices, evidence, etc. (H.M.S.O., London, 1926). (J. D. V.)

RUPERT (HRODBERT), **ST.,** according to the Gesta Sancti *Hrodberti,* which dates from the 9th century, a kinsman of the Merovingian house, and bishop of Worms under Childebert III (695–711). At the invitation of the duke of Bavaria. Theodo II, Rupert went to Regensburg (Ratisbon). where he began his apostolate. He founded the church of St. Peter near the Wallersee, and subsequently, at Salzburg, the church of St. Peter, together with a monastery and a dwelling for the clerks, as well as a convent for women. He died at Salzburg. He is regarded as the apostle of the Bavarians.

RUPERT (1352–1410), German king, and, as Rupert III, elector palatine of the Rhine, was a son of the elector Rupert II and Beatrice, daughter of Peter II, king of Sicily. He was born at Amberg on May 5, 1352, and succeeded to the government of the Palatinate on his father's death in 1398. On Aug. 21, 1400, having helped depose King Wenceslaus at Oberlahnstein, Rupert was elected German king at Rense, and crowned at Cologne on Jan. 6, 1401. An expedition to Italy against Gian Galleazzo Visconti, duke of Milan (1401–2), proved a failure, but he was recognized by Pope Boniface IX in Oct. 1403. After some years of struggle with the anarchy in Germany and the partisans of Wenceslaus. Rupert died at Landskron near Oppenheim on May 18, 1410. He mas buried at Heidelberg. He married Elizabeth, daughter of Frederick IV of Hohenzollern, burgrave of Nuremberg, and left three sons and four daughters. Rupert, who earned the surname of *clemens,* was brave and generous, but his resources were totally inadequate to bear the strain of the German kingship.

RUPERT, PRINCE, COUNT PALATINE OF THE RHINE AND DUKE OF BAVARIA (1619–1682), third son of the elector palatine and "winter king" of Bohemia, Frederick V, and of Elizabeth, daughter of James I of England. was born at Prague late in 1619. A year later his father was defeated at the battle of the White

Mountain, near Prague, and driven from Bohemia. After many wanderings the family took refuge in the Netherlands, where Rupert's boyhood was spent. In 1633 the boy was present at the siege of Rheinberg in the suite of the Prince of Orange, and in 1635 he served in this prince's bodyguard In 1636, during his first visit to England, he was made an M.A. of Oxford and his name was entered as a member of St. John's college. He was also named as the governor of a proposed English colony in Madagascar But this scheme did not mature and Charles I sent his nephew back to the Netherlands, having, however, formed a high opinion of his energy, talent and resolution. In 1637 he was again serving in the wars, and in 1638, after displaying conspicuous bravery, he was taken prisoner by the imperialists at the action of Vlotho (Oct. 17) and held in a not very strict captivity for three years. In 1641 he was released, and rejoined his mother in the Netherlands. Early in 1642 he again visited England but returned immediately as escort to his aunt, Queen Henrietta Maria

Rupert returned to England in July of the same year when the Civil War began. Charles at once made him general of the horse and independent of Lord Lindsey, the nominal commander of the whole army. From this point until the close of the first Civil War in 1646 Prince Rupert was one of the dominant figures of the war. His battles and campaigns are described in the article CIVIL WAR. ENGLISH. He was distinctively a cavalry leader; it was not until the battle of Marston Moor in 1644 that the Royalist cavalry was beaten. The prince's strategy mas bold as well as skilful, as was shown both in the Royalist movements of 1644 which he proposed and in the two far-ranging expeditions which he carried out for the relief of Nenark and of York. In Nov. 1644, in spite of the defeat at Marston Moor, he was appointed general of the king's army But this appointment, though nelcome to the army. was obnoxious to the king's counsellors, who resented the prince's independence of their control to some of the nobility over whose titles to consideration he had ridden roughshod, and to some of the officers whose indiscipline and rapacity were likely to be repressed nith a heavy hand. These dissensions culminated, after the defeat at Naseby and the prince's surrender of Bristol to Lord Fairfax (Sept. 1645), in a complete break with Charles, who dismissed him from all his offices and bade Rupert and his younger brother Maurice seek their fortunes beyond the seas.

Rupert's character had been tempered by these years of responsible command. The parliamentary party accused him not merely of ingratitude for the kindnesses nhich his family had received from English people in the days of the Palatinate War, but also of barbarity in his conduct of the Royalist armies in England. He had, of course, been brought up in the rough school of continental warfare. Moreover, he often had to use force to secure pay and supplies for his troops. But it is clear that he did his best to restrain their licence; and he did on occasion display notable generosity to his enemies. When, after Marston Moor. he became convinced that the king's cause was in a military sense lost, he also became an advocate of peace. In consequence he came to be suspected by Charles's more optimistic advisers such as Lord Digby, while to Charles himself the news of Rupert's capitulation at Bristol came as a thunderbolt. Rupert demanded a court-martial. The verdict of this court smoothed matters for a time, but Rupert was too far estranged from the prevailing party at court to be of any assistance, and after further misfortunes and quarrels they separated. Charles to take refuge in the camp of the Scots. Rupert to stay nithout command in the Oxford garrison. He received at the capitulation a pass from the parliament to leave England. as did also his comrade Maurice.

For some time after this Rupert commanded the troops formed of English exiles in the French army and received a wound at the siege of La Basse in 1647. Charles in misfortune had understood something of his nephew's devotion and wrote to him in the friendliest terms, and though the prince had by no means forgiven Digby, Lord Colepeper and others of the council, he obtained command of a Royalist fleet. The king's enemies were now no longer the Presbyterians and the majority of the English people, but the stern Independent community. with whose aims and aspirations Rupert could not have any sympathy nhatever. A long and unprofitable naval campaign followed, in which Rupert's small fleet was chased by Robert Blake from Kinsale to Lisbon, Cartagena and Toulon. Driven from the Mediterranean, Rupert cruised to the Azores and to the West Indies (1651–52), returning to France in 1653 with a single ship and a few prizes. After this the prince, having again quarrelled with the council, spent six years (1654–60) in Germany. At the Restoration he settled in England again, receiving from Charles II an annuity and becoming a member of the privy council. He never again fought on land but. turning admiral, he played a prominent part in the Dutch Wars. He also took an interest in trading enterprises and was a member of the Royal African company (1663) and of the Hudson's Bay company (1670). He died at his house in Spring Gardens, Westminster, on Nov. 29, 1682.

Prince Rupert is a distinguished figure in the history of art as one of the earliest mezzotinters. One of the most beautiful and valuable of early mezzotints is his "Head of St. John the Baptist." He was also interested in science, experimented with the manufacture of gunpowder, the boring of guns and the casting of shot and invented a modified brass called Prince's metal. Prince Rupert was created duke of Cumberland and earl of Holderness in the English peerage in 1644.

See E Warburton, *Memoirs of Prince Rupert and the Cavaliers including their private correspondence, 3* vol. (London, 1849) ; E. Scott, *Rupert, Prince Palatine* (London, New York, 1899) ; J. Cleugh, *Prince Rupert* (London, 1934). (R. B. WM.; X.)

RUPERT (RUPPRECHT MARIA LUITPOLDT FERDINAND VON WITTELSBACH) (1869–1955), German prince, the eldest son of King Louis III of Bavaria, was born on May 18. 1869. at Munich. In 1906, after extensive travels, he was appointed to the command of the 1st Bavarian army corps. At the outbreak of World War I he was commander of the Bavarian troops (the 6th German army) and later was placed in command on the German front in Artois and southern Flanders. As field marshal he was entrusted with the chief command of the northern group of armies on the western front. In 1900 he married Marie Gabrielle, a sister of the queen of the Belgians, who died in 1912; and in 1921 he married Princess Antoinette of Luxembourg and Nassau. He renounced his rights to the Bavarian crown (although he was later involved in plots to restore the monarchy), on Nov. 8, 1918, and was allowed to reside in his castle near Starnberg, Bavaria, where he died on Aug. 2. 1955. Through his mother, the archduchess Marie-Thérèse of Austria-Este. Prince Rupert was the descendant of the Stuart kings of England and, according to legitimist ideas. in the succession to the British crown.

RUPERT'S LAND, a former district of Canada. The generous charter of Charles II, given in 1670 to the Hudson's Bay company (*q.v.*), was interpreted to include all the country which was drained into Hudson bay. As Prince Rupert was first governor of the Hudson's Bay company his name was given to the concession under the name Rupert's Land. Athabasca. New Caledonia and British Columbia were not included in the grant. They mere held under the title of Indian territories by the Hudson's Bay company by licence terminable every 21 years, the last term closing with 1859. Rupert's Land nas transferred to Canada by the imperial government in 1870, and ceased to exist as a political name. It continued to be used as the title of the Anglican episcopal diocese, in the main coincident with the province of Manitoba; and as a provincial electoral district, the far northern section of the province.

RUPILIUS, PUBLIUS, Roman statesman, consul in 132 B.C. During the inquiry that folloned the death of Tiberius Gracchus, conducted by himself and his colleague Popillius Laenas, he proceeded nith the utmost severity against the supporters of Gracchus. In the same year he was dispatched to Sicily, where he suppressed the revolt of the slaves under Eunus. During 131 he remained as proconsul of the island and, with the assistance of ten commissioners appointed by the senate, drew up regulations for the organization of Sicily as a province. These regulations were known by the fitle of *leges Rupiliae.* Rupilius was subsequently brought to trial (123 B.C.) and condemned for his treatment of the friends of Gracchus. He died soon after.

RURAL EDUCATION. Everywhere, as peoples of the

world seek a larger share in self-determination, education assumes an increasing significance as a means of their achieving stability and self-direction. While many countries of the world may be characterized as rural, social scientists have pointed to the relative decline of the importance of rural life as a major cultural change in the more highly industrialized nations. Advances in the development of mass media communications, rapid transport and migration of labour to jobs are some of the factors in industrialized societies making the distinction between what is urban and what is rural even less sharp. Generalizations about rural education are, therefore, increasingly difficult to make. In the matter of illiteracy (*q.v.*) alone, for example, rates vary from an estimated 1% to 2% in northern and western Europe to over 80% in areas of Africa and south central Asia.

NEWLY DEVELOPING

In many countries education as the key to freedom and independence is a rural problem, two-thirds of the world's population being engaged in agriculture or living in small towns or villages. The relationship between education and the level of living of a people is direct. Nations having an inadequate program of education are also those with the poorest economic conditions. What is going on in the field of education in many parts of the world must be seen against the backdrop of the basic problems of half the people in the world who are chronically hungry, poorly clothed and inadequately housed. Only slightly more than half the world's children are receiving any kind of education in schools. Improved literacy and use of local resources are high priority goals.

There is a growing emphasis upon functional education in most of the newly developing countries, which are basically rural. Educational opportunities are provided through a variety of types of school organization: for example, the *núcleos* in Bolivia, the community schools in the Philippine *barrios*, the tribal schools in Iran, the tent schools of nomadic tribes in Ethiopia and the Second Unit Rural schools of Puerto Rico. All of these programs have a genuine concern for developing basic skills and knowledge in a manner which respects the particular culture, initiating community improvement at a pace acceptable in the community.

Where educational institutions in rural situations have held to the emphasis on the school as a place for formal classes in academic subjects, other agencies have supplemented the work of the school through adult education and community improvement. An increasing number of schools, however, have accepted the responsibility for directing the curriculum toward the needs of all citizens. Education becomes a constant interaction between school and community, a co-operative program that utilizes the skills, the abilities and the efforts of the entire citizenry toward the improvement of community living. The traditional school program does not in itself equip the graduate to participate or take leadership in the community. Participation in community development requires not only the possession of basic skills and knowledge but also the acceptance of personal responsibility toward the community, skill in human relations and the ability to work co-operatively with other persons.

In Asia the traditional concept of education has led, in many places, to the educated person's developing a distaste for manual labour. Economic development has been hindered. Schools were modern, but farmers employed primitive methods of agriculture. In the Philippines the newer concept of the teacher's role now includes both teaching children and leading adults. At every level newer methods of teaching seek to develop skills, impart useful information, inculcate positive attitudes and provide a maximum of carry-over to life situations. Building sanitary latrines, keeping animals corraled, obtaining a pure water supply. growing fruits and vegetables—these represent opportunities to put education to work on people's fundamental problems.

Many agencies other than schools have worked at the task of rural education and have had their influence throughout the world. A few examples are: the Community Welfare centre in Kcora, Africa; the Himayatsagar Extension centre in Hyderabad, India; government workers sponsoring Fundamental Education projects in Ceylon; the Kear East foundation; Crefal centre of the United Nations Educational, Scientific and Cultural organization (UNESCO) in Mexico; and many others. Christian missions from Europe and North America, Buddhists in Asia and Moslems from Egypt have influenced rural education in many sectors of the world. Mass education movements led by James C. Yen in China and by Frank Laubach in the Philippines have helped to lift the sights of people, especially in literacy.

One of the most significant signs of educational progress throughout the world has been the development of rural-school community centres. In these the school leadership assists in teaching both adults and children. The emphasis is on the solution of economic and social problems to bring about improved agricultural practices. sanitation, health, literacy. homes and communities. Among the countries where such developments have made substantial gains are Puerto Rico, Egypt, Korea and the Philippines.

If the gap between where many nations find themselves and their concept of their rightful role is to be bridged in a comparatively short time, the education of adults must proceed apace with that of children. In rural cultures life has not become compartmentalized; therefore, the task of rural education becomes a total community concern. Experience of community educators in the tropics suggests certain guidelines. The most important and lasting results have been achieved by recognizing cultural factors, involving people in learning to help themselves, respecting the opinions of those affected and gaining community acceptance of educational purposes.

The culture of the nations of South America, the West Indies and Central America is derived from the American Indian, Spain, Portugal and France. In general, the educational system has provided tno branches—one for the elite and the other for those of lesser station. In Mexico, Uruguay and Brazil there has been considerable progress toward a single plan for all. The church has been the principal avenue through which the state expressed its interest in education, and church missions have been ardently active in rural regions, church education being public education. The modern period in education has been characterized as one of ferment and one nhich is creating new educational forms. Mexico, Venezuela. Argentina and Cuba are seeking the incorporation of the masses in the educational process, creating an educational profession to do this gigantic task.

The degree of centralization varies widely from country to country (see SCHOOL ADMINISTRATION). In Haiti, as in many other nations, the school system is centralized under the ministry of national education. The rural primary system covers a six-year period divided into three two-year courses. As in Europe the student enters the secondary school by passing a state administered written examination. The five major types of rural elementary schools are farm, rural, village, communal and presbyterial. Schools are often not accessible. Rural secondary schools are few indeed.

In Mexico, there were practically no rural schools before 1920. Within 30 years 80% of the public elementary schools were rural. Of these 70% were supported by the federal government, 24% by state and municipal governments and 8% were private or mixed private and government. All schools are required to adopt a common curriculum related to their particular needs so there is a great variety of programs designed to improve community life. There are still rural regions without elementary schools and many existing schools provide instruction only for two or three grades. The rural normal schools are federally supported. The *misión cultural* is a distinctively Mexican educational invention to promote community education in the fields of public health, agriculture. construction, trades and industry, music, recreation and rural mechanics.

INDUSTRIAL COUNTRIES

Countries that are characteristically industrial, such as the United States and Great Britain, still have rural areas in which schools are faced with special problems of organization, administration and finance. Instruction. in general, has tended to be more or less directly related to agricultural pursuits and domestic

arts, with relatively greater emphasis on terminal education and less on preparation for college.

In the United States there has been a growing movement, through school district reorganization, toward providing centrally located administrative, instructional and purchasing services for rural schools. The C.S. system of universal education has been highly decentralized through local administrative units. However, the number of districts was cut from 127.000 to about 50.000 over a period of 25 years beginning in 1933. Much of this change was the result of improved transportation. Rural schools in the United States generally have a smaller percentage of the school-age children enrolled; teachers have fewer years of college training; supplies, equipment, and buildings are inferior; and teachers are paid lower salaries than those in urban situations. Data from the United States office of education on 101 of the "most rural" counties in the 1950s, selected on the basis of population density and the number of people living on farms, emphasized the wide variety of practices characterizing rural education. For example, one county contained 89 local school districts; another county, only one district. Enrollments in the 101 counties varied from 94 to 7,671; enrollments per school averaged 85.1; and pupils per teacher, 24.7. In contrast to schools in the more sparsely settled areas there were many schools in rural settings which offered children educational opportunities equal to those in the best urban systems. Since 1914 the agricultural extension service has been a great resource for almost every kind of farm problem, channeling consultant help and educational materials into rural communities. The Four-H clubs (*q.v.*) have taught rural children improved approaches to homemaking, family living, farming and citizenship. Many nongovernment agencies, such as church missions and conferences on rural life, have upgraded the quality of rural living. Farmers have had organizations of their own, including the Farm bureau, Farmers union and the Grange —each placing considerable emphasis on educational goals.

Only about 20% of the children of England and Wales attend rural schools. The curricula of these schools give considerable attention to the life and processes of the countryside. The infant stage of the primary schools (ages 5 to 7) is basically the same everywhere. In the junior stage (ages 7 to 11) the field of environmental study is enlarged, application being made through survey measurements and practical exercises. At 11 years children are examined and allocated to secondary education in technical, grammar or modern schools. Rural areas offer secondary education with a vocational emphasis. The country grammar schools emphasize the usual academic subjects. The modern schools are often provided with school gardens and equipped with science and gardening laboratories. Cooking, woodwork, metalwork and agricultural club work take on projects closely related to community life. Children usually are served a midday meal. Those children under eight years living more than two miles from school are transported. The grammar schools are fewer in number than the modern schools and draw pupils from greater distances. (Education in 1952, H.M.S.O., London.)

Those nations with advanced educational programs reaching all segments of their society are taking increasing responsibility for providing technical aid and services to the newly developing nations, in order that the gulf between them be reduced rather than widened. From the world view education is still primarily a rural problem. See also ADULT EDUCATION; AGRICULTURAL EDUCATION AND RESEARCH: AUDIO-VISUAL EDUCATION.

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RURAL ELECTRIFICATION. In such technologically and economically advanced countries as the United States among the larger nations, and Sweden and Switzerland among the smaller ones, more than 90% of the farms may have a supply of electricity, while in comparatively undeveloped lands rural electrification may be virtually unknown. Generally, the degree of farm electrification in any country has depended on such factors as (1) available energy sources such as coal or falling water; (2) the general development of the country and particularly the status of its electric power industry; and (3) the relative importance of agriculture in the nation's economy.

Effect on Farming Methods.—Just as the steam engine revolutionized shipping and the gasoline engine highway transportation, electric power revolutionized manufacturing and has largely revolutionized agriculture. Electric power has been substituted for animal and human muscle power, greatly increasing output per man-hour and the efficiency of farm operations. At the same time it has offered advantages and conveniences previously available only in urban areas.

Uses in the *Household.*—Originally, the aim of the farmer in connecting to an electric supply line was the same as that of the city dweller—to secure electric lighting. Electricity was later used for water pumps, washing machines, electric irons, refrigerators, radios, etc. Many farmers installed electric ranges and electric water heaters, electrically controlled central heating and modern bathrooms. Home freezers rapidly came into use on U.S. farms after World War II. The cost of operating a home freezer was relatively low and it made possible the easy storage of meats, fruits and vegetables produced on the farm for use throughout the year. As television became available throughout the country, farmers quickly installed receiving sets. The popularity of home air conditioning also spread from the cities to the farms.

Dairying.—Electric lights proved particularly useful in dairy barns and milkhouses, where much of the work is done before and after daylight hours. Milking machines and milk-cooling equipment also came into wide use to reduce labour, increase production, improve the quality and promote sanitation of the milk. With the use of milking parlours and bulk milk-handling equipment, it became possible to transfer milk directly from the cow through sanitized pipes to electrically cooled, stainless steel storage tanks and then to a dairy tanker for shipment to market. During cold weather, milk production may be increased as much as 25% through the use of thermostatically controlled drinking fountains. In many dairy barns mechanical devices have been installed in the gutters behind the cows to carry the manure outside to a manure spreader or wagon.

Poultry.—Electricity is especially useful in poultry farming. Artificial illumination timed to lengthen the day to 13 or 14 hours during autumn and winter can increase egg production in these seasons as much as 20% to 30%. An automatic water supply is highly desirable and nearly always used by successful poultry farmers. In cold weather, warming the drinking water to prevent freezing is necessary for maximum egg production. Other electrical equipment used on poultry farms includes: electrically heated brooders to keep young chicks warm and dry; electrically operated fans to remove strong ammonia fumes and excessive moisture from the poultry house; automatic feeders; and motor-driven egg cleaners and graders.

General *Farming.*—Farmers have used electricity for more and more operations each year. Some of its major uses are for ventilation, crop drying, conditioning and storing, feed handling, mixing and grinding, automatic feeding and soil heating. (*See* also CROP DRYING AND PROCESSING.)

The heat lamp is extensively used by farmers as a pig brooder, especially in the colder climates where spring pigs are raised. It has been estimated that at least one additional pig per litter can be raised with the proper use of the heat lamp.

Automatic handling of materials with electrically powered equipment has become increasingly important in such operations as livestock feeding, milk production and poultry farm operations. Environmental control of farm buildings in poultry production and in dairy operations has provided increased efficiency. The

electric heat pump was being studied in the 1960s as a means of maintaining uniform environmental conditions.

Rural Electrification in the United States.—Of the more than 3,700,000 farms in the United States in the 1960s. approximately 98% had electric service. The first steps toward rural electrification in the United States were taken only a few years after Thomas Edison's first generating plant began operation in New York city in 1882. Progress in rural areas lagged behind urban development of electric service, however, because of many technical and financial obstacles. For the first 15 years direct current, which could be transmitted only a few miles. was used and most generating plants were located in cities. In addition, the costs of constructing transmission and distribution lines to serve outlying farms were exceedingly high. Various methods were tried by the electric companies to lower costs. In some cases farmers paid for and owned line equipment and furnished the right of way to the power company in return for electric rates comparable to those in nearby towns. Some power companies bore the entire cost of stringing lines. In most cases, however, some form of "shared-cost" plan was adopted.

By 1920 the electric utility companies had built a vast network of transmission lines which provided 24-hour electric service to practically every city and village in the U.S. The steam turbine had been so perfected that the cost of manufacturing electricity had been greatly reduced, and the combined use of alternating current and transformers made possible the long-distance transmission of electric current at high voltages. These developments made it possible, for the first time. to supply rural electric lines radiating from the urban centres with adequate electric power at a price sufficiently low to fit into the farmer's economy. The foundation for farm electrification on a national scale had been built.

In 1921 the National Electric Light association (NELA) organized a rural service committee to determine what was necessary to step up the electrification of rural areas. It was discovered that a high degree of rural electrification would necessarily entail more than the mere construction of transmission lines into farming areas: new farm equipment would have to be developed and farmers would have to be informed of the advantages of increased electrical use.

To assist in solving these problems a joint committee was set up that included representatives of the American Farm Bureau federation, the Kational Grange, the American Society of Agricultural Engineers, the U.S. department of agriculture, electric companies and others. This organization, known as the Committee on the Relation of Electricity to Agriculture (CREA), was active from 1923 to 1939. It promoted research work at universities and among manufacturers and published and distributed publications dealing with applications of electricity to farm operations.

The aggressive efforts of CREA and scores of local electric companies resulted in a substantial increase in the number of farms connected to power lines each year. In 1928, for example, more than 113,000 farms were newly electrified, as compared with only 27,000 in 1924. The depression of the 1930s retarded this rapid expansion and between 1929 and 1935 relatively little progress was made in extending rural electrification in the Cnited States.

REA.—As conditions resulting from the depression eased, the utility companies were once again able to step up their rural electrification programs. In addition, the federal government set up a new program to assist the farm electrification movement by instituting the Rural Electrification administration (REA) in 1935. Through the lending of funds to newly organized REA co-operatives. it became an increasingly important factor in the growth of rural electrification.

By the second half of the 20th century, REA-financed co-operatives were serving about 51% of all farms receiving electric service. while electric companies served about 43% and government-owned systems supplied the remaining 6%. About 40% of all REA co-operatives' power requirements were being purchased from electric companies under wholesale contracts. The average annual use of electric power on farms east of the 100th meridian was about 5.000 kw.hr. per customer. In many areas where intensive farm development programs had been carried on, annual use averaged about 30% higher than the national figure. On farms west of the 100th meridian. where use is affected by requirements of water pumping for irrigation, average annual use totaled more than 9.000 kw.hr. In comparison. the average nonfarm residential customer in the United States used a total of about 3.600 kw.hr.

(R. F. C.)

Great Britain.—The early pattern of electricity supply in Great Britain was such that privately o ned companies and municipalities electrified the urban areas first and then pushed out to the more densely populated parts of the surrounding areas. After the nationalization of the industry in 1948 rural development was rapid. In England and Wales the number of electrified farms rose from 86,500 out of a total of about 281,000 in 1948 to more than 235,000 by the early 1960s and the average annual consumption per farm from about 3.500 to more than 7,600 kw.hr. In 1953 the Central Electricity authority started a ten-year plan aimed at connecting 85% of all farms. Development of the rural load was helped by the establishment of agricultural development departments by the Central Electricity authority and Area boards, by the Electrical Development association—responsible for publicity—and by the Electrical Research association, which had a rural electrification department to investigate possible applications of electricity to agriculture and horticulture. As in the United States the most important were those for crop drying, farm grinding, water heating and sterilizing in dairies. poultry rearing and for horticulture, including soil warming, artificial illumination and the control of the environment in greenhouses.

Other Countries.—While small electric plants. driven by oil engines or windmills, could supply individual premises with power for domestic use, rural electrification depended largely on the existence of main electrical networks. In many underdeveloped countries these were very limited in extent up to the middle of the 20th century. The benefits of electricity for agricultural areas were appreciated after World War II. particularly, and a number of international conferences, *e.g.,* the World Power conferences in New Delhi (1951), Rio de Janeiro (1954) and Belgrade (1957), paid particular attention to this question.

The United Nations made studies of the energy needs. including rural electrification for Latin America, southeast Asia and Europe, and its Economic Commission for Europe published a three-volume report on rural electrification in 1954 and 1958. Substantial progress was reported, for example, for Austria. France, Hungary and Sweden. In the Ketherlands rural electrification was 96% complete by 1957 with an annual increase in rural consumption of 10%. In Ireland rural electrification was not undertaken until 1947 when .5% of rural inhabitants were served and annual consumption was 300,000 kw.hr.; within five years 27% of rural inhabitants were being served and annual consumption reached 127,000,000 kw.hr. Based on abundant water power, rural electrification in Norway was widespread with the highest per capita consumption in the world.

Many farms and rural communities in the U.S.S.R. were electrified. first by small local stations, later from high-voltage networks.

Extensive rural electrification in New Zealand was done under regional power boards co-operating with groups of consumers. Canadian agriculture benefited greatly through the full rural projects of the provinces. Rural projects progressed in the coastal areas of Australia and Tasmania, where water power abounds.

In Central and South America electricity consumption was generally very low except in urban areas, but some countries, *e.g.,* Trinidad, had developed rural electrification. The per capita consumption of electrical energy was also low in most of Asia, except Japan where hydro power facilitated rural electrification. Under the Colombo plan, development in southeast Asia progressed, especially in Ceylon, India and Malaya. though much remained to be done. In the first Indian five-year plan (1951–56) the electrified villages with populations under 5,000 increased from 2,792 to 5,300, and almost 20.000 had been electrified by 1961.

The International bank made loans in the 1950s for the Aberdeen-Laksapana hydroelectric project in Ceylon, a five-year rural development plan in Algeria, a hydroelectric station in Uruguay

and the Kariba gorge hydroelectric project in the Federation of Rhodesia and Nyasaland, where a national electricity grid served most of the settled areas.

Uganda, helped by the Owen falls hydroelectric project, began to electrify rural districts. In South Africa progress was slow, because of great distances between the large farms, but plans in the intensively cultivated areas were successful. (E. W. G.)

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RURKI: *see* ROORKEE.

RUSCONI, CAMILLO (1658–1728), the most powerful Roman sculptor of the first quarter of the 18th century, was born on July 14, 1658, at Milan. After an early and brief pre-rococo phase ("Cardinal Virtues," S. Ignazio, 1685) he reverted, perhaps under the influence of his older friend, the painter Carlo Maratta, to the classicism of Duquesnoy and Algardi without entirely discarding Bernini's grand baroque manner. The result can be studied in the heroic "classicist baroque" of his four monumental Apostles in San Giovanni in Laterano (*c.* 1708–18) and in the tomb of Pope Gregory XIII (St. Peter's, 1719–25). The type of the tomb is derived from Algardi's tomb of Leo XI, while in the figure of the pope with the majestic gesture the spirit of Bernini's statues of Urban VIII has come to life again. A whole generation of sculptors was educated in Rusconi's studio. He died at Rome on Dec. 8, 1728. (RF. W.)

RUSE (RUSCHUK; Bulg. RUSSÉ), the capital of the Ruse district, Bulg., on the right bank of the Danube, where it receives the Lom. Pop. (1956) 83,472. It is connected by rail with Varna and Sofia; by boat and rail with Bucharest. It is the chief Danubian port of Bulgaria, and an important commercial centre. It possesses sugar. tobacco and cigarette factories, soapworks, breweries, aerated water factories, dyeworks, tanneries, sawmills, brick and tile works and a celebrated pottery.

In Roman times Ruschuk mas one of the fortified points along the line of the Danube. In the *Tabula Peutingeriana* it appears as Prisca, in the *Antonine Itinerary* as Serantaprista, in the *Notitia* as Seragintaprista and in Ptolemy as Priste Polis. Destroyed by barbarian invaders in the 7th century the town recovered its importance only in comparatively modern times. It played an important part in the Russo-Turkish wars of 1810, 1828–29, 1853–54 and 1877–78. In 1877 it was nearly destroyed by Russian artillery.

RUSELLAE, an ancient town of Etruria, Italy, about 10 mi. S.E. of Vetulonia and 5 mi. N.E. of Grosseto, situated on a hill with two summits, the higher 636 ft. above sea level. It was one of the 12 cities of the Etruscan confederation, and was taken in 294 B.C. by the Romans. In 205 B.C. it contributed grain and timber for the needs of Scipio's fleet. The place was deserted in 1138, and the episcopal see was transferred to Grosseto. The walls, nearly 2 mi. in circumference, are in places well preserved. They consist of large unworked blocks of a travertine which naturally splits into roughly rectangular blocks; these are quite irregular, and often as much as 9 ft. long by 4 ft. wide; in the interstices smaller pieces are inserted.

RUSH, BENJAMIN (1745–1813). U.S. physician and medical educator, designated by his contemporaries as the "American Sydenham" and even as the "Hippocrates of Pennsylvania," one of the major figures in the rise of U.S. medicine, was born of a Quaker family on a farm near Philadelphia. Having obtained his B.A. from the College of New Jersey (later Princeton university) at the age of 15. he spent six years in Philadelphia in medical apprenticeship and completed his studies with an M.D. degree from the University of Edinburgh in 1768. After a year of travel in Europe he returned to Philadelphia, where he was appointed professor of chemistry (1769) in the College of Philadelphia (later merged with the University of Pennsylvania) and subsequently professor of the institutes of medicine and clinical practices at the University of Pennsylvania (1791). He introduced clinical instruction at the Pennsylvania hospital and initiated the Philadelphia dispensary. Rush was also deeply involved in the struggle for independence. As a member of the continental congress he was among the signers of the Declaration of Independence, and he served briefly in the army as surgeon general. Involvement in political intrigues, however, led him to return to Philadelphia, where he resumed the practice and teaching of medicine until, in 1797, he accepted Pres. John Adams' appointment as treasurer of the national mint, which office he held until his death in 1813.

Rush was a prolific writer on a vast variety of subjects which also included numerous social causes. He was a fiery proponent of the abolition of slavery. the death penalty and the use of alcohol, and he fought for prison reforms, higher education for women and free public schools for the poor. He also strongly suggested the establishment of a permanent "peace office.)' His medical interests were equally vast, and his therapeutic opinions tended to be dogmatic.

A strong believer in bloodletting and purging, he was inclined to enfeeble his patients upon whom he expended so much devotion and clinical attention. His *Account of the Bilious Remitting Yellow Fever As It Appeared in the City of Philadelphia in the Year 1793* is outstanding for .its graphic description of the disease, but his untiring efforts and courage in taking care of yellow fever patients, until he himself became a victim of the disease, were frequently offset by his insistence upon debilitating therapeutic measures.

Yet the stubbornness which misled him in certain aspects also helped him to pursue novel and important ideas. His *Medical Inquiries and Observations Upon the Diseases of the Mind* (1812) was the first systematic American book on the subject, and his improvement of the housing of mental patients at the Pennsylvania hospital represented a decisive step toward a rational treatment of mental disease. His description of cholera infantum (1773), of dengue (1780) and of the relation between rheumatism and diseases of the teeth illustrate his unusual powers of observation.

Rush died of typhus at Philadelphia on April 19, 1813.

See *Autobiography* of Benjamin Rush, ed. with introduction and notes by George W. Corner (1948); the *Letters* [of Benjamin Rush], ed. by L. H. Butterfield (1951). (I. V.)

RUSH, RICHARD (1780–1859), U.S. statesman and diplomat, son of Benjamin Rush, was born in Philadelphia, Pa., on Aug. 29, 1780. He graduated at Princeton in 1797, and was admitted to the bar in 1800. He was attorney general of Pennsylvania in 1811; controller of the treasury of the United States, 1811–14; attorney general in the cabinet of Pres. James Madison, 1814–17; acting secretary of state from March to Sept., 1817; minister to Great Britain, 1817–25; secretary of the treasury in the cabinet of Pres. J. Q. Adams, 1825–29; and candidate for vice-president on the Adams ticket in 1828. In 1818, while minister to Great Britain, he, in association with Albert Gallatin, concluded with British plenipotentiaries the important treaty which determined the boundary line between the United States and Canada from the Lake of the Woods to the Rocky mountains and provided for the joint occupation of Oregon for ten years. He also conducted the negotiations with Canning in 1823 relating to the South American policy of the Holy Alliance. He followed the Adams-Clay faction of the Democratic-Republican party in the split of 1825–28, but returned to the Democratic party about 1834 on the bank issue. In 1835 he and Benjamin C. Howard, of Baltimore, Md., were sent by President Jackson to prevent an outbreak of hostilities in the Ohio-Michigan boundary dispute. In 1836–38 Rush was commissioner to receive the Smithson legacy (*see* SMITHSONIAN INSTITUTION), and in 1847–49 he was minister to France. He died in Philadelphia on July 30, 1859.

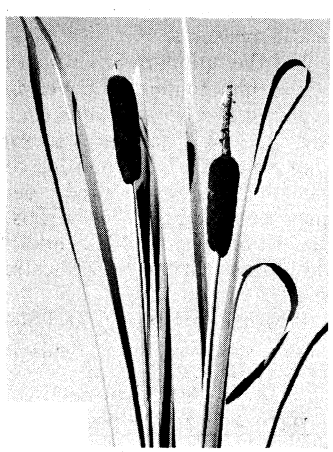
He published *A Narrative of a Residence at the Court of London from 1817 to 1825* (2 vol. 1833–45; all editions after the 1st ed. of the first vol. are entitled *Memoranda of a Residence*, etc.); *Washington in Domestic Life* (1857), compiled from letters

written by Washington to his private secretary in **1790-98;** and *Occasional Productions, Political, Diplomatic and Miscellaneous* (**1860**).

RUSH, WILLIAM (1756–1833), **U.S.** sculptor and wood carver, considered to be "the first native American to devote himself seriously and successfully to sculpture" (Henri Marceau. *William Rush, The First Native American Sculptor*, Philadelphia Museum of Art, 1937), was born in Philadelphia. Pa.. on July 4 1756. He was trained as a maker'of ornamental ship carvings and figureheads During the Revolution he served in the American army and shortly after the close of the war he set up a shop in Philadelphia. He was one of the founders of the Pennsylvania Academy of Fine Arts (1805) and served for many years as a member of the Philadelphia city council. A number of his wood carvings are preserved in various Philadelphia institutions, among the most interesting of which are his vigorous self-portrait (Pennsylvania Academy of Fine Arts), the "Water Nymph and Bittern" (Fairmount park), two allegorical figures, "Comedy" and "Tragedy" (Philadelphia museum), and a statue of George Washington (Independence hall). Few, if any. of his ship carvings and figureheads survived. Rush died at Philadelphia on Jan. **17, 1833.**

See Henri Marceau, *William* Rush, ***The First*** *Native American Sculptor (1937).* (A. T. G.)

RUSH, the name of any of a variety of flowering plants distinguished by cylindrical stalks or hollow, stemlike leaves. The common rushes of the genus *Juncus* in the family Juncaceae (*q.v.*) are used in many parts of the world for chair bottoms, mats and basketwork, and the pith serves as wicks in open oil lamps and for tallow candles—hence the term rush light. The fibrous stems and leaves of the bulrush, reed mace or cattail, *Typha angustifolia,* are used in north India for ropes; mats and baskets. *Scirpus* and other Cyperaceae are used for chair bottoms, mats and thatch; the rush mats of Madras are made from a species of *Cyperus.* The sweet rush. yielding essential oil, is a grass, *Cymbopogon citratus*, known also as lemon grass. Quantities of the horsetail, *Equisetum hyemale,* are used under the name of Dutch or scouring rush for scouring metal and other hard surfaces because of the large proportion of silica the plant contains. Flowering rush is *Butomus umbellatus;* wood rush is the common name for *Luzula (see* JUNCACEAE). *Acorus calamus* (family Araceae), sweet flag, is also known as sweet rush.



RUTHERFORD

BULRUSH OR CATTAIL (TYPHA ANGUSTIFOLIA)

RUSHDI PASHA (c. 1864–1928), Egyptian statesman, was born about **1864,** and educated in France. In April 1914 he was made prime minister, and at the outbreak of World War I, when Turkey entered the war on the side of Germany, he agreed to the proclamation of a British protectorate.

After the armistice Rushdi pressed the British government for a definition of Egypt's position and asked to be received in London to discuss the question. This proposal was not accepted, and on March 1, 1919, he and his cabinet resigned. A few days later Zaghlul Pasha was arrested by the British authorities and deported to Malta. This step led to serious rioting, and he was soon released. The British government had to appeal once more to Rushdi Pasha, who consented, after the release of Zaghlul, to form a ministry again. The treatment which he had received had, however, greatly diminished his prestige, and he was obliged to resign again ten days later. He retired until the Milner commission (1919) had made its report.

An Egyptian cabinet was required which should have sufficient support in Egypt to undertake negotiations in London toward an agreed settlement. Adly Pasha was made prime minister, and Rushdi became president of the council, being chosen to accompany him to England. He died on March **13, 1928.**

RUSHMORE, MOUNT, MEMORIAL: *see* BORGLUM, GUTZON.

RUSHWORTH, JOHN (c. 1612–1690), the compiler of the *Historical Collections* commonly described by his name, was the son of Lawrence Rushworth of Acklington Park, Warkworth, Northumberland. In **1638** he was appointed solicitor to the town of Berwick. He was enrolled in Lincoln's Inn in **1641,** and was called to the bar in **1647.** He attended all public occasions of a political and judicial character, such as proceedings before the Star Chamber or the council, and made shorthand notes of them. On April 25, **1640,** he was appointed an assistant clerk to the house of commons. He became secretary to Fairfax, and then, for a short time, to Cromwell. He was afterward employed by the council of state and during the protectorate, and sat in Cromwell's parliament for Berwick.

He made his peace with the government of Charles II, and though he was threatened with trial as a regicide he was not seriously molested. During the reign of Charles II he continued to act as agent for the town of Berwick, and he sat for it in parliament. He was also for a time agent for Massachusetts. From **1684** till his death on May 12, 1690, he was a resident in the king's bench prison.

RUSKIN, JOHN (**1819–1900**), English writer and critic, was born in London, at Hunter street, Brunswick square, on Feb. **8, 1819,** being the only child of John James Ruskin and Margaret Cox. They were Scots, first cousins, the grandchildren of a certain John Ruskin of Edinburgh (1732–1780). John Ruskin, the author's grandfather, was a wine merchant in Edinburgh, who ran through his fortune, and ended his days in debt. His son, John James Ruskin (1785–1864), father of the author, was sent, on leaving Edinburgh High School, to London to enter the wine trade. There, in **1809,** he founded the sherry business of Ruskin, Telford and Domecq; Domecq being proprietor of a famous vineyard in Spain, Telford contributing the capital of the firm, and Ruskin having sole control of the business. Ruskin built up a great business, paid off his father's debts and formed near London a most hospitable and cultured home, where he maintained his taste for literature and art.

Margaret Ruskin, the author's mother, was a handsome, strong, stern, able, devoted woman of the old Puritan school, Calvinist in religion, unsparing of herself and others, rigid in her ideas of duty, proud, reserved and ungracious. The child was brought up under a rigid system of nursing, physical, moral and intellectual; kept without toys, not seldom whipped, watched day and night, but trained from infancy in music, drawing, reading aloud and observation of natural objects. When he was four the family removed to a house on Herne Hill, then a country village, with a garden and rural surroundings. The father, who made long tours on business, took his wife, child and nurse year after year across England as far as Cumberland and Scotland, visiting towns, cathedrals, castles, colleges, parks, mountains and lakes. At **14** the child was taken through Flanders, along the Rhine, and through the Black Forest to Switzerland, where he first imbibed his dominant passion for the Alps. His youth was largely passed in systematic travelling in search of everything beautiful in nature or in art. And to one so precocious, stimulated by a parent of much culture, ample means and great ambition, this resulted in an almost unexampled aesthetic education. In childhood also he began a systematic practice of composition, both in prose and verse. His mother trained him in reading the Bible, of which he read through every chapter of every book year by year; and to this study he justly attributes his early command of language and his pure sense of style. His father read to him Shakespeare, Scott, Don Quixote, Pope and Byron, and most of the great English classics; and his attention was especially turned to the formation of sentences and to the rhythm of prose. He began to compose both in prose and verse as soon as he had learned to read and write, both of which arts he taught himself by the eye. He wrote enormous quantities of verse, and began dramas, romances and imitations of Byron, Pope, Scott and Shelley.

His schooling was irregular and not successful. At 15 he was sent for two years to the day-school of the Rev. T. Dale of Peckham, and at 17 he attended some courses in literature at King's college, London. In painting he had lessons from Copley Fielding and afterwards from J. D. Harding. But in the incessant travelling, drawing, collecting specimens and composition in prose and verse he had gained but a very moderate classical and mathematical knowledge when he matriculated at Oxford; nor could he ever learn to write tolerable Latin. As a boy he was active, lively and docile; a good walker, but ignorant of all boyish games, as naïve and as innocent as a child; and he never could learn to dance or to ride. He was only saved by his intellect and his fine nature from turning out an arrant prig. He was regarded by his parents, and seems to have regarded himself, as a genius.

At the age of 17 he saw Adèle, the French daughter of Monsieur Domecq, Mr. Ruskin's partner, a lovely girl of fifteen. John fell rapturously in love with her; and, it seems, the two fathers seriously contemplated their marriage. The young poet wooed the girl with poems, romances, dramas and mute worship, but received nothing except chilling indifference and lively ridicule. To the gay young beauty, familiar with Parisian society, the raw and serious youth was not a possible *parti*. She was sent to an English school, and he occasionally saw her. His unspoken passion lasted about three years, when she married the Baron Duquesne. Writing as an old man, long after her death, Ruskin speaks of his early love without any sort of rapture. But it is clear that it deeply coloured his life, and led to the illness which for some two years interrupted his studies and made him a wanderer over Europe.

As the father was resolved that John should have everything that money and pains could give, and should one day be a bishop at least, he entered him at Christ Church, Oxford, as a gentleman-commoner — then an order reserved for men of wealth and rank. Ruskin's Oxford career, broken by the two years passed abroad, was not very full of incident or of usefulness. Both he and his college took kindly the amazing proceeding of his mother, who left her husband and her home to reside in Oxford, that she might watch over her son's health. The one success of his Oxford career was the winning the Newdigate Prize by his poem "Salsette and Elephanta," which he recited in the Sheldonian Theatre (June 1839). Two years of ill-health and absence from home ensued. And he did not become "a Graduate of Oxford" until 1842, in his 24th year, five years after his first entrance at the university. In fact, his desultory school and college life had been little more than an interruption and hindrance to his real education — the study of nature, of art and of literature. Long before Ruskin published books he had written for various periodicals on architectural and other subjects.

After leaving Oxford, Ruskin set to work steadily at Herne Hill on the more elaborate defence of Turner, which was to become his first work. *Modern Painters*, vol. i., by "a Graduate of Oxford," was published May 1843, when the author was little more than twenty-four. It was vehemently attacked by the critics, and coolly received by the painters. Even Turner was somewhat disconcerted; but the painter was now known to both Ruskins, and they freely bought his pictures. The family then went again to the Alps, that John might study mountain formation and "Truth" in landscape. In 1845 he was again abroad in Italy, working on his *Modern Painters*, the second volume of which appeared in 1846. He had now plunged into the study of Bellini and the Venetian school, Fra Angelico and the early Tuscans, and he visited Lucca, Pisa, Florence, Padua, Verona and Venice, passionately devoting himself to architecture, sculpture and painting in each city of north Italy. He wrote a few essays for the *Quarterly Review* and other periodicals, and in 1849 (*aet.* 30) he published *The Seven Lamps of Architecture*, with his own etchings, which greatly increased the reputation acquired by his *Modern Painters*.

On April 10, 1848, a day famous in the history of Chartism, Ruskin was married at Perth to Euphemia Chalmers Gray, a lady of great beauty, of a family long intimate with the Ruskins. The marriage, we are told, was arranged by the parents of the pair, and was a somewhat hurried act. It was evidently ill-assorted, and brought no happiness to either. They travelled, lived in London, saw society, and attended a "Drawing-room" at Buckingham Palace. But Ruskin, immersed in various studies and projects, was no husband for a brilliant woman devoted to society. No particulars of their life have been made public. In 1854 his wife left him, obtained a nullification of the marriage under Scots law, and ultimately became the wife of John Everett Millais. John Ruskin returned to his parents, with whom he resided till their death; and neither his marriage nor the annulling of it seems to have affected seriously his literary career.

Ruskin's architectural studies, of which *The Seven Lamps* was the first fruit, turned him from Turner and *Modern Painters*. He planned a book about Venice in 1845, and *The Stones of Venice* was announced in 1849 as in preparation. After intense study in Italy and at home, early in 1851 (the year of the Great Exhibition in London) the first volume of *The Stones of Venice* appeared (*aet.* 32). It was a concrete expansion of the ideas of *The Seven* Lamps — that the buildings and art of a people are the expression of their religion, their morality, their national aspirations and social habits. It was, as Carlyle wrote to the author, "a sermon in stones," "a singular sign of the times," "a new *Renaissance.*" It appeared in the same year with *The Construction of Sheepfolds* — a plea for the reunion of Christian churches — in the same year with the essay on *Pre-Raphaelitism*, the year of Turner's death (19th December). *The Stones of Venice* was illustrated with engravings by some of the most refined artists of his time. The author spent a world of pains in having these brought up to the highest perfection of the reproductive art, and began the system of exquisite illustration, and those facsimiles of his own and other sketches, which make his works rank so high in the catalogues and price-lists of collectors. This delicate art was carried even farther in the later volumes of *Modern Painters* by the school of engravers whom Ruskin inspired and gathered round him. And these now rare and coveted pieces remain to rebuke us for our modem preference for the mechanical and unnatural *chiaroscuro* of photogravure — the successor and destroyer of the graver's art.

Although Ruskin was practised in drawing from the time that he could hold a pencil, and had lessons in painting from some eminent artists, he at no time attempted to paint pictures. He said himself that he was unable to compose a picture, and he never sought to produce anything that he would call a work of original art. His drawings, of which he produced an enormous quantity, were always intended by himself to be studies or memoranda of buildings or natural objects precisely as they appeared to his eye. Clouds, mountains, landscapes, towers, churches, trees, flowers and herbs were drawn with wonderful precision, minuteness of detail and delicacy of hand, solely to recall some specific aspect of nature or art, of which he wished to retain a record. In his gift for recording the most subtle characters of architectural carvings and details, Ruskin has hardly been surpassed by the most distinguished painters.

In 1853 *The Stones of Venice* was completed at Heme Hill, and he began a series of *Letters* and *Notes* on pictures and architecture. In this year (*net.* 34) he opened the long series of public lectures wherein he came forward as an oral teacher and preacher, not a little to the alarm of his parents and amidst a storm of controversy. The Edinburgh Lectures (November 1853) treated Architecture, Turner and Pre-Raphaelitism. The Manchester Lectures (July 1857) treated the moral and social uses of art, now embodied in *A Joy for Ever*. Some other lectures are reprinted in *On the Old Road* and *The Two Paths* (1859). These lectures did not prevent the issue of various *Notes* on the Royal Academy pictures and the Turner collections; works on the *Harbours of England* (1856); on the *Elements of Drawing* (1857); the *Elements of Perspective* (1859). At last, after prolonged labour, the fifth and final volume of *Modern Painters* was published in 1860 (*aet.* 41). This marks an epoch in the career of John Ruskin; and the year 1860 closed the series of his works on art strictly so called.

The last forty years of his life were devoted to expounding his views, or rather his doctrines, on social and industrial problems, on education, morals and religion, wherein art becomes an incidental and instrumental means to a higher and more spiritual life.

And his teaching was embodied in an enormous series of lectures, letters, articles, selections and serial pamphlets. These are now collected in upwards of thirty volumes in the final edition. The entire set of Ruskin's publications amounts to more than fifty works having distinctive titles. For some years before 1860 Ruskin had been deeply stirred by reflecting on the condition of all industrial work and the evils of modern society. His lectures on art had dealt bitterly with the mode in which buildings and other works were produced. In 1854 he joined F. D. Maurice, T. Hughes and several of the new school of painters, in teaching classes at the Working Men's College. But it was not until 1860 that he definitely began to propound a new social scheme, denouncing the dogmas of political economy. Four lectures on this topic appeared in the *Cornhill Magazine* until the public disapproval led the editor, then W. M. Thackeray, to close the series. They were published in 1862 as *Unto this Last.* In the same year he wrote four papers in the same sense in *Fraser's Magazine,* then edited by J. A. Froude; but he in turn was compelled to suspend the issue. They were completed and ultimately issued under the title *Munera Pulveris.* These two small books contain the earliest and most systematic of all Ruskin's efforts to depict a new social Utopia. They contain a vehement repudiation of the orthodox formulas of the economists; and they are for the most part written in a trenchant but simple style, in striking contrast to the florid and discursive form of his works on art.

In 1864 Ruskin's father died, at the age of 79, leaving his son a large fortune and a fine property at Denmark Hill. John still lived there with his mother, aged 83, infirm, and failing in sight, to whom came as a companion his cousin, Joanna Ruskin Agnew, afterwards Mrs. Arthur Severn. At the end of the year 1864 Ruskin delivered at Manchester a new series of lectures — not on art, but on reading, education, woman's work and social morals — the expansion of his earlier treatises on economic sophisms. This afterwards was included with a Dublin lecture of 1868 under the fantastic title of *Sesame and Lilies* (perhaps the most popular of his social essays), of which 44,000 copies were issued down to 1900. He made this, in 1871, the first volume of his collected lectures and essays, the more popular and didactic form of his new Utopia of human life. It contains, with *Fors,* the most complete sketch of his conception of the place of woman in modern society.

In the very characteristic preface to the new edition of 1871 Ruskin proposes never to reprint his earlier works on art; disclaims many of the views they contained, and much in their literary form; and specially regrets the narrow Protestantism by which they were pervaded. In the year 1866 he published a little book about girls, and written for girls, a mixture of morals, theology, economics and geology, under the title of *Ethics of the Dust;* and this was followed by a more important and popular work, *The Crown of Wild Olive.* This in its ultimate form contained lectures on "Work," "Traffic," "War" and "The Future of England." It was one of his most trenchant utterances, full of fancy, wit, eloquencd and elevated thought. But a more serious volume was *Time and Tide* (1867), a series of twenty-five letters to a workman of Sunderland, upon various points in the Ruskinian Utopia. This little collection of "Thoughts," written with wonderful vivacity, ingenuity and fervour, is the best summary of the author's social and economic programme, and contains some of his wisest and finest thoughts in the purest and most masculine English that he had at his command. In 1869 he issued *The Queen of the Air,* lectures on Greek myths, a subject he now took up, with some aid from the late Sir C. Newton. It was followed by some other occasional pieces; and in the same year he was elected Slade professor of art in the University of Oxford.

He now entered on his professorial career, which continued with some intervals down to 1884, and occupied a large part of his energies. His lectures began in February 1870, and were so crowded that they had to be given in the Sheldonian Theatre, and frequently were repeated to a second audience. He was made honorary fellow of Corpus Christi, and occupied rooms in the college. In 1871 his mother died, at the age of 90, and his cousin, Miss Agnew, married Arthur Severn. In that year he bought from Linton, Brantwood, an old cottage and property on Coniston Lake, a lovely spot facing the mountain named the Old Man. He added greatly to the house and property, and lived in it continuously until his death in 1900. In 1871, one of the most eventful years of his life, he began *Fors Clavigera,* a small serial addressed to the working men of England, and published only by George Allen, engraver, at Keston, in Kent, at 7d., and afterwards at 10d., but without discount, and not through the trade. This was a medley of social, moral and religious reflections interspersed with casual thoughts about persons, events and art. *Fors* means alternatively fate, force or chance, bearing the *Clavis,* club, key or nail, *i.e.,* power, patience and law. It was a desultory exposition of the Ruskinian ideal of life, manners and society, full of wit, play, invective and sermons on things in general. It was continued with intervals down to 1884, and contained ninety-six letters or pamphlets, partly illustrated, which originally filled eight volumes and are now reduced to four.

The early years of his Oxford professorship were occupied by severe labour, sundry travels, attacks of illness and another cruel disappointment in love. In spite of this, he lectured, founded a museum of art, to which he gave pictures and drawings and £5,000; he sought to form at Oxford a school of drawing; he started a model shop for the sale of tea, and model lodgings in Marylebone for poor tenants. At Oxford he set his pupils to work on making roads to improve the country. He now founded "St. George's Guild," himself contributing £7,000, the object of which was to form a model industrial and social movement, to buy lands, mills and factories, and to start a model industry on co-operative or Socialist lines. In connection with this was a museum for the study of art and science at Sheffield. Ruskin himself endowed the museum with works of art and money; a full account of it has been given in E. T. Cook's *Studies in Ruskin* (1890), which contains the particulars of his university lectures and of his economic and social experiments. It is unnecessary to follow out the history of these somewhat unpromising attempts. None of them came to much good, except the Sheffield museum, which is an established success, and is now transferred to the town.

In *Fors,* which was continued month by month for seven years, Ruskin poured out his thoughts, proposals and rebukes on society and persons with inexhaustible fancy, wit, eloquence and freedom, until he was attacked with a violent brain malady in the spring of 1878 (*aet.* 59); and, although he recovered in a few months sufficiently to do some occasional work, he resigned his professorship early in 1879. The next three years he spent at Brantwood, mainly in retirement, and unhappy in finding nearly all his labours interrupted by his broken health. In 1880 he was able to travel in northern France, and began the *Bible of Amiens,* finished in 1885; and he issued occasional numbers of *Fors,* the last of which appeared at Christmas 1884. In 1882 he had another serious illness, with inflammation of the brain; but he recovered sufficiently to travel to his old haunts in France and Italy — his last visit. And in the following year he was re-elected professor at Oxford and resumed his lectures, but increasing brain excitement, and indignation at the establishment of a laboratory to which vivisection was admitted, led him to resign his Oxford career, and he retired in 1884 to Brantwood, which he never left. He now suffered from frequent attacks of brain irritation and exhaustion, and had many causes of sorrow and disappointment. His lectures were published at intervals from 1870 to 1885 in *Aratra Pentelici, The Eagle's Nest, Love's Meinie, Ariadne Florentina, Val d'Arno, Proserpina, Deucalion, The Laws of Fesolé, The Bible of Amiens, Tlze Art of England* and *The Pleasures of England,* together with a series of pamphlets, letters, articles, notes, catalogues and circulars.

In the retirement of Brantwood he began his last work, *Praeterita,* a desultory autobiography with personal anecdotes and reminiscences. He was again attacked with the same mental malady in 1885, which henceforth left him fit only for occasional letters and notes. In 1887 it was found that he had exhausted (spent, and given away) the whole of the fortune he had received from his father, amounting, it is said, to something like £200,000; and he was dependent on the vast and increasing sale of his works, which produced an average income of £4,000 a year, and at times

on the sale of his pictures and realizable property. In **1872** a correspondent had remonstrated with him in vain as to taking "usury," *i.e.*, interest on capital lent to others for use. In **1874** Ruskin himself had begun to doubt its lawfulness. In **1876** he fiercely assailed the practice of receiving interest or rent, and he henceforth lived on his capital, which he gave freely to friends, dependants, public societies, charitable and social objects. The course of his opinions and his practice is fully explained in successive letters in *Fors*.

Until **1889** Ruskin continued to write chapers of *Praeterita*, which was designed to record memories of his life down to the year **1875** (*aet.* **56**). It was, in fact, only completed in regular series down to 1858 (*aet.* 39), with a separate chapter as to Mrs. Arthur Severn, and a fragment called *Dilecta*, containing letters and early recollections of friends, especially of Turner. These two books were published between 1885 and **1889**; and except for occasional letters, notes and prefaces, they form the last writings of the author of *Modern Painters*. His literary career thus extends over fifty years. But he has left nothing more graceful, naïve and pathetic than his early memories in *Praeterita*—*a* book which must rank with the most famous "Confessions" in any literature. The last ten years of his life were passed in complete retirement at Brantwood, in the loving care of the Severn family, to whom the estate was transferred, with occasional visits from friends, but with no sustained work beyond correspondence, the revision of his works, and a few notes and prefatory words to the books of others. He wished to withdraw his early art writings from circulation, but the public demand made this practically impossible.

The close of his life was one of entire peace and honour. He was loaded with the degrees of the universities, and membership in numerous societies and academies. "Ruskin Societies" were founded in many parts of the kingdom. His works were translated and read abroad, and had an enormous circulation in Great Britain and the United States. He died suddenly after only two days' illness on Jan. 20, 1900. He was buried in Coniston churchyard by his own express wish, the family refusing the offer of a grave in Westminster Abbey.

Ruskin's life and writings have been the subject of many works composed by friends, disciples and admirers. The principal is the *Life*, by W. *G*. Collingwood, his friend, neighbour and secretary (2 vols., 1893; 2nd ed., 1900). His pupil, E. T. Cook, published his *Studies in Ruskin in* 1890, with full details of his career as professor, and a *Life of Ruskin* in 1911. J. A. Hobson, in *John Ruskin, Social Reformer* (2nd ed., 1899), has elaborately discussed his social and economic teaching, and claims him as "the greatest social teacher of his age." An analysis of his works has been written by Mrs. Meynell (1900). His art theories have been discussed by Professor Charles Waldstein of Cambridge in *The Work of John Ruskin* (1894), by Robert de la Sizeranne in *Ruskin et la religion de la beauté* (1897), and by Professor H. J. Brunhes of Fribourg in *Ruskin et la Bible* (1901). The monumental "library edition" of Ruskin's works (39 vols., 1903–12), prepared by E. T. Cook, with A. Wedderburn, is the greatest of all the tributes of literary admiration. *See* also *Centenary Addresses* (1919) ed. J. H. Whitehouse; J. R. Morley, *John Ruskin and Social* ***Ethics*** (1917); A. Williams-Ellis, *The Tragedy of John Ruskin* (1928). (*F.* HAR.)

RUSSELL (FAMILY). The great English Whig house of the Russells, earls and dukes of Bedford, rose under the favour of Henry VIII. Obsequious genealogists have traced their lineage from "Hugh de Rozel," *alias* "Hugh Bertrand, lord of le Rozel," a companion of the Conqueror, padding their fiction with the pedigree of certain Russells who are found holding Kingston Russell in Dorset as early as the reign of King John. But the first undoubted ancestor of the Bedford line is Henry Russell, a Weymouth merchant, returned as a burgess for that borough in four parliaments between 1425 and 1442. He may well have been the son of Stephen Russell, another Weymouth merchant, whose name is just before his in the list of those men of substance in Dorsetshire who, in 1434, under the act of parliament, were to be sworn not to maintain breakers of the peace. Stephen Russell, having served the office of bailiff of Weymouth, was returned as burgess to the parliament of 1395, and one William Russell was returned for King's Melcombe in 1340. Both Stephen and Henry were in the wine trade with Bordeaux, and in 1427 Henry Russell was deputy to the chief butler of England for the port of Melcombe. In 1442 a pardon under the privy seal significantly describes Henry Russell of Weymouth, merchant, as *alias* Henry Gascoign, gentleman, and it is therefore probable that the ducal house of Bedford springs from a family of Gascon wine-merchants settled in a port of Dorsetshire, a county remarkable for the number of such French settlers.

Henry Russell of Weymouth made a firm footing upon the land by his marriage with .Elizabeth Hering, one of the two daughters and co-heirs of John Hering of Chaldon Hering, a Dorsetshire squire of old family, heir of the Winterbournes of Winterbourne Clenston and of the Cernes of Draycot Cerne. John Russell, eldest son of this match, born before 1432, and returned to parliament for Weymouth in 1450, had his seat at Berwick in Swyre, he and his son and heir, James Russell, being buried in the parish church of Swyre.

JOHN RUSSELL, son and heir of James, on the accession of Henry VIII. advanced rapidly serving the crown as soldier and as diplomatic agent. At the crowning of Edward VI. he was lord high steward, and after his defeat of the western rebels was raised, in **1550**, to the earldom of Bedford. Queen Mary, like her brother, made him lord privy seal. He died in **1555**. He left an only son, FRANCIS, second earl of Bedford, K.G. (c. 1527–1585), who, being concerned in Wyatt's plot, escaped to the Continent and joined those exiles at Geneva whose religious sympathies he shared. He returned in **1557**, and was employed by Queen Mary before her death. Under Queen Elizabeth I he governed Berwick, and was lord lieutenant of the northern counties.

Three of his four sons died before him, the third, killed in a border fray, being father of Edward, third earl of Bedford, who died without issue in **1627**. The fourth son, William, created Lord Russell of Thornhaugh in **1603**, was a soldier who fought fiercely before Zutphen beside his friend Sir Philip Sidney, whom he succeeded as governor of Flushing, and was from **1594** to **1597** lord deputy of Ireland. He died in **1613**, leaving an only son, FRANCIS, who in **1627** succeeded his cousin as fourth earl of Bedford. He died of the smallpox in **1641**. WILLIAM, the eldest surviving son, succeeded as fifth earl, Edward. the youngest son, being father of Edward Russell (1653–1727), admiral of the fleet, who, having held the chief command in the victory of La Hogue, was created in **1697** earl of Orford. The fifth earl of Bedford, after fighting for the parliament at Edgehill and for the king at Newbury, surrendered to Essex and occupied himself with completing the drainage of the Bedford Level. He carried St. Edward's staff at the crowning of Charles II., but quitted political life after the execution of his son, Lord Russell, in **1683**. In **1694** he mas created duke of Bedford and marquess of Tavistock, titles to which his grandson, WRIOTHESLEY RCSSELL, succeeded in 1700. Lord Russell had added to the family estates by his marriage with Rachel. daughter of Thomas Wriothesley. the fourth earl of Southampton. Her son, second duke of Bedford, married the daughter of John Howland of Streatham. The third duke, WRIOTHESLEY (1 708–1732), died without issue, his brother JOHN (1 **710-1771**) succeeding him.

His son Francis, styled marquess of Tavistock, was killed in **1767** by a fall in the hunting field, and Lord Tavistock's son FRANCIS **(1765-1802)** became the fifth duke. This was the peer whom Burke, smarting from a criticism of his own pension, assailed as "the Leviathan of the creatures of the crown," enriched by grants that "outraged economy and even staggered credibility." Dying unmarried, he was succeeded by his brother JOHN, the sixth duke (1766–1839), whose third son was the statesman created, in **1861**, Earl Russell of Kingston Russell, better known as Lord John Russell. Lord Odo Russell, a nephew of "Lord John," and ambassador at Berlin from **1871** to his death in **1884**, was created Lord Ampthill in **1881**. HERBRAND ARTHUR RUSSELL (1858–1940), the eleventh duke and fifteenth earl, succeeded an elder brother in **1893**. (O. B.)

See also BEDFORD, EARLS AND DUKES OF.

RUSSELL, BERTRAND ARTHUR WILLIAM RUSSELL, 3RD EARL **(1872-)**, English philosopher, famous also for his eloquent championship of individual liberty, which made his

position in the intellectual life of his time comparable with that of Voltaire in the 18th century or with that of J. S. Mill in the 19th, was born on May 18, 1872. His grandfathers were Lord John Russell (afterward Earl Russell) and the second Lord Stanley of Alderley. His godfather (in a purely social sense) was J. S. Mill. At the age of three he was left an orphan. His father, Lord Amberley, had wished him to be brought up as an agnostic; to avoid this he was made a ward of court and brought up by his grandmother at Pembroke lodge, in Richmond park. Instead of being sent to school he was taught by governesses and tutors and thus acquired his perfect knowledge of French and German. In Oct. 1890 he went into residence, as a shy undergraduate, at Trinity college, Cambridge. After being a high wrangler and obtaining a first class with distinction in philosophy he was elected a fellow of his college in the autumn of 1895. But he had already left Cambridge in the summer of 1894 and for some months was attaché at the British embassy in Paris.

In Dec. 1894 Russell married Alys Pearsall Smith. After spending some months in Berlin studying social democracy *(German Social Democracy,* 1896), they went to live near Haslemere. where he devoted his time to the study of philosophy and wrote *A Critical Exposition of the Philosophy of Leibniz* (1900). He published *The Principles of Mathematics* in 1903 and then. with his friend A. N. Whitehead, proceeded to develop and extend the mathematical logic of Giuseppe Peano and Gottlob Frege. The three volumes of their joint book, *Principia Mathematica,* were published in 1910, 1912 and 1913. During all this period Russell lived simply and worked hard. He was elected a fellow of the Royal society in 1908 and was appointed lecturer at his old college in 1910.

After World War I broke out he took an active part in the No Conscription fellowship. He was fined £100 as the author of a leaflet criticizing a sentence of two years on a conscientious objector. His library was seized to pay the fine; it was bought in by a friend, but many valuable books were lost. His college deprived him of his lectureship. He was offered a post at Harvard university, but was refused a passport. He intended to give a course of lectures (published in the U.S. as *Political Ideals* in 1918) but was prevented by the military authorities. In 1918 he was sentenced to six months' imprisonment for a pacifist article he had written in the *Tribunal.* His excellent *Introduction to Mathematical Philosophy* (1919) was written in prison. *The Analysis of Mind* (1921) was the outcome of some lectures that he gave in London, a few friends having raised a subscription for the purpose. *The Practice and Theory of Bolshevisnz* (1920) was written after a short visit to Russia.

In the autumn of 1920 he went to China to lecture on philosophy at the Peiping university. On his return in Sept. 1921, having been divorced by his first wife, he married Dora Black. He then earned a livelihood by lecturing, journalism and writing popular books such as *The A.B.C. of Atoms* (1923), *The A.B C. of Relativity* (1925) and *On Education* (1926). Other publications of this period were the introduction to the second edition of *Principia Mathematica* (1925); *The Analysis of Matter* (1927); *An Outline of Philosophy* (1927); *Mysticism and Logic* (1929); *Marriage and Morals* (1929). In 1927 he and his nife started a school for young children, which they managed until 1932. He succeeded to the earldom in 1931. Divorced by his second wife in 1935, Russell the following year married Patricia Helen Spence, with whom he published *The Amberley Papers* (1937). In 1938 he went to the United States, where he taught at many of the leading universities. When his appointment to teach philosophy at the College of the City of New York (1940) was cancelled because of his views on morality Russell accepted a five-year contract as a lecturer for the Barnes foundation, Merion, Pa, but cancellation of this was announced in Jan. 1943.

After 1944 Russell lived mostly in England, becoming well known to large audiences through his broadcasts. which included the first series of Reith lectures *(Authority and the Individual,* 1949). He received the Order of Merit in 1949 and the Nobel prize for literature in 1950. In 1952 he was divorced for the third time and married Edith Finch. A collection of five short stories appeared under the title *Satan in the Suburbs* in 1953.

Apart from those already mentioned, Russell's writings include *The Conquest of Happiness* (1930); *The Scientific Outlook* (1931); *Education and the Social Order* (1932); *Freedom and Organisation, 1814–1914* (1934); *Power: a New Social Analysis* (1938); *An Inquiry Into Meaning and Truth* (1940); *A History of Western Philosophy* (1946); *Human Knowledge, Its Scope and Limits* (1948); *Unpopular Essays* (1950); *New Hopes for a Changing World* (1951); and *Human Society in Ethics and Politics* (1954). (C. P. SA.; W. C. K)

Philosophy. — What is fundamental in Russell's philosophy is his logic: his views on metaphysics and ethics, on the nature and relations of matter and mind. changed profoundly in the course of his life, but these changes all proceeded from successively deeper applications of his logical method. He. therefore, preferred to classify his philosophy not as a species of idealism or realism but as "logical atomism," since what distinguishes the whole of his work is his use of logical analysis as a method and his belief that by it we can arrive at ultimate "atomic facts" logically independent both of one another and of being known.

First Russell tried to free logical analysis from the domination of ordinary grammar by showing that the grammatical form of a sentence often fails to reflect the logical form of its meaning. In his *Principles of Mathematics* he insisted that relations could not be reduced to qualities of their terms and that relational facts were not of the subject-predicate forms. but he still thought that any descriptive phrase nhich could be made the subject of a sentence must stand for a term which had being, even if like "the round square" it were self-contradictory, In his article "On Denoting" *(Mind,* 1905) and in subsequent writings, he put forward his theory of descriptions, nhich is perhaps the most important and influential of his innovations in logic. According to this theory "the present king of France" is not a name for a nonexistent entity but an "incomplete symbol" which only has meaning in connection with a context. The meaning of such a statement as "the present king of France is bald" is first that there is someone who is at present both king of France and bald and secondly that there are not at present tno kings of France; and when such statements are analyzed in this nay the need to believe in entities such as "the present king of France" (which are said by some philosophers to have "being" but not "existence") is altogether removed. Similarly when it is said that "unicorns are not real," this does not mean that certain animals. namely unicorns, lack the characteristic of reality but that there are no horselike animals with one horn.

Russell applied similar methods to classes and to numbers and argued that each of these categories consists of what he called "logical constructions." In saying, for instance, that classes are logical constructions, he did not mean that they are entities constructed by the human mind, but that when we express facts by sentences which have for subject such a phrase as "the class of men," the true analysis of the fact does not correspond to the grammatical analysis of the sentence. When, for instance. we say "the class of men includes the class of criminals," the fact asserted by us is really about the characteristics of being a man and being a criminal and not about any such entities as classes at all. This notion of a logical construction was much employed by Russell in his work in mathematical logic, and he also used it extensively in the philosophy of matter and mind, and even adopted as a fundamental principle that constructions (in his special sense of the word) are to be substituted for inferred entities wherever possible.

By applying this method he was led to a view of the world on which the ultimate constituents of mind and matter are of the same type, the difference between minds and bodies lying in their structure and not in the elements of nhich they are composed. A man's mind is composed of sensations and images, which are identified by Russell with physical events in his brain, and the difference betneen physics and psychology lies not in the events which they study but in the kind of laws about those events which they seek to establish, physics being concerned with structure and psychology with quality. This theory was worked out in connection with physics in *The Analysis of Matter.*

In the theory of knowledge Russell's earlier rationalism was considerably modified in a pragmatist or behaviourist direction, and in *The Analysis of Mind* he rejected consciousness as a fundamental characteristic of mind and adopted a form of "neutral monism" about perception. which he. combined with representationism in regard to memory and judgment.

Russell's logical atomism was the starting point for the *Tractatus Logico-Philosophicus* (1921) of his pupil L. Wittgenstein and so one of the sources of logical positivism. Then, after a period between World Wars I and II when it dominated the philosophy of the English-speaking world. his program was brought into doubt by the later teaching of Wittgenstein, according to which philosophical difficulties arise not from any inadequacy of ordinary language but from failure to respect the limits of normal usage. In his own later writings Russell showed some misgivings about logical atomism, but for different reasons. He came to think, for example, that there might be necessary connections between distinct events.

Mathematics. — Russell maintained that mathematics and formal logic are one and that the whole of pure mathematics can be rigorously deduced from a small number of logical axioms. He argued this in outline in *Principles of Mathematics* and then tried to give a detailed demonstration of his thesis in *Principia Mathematica*, written with A. N. Whitehead. In this colossal work the deduction is carried so far as to include all the essential parts of the theory of aggregates and real numbers. Besides this the great advances made by Russell in the analysis of logical concepts allowed the deductions to be carried not only much farther forward but also much farther backward toward first principles. Above all he appeared to solve the notorious paradoxes of the theory of aggregates by means of the theory of types. In this connection. however; he found it necessary to introduce an "axiom of reducibility" which has never won general acceptance, so that his work cannot be regarded as a final solution of the problem.

See MATHEMATICS, FOUNDATIONS OF: *see* also Index references under "Russell, Bertrand Arthur" in the Index volume.

(F. P. R.; W. C. K.)

RUSSELL, CHARLES TAZE (PASTOR RUSSELL) (1852–1916), founder of the International Bible Students association, forerunner of the modern Jehovah's Witnesses (*q.v.*), was born at Pittsburgh. Pa., on Feb. 16. 1852. Of Presbyterian and Congregationalist background, Russell renounced the creeds of orthodox Christian denominations and in 1872 organized an independent Bible study class in Pittsburgh. From 1877 he preached that Christ's second advent would be invisible, that the end of the Gentile times would come in 1914. followed by war between capitalism and communism or socialism, after which God's Kingdom by Christ would rule the whole earth. Russell (who, though popularly called Pastor Russell, mas never ordained) dedicated his life and his considerable fortune to preaching Christ's millennial reign. In 1879 he started a Bible journal later called the *Watchtower*. His wife disputed editorship and eventually sought legal separation. which was granted; she never sought nor obtained absolute divorce. The *Washington Post* and *Chicago Mission Friend* charged marital promiscuousness, but Russell sued both papers for libel and won both cases.

Russell's religious stand opened the door for a number of controversial incidents publicized during his life. One such incident in 1911 involved a gift to Russell's organization of a quantity of "miracle wheat" (so named by its discoverer). which, at the donor's request, was sold, the proceeds (about $1,800) to be applied to charitable work. Russell in 1884 founded the Watchtower Bible and Tract society. which became a flourishing publishing business. His own books and booklets (notably six volumes of *Studies in the Scriptures*) reached a circulation of 16,000,000 copies in 35 languages, and 2,000 newspapers published his weekly sermons. Russell died on a train in Pampa, Tex., on Oct. 31. 1916. while on a speaking tour.

See M. Cole, *Jehovah's Witnesses—the New World Society* (1955).

(M. Co.)

RUSSELL, GEORGE WILLIAM (1867–1935), Irish writer and painter, known as Æ, was born at Lurgan, Co. Armagh, April 10, 1867. Educated at Rathmines school, Dublin, he entered an accountant's office, but in 1897 joined the Irish Agricultural Organization society, and became an organizer of agricultural societies. From 1904 to 1923 he was editor of *The Irish Homestead*, the organ of the agricultural co-operative movement. In 1923 he became editor of *The Irish Statesman*.

Russell's publications include *Homeward: Songs by the Way* (1894); *The Earth Breath* (1897); *Literary Ideals in Ireland* (1899), a collection of essays written in collaboration with W. B. Yeats, W. Larminie and John Eglinton; *Ideals in Ireland* (1901), another book of collaborative essays; *The Nuts of Knowledge* (1903), a selection of lyrics. In 1904 appeared two books of verse, *The Divine Vision* and *New Poems*, an anthology of verses by young Irish poets; and a collection of mystical tales, *The Mask of Apollo*. Other books of verse include *By Still Waters* (1906), *Collected Poems* (1913), and *Gods of War* (1915). *The Hero in Man* (1909) and *The Renewal of Youth* (1911) were imaginative musings, as was *Imaginations and Reveries* (1915). In 1906 appeared *Some Irish Essays*, and in 1907 *Deirdre*, a three-act play. *Co-operation and Nationality* and *The Rural Community*, published in 1912 and 1913 respectively, were pamphlets embodying co-operative ideals, which are further developed in his *The National Being, Thoughts on an Irish Polity* (1916). *The Candle of Vision*, an attempt to discover the element of truth in the mystical imagination, appeared in 1918. This was followed by *The Interpreters* (1920), a symposium in the Platonic fashion.

RUSSELL, HENRY NORRIS (1877–1957), U.S. astronomer, the inventor (with the Danish astronomer Ejnar Hertzsprung) of the "Hertzsprung-Russell diagram," was one of the most important influences in the development of 20th-century astrophysics and stellar astronomy. He was born at Oyster Bay, N.Y., on Oct. 25, 1877, and died in Princeton, N.J., on Feb. 18, 1957. After attending Princeton university he went to Cambridge, Eng., where he was engaged in the determination of stellar parallaxes by photography — a method which at that time (1903–05) was in its infancy.

Russell returned to Princeton in 1905 to embark on a long and brilliant career in astronomy. Russell's work included investigations in almost every field of modern astronomy, as well as in spectroscopy. He developed a method for the determination of the dimensions of double stars whose components periodically eclipse each other; in addition, he and Hertzsprung independently discovered a way to determine the distances from the solar system of double stars which are observed through the telescope to be in revolution about their common centre of gravity. The diagram known variously as the Russell diagram or Hertzsprung-Russell diagram was formulated in its modern form by Russell in 1913. The information which it gives about the stars is fundamental and its uses are varied. The diagram illustrates the relationship between the spectral types (that is to say, surface temperatures) and absolute magnitudes of the stars. (The absolute magnitude is a measure of the true brightness — as distinguished from the apparent brightness — of a star.)

The theory of stellar evolution advanced by Russell in 1913 was favoured almost universally for many years thereafter; although it is no longer supported, its importance in the development of the subject was great. Russell was one of the most active workers in the analysis of the line spectra of the elements and he utilized the new developments in studies of the characteristics of stellar atmospheres.

Among Russell's writings may be mentioned, *Modifying Our Ideas of Nature: the Einstein Theory of Relativity* (reprinted in the *Smithsonian Report for 1921*); *The Constitution and Evolution of the Stars* (reprinted in the *Smithsonian Report for 1923*); *The Composition of the Stars* (1933); *The Atmospheres of the Planets* (reprinted in the *Smithsonian Report for 1935*); and *The Solar System and Its Origin* (1936).

(W. W. M.)

For a description of the spectral type-absolute magnitude diagram, *see* H. N. Russell, R. S. Dugan and J. Q. Stewart, *Astronomy*, 2 vol. (1926–27; vol. I rev., 1945; vol. II, 2nd ed., 1938).

RUSSELL, JOHN RUSSELL, 1ST EARL (1792–1878), British statesman, third son of the 6th duke of Bedford, by Georgiana

Elizabeth Byng, second daughter of the 4th Viscount Torrington, was born in London on Aug. 18, 1792. He was a frail, puny child; as a consequence he attended Westminster school, the traditional school of the Russells, for one year only, 1803–04. In 1809 he was sent to Edinburgh university. His contacts there with such men as the mathematician and philosopher John Playfair with whom he resided and Dugald Stewart for whose teaching he expressed gratitude in a sonnet, and his membership of the Speculative society of which he became president in 1811–12 had a profound effect in directing his thoughts and teaching him the art of debate. While at the university and after leaving he travelled in Spain and Portugal.

His political career began when in 1813 he was returned to parliament in the Whig interest for the family borough of Tavistock. He was still regarded as delicate and his short stature and air of frailty were to prove, throughout his political life, in the nature of a gift to the cartoonists, notably John Leech in Punch. His first notable speech, in 1817, showed the trend of his mind. He spoke in opposition to the proposal to suspend the Habeas Corpus act. one of the measures designed to repress the prevailing industrial unrest. To Russell, bred in the Whig tradition, the proposal was an infringement of civil liberty. The suspension went through. But behind the troubles which culminated in the Cato Street conspiracy—a plot to murder the cabinet (1820)—new ideas were making their way. Young Russell was aware of them. In 1818 he was re-elected for Tavistock. In 1819 he began his advocacy for the reform of parliamentary representation by moving an inquiry into the corruption of one particular constituency, Grampound in Cornwall, the disenfranchisement of which he secured in 1821 when he had transferred as member to the county of Huntingdon. It was a sign of what was coming. In the meantime Russell turned his attention to another issue. On the matter of Catholic emancipation, now to the fore, the Whigs stood solid. Toleration was part of their creed. As one of their foremost spokesmen Russell lost his seat for Huntingdon in the 1826 election. Another was found for him in the Irish constituency of Bandonbridge. In Feb. 1828 when Wellington had replaced Liverpool as prime minister, Russell led the attacks on the Test acts which resulted in their repeal, a triumph which was followed by the government's recognition of the necessity for the Catholic Relief act, passed the next year.

June 1830 saw the death of George IV. In November Wellington resigned and King William sent for Earl Grey. Russell was made paymaster-general. Grey had determined on the immediare drafting of a Reform bill and appointed a committee of four. of which Russell was one. Although not yet a member of the cabinet, he was chosen to move the first reading in the house. March 31, 1831. When the bill was finally passed in the house of lords on June 4, 1832, Russell, who had been given a seat in the cabinet the previous June. was justly regarded as its chief architect. He had revealed the characteristics that informed his entire political career. He was a true Whig, as opposed to the radical wing of the party. when he described himself as "an enemy to extensive reform."

The passing of the Reform bill was followed by a general election in which the Whigs were again returned. Russell. elected for both Tavistock and South Devon, chose the county constituency, continuing as paymaster-general. In May 1834. when Ireland was in turmoil and Daniel O'Connell active, he intervened in the debate on the Irish Tithe bill in favour of diverting part of the revenues of the Irish church to other purposes, an ill-timed suggestion which caused much perturbation among his own party and called forth the remark by Lord Stanley, then Irish secretary, that "Johnny Russell has upset the coach." Russell had indeed displayed a trait that was to become more marked; a habit of expressing his own opinion without considering the effect on the government of which he was a member. Nevertheless. after Sir Robert Peel. he was the most commanding figure on the political stage. In April 1835, with Lord Melbourne as prime minister, he became home secretary and leader of the house of commons, a position grudgingly accepted by William IV who both disliked and distrusted him. It was a weak government whose life was only prolonged first by the death of William IV (June 1837) and then by the struggle between the young queen and Peel over the ladies of her household. In May 1839 Russell quitted South Devon for the borough of Stroud. In September he became secretary for war and the colonies. But the fall of the Whigs was at hand. One of the few bright spots in their collapse at the general election of 1841 was the return of Russell, although only in the fourth place, for the City of London. It was to his. constituents there that he addressed from Edinburgh in Nov. 1845 the letter, that "blast from a trumpet," which announced his conversion to the repeal of the corn laws. unaware that Peel, as prime minister! had already decided they must go. The act for the repeal, which passed that year. was therefore the work of Peel with the support of John Russell. When in 1846 Peel resigned Lord John, "our little giant," became, at the age of 54, prime minister and remained so for six years.

They were not easy years in either home or foreign affairs. Russell was only moderately successful in dealing with the problem of the Irish famine, 1847 But in the next year, 1848, that year of revolutions, his skilful handling of Chartism saved England from the threat of anarchy. The letter of 1850 to the bishop of Durham with its attack on the Roman hierarchy, occasioned by the papal bull creating Roman Catholic bishops in England. was one of his worst mistakes. Abroad. the struggle in the kingdoms of western Europe for liberty, the aftermath of 1848, commanded the sympathy and approval of Russell and no less of Lord Palmerston as foreign secretary. But Palmerston often made the situation difficult for the prime minister. Queen Victoria resented, not without reason, the foreign secretary's high-handed habit of acting on his own responsibility. Her resentment mas the deeper because her sympathy was with the European dynasties. The climax came in Dec. 1851 when Palmerston. without reference to either queen or prime minister, sent a dispatch to Paris approving Louis Napoleon's coup d'etat. Russell dismissed Palmerston. The next month the latter had his revenge when he brought about, over the Militia acts, the fall of the government.

In Lord Aberdeen's compromise ministry of Whigs and Peelites Russell remained in the cabinet, first as foreign secretary, then without office, and in 1854 as lord president. In 1853–54 he drew up the draft for a new Reform bill, which was brought to nothing by the outbreak of the Crimean War. Russell then fell into two errors, the first, his resignation in 1855 over the Crimean inquiry, an act pronounced by the queen, and not by her only, as completely selfish; the second his mistaken handling of the negotiations at the Vienna conference whither he was sent as British representative after his resignation. But at least one brilliant moment in his career was still before him. In 1859 he became foreign minister with Palmerston as prime minister, at the moment when the national struggle in Italy was moving toward its climax. Russell's Italian diplomacy was wise and resolute. He had the complete support of his chief but not of the queen. But though he had to endure with ill grace the clipping of his dispatches he carried out triumphantly the main lines of his policy. United Italy owed the English minister much. It was his last great consistent effort in the cause of liberty, embodied in the historic dispatch of Oct. 27, 1860. to the ambassador at Turin. He was less successful in his handling of the Civil War in the U.S. and the Schleswig-Holstein controversy. In Oct. 1865, having four years previously accepted an earldom, he again became prime minister, but for no more than a few troubled months. The irony of fate brought about the defeat of his government on a new Reform bill.

Russell retired from politics to spend his time at Pembroke lodge, Richmond. a residence presented for life to him by the queen in 1847, in writing his recollections and editing documents. He died on May 28, 1878.

Russell married first in 1835 Adelaide. daughter of Thomas Lister and widow of Thomas, second Lord Ribblesdale, and secondly in 1841 Frances Anne Maria Elliot, daughter of Gilbert, 2nd earl of Minto.

BIBLIOGRAPHY.—Russell's most important contribution to historical literature is his edition of the *Correspondence of* John, *Fourth Duke of Bedford*, 3 vol. (London, 1842–46).

The chief biography is that by Sir Spencer Walpole, 2 vol. (London,

1891). The volume by Stuart J. Reid (London, 1895, "Prime Ministers of Queen Victoria" series) should also be consulted. A valuable survey of his career from 1840 onward is given by G. P. Gooch (ed), in his edition of *The Later Correspondence of Lord John Russell, 1840–1878* (London, New York, 1925). (G S T.)

RUSSELL, THOMAS (1762–1788), English poet, was born at Beaminster, early in 1762. He was educated at Winchester under Joseph Warton, and at New college, Oxford. In 1789 was published a thin volume, containing his *Sonnets* and *Miscellaneous Poems*, now a very rare book. It contained 23 sonnets, of regular form, and a few paraphrases and original lyrics. The sonnets are the best, and by right of these Russell takes his place as a precursor of the romantic school His sonnet, "Suppos'd to be written at Lemnos," is his masterpiece.

RUSSELL, LORD WILLIAM (1639–1683), English politician, was the third son of the 1st duke of Bedford and was born on Sept. 29, 1639. About 1654 he was sent to Cambridge with his elder brother Francis (on whose death in 1678 he obtained the courtesy title of Lord Russell). On leaving the university, the two brothers travelled abroad, visiting Lyons, Geneva, Augsburg, and Paris, but returned to Woburn in December 1659. At the Restoration he was elected for the family borough of Tavistock. He appears to have indulged in the follies of court life and intrigue; for both in 1663 and 1664 he was engaged in duels, in the latter of which he was wounded. In 1669 he married Rachel (1636–1723), second daughter of the 4th earl of Southampton, and widow of Lord Vaughan, thus becoming connected with Shaftesbury, who had married Southampton's niece. With his wife Russell always lived on terms of the greatest affection and confidence. She corresponded with Tillotson and other distinguished men, and a collection of her admirable letters was published in 1773.

On the formation of the "country party," in opposition to the Cabal and Charles's French-Catholic plots, Russell began to take an active part in affairs. He then joined Cavendish, Birch, Hampden, Powell, Lyttleton and others in vehement antagonism to the court. With a passionate hatred and distrust of the Catholics. and an intense love of political liberty, he united the desire for ease to Protestant Dissenters. He inveighed (Jan. 22, 1673) against the stop of the exchequer, the attack on the Smyrna fleet, the corruption of courtiers with French money, and "the ill ministers about the king"; he supported the proceedings against the duke of Buckingham, and against Danby (*see* LEEDS, THOMAS OSBORNE); and in March 1678 he seconded the address praying the king to declare war against France. The country party hated Danby and James more than they hated Louis. The French king formed a temporary alliance with Russell, Hollis and the opposition leaders, on terms. Russell in particular entered into close communication with the marquis de Ruvigny (Lady Russell's maternal uncle), who came over with money for distribution among members of parliament. By the testimony of Barillon, however, it is clear that Russell refused any part in the intended corruption.

By the wild alarms which culminated in the Popish Terror Russell was apparently deeply affected. He threw himself into the party which looked to Monmouth as the representative of Protestant interests, a grave political blunder, though he afterwards was in conndential communication with Orange. On Nov. 4, 1678, he moved an address to the king to remove the duke of York from his person and councils. At the dissolution of the pensionary parliament, he was, in the new elections, returned for Bedfordshire. Danby was at once overthrown, and in April 1679 Russell was one of the new privy council formed by Charles on the advice of Temple. Only six days after this we find him moving for a committee to draw up a bill to secure religion and property in case of a popish successor. He does not, however, appear to have taken part in the exclusion debates at this time. In June, on the occasion of the Covenanters' rising in Scotland, he attacked Lauderdale personally in full council.

In January 1680 Russell, along with Cavendish, Capell, Powell, Essex and Lyttleton, tendered his resignation to the king, which was received by Charles "with all my heart." On June 16, he accompanied Shaftesbury, when the latter indicted James at Westminster as a popish recusant; and on Oct. 26 he took the extreme step of moving "how to suppress popery and prevent a popish successor"; on Nov. 2, now at the height of his influence, he seconded the motion for exclusion in its most emphatic shape, and on the 19th carried the bill to the House of Lords for their concurrence. The limitation scheme he opposed, on the ground that monarchy under the conditions expressed in it would be an absurdity. On December 18 he moved to refuse supplies until the king passed the Exclusion Bill. The prince of Orange having come over at this time, there was a tendency on the part of the opposition leaders to accept his endeavours to secure a compromise on the exclusion question. Russell, however, refused to give way a hair's-breadth.

On March 26, 1681, in the parliament held at Oxford, Russell again seconded the Exclusion Bill. Upon the dissolution he retired into privacy at his country seat of Stratton in Hampshire. In the wild schemes of Shaftesbury after the election of Tory sheriffs for London in 1682 he had no share; upon the violation of the charters, however, in 1683, he began seriously to consider as to the best means of resisting the government, and on one occasion attended a meeting at which treason, or what might be construed as treason, was talked. Monmouth, Essex, Hampden, Sidney and Howard of Escrick were the principal of those who met to consult. On the breaking out of the Rye House Plot, of which neither he, Essex, nor Sidney had the slightest knowledge, he was accused by informers of promising his assistance to raise an insurrection and compass the death of the king. Refusing to attempt to escape, he was brought before the council, when his attendance at the meeting referred to was charged against him. He was sent on June 26, 1683, to the Tower. Monmouth offered to appear to take his trial, if thereby he could help Russell, and Essex refused to abscond for fear of injuring his friend's chance of escape. Before a committee of the council Russell, on June 28, acknowledged his presence at the meeting, but denied all knowledge of the proposed insurrection. He reserved his defence, however, until his trial. He would probably have saved his life but for the perjury of Lord Howard, who expressly declared that Russell had urged the entering into communications with Argyll in Scotland. Howard's perjury is clear from other witnesses, but the evidence was accepted. Russell spoke with spirit and dignity in his own defence, and, in especial, vehemently denied that he had ever been party to a design so wicked and so foolish as that of the murder of the king or of rebellion. The legality of the trial, in so far as the jurors were not properly qualified and the law of treason was shamefully strained, was denied in the act of 1 William & Mary which annulled the attainder. Hallam maintains that the only overt act of treason proved against Russell was his concurrence in the project of a rising at Taunton, which he denied, and which, Ramsay being the only witness, was not sufficient to warrant a conviction.

Russell was sentenced to die. Many attempts were made to save his life. The old earl of Bedford offered £50,000 or £100,000, and Monmouth, Legge, Lady Ranelagh, and Rochester added their intercessions. Russell himself, in petitions to Charles and James, offered to live abroad if his life were spared, and never again to meddle in the affairs of England. He refused, however, to yield to the influence of Burnet and Tillotson, who endeavoured to make him grant the unlawfulness of resistance, although it is more than probable that compliance in this would have saved his life. He drew up, with Burnet's assistance, a paper containing his apology, and he wrote to the king a letter, to be delivered after his death, in which he asked Charles's pardon for any wrong he had done him. A suggestion of escape from Lord Cavendish he refused. He behaved with his usual quiet cheerfulness during his stay in the Tower, and spent the last morning in devotion with Burnet. He was executed at Lincoln's Inn Fields on July 21, 1683.

A true and moderate summing-up of his character will be found in his *Life*, by Lord John Russell (1820).

RUSSELL, SIR WILLIAM HOWARD (1821–1907), English war correspondent, was born at Lilyvale, near Tallaght, Co. Dublin, on March 28, 1821, being one of the Russells of Limerick, whose settlement in Ireland dates from the time of

Richard II. He entered Trinity college in 1838. Three years later he was thrown very much on his own resources, but a relative, R. W. Russell. who had been sent to Ireland by *The Times*, deputed him to report the Irish elections at Longford, and his success definitely turned his attention to journalism. Coming to London in 1842, he went to Cambridge, but left before taking a degree. He was special correspondent for *The Times* in Ireland in 1845, in Denmark in the war of 1849–50, and in the Crimean War. His letters written from the Crimea were published in book form as *The War, 1855–56*. The exposure made by Russell of the mismanagement in the Crimea contributed to the fall of the Aberdeen ministry. Russell also served as correspondent in India in 1858, in America in 1861–3, in the Seven Weeks' War of 1866, in the Franco-German war of 1870; and he was with Wolseley in South Africa in 1879 and in Egypt in 1882. In 1860 he founded the *Army and Navy Gazette*. Russell was knighted in May 1895, and was the recipient of numerous war medals and various foreign orders. He died on Feb. 11, 1907.

His works include: *My Diary in India in 1858–59* (1860); *My Diary, North and South, during the Civil War in America*, 1862 (1862); *My Diary during the Last Great War* (the Franco-Prussian War of 1870) (1873); *Hesperothen*, a description of a tour in the United States and Canada (1882); and *The Great War with Russia* (1895).

RUSSELL OF KILLOWEN, CHARLES RUSSELL, BARON (1832–1900), lord chief justice of England, was born at Newry, County Down, on Nov. 10, 1832, the son of Arthur Russell. The family was Roman Catholic. Educated first at Belfast, afterward in Newry and finally at St. Vincent's college, Castleknock, Dublin, he was articled in 1849 to a firm of solicitors in Newry. In 1854 he was admitted and began to practise his profession. In the legal proceedings arising out of Catholic and Orange disturbances young Russell distinguished himself in the cause of his co-religionists.

After practising for two years he determined to seek a wider field for his abilities. He went to London in 1856 and entered Lincoln's Inn. In 1858 he married Ellen, daughter of Joseph Mulholland of Belfast, and in 1859 he was called to the bar and joined the northern circuit. He possessed immense personality, an embodiment of energetic will that riveted attention, dominated his audience and bore down opposition. In his early years Russell's practice was mostly at the passage court at Liverpool, and he published a book on its procedure in 1862.

In 1872 Russell took silk, and his success as a queen's counsel during this period of his career was prodigious. He excelled in the conduct alike of commercial cases and of those involving, as he said, "a human interest," although undoubtedly it was the latter which more attracted him. He was seen to the least advantage in cases which involved technical or scientific detail.

In 1880 Russell was returned to parliament as an independent Liberal member for Dundalk. From that time forward until 1894 he sat in the house of commons: for Dundalk until 1885, and afterward for South Hackney. From 1880 to 1886 as a private member, and as the attorney general in Gladstone's administrations of 1886 (when he was knighted) and 1892, he worked in and out of parliament for the Liberal policy in regard to the treatment of Ireland as few men except Russell could or would work. His position throughout was clear and consistent. Before 1886 on several occasions he supported the action of the Irish Nationalist party. He opposed coercion, voted for compensation for disturbance, advocated the release of political prisoners and voted for the Maamtrasna inquiry. But he never became a member of the Irish Home Rule or of the Parnellite party; he was elected at Dundalk as an independent Liberal, and such he remained. When he warmly advocated the establishment of a subordinate parliament in Ireland, he did so because he sought the amelioration and not the destruction of Ireland's relations with the rest of the kingdom.

Russell rapidly became in London what he was already in Lancashire, a favourite leader in nisi prius actions (those held for trial on the issue of facts before a jury and single judge). More important, however, as well as more famous, than any of his successes in the ordinary courts of law during this period were his performances as an advocate in two public transactions of note in British history. The first of these was the Parnell commission of 1888–90, in which Russell appeared as leading counsel for Parnell. In April 1889, after 63 sittings of the commission, Russell. who had already destroyed the chief personal charge against Parnell by a brilliant cross-examination in which he proved it to have been based upon a forgery, made his great opening speech for the defense, lasting several days. This speech, besides its merit as a wonderful piece of advocacy. possesses permanent value as a historical survey of the Irish question during the 19th century from the point of view of an Irish Liberal. The second was the Bering sea arbitration, held in Paris in 1893. Russell, with Sir Richard Webster (afterward Lord Alverstone), was the leading counsel for Great Britain. The award was, substantially, in favour of Great Britain.

In 1894, on the death of Lord Bowen, Russell accepted the position of a lord of appeal and was raised to the peerage. A month later he was appointed lord chief justice of England in succession to Lord Coleridge. Brief as was his tenure of the office, he proved himself well worthy of it. He had dignity without pomposity, quickness without irritability, and masterfulness without tyranny. In 1896 Lord Russell presided at the trial at bar of the leaders of the Jameson raid. His conduct of this trial, in the midst of much popular excitement, was by itself sufficient to establish his reputation as a great judge. One other event at least in his career while lord chief justice deserves a record, namely. his share in the Venezuela arbitration in 1899. Lord Herschell, a British representative on the commission, died before the beginning of the proceedings, and Lord Russell took his place.

Lord Russell contributed to the reform of the law by his advocacy of improvement in the system of legal education, and in promoting measures against corruption and secret commissions, though the bills he introduced did not become law. He died on Aug. 10, 1900. Few English lawyers have ever excited the admiration abroad that Lord Russell did, both in Europe and America.

See R. B. O'Brien, *The Life of Lord Russell of Killowen* (1908).

RUSSELL SAGE FOUNDATION, an institution established by Mrs. Russell Sage in memory of her husband. The initial endowment was $10,000,000, to which $5,000,000 was added by her will. It was incorporated by an act of the legislature of New York in April 1907, "for the improvement of social and living conditions in the United States of America." The charter further states: "It shall be within the purposes of said corporation to use any means to that end which from time to time shall seem expedient to its members or trustees, including research, publication, education, the establishment and maintenance of charitable or benevolent activities, agencies and institutions, and the aid of any such activities, agencies or institutions already established." The income only may be spent.

The management of the foundation is vested in a board of twelve trustees, which is self-perpetuating. The staff of the foundation study social conditions and methods of social work, interpret the findings, make the information available by publications, conferences and other means of public education, and seek in various ways to stimulate action for social betterment. Departments exist for dealing with charity organization, industrial relations, consumer credit, family welfare, social statistics, etc. The foundation does not relieve individual need and it avoids duplicating the work of existing agencies. In 1922 the foundation organized the Committee on Regional Plan of New York and its environs, providing the funds and office space and some staff assistance in preparing a plan for the future development of the New York region, an undertaking which took about seven years to complete.

RUSSIA, the name given to territories of the Eurasian continent which once constituted the Russian empire and which after World War I were included nithin the Union of Soviet Socialist Republics. Occupying almost one-seventh of the land surface of the world, it is the world's largest state and has the third biggest population. including many races, religions and nationalities. The name "Russia" (Rossiya) comes from the Slavonic Rus, possibly derived from *Ruotsi* (a Finnish name for the Swedes), which seems to be a corruption of the Swedish *rothsmenn* "rowers" or "seafarers."

After an account of the political divisions of the U.S.S.R. and a description of its geographical limits, this article is divided into 15 main sections as follows:

The U.S.S.R. was formally organized on Dec. 30, 1922, and originally consisted of the Russian Soviet Federated Socialist Republic (*q.v.*), the Ukrainian Soviet Socialist Republic (see UKRAINE), the Byelorussian S.S.R. (see BELORUSSIAN SOVIET SOCIALIST REPUBLIC) and the Transcaucasian S.F.S.R. In 1924 it was decided that the Turkistan Autonomous Soviet Socialist Republic. a component part of the R.S.F.S.R., should be divided on a nationality basis and transformed into five component republics of the U.S.S.R. This process took 12 years to complete: Uzbekistan and Turkmenistan (*qq.v.*) were officially admitted to the union in Jan. 1925, Tajikistan (*q.v.*) was admitted in Dec. 1929. and Kazakhstan and Kirghizia (*qq.v.*) were admitted in Dec. 1936. In Dec. 1936, too, the Transcaucasian federation was dissolved and Georgia. Armenia and Azerbaijan (*qq.v.*) became direct members of the union. To the above 11 republics five others were added during World War II, namely Karelia. Estonia. Latvia, Lithuania and Moldavia (*qq.v.*), the first being admitted in March 1940 and the remaining four in Aug. 1940. (See Table I.) On July 16. 1956, Karelia (Karelo-Finnish S.S.R.) was included into the Russian S.F.S.R. as the 13th A.S.S.R.

In 1956 the R.S.F.S.R. included 13 self-governing towns; 53 regions or *oblasti;* 6 territories or ***krai*** (Krasnodar and Stavropol in Europe and Altai, Krasnoparsk, Primorsky and Khabarovsk in Asia); 12 autonomous soviet socialist republics or A.S.S.R., namely Bashkiria, Chuvashia, Daghestan. Kabarda, Komi (Zyryania), Marii (Cheremisia), Mordvinia, North Ossetia, Tataria, Udmurtia (Votyakia), Buriat Mongolia and Yakutia (see Table II); 6 autonomous regions or A.O., namely 2 in Europe (Adyghei and Cherkess) and 4 in Asia (Gorno-Altai, Jewish, Khakass and Tuva) (see Table III); and 10 national districts or N.O., namely 2 in Europe (Nenets or Samoyed and Komi-Permyak) and 8 in Asia (Yamalo-Nenets, Taimyr or Dolgano-Nenets, Khanty-Mansi or Ostyak-Vogul, Evenki or Tungus, Chukot, Koryak, Ust-Orda and Aghin (see Table IV).

TABLE I.—Union of Soviet Socialist *Republics* after World War *II*

Republic	Capital	Area (sq.mi.)	Population (1940 est.)	Population (1956 est.)
Russian S.F.S.R.	Moscow	6,523,524*	108,800,000†	112,600,000
Ukrainian S.S.R.	Kiev (Kyiv)	232,618	40,525,000‡	40,600,000
Byelorussian S.S.R.	Minsk	80,154	9,000,000	8,000,000
Kazakh S.S.R.	Alma-Ata	1,063,242	6,146,000	8,500,000
Uzbek S.S.R.	Tashkent	157,336	6,282,000	7,300,000
Georgian S.S.R.	Tiflis (Tbilisi)	29,488	3,542,300	4,000,000
Azerbaijanian S.S.R.	Baku	33,089	3,209,700	3,400,000
Lithuanian S.S.R.	Vilnius (Wilno)	25,174	3,000,000	2,500,000
Moldavian S.S.R.	Kishinev (Chisinau)	13,050	2,700,000	2,700,000
Latvian S.S.R.	Riga	24,903	1,950,000	2,000,000
Kirghiz S.S.R.	Frunze	76,023	1,459,300	1,900,000
Tajik S.S.R.	Stalinabad	55,958	1,485,100	1,800,000
Armenian S.S.R.	Yerevan	11,506	1,281,600	1,600,000
Turkmen S.S.R.	Ashkhabad	187,181	1,252,000	1,400,000
Estonian S.S.R.	Tallinn (Reval)	17,413	1,117,300	1,100,000
Karelo-Finnish S.S.R.	Petrozavodsk	68,919	606,300	600,000
Total		8,598,678	192,357,000	200,200,000

Sources: Areas and population estimates for 1940 are taken from the *Bolshaya Sovietskaya Entsiklopedia: S.S.S.R.* (Moscow, 1948); population estimates for 1956 irom *Narodnoye Khozyaistvo* S.S.S.R. (Moscow, 1956).

*Excluding the Crimea which from Feb. 19, 1954 was part of the Ukraine.

†According to the 1939 census the population of the R.S.F.S.R. was 109,278,614; its reduction was explained by the fact that the Karelian A.S.S.R. (469,145 inhabitants in 1939) iormed with the areas ceded by Finland in 1940 a Karelo-Finnish S.S.R.

‡Excluding the population of Sub-Carpathian Ruthenia (725,000) which was incorporated with the Ukraine in 1945.

TABLE II.—*Autonomous Soviet* Socialist Republics, Jan. 1, *1956*

Name	Date of formation	Area (sq.mi.)	Population (1939)	Capital
In the R.S.F.S.R.:				
Bashkiria	March 23, 1919	55,405	3,144,713	Ufa
Chuvashia	1920	7,066	1,077,614	Cheboksary
Daghestan	Nov. 13, 1920	14,749	930,527	Makhachkala
Kabarda*	Sept. 1, 1921	4,556	359,236	Nalchik
Komi (Zyryania)	July 22, 1921	156,216	319,469	Syktyvkar
Marii (Cheremisia)	Nov. 4, 1920	8,919	579,466	Yoshkar Ola
Mordvinia	Jan 10, 1930	10,077	1,189,000	Saransk
Nortli Ossetia	July 7, 1924	3,552	328,885	Ordzhonikidze
Tataria	May 27, 1920	26,100	2,919,423	Kazan
Udmurtia (Votyakia)	Nov. 4, 1920	16,293	1,220,007	Izhevsk
Buriat Mongolia	May 30, 1923	135,676	542,170	Ulan Ude
Yakutip	1922	1,182,300	400,544	Yakutsk
In Georgia:				
Abkliazia	March 4, 1921	4,359	259,100	Sukhnmi
Adzharia	June 16, 1921	1,120	153,800†	Batumi
In Azerbaijan:				
Nakhichevan	Feb. 9, 1924	2,008	125,000‡	Nakhichevan
In Uzbekistan:				
Kara-Kalpakia	May 11, 1925	61,467	373,500†	Nukus

*Until April 1944 the officialname was Kabardino-Balkar A.S.S.R. At that timeabout 43,000 Balkars were deported to central Asia and the name was changed to Kabardinian A.S.S.R. †1933. ‡1936.

TABLE 111.—Autonomous Regions (A.O.)

Name	Date oi formation	Area (sq.mi.)	Population	Capital
In the R.S.F.S.R.:				
Adyghei	July 27, 1922	1,699	241,773 (1939)	Maikop
Cherkess	April 26, 1926	1,544	80,800 (1933)	Cherkessk
Gorno-Altai	June 1, 1922	35,733	161,400 (1939)	Gorno-Altaisk
Jewish	May 7, 1934	13,822	108,400 (1939)	Birobidzhan
Khakass	Oct. 20, 1930	23,707	270,655 (1939)	Abakan
Tuva	Oct. 11, 1944	66,139	95,000 (1941)	Kyzyl
In Georsia:				
South Ossetia	1921	1,429	104,600 (1937)	Staliniri
In Azerbaijan:				
Nagorno-Karabakh	June 7, 1923	1,737	153,900 (1933)	Stepanakert
In Tajikistan:				
Gorno-Badakhshan	Jan. 2, 1925	23,591	35.700 (1933)	Khorog

TABLE IV.—*National* Districts (N.O.) of the R.S.F.S.R.

Name	Date of formation	Area (sq.mi.)	Population	Capital
Nenets (Samoyed)	July 15, 1929	67,297	28,100 (1937)	Naryan-Mar
Komi-Permyak	Feb. 26, 1925	12,046	160,100 (1939)	Kudymkar
Yamalo-Nenets	1930	258,841	12,800 (1926)	Salekhard
Taimyr (Dolgano-Nenets)	1930	316,680	29,100 (1939)	Dudinka
Khanty-Mansi (Ostyak-Vogul)	1930	215,482	102,200 (1933)	Khanty-Mansiysk
Evenki (Tungus)	1931	285,907	...	Tura
Chukot	1925	274,517	15,000 (1926)	Anadyr
Koryak	Dec. 10, 1930	151,737	21,000 (1939)	Palana
Ust-Orda	1937	7,954	...	Ust-Orda
Aghin	Sept. 26, 1937	9,382	...	Aghinskoye

The four A.S.S.R. outside the R.S.F.S.R. are Abkhazia and Adzharia, which are parts of Georgia; Nakhichevan, which is part of Azerbaijan; and Kara-Kalpakia, which is part of Uzbekistan. The three A.O. outside the R.S.F.S.R. are the Nagorno-Karabakh (part of Azerbaijan), the South Ossetia (part of Georgia) and Gorno-Badakhshan (part of Tajikistan).

The area of the Russian empire before 1914 was about 8,674,000 sq.mi. As a consequence of the proclamation of Finland. Estonia. Latvia and Lithuania as independent states; of the restoration of Poland; and of the recovery of Bessarabia by Rumania and of the Kars-Xrdahan-Artvin area by Turkey, by 1921 the area of the U.S.S.R. was reduced to 8,333,000 sq.mi.

Between 1939 and 1945 the U.S.S.R. annexed the following territories. the formerly Polish western Ukraine and western Byelorussia, the formerly Finnish Karelia and Petsamo (Pechenga), Estonia. Latvia, Lithuania, the formerly Rumanian Bessarabia and northern Bukovina, the formerly Czechoslovakian Sub-Carpathian Ruthenia. the formerly German northeast part of East Prussia

(renamed the Kaliningrad region and part of the R.S.F.S.R.), the formerly Japanese Karafuto (southern Sakhalin) and Kurile (Kurilskyie) Islands and the formerly "independent" republic of Tuva. (*See* Table V.) The total area of the Soviet Union including these new territories mas 8,598,678 sq mi.

The Soviet Union extends over the eastern part of Europe and the northern and central parts of Asia, stretching north and south from Cape Chelyuskin (77° 43' N. lat.) to Kushka on the Afghan frontier (35° 08' N. lat.). East and west the country extends approximately from a point on the Gulf of Danzig near 19° 38' E. long. to Cape Dezhnev (East cape) on the Chukchi (Chukotski) peninsula at 169° 40' W. long.

The western frontier of the U.S.S.R. runs from the shores of the Barents sea down to the Black sea. On the west the Soviet Union borders on Norway, Finland, Poland, Czechoslovakia, Hungary and Rumania. The southern frontier runs from the Kiliya mouth of the Danube and proceeds along the shores of the Black sea. Thence it extends eastward along the southern limit of the Armenian highland to Nakhichevan, along the Araks river. south along the Talysh range and across the Caspian sea. The frontier from the eastern shore of the Caspian sea follows approximately along the crest of the Kopet Dagh range and east onto the Pamir highland. Thence it extends along the Tien-Shan. the Altai, the Tannu Ola and the Transbaikalia mountains. From the Manchurian frontier the boundary runs along the Argun river to its confluence nith the Shilka and thence along the Amur river to its junction nith the Ussuri, where it turns south to follow the Ussuri river to Lake Khanka whence it runs to the shore of the Sea of Japan. On the south the Soviet Cnion borders on Turkey, Iran, Afghanistan, China (Sinkiang). Mongolia, China again (Manchuria) and Korea. The eastern frontier is entirely a sea border.

More than two-thirds of the Soviet borders are maritime. The northern frontier on the Arctic ocean is maritime in its entire length, but apart from Murmansk. which is washed by the warm Atlantic drift, this frontier is frozen for nearly ten months of the year.

The island possessions of the Soviet Union are numerous, but the majority are in the Arctic ocean and are of little use. The Aleutian archipelago and Alaska were sold to the United States in 1867 The Kurile Islands, ceded to Japan in 1875, were recovered by the Soviet Union in Sept. 1945. A group of small islands in the gulf of Finland. given up after the revolution of 1917, were recovered from Finland in 1940. The Komandorskyie Islands off Kamchatka. the Shantar Islands near the Pacific coast and from Aug. 1945, the whole of the island of Sakhalin are Soviet possessions. The chief Soviet islands off the arctic coast are Kolguyev Island. Novaya Zemlya and Vaigach Island, the Severnaya Zemlya (formerly Nicholas II Land) north of the Taimyr peninsula, the New Siberian Islands (north of Laptev sound) and Wrangel Island Franz Josef Land is Soviet territory, but Spitsbergen and Bear Island were recognized in 1920 as being under Norwegian sovereignty. (I. GY.; K. SM.)

I. PHYSIOGRAPHY AND STRUCTURE

In very general terms Russia may be described as a wide amphitheatre open to the Arctic but bordered to the east, to the south and to the west by the high mountain and plateau belt that forms the middle zone of the Eurasian land mass. The great inner lowland can be divided into four regions: viz., the east European plain, the west Siberian plain, the Aralo-Caspian basin and the central Siberian plateau. The first two of these regions, both plains of low relief. are similar in most of their geographical features but are separated by the Ural mountains; the third is a southward extension of the west Siberian plain separated from it by a belt of low hills and lying east of the Caspian sea. The central Siberian region is an ancient plateau with a gently undulating surface but deeply dissected by streams draining to the Yenisei and Lena. The mountain border includes, from nest to east, the following highlands, all on or near the U.S.S.R. frontiers: the Carpathians, the Caucasus, the Kopet Dagh, the Pamirs and Tien-Shan, the Altai and Sayan mountains, and the East Siberian highlands.

East European Plain. — This immense lowland forms almost the nhole of European Russia. It rises almost imperceptibly eastward toward the Urals. Underlying it is a relatively undisturbed floor or platform of Archaean and Palaeozoic rocks. Though usually buried beneath later deposits, this platform is exposed in the northnest and southwest. In the former area the Fennoscandian shield extends into Karelia and the Kola peninsula as far as the great lake belt between the White sea and the Gulf of Finland. In the southnestern area the Azov-Podolian shield underlies the Volhyno-Podolian upland of the Ukraine. The platform surface is not quite horizontal throughout for it suffered warping and some dislocation as a result of Huronian and Caledonian earth movements. Still more important deformations resulted from the pressures set up by Hercynian folding. The more recent Tertiary folding had little effect outside the highland borders.

Much more important in the geological history of the country than these violent crustal movements were the alternating advances and retreats of the surrounding seas over the land. In the wide shallow basins so formed were laid down, age after age, the sedimentary rocks nhich now cover most of the platform. In general these rocks are of decreasing age from northwest to southeast and are still almost as horizontally disposed as when they were first laid donn.

The major relief features of the plain are thus of ancient origin but the detailed topography is nearly everywhere the result of more recent happenings. Chief among these were the invasion of the Pleistocene ice sheets — mainly from Scandinavia but also from the northern Urals — and the marine transgressions and regressions in the north and the southeast. The separation of the Aralo-Caspian depression from the Arctic was completed only after Oligocene times. The breaking of its former link with the Black sea through the Manych depression was still more recent.

The rivers of the east European plain are slow and minding, with almost insignificant gradients. The main divide is the morainic ridge which forms the Lithuanian-Byelorussian and Valdai hills and extends northeastward to the middle Urals. Its maximum height, in the Valdai area, is 1,053 ft. In spite of its low altitude, this ridge separating the northward and southward draining areas is the most significant feature of the plain.

The Northern Plain. — This includes the Russian section of the Fennoscandian shield. From the line from the White sea to the Gulf of Finland via Lakes Ladoga and Onega (discussed in the article on Europe, *q.v.*) eastward toward the northern Dvina. Palaeozoic, Devonian. Carboniferous and Permian rocks succeed

TABLE V.—*Areas Annexed by the U.S S.R., 1939–45*

Area	Date and form of incorporation		Population (est)
In Europe:			
Estonia	Decision of the supreme soviet of the U.S.S.R. Aug. 6, 1940	18,357	1,134,000
Latvia	Aug. 5, 1940	25,395	1,994,000
Lithuania (including both Klaipeda and Vilnius)	Aug. 3, 1940	25,174	3,032,000
From Finland (Karelia and Petsamo-Pechenga)	Soviet-Finnish treaty of March 12, 1940; Finnish-Allied armistice of Sept. 19, 1944	17,598	54,000*
From Poland (excluding the Vilnius area)	German-Soviet agreement of Sept. 28, 1939; Polish-Soviet treaty of Aug. 16, 1945	65,610	10,315,000
From Rumania (Bessarabia and northern Bukovina)	Soviet ultimatum of June 28, 1940; Paris peace treaty of Feb. 10, 1947	19,247	3,700,000
From Czechoslovakia (Sub-Carpathian Ruthenia)	Soviet-Czechoslovakian treaty of June 29, 1945	4,866	850,000
From Germany (northeast part of East Prussia)	Decision of the Potsdam conference, Aug. 2, 1945	5,361	1,187,000
Total (Europe)		181,610	22,266,000
In Asia:			
From Japan: Karafuto (southern Sakhalin)	Yalta agreement of Feb. 11, 1945	13,935	415,000
Kurile Islands	Japanese surrender of Sept. 2, 1945	3,994	
Tuva People's Republic	Decision of the supreme soviet of the U.S.S.R. Oct. 10, 1944	66,139	95,000
Total (Asia)		84,068	514,000
Grand total		265,678	22,780,000

*In 1940 425,301 Karelians left to resettle in Finland.

one another. Beyond that river the lower levels are mainly alluvials with Pleistocene glacial deposits between the river lines. The basin of the Pechora is divided from the land farther west by a minor fold belt bringing up Devonian and some crystalline schist along the line of the Timan hills that may be traceable as,a branching of the mid-Urals northwestward to Cape Kanin. The whole northern region has a very low relief. Apart from the Timan hills it is all below the 600-ft. contour. The chief rivers are the Pechora (1,150 mi.), the Mezen (500 mi.) and the Northern Dvina (470 mi.). All are frozen for long periods (seven months on the lower Pechora) each winter. The Neva carries the abundant lake outflow to the Gulf of Finland, and the Western Dvina and Niemen flow into the Baltic.

The Pleistocene glaciation had its most marked effects on the northern plain. The Scandinavian sheets reached their maximum extension in the Riss period when they penetrated to the edge of the Volhyno-Podolian and central Russian uplands with two great lobes into the Dnieper and Oka-Don lowlands and thence along the foot of the Volga upland to the mid-Urals. The later Würm glaciation left most of the existing effects. its terminal moraine forming the main divide. Over Finland and Karelia these effects were mainly erosive, removing surface soils and leaving bare rock surfaces with many lakes in irregular shallow hollows. Long, low, sandy ridges (eskers) cross the region. Beyond this belt to the limit of the ice sheets is the accumulation belt covered mainly with boulder clays as far as the main end moraine. Many great channels (German *Urstromtäler*) run parallel to but within the moraine, such as that followed by the two great headwaters of the Northern Dvina.

The Southern Plain.—Although never covered by the continental ice sheets the southern section of the European plain has been much affected by them. Boulder clay deposits were left in the Dnieper and Oka-Don lobes. After the final retreat of the ice fine-grained clay and sand were washed southward by the melting water and, as they dried, carried still farther by wind. These form a covering of loess and *limon* over vast unglaciated areas. Much of the ravine and gully country of the southern plain has been created by erosion in this easily weathered material. Where coarser material formed outwash plains as in the Pripet, Dnieper, Oka and Tsna valleys these are now covered by swampy woodlands (polesye).

The main structural features underlying the southern plain are slight undulations, anticlines and synclines with axes northwest to southeast; the down-faulted Donets basin in which rich coal measures have been preserved; the up-thrusted Kursk-Voronezh horst, forming part of the central Russian upland. Other areas of eroded uplift include the Volga heights on the right bank of the middle Volga, the horst of the Ufa plateau west of the middle Urals, and the Stavropol plateau along the northern foot of the Caucasus. The exposed platform area already referred to contains the Ukrainian iron ores of Krivoy Rog and the manganese ores of Nikopol.

The Dnieper from Kiev to Dnepropetrovsk follows the northern edge of the platform to the latter town and then cuts across it to the sea. To the north of the middle Dnieper is the faulted syncline of the Donets basin with wide areas of Tertiary rocks, though Palaeozoic rocks come to the surface in the higher country near the Sea of Azov. Next to the north is the central anticline along whose axis the Don flows to the southeast. The rocks there are mainly Cretaceous capped interfluvially by early Tertiary here and there.

The Moscow Basin.—Northeast of this anticlinal zone is the immense "Moscow basin," floored by Palaeozoic rocks mainly still horizontal, with some Triassic deposits; but there are patches of Jurassic and Cretaceous strata as, for example. around Moscow and in the great bend of the Volga and also farther north from Kostroma to Syktyvkar (Ust-Sysolsk) on a tributary of the Vychegda. There was an intrusion of the sea in Jurassic times which became much more extensive in the Cretaceous period; no upper Cretaceous is known, honever, in northern Russia. Around the Moscow basin in the southwest and west the Lower Carboniferous system (with poor coal at Tula, etc.) outcrops in a great curved belt from the region of Tula almost to the White sea Beyond this belt northnestnard is the area of Devonian rocks toward Latvia and Estonia and across to the White sea. They rest unconformably on Silurian rocks which outcrop along the southern shore of the Gulf of Finland and of Lake Ladoga. The Devonian rocks are partly lacustrine (old red sandstone) and partly marine in origin, and the two types are often interstratified: a basal red sandstone is covered by a dolomitic limestone which in turn has a sandstone over it. The Timan hills on the northeast may be said to be an upfold bordering the Moscow basin.

The main axis of the basin is parallel to the course of the Volga above Gorki (Nizhny-Novgorod), continued northwestward by the Mologa; i e., rivers running broadly parallel to the sections of the Dnieper, Donets and Don already noted. Permian rocks outcrop over large areas on the north. The dips of the strata are small, and anticlines and synclines there are really slight undulations which might be folloned right across Russia from the Dniester to the Timan hills, always nith lines roughly northwest to southeast (or west-northwest to east-southeast) well marked in geology and drainage, though not much indicated in relief save that there is a marked low line of the Dnieper valley above Dnepropetrovsk, the Pripet marshes or Rokitno swamps and the upper Bug, where it continues the line of the Dnieper and Pripet into Poland. This belt of lonlands is of special importance because of the great marshes just named; they form the historic barrier between Russia and peninsular Europe.

The main rivers of the southern plain are the Dnieper (1,400 mi.) and Don (1,100 mi.) both of which flow southeastward for a considerable distance and then turn sharply southward to the Black sea, probably as a consequence of the recent dominance of flow toward the Aegean following the sinking of the latter. Before that sinking the Danube may for a time have made its way eastward across the lowland to the Caspian area via the curious Manych depression. The Volga (2,300 mi.) is the longest river of Europe, flowing broadly east-southeast parallel to the axis of the Moscow basin and meeting the Kama as it turns south below Kazan. On its course southnard it has a sharp eastward loop with Kuibyshev at the head opposite the southward bend of the Don. Below Stalingrad the Volga bends southeast, thus continuing the previous line of the Don and so reaches its delta on the Caspian sea. The Volga is Russia's principal waterway. It is linked through its headstreams to Moscow, by the Mariinsk canal system between the Rybinsk reservoir and the Baltic sea at Leningrad, and thence by the Baltic-White sea canal to the Arctic. The Volga-Don canal gives a connection to the Black sea. Hydroelectric power schemes have been developed on a great scale, particularly on the Dnieper and Volga and the latter river has also been used for the irrigation of considerable areas north of the Caspian.

The **Urals.**—In the Urals the Palaeozoic strata are folded on the west of a longitudinal axis nhich exhibits crystalline rocks and is faulted on a large scale. The Devonian rocks in this area are of marine origin. Its greatest heights are chiefly in the regions of folded Palaeozoic rocks and the folds die away into the Russian platform westward in small parallel chains known as Parma. Though there is much copper in the Permian rocks on the west the main metalliferous veins of the area are in the faulted zone of crystalline rocks to the east. The greatest heights reached in the Urals are Mt. Narodnaya (6.184 ft.) and Mt. Tel-pos-iz (5,545 ft.), both in the northern section of the range. The passes are often low, that on the way from Molotov (Perm) to Sverdlovsk being only 1,245 ft. above sea level. The range is continued to the Arctic coast, Vaigach Island and Novaya Zemlya. (See further NOVAYA ZEMLYA; URAL MOUNTAINS.) On the south the Urals finger out in a plateau region dissected by feeders of the Ural and a few feeders of the Volga. The Ural river drains the southern Ural mountains, turns west and then south to the Caspian sea, which it reaches after a course of 1,477 mi.

The West Siberian Plain.—This plain, practically coincident with the basin of the Ob, extend, eastward from the Urals for about 1,250 mi. and southward from the Arctic for 1,500 mi. It is probably the largest area of unbroken lowland in the world. River gradients are all low, the fall on the Ob being only 350 ft. in its

last 1,250 mi. Ridges between its major tributaries seldom rise more than 30 ft. above the surrounding country. The river rises in the westward prolongations of the Sayan mountains and is 3,200 mi. long. Its great tributary, the Irtysh. rises much further south near the Dzungarian gate. The ancient Russian platform is assumed to extend beneath the lowland but it is covered by a great thickness of horizontal sedimentary beds varying in age from very early to Quaternary. The surface rocks are mainly Tertiary and post-Tertiary with glacial deposits as far south as the 60th parallel. The ice sheets were much thinner than on the European plain and in the northern areas their deposits were largely removed by an advance of the sea in postglacial times or covered by the deposits left during that advance. Mesozoic limestones occur at the surface at some points in the lower Ob basin and in a narrow extension of the plain which runs eastward between the Arctic shores and the central Siberian plateau. Older rocks emerge where the plain approaches the Yenisei and on its southeastern margins.

The Aralo-Caspian Basin.—This region is separated from the west Siberian plain by the higher ground of Karaganda and the Turgai plateau. The former is structurally related to the Altai. It is floored by Palaeozoic and igneous rocks and includes an important coal basin. The Turgai is a series of low plateaus 300 to 650 ft. in height and consisting of horizontal Tertiary and Quaternary sediments. The basin itself is a vast extent of dry steppe and clayey or sandy deserts surrounding the shallow Aral sea. Surface rocks are mainly of Tertiary or later age laid down in the great Pontic lake after its separation from the Tethys sea of Mesozoic times. Continuations of the Tien-Shan folds to the northwest sink below these beds. The area, except on its mountain margins, was not subject to glaciation but the erosive action of winds is very evident. The Kyzyl Kum (Turkish, "red sands") desert near the Syr Darya is a dry alluvial plain with scattered dunes; its central area is deeply buried in loose sands. In the Kara Kum (Turkish, "black sands") low sandy ridges separated by stony depressions are characteristic of the northern area; the southern part is more irregular with sands covering a surface formerly modelled by river action. The two great rivers of the area are the Amu Darya (Oxus), and the Syr Darya, both about 1,500 mi. long and both entering the Aral sea. Utilization of their waters for irrigation purposes was being extended in the 1950s.

Central Siberian Plateau.—East of the Yenisei the character of the land changes abruptly: a sharp edge rises rapidly to more than 600 ft. and in one place to about 3,300 ft. above sea level, and east of this edge is a great dissected plateau of ancient rocks. Archaean rocks with granites. etc., are exposed near the Yenisei and away to the northeast, but there are larger areas of Cambrian and Silurian rocks and these are covered over a vast stretch of country by Permo-Carboniferous rocks. The plateau extends eastward to the Lena, along the valley of which is found evidence of an invasion of the sea in Cretaceous times. The plateau is an ancient block to which E. Suess gave the name of Angara land. Large areas on this plateau rise somewhat above the 1,600-ft. contour, and the diversities of surface are largely the result of river dissection. There is evidence in the Taimpr peninsula of a fold axis with a general direction from west-southwest to east-northeast but apparently no heights reaching above the 1,500-ft. contour.

The Yenisei is the collecting stream beneath the western edge of this old block, and it rises in the Sayan mountains receiving nearly all its tributaries from the eastern side. Of these the Upper Tunguska or Angara comes from Lake Baikal, the Middle or Stony Tunguska and the Lower Tunguska from the block itself. The river is 2,800 mi. long.

The mountain ranges which border the Russian lowlands on the south were uplifted at various periods. those to the west being generally younger than those to the east. In central Asia they show a characteristic arrangement in echelon from southwest to northeast.

Eastern Siberia.—This area has a most irregular surface. It is a complex of great blocks and rifts, of plateaus separated from one another by steep scarps as they rise in tiers toward ridges crowned with snow-clad peaks of Alpine appearance. Side by side are features obviously of great age and others, such as gorges and rapids, indicative of recent change. In the northeast the Verkhoyansky and Kolpmsky ranges form a great semicircle facing the Arctic and encircling parallel ranges such as the Chersky mountains (Mt. Pobeda 10,326 ft.), all drained northward by the Kolyma. Indigirka and Yana rivers. The Anadyr mountains continue the Kolymsky ranges. but parallel to the Xrctic shores as far as the Bering strait. A similar arc to that of the Verkhoyansky-Kolymsky is formed by the Stanovoy ranges. The area between them is drained by the Lena (2,800 mi.) and its Aldan and Vilyui tributaries. Below their junction the Lena follows a deep trench along the eastern edge of the Angara block. The Stanovoy ranges rise to 8,000 ft. and stretch south and west from the junction of the Verkhoyansky and Kolymsky mountains. They mere originally uplifted by Caledonian movements, then covered by later deposits and again faulted and folded. The Kamchatka peninsula is followed by two parallel ranges, both with volcanic cones (see KAMCHATKA). Southeast of the Stanovoy is a region of broken plateaus with parallel ranges, of which the Sikhote Alin is the highest and nearest the coast. Tectonic movements there occurred mainly during the Mesozoic and Tertiary periods. The Amur river (2,900 mi.) crosses the region in a great southward curve.

The area east of Lake Baikal is marked by severe dislocation. The ancient rocks which underlie the surface have been faulted to form great blocks, uplifted into horsts separated by rift valleys. Lake Baikal covers the floor of what is perhaps the finest example of such a rift. The lake is over 5,700 ft. deep. The horsts form flat-surfaced plateaus at heights of around 3,000 ft. separated by deep and wide valleys. The Yablonovoy mountains (8,000 ft.) mark the limit of this region and stretch in a great arc parallel to the general direction of the lake.

The Central Asiatic Ranges.—These ranges stretching from Lake Balkhash to Lake Baikal are sometimes grouped together as the Sayanid system. They form the border country between the U.S.S.R. and Mongolia, a barrier difficultto cross. Though sometimes described as of Tertiary origin, all the ranges were first formed at a much earlier date. After a long period of erosion which had almost reduced many of them to peneplains they were again uplifted by Alpine movements. Thus the Sayan mountains west of Lake Baikal, formed during the Caledonian period, were later raised without sufferingmuch other disturbance to heights of 8,000 to 10,000 ft. yet still show flat eroded surfaces on their summit areas. The Altai on the other hand were heavily faulted in this later uplift, while the Tien-Shan were intensely folded, especially to the south. Between the two latter series is the relatively low Dzungarian gate, the historic highway from China across Mongolia to the Kazakh steppes and so to the Volga. The southern Tien-Shan have peaks reaching over 20,000 ft., wide snowfields and glaciers which rank among the greatest outside the polar regions. The Tien-Shan proper extend westward in the Kirghiz ranges north of the Syr Darya and the Alai chain between the headstreams of that river and of the Amu Darya. The latter range is notoriously difficultto cross because of the infrequency and the great height of its passes (over 11,000 ft.). The Alai valley, eroded along a great fracture zone, marks the southern limit of the Tien-Shan and was followed by the ancient caravan route to Kashgar (Shufu). The Trans-Alai is a great barrier range of red sandstones 5,000 ft. higher than the Alai (Mt. Stalin 24,589 ft.; Mt. Lenin 23,383 ft.) and with greater snowfields. Next to the south is the Pamir, a region of high plateaus separated from one another by low ridges. It is a high-level desert where low precipitation has severely limited both erosion and vegetation. The Kopet Dagh and associated ranges on the borders of Turkistan and Iran reach heights of about 9,000 ft. They are composed of Cretaceous and Tertiary beds folded and fractured in late Tertiary times.

The main value of the central Asiatic ranges lies in the waters they supply to the neighbouring lonlands. All the great rivers of western Asiatic Russia have their sources there, many of them in high-level glaciers. The finer soils brought down from the higher slopes and the narrow belt of loess which generally marks the meeting of highland and plain are generally fertile and the

mountain streams provide water for their irrigation. Rain and snowfall, especially on slopes facing north or west, are heavier than that on the plains and so good pastures occur almost to the snow line.

The Caucasus and **Transcaucasia.**—This includes the whole area between the deep basins of the Black sea and the southern Caspian. Its main features date from the Alpine uplift. The chief elements are, from north to south: (1) a gently rising foreland reaching about 2,500 ft. in the Stavropol plateau; (2) a narrow downfold, with Quaternary deposits, crossed by a minor uplift toward the west which separates the Terek and Kuban river basins; (3) the Great Caucasus, parallel ranges with heights up to 18,500 ft. (Elbrus) and a maximum width of 100 mi. (the central range includes ancient crystalline rocks but the flanking ridges are of later formations); (4) the tectonic depressions drained to the west by the Rion and to the east by the Kura and Araks (see Caucasus).

The Yaila ridge (5,000 ft.) is the highest of several parallel ridges forming a mountain belt 20 mi. wide which runs across the southern Crimea. They form a short link in the line of the Alpine-Himalayan uplift.

II. CLIMATE

The climate of the U.S.S.R. has two outstanding characteristics: its uniformity and its continentality. They are results of its low relief and compact form. Its great plains present over immense distances the same monotony of climate as of level. It is possible, of course, to recognize areas whose climates differ significantly one from another, but the transition from one such province to its neighbours is, practically everywhere, accomplished by almost imperceptible gradations.

Maritime influences are extremely feeble, which is not surprising because 75% of the area is more than 250 mi. from the surrounding seas, several of which, moreover—the Baltic, the Black and the Caspian seas—are land-enclosed. The frozen Arctic ocean obviously can have little effect; the mountain barrier shuts out monsoonal winds from the south; and offshore ninds and high coastal ranges limit Pacific influences to a narrow coastal belt on the east. Hence the Soviet lands almost everywhere show to a high degree the features of a continental climate: great extremes of temperature, both diurnal and annual; abrupt change from winter to summer and vice versa; low rainfall with summer maximum and largely convectional in character; violent windstorms. The south coast of the Crimea and Transcaucasia (both sheltered by high ground on the north and with winter rains drawn from the Black sea) and the area between the lower Amur and the Pacific (feebly monsoonal in character) are the only areas to which this general description does not apply.

The climate of the U.S.S.R. is dominated by the polar continental air mass which extends over the whole land for the greater part of the year. In the summer it shrinks to a narrow belt along the arctic coasts of Asiatic Russia. It is characterized by its low temperature and low humidity. Disturbances are infrequent and local. Thus, dry, still days with clear skies, very low temperatures and slight snowfall are characteristic of the nine months or so during which it covers the land—conditions which though harsh are by no means unhealthful but do severely limit human activities.

In winter, pressures are high over the whole of Siberia, especially so near Lake Baikal where in January they exceed 30.j in. Outblowing winds are therefore normal over Asiatic Russia. A narrow extension of this high-pressure area spreads westward, roughly along lat. 50° N., as far as central Europe. On its northern side southwest and west winds blow, while to the south the winds are generally between north and east. The feeble low pressures experienced during the brief summer give a much more irregular air circulation.

Rainfall is generally less than 20 in. except in coastal and mountainous areas and the middle and western areas of European Russia. It is almost entirely derived from Atlantic sources, being brought by cyclonic disturbances, more frequent in summer. The total precipitation decreases eastward along a middle zone from Moscow to Lake Baikal and, much more rapidly, both to the northeast and to the southwest of this zone. The arctic northeast has a rainfall as low as that of the desert Aral basin.

The summer isotherms follow the latitudinal lines with remarkable regularity. In January their direction is rather from northwest to southeast, with the pole of cold in the region of Verkhoyansk (January mean −58° F., minimum recorded near −100°). Temperature ranges thus increase toward the east. from 31° at Batum to more than 100° northeast of Yakutsk. In the Siberian arctic only 60 days, on the average, are frost-free, and even in European Russia it is only in the Ukraine that the surface is snow-covered for fewer than 100 days. Both the Sea of Azov and the northern half of the Caspian are frozen over in January.

Siberia.—All the features of the Russian climate already outlined are particularly sharply shown in Siberia. Its northerly situation, its isolation from Atlantic and Pacific, the increasing altitude of the land toward the south (offsetting in part the decreasing latitude) and its openness toward the arctic all tend to bring down its temperatures. By reason of its winter high pressures, bitterly cold winds blow out from it over the surrounding lands. Its low atmospheric pressure in summer drams in warmer and more humid air from beyond its borders, thus producing its summer maximum rainfall. Snow lies long, but the depth of fall is slight—in the northeast so slight in many parts that the sledge is not usable. On the whole the weather is dry, the sky generally cloudless. Temperature ranges are unequalled in any other land. Verkhoyansk is generally credited with the lowest recorded temperature (about −100° F.), but it has also recorded 100° F. The Siberian summer, though short, is hot rather than warm.

Winter is clearly the dominant season, as much by its unchangeableness during many weeks as by its severity. The general absence of wind alone makes the cold bearable. When the buran (Siberian blizzard) blows, only shelter from its blast mill save the life of the traveller. In the absence of heavy snow the soil and subsoil are deeply frozen. Over nearly all Siberia east of the Yenisei "permafrost" obtains: the subsoil is frozen all the year and the surface soil thaws only for a brief period and only to shallow depths in summer. The depth of this thaw has important effects in determining the nature of the vegetation.

Spring arrives in April. The ice on the rivers breaks up rapidly and, as the thaw begins in the south, the flowing waters cause floods over the still frozen northern channels. As the snow melts, village streets become apparently bottomless seas of mud. For several days outdoor movement of man or beast becomes almost impossible. The surface soon dries, however, and a brief period of delightful spring weather is experienced, though often interrupted by the return of severe cold for a short time. Summer follows quickly. The days are warm or hot and the hours of daylight long. Its monotony is broken by sudden storms, sometimes accompanied by hail, or there may be short burning spells with dust storms. In any case one can be sure of the return of clouds of voracious mosquitoes. By August, however, or by early September in the south, night frosts are experienced and in two or three weeks winter has returned.

Over such a vast expanse there are naturally variations in climatic conditions, and these make possible a division into climate provinces or regions.

The polar or tundra province includes a narrow belt along the Arctic shores from the Kola peninsula to the Bering strait. Its southern limit may be taken at the 50° July isotherm, which is also near the limit of tree growth. The chief characteristics are its very long winters (about ten months), short summers (temperatures as high as 80° F. have been recorded): low precipitation and strong winds. Both temperature and precipitation decrease eastward, the latter falling as low as four inches near the Lena delta. Winter temperatures are higher near the coast than in the interior.

The far eastern province is characterized by a monsoonal reversal of wind direction—land to sea in winter, sea to land in summer. Winter conditions are severe (even Vladivostok, in the extreme south, has 110 days of frost and a January mean temperature of 7° F.). It is sharply distinguished from other Siberian regions by its humidity. Fogs are frequent, snowfall heavy (par-

ticularly near the Sea of Okhotsk) and rainy days numerous in summer.

Eastern Siberia is notably dry and cold. Precipitation varies from 14 in. near Lake Baikal to 4 in, in the north. Days with snow are few (nine at Blagoveshchensk, none in some years and in some sections). Immense areas have mean annual temperatures below freezing point. On the other hand, the July isotherm of 68" F. does not reach so far north in any other part of the world.

Central Siberia is also very dry. The number of snowy days is higher, though the total fall is still slight. Temperatures remain very low (Irkutsk. January mean −5° F.). Lake Baikal reduces temperature ranges considerably in its immediate vicinity.

In western Siberia the winters are still harsh (Tomsk, January mean −3° F.). Heavy snow is often brought by violent storms and piled in great drifts. Tomsk has an average of about 120 snowy days. The snow cover limits the depth to which the soil is frozen, so that it is quickly fit for cultivation after the spring thaw. Its thorough soaking at this time is also favourable to seed germination. During the warm-to-hot summer, rain falls in heavy showers, though the total precipitation is still only moderate (Tomsk 20 in.. Omsk 12 in.).

European Russia.—The climate of European Russia is controlled by the same major influences as that of Siberia: its northerly latitude and openness toward the arctic, the absence of any barrier on the Asiatic side and the shutting out of marine influences (except to a limited degree) by the Scandinavian highlands, the Carpathians and the Balkans. It is accordingly both continental and uniform, in marked contrast to that of the rest of Europe. Nevertheless, the Baltic depression and the north German plain do permit, if only in attenuated form, the penetration of Atlantic influences.

As has been seen. the Siberian anticyclone in winter throws west across central Russia an arm of high pressure bringing cold Asiatic winds to the east, centre and south of the country. The lower pressures to the northwest permit the entry of humid and relatively mild air from the west. In summer, while the east and south still receive hot, dry continental winds, the north, northwest and centre experience cooler and moister oceanic air. Precipitation therefore decreases from northwest to southeast (Riga 22 in., Moscow 21, Saratov 15, Astrakhan 6). Snowfall! fairly heavy in the lake region, becomes quite light toward the Black sea and the lower Volga, a reminder that winter is the season of least precipitation (Moscow 16%). The summer, though it has often long periods of drought interrupted by brief but heavy rainstorms, is the season of greatest precipitation (Moscow 36%, Kaluga 40%).

Latitude has a marked effect on summer temperatures (Archangel July mean 60° F., Astrakhan 78° F.) but has less effect in winter when distance from the sea becomes a more important factor (Leningrad January mean 15°, Moscow 12°, Orenburg 3° F.). But it is the length of the seasons rather than their mean temperatures that has most influence on Russian life. In the far north at least six and one-half months of frost can be expected, Leningrad, Nizhny-Novgorod (Gorki) and Orenburg (Chkalov) have from five to six, Moscow and Kuibyshev from four to five, Odessa and Kherson from one to three. Unlike the Siberian winter, however, conditions are liable to violent changes: blizzards, sudden falls in already low temperatures, or brief thaws.

Spring. coming in April or May, sets free the frozen rivers and puts an end to all outdoor movement. In a couple of months, except in the far north, summer has arrived, bringing hot days everywhere. Evaporation is then intense, the soils dry quickly and river levels fall considerably. Dry winds from the east bring dust storms that may cover and often scorch the growing crops. Harvest follows seedtime with but a brief interval for festival between. By early October the first snow showers have fallen in Moscow. From mid-November winter tightens its grip on the whole country once more.

The southern shores of the Crimea and the northeastern coast of the Black sea have a Mediterranean climate. There the winters are generally mild and rainy, the summers dry and rainless. Frosts are experienced only in a few days in January and February. High ground to the north provides shelter in each case.

Transcaucasia has a subtropical climate. The Rioni valley, open on the west to the Black sea, has a milder winter than even the Crimea and a cooler summer. Precipitation is heavy with a slight winter maximum. Winds from the Caucasus produce foehn effects.

Turkistan.—Across the lower Volga, in Kazakhstan, the climate becomes yet drier and more extreme. Wild blizzards sweep it in winter, though the total snowfall is slight. Autumn and spring are virtually nonexistent, a grilling summer (July mean 77°) following immediately on a bitterly cold winter (January mean 5°).

Further south, in the Aralo-Caspian basin, conditions are still more severe. Precipitation varies between 3 in. and 8 in. a year, except along the mountain margins (Tashkent 14 in.). Most of it falls in spring and the rest near the end of the year. Temperature ranges, both annual and diurnal, are large. Cold waves from the north sweep across the basin in winter. while the cloudless summer skies and dry air give full play to a burning sun. The Aral sea is frozen for five months; in summer eggs can be cooked in the sands near its shores.

III. SOILS AND THEIR INFLUENCE

The science of pedology or soil study owes much to the work of Russian investigators. This might perhaps have been expected in a land for so long almost wholly dependent on agriculture. Uniformity of level and of climate over nide areas naturally emphasized the importance of soil variations in the choice of crops and in their productivity. The derivation of the soil from the underlying surface rocks by processes of denudation was of course widely recognized. The main value of Russian work arose from its emphasis placed on regarding the soil as an evolving thing.

Among the first of Russian workers in this field mas V. V. Dokuchayev (1846–1903). It was the publication in 1928 by the department of agriculture of the United States of a translation of K. D. Glinka's classic *The Great Soil Groups of the World and Their Development* that first made the work of the Russian school known to English-speaking students.

The soils of Russia fall into three main groups. Those of the north are derived from the drift left on the final recession of the ice sheets. To the south lies the belt of loessic soils produced by uind action on the drying surface of the newly uncovered glacial deposits. Over the areas formerly covered by the Aralo-Caspian sea the surface consists of marine deposits. Since their formation, all have been changed by the action of the weather and soil water. The growth and decay oi the vegetation that covered them and the action of burrowing animals, of cultivators and especially of bacteria all helped to determine the nature of the soil cover. The rise of temperature, decrease of rainfall and increase of evaporation from northwest to southeast are evidently largely responsible for the soil changes.

The soil is clearly "alive" in the sense that it is still developing. The humus produced from decaying vegetation largely determines soil colour and is of great importance because of its water-holding property. In suitable conditions bacteria rapidly reduce the organic content of the soil to inorganic forms which then become available for new plant growth. These salts are normally dissolved in the soil water and so carried to the lower soil layers. In this way is produced the soil profile, which in a well-developed soil consists of three horizons: the upper or A horizon, usually loose in texture and being robbed of its mineral content by the soil water; the B horizon, more compact and containing most of the salts leached from A; and the C horizon, consisting mainly of fragments of the underlying mother rock.

In arid regions the soils naturally contain little humus. Excessive evaporation brings soil water to the surface where it leaves behind its dissolved mineral contents. Frost, with the check that it places on plant growth and on bacterial activity, prevents development. The steepness of mountain slopes also checks development.

Tundra Soils.—This most northerly group of soils is found beyond the tree line (the word "tundra" implies the absence of trees)

to the shores of the Arctic ocean. Their outstanding characteristics are due to the rigorous climate. In the brief summer only the upper layers are thawed, the subsoil remaining permanently frozen and therefore impervious. Marsh conditions are widespread over all the lower areas in this warmer period. Vegetation is shallow-rooted and scanty. Its decaying remains accumulate on the surface to form a black acid layer. This bog soil is, almost entirely, partially decomposed vegetable matter. The subsoil. on the other hand. is almost wholly inorganic. Low temperatures limit bacterial activity and the frozen subsoil prevents earthworms from carrying on their beneficent work.

Where the subsoil is sandy there is some leaching from the surface soil. and tundra soils approach the podsol type. In the tundra of the far northeast of Siberia the very low precipitation is accompanied by an almost total absence of vegetation, and the land surfaces are often of bare rock. with little soil of any kind.

Under such conditions agriculture is clearly impossible. The few inhabitants are pastoral nomads dependent on their reindeer herds. on summer fishing and on winter hunting in the forest fringe. Transition from tundra to forest gives rise to a narrow belt where scattered examples of dwarf species of birch and spruce are typical. These first become evident in the river valleys, where there is some shelter from winds.

Forest Soils.—Soils of this group cover more than half the U.S.S.R. All are podsols or modified podsols; that is to say, soils of an ash-gray colour typical of cool, humid climates. They are best developed in the taiga or coniferous forest region. There temperatures are high enough to prevent the permanent freezing of the subsoil and, in dry periods, to cause some rise of water to replace the slight loss from the surface by evaporation. These conditions are favoured by the forest cover, for it prevents heavy leaching while maintaining fairly constant humidity of the soil. The shelter it gives from winds also reduces losses by evaporation. On the other hand, leaf transpiration keeps the subsoil fairly dry.

Coniferous Forest Type.—The decay of the resinous needle leaves of the conifers proceeds slowly. It produces a very acid type of humus and the soil water passing through it is therefore capable of bringing about almost complete decomposition of the mineral constituents of the underlying layer, leaving behind little but silica or fine clay. The A horizon in a typical podsol is thus frequently sandy and grayish but sometimes almost nhite. Since almost all the plant food it contained has been removed, these soils are agriculturally of little value. Horizon B shows two distinct layers. The upper of these is brownish yellow or coffee coloured and contains most of the products of humus decomposition. The lower section is usually rusty brown in colour and heavily impregnated with iron hydroxide.

Coniferous trees form the major part of the vegetation except on the northern edge of the forest; there a belt of birch occurs, at first dwarf but increasing in size and number southward. Where the A horizon is sandy the Scotch pine is prevalent, on the clays some variety of spruce. In Siberia the silver fir and Siberian larch are the commonest trees.

Mixed Forest Soils.—From central Europe across European Russia to the Urals near Molotov (Perm) there extends a wedge of mixed forest where deciduous trees mingle with and ultimately almost replace the northern conifers. Beyond the Urals this forest occurs again in a narrow belt as far as the Ob. This is the area in which Atlantic influences upon the Russian climate are evident in the heavier precipitation. The soils in general show a transition from the podsolized soils of the coniferous forest to the black earth of the steppe.

Heavier precipitation causes a continuance of the leaching of the A horizon. Higher temperatures encourage more complete decomposition with greater activity of earthworms and bacteria. The horizon is darker in colour, gray rather than white, as the humus content of the upper layer rises to from 3% to 6%. This upper layer accounts for the greater agricultural productivity of this zone as compared with the region to the north. The colour of this horizon is generally brown. grayish in the upper layers but reddish in the lower. Very fine clay particles and some calcareous material occur at the lower levels. The origin of these grayish soils is disputed. Some hold that they represent a degraded form of the black earth, caused by a southward spread of tree growth over the steppe, others that they are mainly the result of forest clearing and the improvement by long-continued cultivation of a formerly podsolized soil.

The gray soils occur in a narrow but irregular band across European Russia and in the still narrower zone of the wooded steppe of western Siberia. Though still essentially forested, this country allowed its early inhabitants to maintain themselves by agriculture in the clearings. As settlement increased these were extended by cutting and burning. The longer frost-free period makes possible the growth of deciduous trees. The heavier leaf fall increases the supply of humus to the surface layer of soil. The richer undergrowth, mainly perennial grasses, contributes to the same result and encourages the rearing of farm animals.

In the narrow west Siberian area the trees are mainly aspen and birch. West of the Urals the forest is much richer in species. The most important of these are the oak, lime, maple and ash. The last-named is most abundant in the more southerly areas. Conifers are still common, more particularly on the sandy outwash soils.

The mixed forest zone has played a great part in the history of Russia. Groups fleeing from the Asiatic invaders of the steppes there found shelter. Under the influence of a settled agricultural life they were welded into groups which later coalesced to form the first Russian state. All the suitable land has long been cultivated and the hardier cereals—barley, rye and oats—grown. Flax and hemp provided fibres for early industrial use, and the potato was soon widely grown after its first introduction. Forage crops—hay and lucerne—also do well and support the growing dairying and cattle-breeding industry.

Bog and **Marsh** Soil.—This is common north of about the 60th parallel of latitude in Europe, in the wide, ill-drained northern parts of the west Siberian lowland and in the Pripet area of western Russia. It is especially common on surfaces of glacial clay. Decomposition of vegetation is incomplete because of lack of aeration, so that peaty surface layers are common. The remains of dwarf birch and alder and of marsh plants and mosses accumulate slowly, giving an acid surface soil. Peat is worked extensively and is used for power production in some areas.

Black **Earth.**—Soils of the black earth type (chernozem) underlie about 12% of the U.S.S.R. and form in European Russia the largest continuous area of the type anywhere. They occur south of the forest soils and north of the arid and mountain areas. Their essential characteristics are the high humus content and the presence of calcium salts, especially the carbonate. They evidently represent a modification of an earlier soil enriched by the decay of animal and plant remains. Loess and the *limons* found over calcareous rocks are particularly favourable to their development. Sandy subsoils, too, carry thicker coverings of chernozem than do clayey subsoils. The better drainage is probably the reason in each case.

The humus content of the black earth varies from 6% to about 16%. It increases to the south and east. Thus the percentage varies from 6 to 10 in the Ukraine, but increases to 1 j or 16 east of the Volga and in western Siberia. The black earth is thickest in the Ukraine.

The principal factor leading to the development of chernozem is climate. It occurs in regions with a long and severe winter but with summer conditions of high evaporation leading to a virtual desiccation of the surface soils. Snow accumulates during the winter, and the spring thaw provides the moisture necessary for an abundant growth of grass. This water supply, however, is exhausted by late May or early June. Rain falls during the summer months but the total amount is small. The intervening periods of drought stop the growth of the steppe grasses. They also prevent the growth of trees. The blackness of the surface layer is due to the long-accumulated products of the decomposition of grass roots. The droughts of summer and the frosts of winter both slow down the rate of decomposition. Leaching of the A horizon is largely prevented by the low summer precipitation and rapid evaporation. These also lead to a concentration of mineral salts just

below the humus level, another factor inimical to the growth of trees.

The typical soil profile in a black earth region shows two major horizons. The upper portion of the A horizon is normally neutral, not acid. The surface soil is crumbly and black or deep chocolate in colour because of the high humus content. The lower portion of the horizon, which has a total thickness of 18–40 in., is grayish black to yellowish brown. It is in this portion of the profile that calcareous concretions occur, the carbonates formed in the humus horizon being carried down by leaching.

The black earth lands practically coincide with what are sometimes called the tillable steppes. These have produced grain for many centuries without any great loss of fertility. The main handicaps to their utilization are climatic. Recurrent drought has given rise to terrible famines. The dry soils in the summer months are particularly liable to wind erosion and to loss of topsoil in heavy rain showers. Modern cultivation by machines on a large scale, as in the United States, tended to accentuate these difficulties. Diversification of crops, the construction of tree belts as windscreens and the utilization of Volga waters for irrigation were developed to offset them. For further information on the region *see* UKRAINE.

Arid Soils.—Beyond the black earth zone to the southeast, climatic conditions rapidly approach desert character. The decrease in total rainfall, its increasing uncertainty and the rapid rise in the evaporation rate produce marked changes. The cultivation of the steppe becomes more and more uncertain, though it is perhaps no longer true to speak of the whole region as untillable steppe. The chestnut soils are fertile when, or where, sufficient moisture is available, the brown soils less so and the gray desert soils only occasionally and then with great difficulty. The humus content decreases rapidly and salinity increases as the chernozems are left behind. A fertile belt, however, lies along the foot of the bordering ranges.

Chestnut and Brown Soils.—These extend from the Crimean steppes across the Volga delta and through Kazakhstan and the extreme south of western Siberia. The chestnut soils are the result of extreme temperatures accompanied by a low rainfall and high summer evaporation. The grass cover is much less rich than on the chernozem, with the result that the humus content of the surface soils falls to 5%. Increasing aridity produces the brown soils with only 3% humus. Insufficient leaching of the surface soils causes an increase of their soluble salt content. limiting vegetation. The A horizon in the chestnut soils seldom exceeds 25 in. (with a humus zone 12–18 in. thick) and in the brown soils falls to 12 or 15 in. Both types show a prismatic structure. The rising soil waters cause the concentration of soluble salts in the upper layers. Calcareous concretions often form an almost continuous layer quite near the surface. Because of the poverty of vegetation the nature of the mother rock has more influence on the soil character than is usual.

All arid soils show a tendency toward salinity. This is particularly evident in surface depressions or where there is poor drainage or a high water table. Under such conditions the ground water is often brackish. This is most marked in soils resting on argillaceous rocks. Saline soils of the type known as *solonchak* are found in these areas. Their salinity is harmful to vegetation. A white crust sometimes appears if the concentration of soluble salts is excessive. An alkaline soil known as *solonets* is produced by the leaching of *solonchak; e.g.,* if it is irrigated or if its drainage is improved in any way. The flocculated clay particles of the *solonchak* are dispersed so that the *solonets* is sticky and plastic when wet but sets into hard clods when dry. It is thus practically unworkable.

The chestnut soils are very fertile when supplied with enough water. but their irrigation must be carefully controlled. Raising of the water table is liable to produce alkalinity at the surface and thus bring about the formation of *solonchak* or *solonets*.

Gray Soils.—These are found chiefly in the inland drainage areas of Asiatic Russia. They underlie the shifting sands of the deserts and cover the loessic deposits of their southern mountain margins. Under desert conditions neither water nor vegetation is sufficient to play much part in soil production and the evolution of the soil has not proceeded far. In the areas where drifting sand forms the surface one can say it has not begun. Along the northern edge of the basins occur *solonets* clay.

The gray soils are alkaline and clayey with a humus content seldom more than 1%. Their colour results from the presence of sodium salts and their bleaching effect. Where the gray soils cover the southern loess they are rich in calcium carbonate, the content being sometimes as high as 15% at the surface and increasing to 25% at lower levels. Where they are well watered, as where mountain streams emerge, they may be very fertile.

Mountain Soils.—In general these vary with altitude wherever the slopes are gentle enough to permit their development and stream or ice erosion does not remove them. As temperatures fall and humidity increases with height, the succession of soils closely parallels that seen in travelling from southeast to northwest across the plains. Thus, in the Altai, chestnut soils at the foot pass into black soils and then to podsolized forest soils at higher levels. The gray desert soils of the Turkistan lowlands similarly pass into chestnut and then into black earths on the mountain slopes. In eastern Siberia, where the soil generally is of the coniferous forest podsol type, the mountain ranges are capped with tundra-type soils.

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(T. HER.)

IV. FLORA AND FAUNA

A general account of the flora and fauna of Asiatic Russia will be found in the article ASIA; for details of the different regions, see the articles on the individual Asiatic republics, European Russia only is dealt with here; *see* also EUROPE.

Flora and Vegetation.—The flora and vegetation of most of European Russia are, in accord with the climate, continental in character. The flora has approximately 3,500 species of seed-bearing plants and is thus poor in relation to the area covered. The principal families (with number of species in parentheses) represented in it are: Compositae (438), Gramineae (298), Cruciferae (212), Cyperaceae (190), Caryophyllaceae (183), Scrophulariaceae (147), Umbelliferae (141), Rosaceae (135), Leguminosae (128) and Labiatae (116). Among the largest genera may be mentioned: *Carex* (141), *Salix* (58), *Astragalus* (52), *Hieracium* (46), *Centaurea* (42), *Potentilla* (40), *Allium* (40), *Euphorbia* (38) and *Silene* (37).

There are four main botanical zones: the tundra, the forests, the steppes, and the desert and semidesert. The boundaries between them are neither sharp nor straight but the zones differ markedly from one another in both flora and vegetation as well as in economic values.

The northernmost zone of the tundra occupies a belt along the shores of the Arctic ocean and extends inland for about 100 mi. to the margin of the forest zone. The tundra is treeless, except for some wooded "islands," and consists of moss- and lichen-covered flats and areas of low-growing shrubs. Among the mosses, species of *Sphagnum* and *Polytrichum* are important. Most of the ground is permanently frozen below a few inches that thaw out in the short summer. There are numerous peat ridges and water pools. The plant constituents of the vegetation include shrubs of birches, junipers, heather and other members of its family, and willows, dwarf cornel, cloudberry, sedges, cotton grasses. rushes, sundew and louseworts. Toward the southern limit of the tundra there is often a belt of birches.

The forest zone is a much wider one and has several divisions. In the north, conifers predominate, forming what is often called the taiga. Spruce *(Picea obovata)* and Scotch pine (*Pinus silves-*

tris) are the dominant trees, especially in the western portion, the latter on sandy soils. In the eastern part Siberian trees, especially Siberian larch (Larix sibirica). Siberian fir (Abies sibirica) and Siberian pine (*Pinus* sibirica) are mixed with the spruce and Scotch pine. The southern part of the forest zone has much oak which, however, is still frequently intermingled with spruce and pine. In the oak region other west European trees and their associated shrubs and herbs reach the eastern limit of their ranges. These include the hornbeam and the yew. Much of the broad-leaved forest has been destroyed and many of the interspersed marshes have been drained or have dried out. The southern limit of the forest zone is in the southwest about 50° N. and in the northeast approximately 55° N.

The steppe zone follows to the south of the forest zone and largely coincides with the area of the black earth which. it has been stated, owes its origin to past steppe vegetation. Most of the steppe zone, with one of the richest soils in the world, is now cultivated and remnants of the natural plant life are restricted to river valleys and ravines and relatively small areas not yet converted to the carrying of crops. The steppe zone is largely, but not entirely, treeless. The natural vegetation consists of herbs resistant to cold and drought and among these grasses of tufted habit are prominent. Feather grasses (Stipa spp.) characterize the true steppes but with these are associated tall-growing herbs such as wormwoods (Artemisia spp.), ragworts (Senecio spp.), buttercups, sages and other labiates, various legumes, composites and umbellifers. In the spring, bulbous plants form a conspicuous feature. Low shrubs are sometimes frequent and include dwarf almond, dwarf plums and cherries, brooms and roses. Some areas have salt marshes with a halophytic vegetation with numerous chenopods, including seablites (Suaeda spp.) and glassworts (Salicornia spp.).

The desert zone in European Russia is limited to the area immediately to the northwest of the Caspian sea and is an extension westward of the larger desert region of the Aralo-Caspian basin. Much of it is semidesert rather than extreme desert. The flora consists mainly of drought-resistant herbs and shrubs, such as various grasses, wormwoods, labiates, composites, and bulbous plants and also, in many places, of plants favouring habitats with high salt content, such as chenopods of various genera (Campkorosma, Kockia, *Salicornia,* Anabasis and others). The vegetation is often sparse and mostly very open.

Special mention must be made of the southern portion of the Crimea. The flora and vegetation there are more Mediterranean than continental. Many of the trees, shrubs and herbs belong to genera and even species characteristic of the evergreen macchia and include olive, laurel and junipers besides a rich herbaceous flora. (W. B. T.)

Fauna. — The most characteristic phenomenon of animal distribution within Russia is the latitudinal zonation, continuing far into Asiatic Russia. These zones begin in the north with the arctic tundra, followed southward by the taiga, the deciduous forests, the steppe and in the far southeastern corner of Europe by the desert. No high mountains interrupt the flat lowlands until the Ural mountains in the east, and the Caucasus mountains in the southeast.

Most animals of European Russia, such as the common and the water shrew (*Sorex* araneus and Neomys fodiens), a number of bats, the wolf (*Canis* lupus), the red fox (*Vulpes* vulpes). the brown bear (*Ursus* arctos), the red squirrel (Sciurus vulgaris) and many other small carnivores and rodents, have a wide palaearctic distribution. The most characteristic animals of the tundra are the wild and the domestic reindeer (Rangifer tarandus). In the taiga the glutton (Gulo *gulo*), the elk (Alces alces), the European flying squirrel (Pteromys volans) are found. Typical of the deciduous forest are the red deer (Cervus *elaphus*), the roe deer (*Capreolus capreolus*), the lynx (*Felis* lynx). The steppes were, until relatively recently, populated by herds of the European tarpan (*Equus caballus*) and of the European wild ass (*Equus hemionus*). In mid-20th century, a few remainders of the saiga (Saiga tatarica) were maintained in a few reservations. Rodents abound in all zones of Russia, but are nowhere as conspicuous as in the steppes. Of its peculiar forms, mention may be made of the great jerboa (*Allactaga*), some species of suslik (Citellus), the bobak (*Marmota* bobak). the migratory hamster (*Cricetulus* migratorius) and the mole rat (*Spalax microphthalmus*). In the basins of the Volga and the Don lives the peculiar desman shrew (Desmana moschata). The following animals are typical of the Caucasus: the Asiatic mouflon (Ovis orientalis), the Caucasian tur (*Capra caucasica*), the chamois (*Rupicapra rupicapra*) and forms of the golden hamster (*Mesocricetus* nuratus).

Domestic animals include the sledge dogs in the north and the bactrian camel in the south. The small peasant horse still has many traits in common with its tarpan ancestors. Fur-bearing animals. such as hermelin, zobel, mink, etc., are mainly derived from Asia; but the breeding of various fur animals spread into European Russia. (F. S. BR.)

V. HISTORY

The great east European plain which was united, together with Siberia, under the Russian tsars, presents in spite of its general uniformity two contrasting geographic aspects which profoundly influenced the trend of its historical development. the northern and the southern. A primitive forest extending over the northern part of Russia reminds one of that described by Tacitus in his *Germania.* It was indeed its continuation and connected Russia uith the western part of the European plain It was comparatively late that this part of Europe was set free from its prehistoric ice cover. It is still full of lakes and great rivers which for long remained the only ways of communication for a scanty population scattered in distant glades. The primitive settlers added a few patches of cultivated land to their habitual means of litelihood — river fish, wild beehives and fur-bearing animals in the forests.

Quite different is the southern Russian landscape. It is the steppe. the prehistoric seat of nomad hordes which inhabited it from time immemorial until quite recently. These lived on horseback and in tents, used mare's milk as their food and throve on the booty taken in regular incursions against northern sedentary tribes. There the most ancient traces of aborigines are found, of the Palaeolithic stage, followed by the Neolithic, with traces of Aegean culture in its primitive form. There also we learn, by the intermediary of ancient Greek colonies on the northern Black sea shore, the names of ancient peoples of southern Russia; we are unable, however, to identify their nationality. The most ancient of them, the Cimmerians, are said to have been replaced by the Scyths (see SCYTHIA) and these by Sarmatians (see SARMATAE). Some patriotic Russian historians (I. Y. Zabelin, D. I. Ilovaisky, D. Y. Samokvasov) tried to prove that these populations were Slavs, but later research pointed to an Iranian origin; for instance, the modern representatives of the Sarmatae-Alani are found to be the Ossetes. who are not Slavs but a Caucasian people.

The original home of all Slavs is not to be sought in the steppe, but in the forest. Lubor Niederle stated that. originating in the marshy land between the Vistula and Dnieper, the southern Slavs (Serbs) descended to the Danube as early as the 1st century AD. The first federation of eastern Slavonic tribes (Russians) appears in the 3rd–4th centuries A.D. as a powerful and numerous people called Antae. living between the Dnieper and Dniester. They were involved in the wars of the Goths and Huns and were defeated by the Avars in the 6th–7th centuries. In the 7th century appears a new conquering nomad nationality in the steppe, the Khazars (*q.v.*), possessing a certain degree of civilization. They brought under their subjection some eastern Slavonic tribes whose names are given in the ancient Russian annals (Severyane, Radimichi, Vyatichi, Polyane). Khazar domination lasted until the beginning of the 10th century. when other nomads of Turkic descent and wilder habits—Hungarians (middle 9th century) and Pechenegs (end of 9th century) — overran the steppe and broke for long the connection between Slavonic settlements and the Black sea shore.

Origin **of the Rus.**—The Slavonic forest tribes were obliged to adapt themselves to the new situation. As a reply to the invasion of the steppe by the Turkic hordes there appears a new organization of defense from the north. The defenders are the

"Rus"—a Varangian tribe, in ancient annals considered as related to the Swedes, Angles and Northmen. Both Rus and Varangians are also knonn to Byzantine chroniclers (*Rōs, Varaggoi*), first as Norse pirates, then as warriors serving in the imperial guard and finally (10th century) as chiefs of the caravans of traders coming yearly to Constantinople by the "Great Waterway." the *Austrvegr* of northern sagas, through the waterfalls of the Dnieper, whose names are given by the emperor Constantine Porphyrogenitus both in "Russian" (Scandinavian) and in "Slavonic" (Rossisti and Sklaviusti). Arabian writers represent the original seat of the Rus as an island covered with woods and marshes; this brings us to the source of the waterway mentioned—Lake Ilmen, near the ancient tonn of Novgorod, and Lake Ladoga, where the river Neva has its origin. Excavations of 9th–10th century tumuli confirm the presence of Norse warriors, buried (or burned) with their horses and arms, in that very tableland where four chief waterways of Russia, the Neva basin, Volga, Dnieper and Dvina, converge and form outlets to the Baltic, the Caspian and the Black seas and thus determine the direction of ancient trade routes. Numerous finds of Arabian, Byzantine and Anglo-Saxon coins (9th–11th centuries) along all these routes testify to a flourishing trade which corresponds exactly to the period of foundation of new states by Vikings at the one end and the florescence of Arabian and Persian caliphates before the Mongol invasion at the other end of these trade routes.

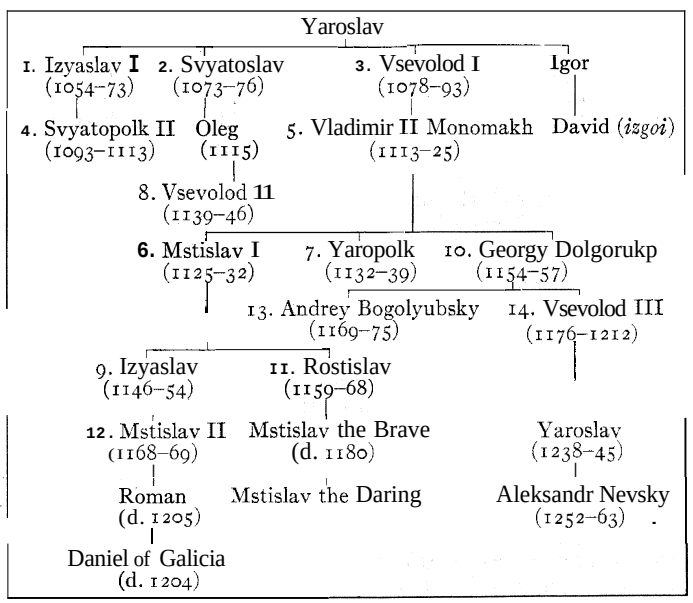
A. KIEV

Russian legend says that the Rus were first asked to come to Novgorod by the local population to put an end to their internal feuds. Rurik (Hrorekr) was the first (semilegendary) *knyaz* (*koning*, prince) of Novgorod, but his companions wished to descend the Austrvegr, nearer to Byzantium, and Oleg (Helgi) settled in Kiev. The Russian annals date the arrival of Rurik in Novgorod A.D. 862. But the first reliable datum is Oleg's commercial treaty with the Byzantines (911). A subsequent treaty was concluded in A.D. 945 by Oleg's successor, Igor (Ingvar), together with his companions, whose signatures contain 3 Slavonic names among 50 Norse. Constantine Porphyrogenitus gave a very picturesque description of this trade which still remained the chief business of the Rus dynasty. During winter the princes and their *gesiths*, who distributed among themselves the towns in the basin of the Dnieper. were busy making circuits among neighbouring tribes in order to force them to pay annual tribute. Their booty consisted of furs, money and slaves. As spring came they loaded their small boats "made of one single tree" (*monoxulos*) and convoyed their caravans down the Dnieper ready to ward off the attacks of nomad steppe tribes. In the treaties mentioned their rights of trading in the capital were strictly defined. The *konings* extended their power over local tribes and, to defend the land from nomad incursions, they constructed earthen walls on the frontiers of the steppe. The local aristocracy joined the ranks of their *druzhina* (*gesith*, cornitatus) and the process of assimilation began. The term "Rus" was now used to designate the southern outpost of the whole system of defense; *i.e.*, Kiev with the surrounding country. The son of Igor and his wife Olga (Helga) had already a Slavonic name, Svyatoslav. However, he remained part northern Viking as well as part southern nomad. Svyatoslav did not yet feel at home in Kiev. He wanted to come still nearer to Byzantium and chose Pereyaslavets on the Danube in the Bulgarian land, because. he said "there was the centre where all goods gather from all parts: gold, clothes, wine, fruits from the Greeks, silver and horses from the Czechs and Hungarians, furs, wax, honey and slaves from the Rus." Svyatoslav also defeated the Khazars and the Volga Bulgars, but he was defeated by the emperor John I Tzimisces and slain on his way back home by the Pechenegs (972). With him died the Scandinavian tradition of the Kiev dynasty.

From the reign of Svyatoslav's youngest son. Vladimir, the Norman dynasty was definitely settled in Kiev. It still preserved its connections with other parts of Europe, attempted distant military expeditions against its Slav neighbours and ruled the large territory from the northern lakes to the steppe and from the then uncertain Polish frontier to the river Volga and the Caucasus. This was the most brilliant period of southern Russian history. but its brilliance rested on an extremely unsafe base, as the connection between the newly built state and the country inhabitants remained very loose. The only link which unified the subdued tribes was the power of the grand duke of Kiev. The people paid their tribute to the prince's tax collectors, but otherwise they were left to themselves and preserved their ancient tribal organization and habits.

Another element of union of enormous importance was added by the acceptance of Christian faith in **988** by Vladimir the Saint. He took his religion from Byzantium, but the service was in the vernacular as the prayer books and Bible had been translated into Slavonic by the apostles of the Slavs, Cyril and Methodius, in the 9th century. From 1037 the Russian church was subject to the Constantinopolitan patriarchate; for two centuries nearly all metropolitans and most bishops mere Greeks. Eventually the Slavonic and Russian element prevailed. After Vladimir's death (1015), his son Svyatopolk the Damned assassinated his brothers (Boris and Gleb, canonized as saints) but was defeated by another brother, Yaroslav, elective prince of Novgorod, who reunited all territory under the grand duchy of Kiev and embellished his capital with a cathedral in Byzantine style. He also founded the monastery at Pechersk, which became a famous seat of faith and learning; he collected books and had them translated. Under Yaroslav the earliest document of Russian lam was revised under the name of *Russkaya* pravda ("Russian right"). He gave refuge to two sons of Edmund of England who fled from Canute. to Olaf II of Norway and also to Harald III Haardraade, who married his daughter; he gave his other daughter to Andrew I of Hungary; his third daughter married Henry I of France. His sons married Polish. Greek and German wives.

Yaroslav died in 1054. In order to prevent feuds among his numerous descendants he introduced an order of succession to the grand duchy of Kiev which was based on the principle that all territory as a whole belonged to the family, and different parts of it were distributed among them in temporary possession according to seniority and to the profitableness of the seat of administration. The most profitable towns on the main trade route were Kiev, Pereyaslavl (on the steppe frontier), Novgorod (the first Norman residence), then Smolensk (on the upper Dnieper) and Chernigov (on its confluent, the Desna). All brothers of the first generation were considered as senior to the following generation. As soon as Kiev passed to another brother all the members of the family changed their seats and approached one step nearer to Kiev. If one died before reaching Kiev, his descendants were called izgoi and excluded from "mounting the scale." In the accompanying chart are numbered the successive reigns in Kiev during seven



generations after Yaroslav.

The order of succession from brother to brother was kept only in the two first generations (1 to 5). Numbers 9 and 12 show preference given to nephews over uncles. And indeed, as early as 1097, at a conference held by the dukes at Lyubech it was decided that the sons should keep their fathers' heritages. The direct succession from father to son prevailed in all dukedoms. Kiev was seen to be losing its former significance. Its great importance was based on trade; but southern trade was destroyed by the appearance in the steppe (1054) of the Polovtsy (Cumans), nomads far more dangerous than the Pechenegs. It will also be seen that of all Yaroslav's sons only one line survived: that of Vsevolod and his brilliant son Vladimir Monomakh. Monomakh's line was then divided into two: the elder one (6, 9, 12) remained in Kiev and in its turn it mas subdivided in two—Roman and Daniel preferred to move west from the then unsafe Kiev to Halicz (Galich; see GALICIA), while two Mstislavs, the Brave and the Daring. as their nicknames show. remained to the end the knights errant of the chivalrous south. The cadet branch of Vladimir Monomakh (10, 13, 14) opened a new period of Russian history. The centre of influence changed then to northern woodland, far from the steppe. It was a far poorer but safer and, in the long run, more profitable settlement. In 1169 Xndrey's troops stormed Kiev. This was the end of southern brilliance, though Kiev was not definitely destroyed till 1240 by a last and most terrible invader, the Mongol Batu, Jenghiz Khan's nephew.

The title of grand duke of Kiev thus lost its importance and with it broke down the unity of Russia. Ducal appanages became independent dukedoms; Russian territory was split in a dozen separate units which waged endless wars against each other. The old Kiev centre suffered the most from these internal dissensions and from incursions from the steppe. The frontier population was nearly exterminated and mixed with Turkish ethnic elements. However, the ancient tribes remained untouched to the west and north of the river Dnieper. In their midst, about the 14th century, appeared new branches of Russian people, speaking their separate dialects: the Ruthenians (later known as Ukrainians) and the Byelorussians (the old Krivichi).

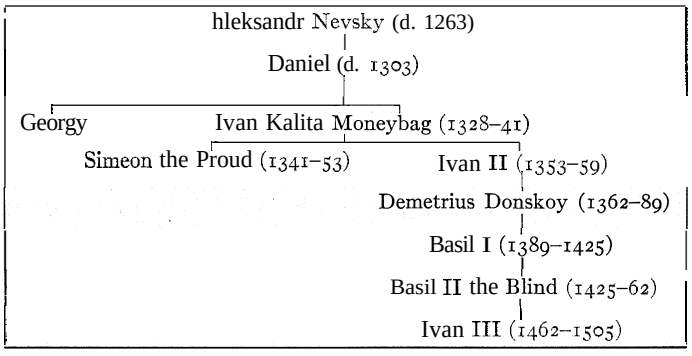
B. NOVGOROD AND MOSCOW

By and by three distinct centres emerged from the chaos: Halicz, Novgorod and Moscow. Each was characterized by the prevalence of one of three main features of the political life of Russia during the Kiev period. These three features are: (1) the popular assembly (veche), which represented the ancient tribal organization and which met in towns thus consisting chiefly of townsfolk; (2) the princes; (3) the boyars and the druzhina (*comitatus*), a landed aristocracy, partly of ancient tribal descent, partly the military companions of the prince at the conquest. This aristocracy developed especially in Halicz, where the social structure approximated to western feudalism. On the northwestern frontier it was, on the contrary, the democratic element that prevailed. The chief city, Novgorod, became a republic. "Lord Novgorod the Great" was ruled by a popular assembly (veche) which elected its mayor (*posadnik*) and its commandant (tysyatsky) and concluded treaties with the dukes who were invited only to watch over the defense. Novgorod had a largely developed trade and large dominions extending from its gates and from the mouth of the Neva over the whole Russian north up to the White sea and the Urals. That country was rich in furs, the chief export. The higher class of citizens was here formed of capitalists and rich merchants, who were to form the aristocratic element in Sovgorod.

Another element existed in the political structure of central Russia: the backwoods of the Oka and upper Volga. This country was cut off from all European connections. Its population consisted exclusively of agricultural colonists settled on ducal land. Thus, the duke appeared there as a proprietor and as the organizer of social life. Towns were scarce and the population scattered in clearings. The few veches in the chief towns had no influence; noble landed proprietors were completely absent. Thus. the poner of the duke was there practically unlimited Ducal psychology was framed accordingly; unlike the valiant knights of the south, they formed a dynasty of great appropriators, stingy and acquisitive, ruling their dukedoms as private estates. They thus accumulated elements of strength which as time went on aided them to become masters of the nhole of Russia.

After the conquest of Kiev by Andrey Bogolyubsky the title of grand duke passed from Kiev to a northern town, Suzdal, and from there to Vladimir on the Klyazma. But as early as 1147 Moscow is mentioned in the annals. Its situation was exactly at the centre of Rassia between the Oka and the upper Volga. It had long been a great centre of continental river trade, far from the southern area of Tatar devastation. The line of dukes of Moscow starts from Aleksandr Nevsky's younger son Daniel. Their genealogy during the domination of the Golden Horde (1240–1480) is shown in the accompanying table.

All these princes had to ingratiate themselves with the khans of the Golden Horde to receive from them the yarlyk (investiture) as grand dukes. They regularly journeyed to Sarai, the capital of the khans at the mouth of the Volga, and underwent every kind of humiliation. But they returned as chief collectors of the Tatar tribute, which gave them power over neighbouring dukedoms. Only the dukedom of Tver competed with them very stubbornly.



The dukes themselves involved the Tatars in their feuds and brought punitive expeditions on Russia. The khan's protection gave the Muscovite dukes the upper hand over their enemies. They soon succeeded in increasing their possessions. Ivan I extended his domains, by purchase and by violence, over the whole province of Moscow. Demetrius (Dmitry) added to it the upper Volga region (excepting Tver and Uaroslavl). Tula and Kasimov; Basil (Vasily) I the remaining part of Oka and Suzdal, Vladimir, Murom and Nizhny-Xovgorod; Basil II Elets in the south, Vologda and Ustyug in the north. A religious sanction was given to Muscovite unionist tendencies by the metropolitans of the Russian church who in the persons of Peter, Theognost and Alexius settled in Moscow. Accordingly, the grand dukes of Moscow added to their title: "of all Russia." Demetrius won a great name by his brilliant victory over the Tatars of the Golden Horde led by Mamai in a bloody battle on Kulikovo plain (1380). He thus appeared as a leader of all the national forces (excepting the grand duke of Ryazan) against the oppressors, and he received the blessings of the church at the hand of St. Sergius of Radonezh. the prior of the convent of the Holy Trinity. However, two years later Moscow was sacked and burned by another conqueror, Toktamish, who in his turn was defeated by Timur, his former protector. The Mongolian yoke lasted for another hundred years. although in milder forms. While Moscow mas steadily growing in importance in comparison with the rival grand dukedoms of Tver and Ryazan. the boyars and other "men of service" came in crowds to serve the grand duke of all Russia. The institutions of Moscow, which up to then resembled very much those of a large private estate, began to evolve into a system of state administration.

Ivan **III and Basil** 111.—Ivan III's acquisitions of Novgorod and Tver (1471 and 1485) enlarged Russian territory up to the limits of settlement of the Great Russian branch of the nation and brought Russia into direct contact with other countries. Livonia, Lithuania and the Tatar khanate of Crimea The title "of all Russia" became a reality. and systematic foreign relations

were started. The all-Russian potentate proffered historical claims against Lithuania, which possessed the Byelorussian territory.

The successful wars which followed extended the western frontier to Chernigov and Novgorod Seversk, while leaving further claims for Smolensk, Kiev "and all Russian patrimony" to Ivan's successors. Ivan also built the fortress Ivangorod close to the Gulf of Finland, thus opening the chapter of Russian pretensions on the Baltic. The Crimean khan Mengli Ghirai accepted his friendship and helped him to put an end to the Golden Horde. As early as 1480 Ivan refused the Tatar tribute and threw off the yoke.

The title of grand duke seemed inadequate after all these successes; more pretentious claims were based on a new theory suggested by southern Slav and Greek divines. According to this theory the Muscovite duke was a successor of the Byzantine emperors and the only representative of the Orthodox Church in the world. Indeed, the Greek Orthodox Church had accepted the "union" with the Catholics as early as 1439, at the council of Florence, while Constantinople. "the second Rome," had been taken by the Turks in 1453. Obviously, the Greeks had been punished by God for their apostasy, and their succession had to pass to the third Rome. which was Moscow, and to the Russian grand duke, who remained the only faithful and really Christian prince in the world.

The realization of this new scheme began with the marriage of Ivan III with Zoe (in Russia, Sophia). the only niece of the last Byzantine emperor, Constantine Palaeologus (1472). With her arrival ne habits appeared at the Muscovite court intended to magnify the new autocrat (a title used by Ivan in foreign relations). The church that gave its sanction to that change claimed a reward: the prince had to help it against all heresies and internal dissensions. The prior of Volokolamsk convent, Joseph, insisted on burning some rationalistic heretics in Novgorod. He also defended the principle that wealth gives power to the church, and he mercilessly crushed monastic and ascetic tendencies of the reformer Nil Sorsky, the "abstainer from property." Thus, the official theory on Russian church and state was formed as early as the end of the 15th century. Under Basil III the unification of Russian territory was consummated by the acquisition of another republic, Pskov (1510); by the final annexation of Ryazan, the last independent grand dukedom; and by a new extension at the expense of Lithuania—the acquisition of the frontier city of Smolensk (1514). The minority of Basil's son Ivan, who was three years old when his father died (1533), and subsequent disputes over the regency between rival factions. lasting 14 years, did not interrupt the growth of the Muscovite state. The reign of Ivan the Terrible marks the beginning of a new period of Russian history.

Ivan IV the Terrible (1533–84).—The reign of Ivan IV the Terrible was an epoch of great and systematic reform. It gave its final shape to the Muscovite tsardom which it preserved until the epoch of Peter the Great. At the age of 17 Ivan demanded to be crowned as tsar (shortened from Latin Caesar), and he connected this official assumption of title with a legend according to which the imperial regalia had been handed over to his predecessor Vladimir Monomakh by a Byzantine *basileus*. The Constantinopolitan patriarch was induced to confirm that legend, but he substituted Vladimir the Saint for Vladimir Monomakh in order to make good a chronological error. Popular songs preserved the memory of Ivan IV as a democratic tsar, who "ferreted out treason [*i.e.*, the boyars] from Russian land." And, indeed, he definitely deprived the "little dukes" nho gathered at his court of their remaining sovereign rights and forced them to exchange their hereditary possessions for other landed estates, while their service to Moscow was made obligatory. To pass over to foreign countries was qualified as treason. The same measures were extended to boyars. Both dukes and boyars tried to recompense themselves by assuming political power in the duma of the tsar, and the most powerful of them formed a "selected rada" (a sort of privy council) through which they ruled the state. They summoned the first Russian *zemsky sobor* or "assembly of the country" in 1550, at which representatives of the people revised the criminal code of Ivan III. They also took part in a church council of 1551, where this code was signed and certain traditional rites in church and private life were sanctioned as specifically national. At two previous synods of 1547 and 1549 about 40 new Russian saints were canonized.

However, the regime of the selected rada did not last long. Ivan IV resented it as an interference with his own power, and he broke with the counsels of his youth. He grew nervous and suspicious and began systematically to extirpate ducal and boyars' families. To show his wrath against his enemies he left Moscow (1564) and settled in Aleksandrovskaya Sloboda. He then divided the kingdom into two parts: his private *oprichnina* which he ruled personally, and the remaining "land" (*zemshchina*) which he handed over to a christened Tatar, Prince Simeon Bekbulatovich. Far from suspending reconstruction, this curious division helped to reorganize the Russian ruling class—the men of service—on more democratic lines. Ivan IV imitated for this purpose Byzantine patterns. He strictly regulated the connection between possession of landed estates and military obligations. His foreign policy—his long and successful war nith Poland, Lithuania and Sweden in order to break through to the Baltic—also forced him to adopt reforms in the army and the financial system. Russian fusiliers (streltsy) and foreign mercenaries first appeared under Ivan IV. He also introduced new military taxation and ordered a first general description of taxable land (*pistsoviya* knighi) in order to make the levies proportionate to the record of lots of taxed land; here too he borrowed his system from Byzantium. At the same time he centralized the receipts of the state in a "great treasury" while separating them from his own income, which was concentrated in the "great palace." Through its four boards (the fourths) the great treasury collected taxes chiefly from the north, while the peasants of the Muscovite centre had to work for men of (military) service. The nobles received the honorary title of "courtiers" (dvoryane), to distinguish their upper section—the tsar's guard—from the "sons of boyars," who formed the lower section—the provincial gentry. Both courtiers and sons of boyars were yearly sent to defend the western and the southern frontiers—especially the latter, which was fortified by walls and hedgerows (*zaseki*)—against the Tatar incursions. The posts of commandants for each campaign were distributed by the central board.

Theodore (1584–98).—The son and heir of Ivan IV, Theodore (Fedor, Fyodor), was a weak man whom Ivan called more fit to be a bell ringer in a convent than a tsar. The direction of affairs fell to his brother-in-law Boris Godunov, an able man who continued Ivan's policy. The Church of Russia received its independence and equality with other Orthodox churches by the granting to its head, the metropolitan Job, of the title of patriarch at the hands of Jeremiah, patriarch of Constantinople (1589). Another important measure was intended to strengthen economically the middle landlord class created by Ivan IV as against the boyars. Peasant labourers were forbidden to leave their estates or migrate to other landowners. All such fugitives who fled from their masters after 1592 (the time of the completion of government registers) were ordered back in 1597. This was the origin of legal serfdom.

Boris Godunov and Basil Shuisky.—In 1598 Theodore died; after some hesitation Boris had himself elected tsar by a *zemsky sobor*. He pursued Ivan IV's policy of weakening the boyars, but he met with opposition on their part. The only legal heir of Theodore, Demetrius, had been killed in Uglich, the place of his exile, in 1591. But the boyars with the help of the Poles opposed to Boris a "Pseudo-Demetrius," a young and well-educated man of obscure origin. Boris died (April 1605) soon after the appearance of this pretender (autumn. 1604), who was accompanied by Polish volunteers and aided by the Cossacks.

On June 19 Old Style (New Style, June 29), 1605, the impostor entered Moscow.[1]

[1]After 1582 the Gregorian calendar came into general use in Europe but was not adopted in Russia until 1918. Consequently, from 1582 to 1699 hates of the month in Russia were 10 days earlier; from 1700 to 1799, 11 days earlier; from 1800 to 1899, 12 days earlier; and from 1900 to Feb. 1, 1918, 13 days earlier. In this article the Old Style dates peculiar to Russia are given first; the New Style dates are given in parentheses.

On May 17 (27), 1606, Pseudo-Demetrius I was killed in a popular outbreak caused by the boyars, who took advantage of the popular dislike of his free habits of life and the Catholic tendencies of his Polish protectors. The old dynasty was completely extinguished. The throne of the tsar passed to an influential boyar, Basil (Vasily) Shuisky (1606–10). He gave a formal promise to the boyars "not to repeat the policy of Ivan IV" against them; *i.e.*, not to exterminate them by capital punishment or by exile and the confiscation of estates, without resorting to their court.

However, the power of the boyars could not be restored; much more influential now was the rising class of small landlords, men of service. Still more dangerous for Basil were the Cossacks and the fugitive serfs in the nenly colonized south of Russia. A real social uprising was started in the south by a former serf, Bolotnikov. The ferment was rife over the south and the east A second false Demetrius appeared and in the spring of 1608 marched on Moscow. He established his camp at Tushino, near Moscow. The boyars wavered between the tsar Basil and the "thief of Tushino"; there were many flittings. Basil turned to Sweden for help, but as soon as he received aid from Charles IX of Sweden Charles's rival, Sigismund III of Poland, also entered Russia as Basil's adversary and as pretender also to the Russian throne. In Sept. 1609 Sigismund appeared before Smolensk. In July 1610 Basil was dethroned by the boyars and the men of service. The throne remained empty through internal dissensions. and a real time of troubles set in nhich lasted for three more years (1610–13).

The "Time of Troubles."——The boyars preferred a Polish candidate, and together with the men of service they offered the Muscovite throne to Sigismund's son Wladyslaw. A delegation was sent to Srnolensk, and Moscow voluntarily received Polish troops under Stanislaw Zolkiewski. A treaty was concluded with Wladyslaw which secured the rights of the duma and the privileges of the landed gentry. A Polish dynasty might have settled in Moscow but for Sigismund's desire to keep the throne for himself. Sigismund's pretension woke up the spirit of national opposition. The second Pseudo-Demetrius at once won popularity, especially among the Cossacks and the loner classes. But in Dec. 1610 the impostor was killed by a Tatar of his suite. The middle landlord class then took action on the urging of the patriarch Hermogen. The men of service under Prokopy Petrovich Lyapunov and the Cossacks under Prince Dmitry Timofeyevich Trubetskoy and the ataman Ivan Martynovich Zarutsky blockaded Moscow; inside the town a popular uprising forced the Poles to retreat to the Kremlin. But here again dissensions arose among the besiegers. Lyapunov was killed by the Cossacks, and the men of service returned to their homes. The south of Russia was in complete disorder; crowds of Cossacks and Polish marauders dispersed all over the north. This finally decided the gentry to make a new effort and to gather a new national army which would "exclude the Cossacks and stand firm until a new sovereign is elected by all the land." Prince Dmitry Mikhailovich Pozharsky was made commander in chief of the army and Kuzma Minin, a butcher from Nizhny-Novgorod, the treasurer. All northern towns and districts sent their detachments and their representatives to the army as it advanced up the Volga. In April 1612 it stopped at Taroslavl. As Novgorod had been taken by the Swedes, Pozharsky offered the throne to Charles Philip, brother of Gustavus Adolphus. In August Pozharsky's army moved southnard to Moscow. On Oct. 26 (Nov 5) the Poles capitulated in the Kremlin, and a national candidate was set free: the young Michael Romanov, whose father, the metropolitan Philaret (Theodore Nikitich Romanov), a nephen of the first wife of Ivan IV, was at that moment a prisoner in Poland. All votes were at the disposal of a national tsar, more acceptable to the gentry as he did not belong to an old princely family and mas young enough (he was 17) to secure the boyars against overbearing conduct. Michael was unanimously elected by a regular *zemsky sobor* on Feb. 21 (March 3), 1613.

C. THE ROMANOV (ROMANOFF) DYNASTY

Michael and Alexius.— The *zemsky sobor* which elected Michael (1613–45) continued its session for three years, helping the new tsar to restore the disorganized and ravaged country. A second zemsky *sobor* was then summoned, which pursued for three more years the work of pacification. The co-operation of the tsar with the representatives of different social groups was becoming a regular system. But as the third year's session began (1619), Michael's father Philaret, now patriarch, came back from Polish captivity, and until his death in 1633 he ruled Russia as the "second lord" at the side of his weak son. Peace was concluded with the Swedes, who gained the Finnish seashore, at Stolbova in 1617 and with the Poles, who gained Smolensk, at Deulino (1618). But the struggle on the western as nell as on the southern frontier was far from being finished. Anticipating new conflicts the government entirely reconstructed the army; it invited foreign commanders and hired whole regiments of mercenary infantry. To cover the increased expenses it had to introduce new heavy taxation. New registers of lots of cultivated land which had survived the devastation of the troubled times were established. However, an attempt to take back Smolensk from the Poles (1632–34) proved unsuccessful and the government did not feel strong enough to wage war with the Turks to retain Xzov, nhich had been taken by a Cossack raid in 1642. The Russian colonization at that time nent no farther than the lines of Byelgorod and those of Simbirsk of Zakamsk. which were fortified in the period 1636–56. To the south of the Byelgorod line there developed at that very time a crosscurrent of Ukrainian colonization from the western bank of the Dnieper. The new Cossack settlers (Poltava, Kharkov) felt the more independent from the Poles the farther they went east, and in 1654 their hetman Bogdan Chmielnicki (Khmelnitsky) voluntarily surrendered the Ukraine to the protectorate of the Eastern Orthodox tsar. A large autonomy of the Ukraine was acknowledged by Alexius (Aleksey), Michael's son and successor (1645–76). A war with the Poles ensued in which the Russians finally took Smolensk, occupied Vilnius and Kaunas and forced Lublin to surrender. But before finishing with the Poles Moscow mas implicated in a war with Sweden. By the peace of Kardis (1661) Russia gave Livonia to Sweden; by the peace of Andruszovo it resigned Byelorussia to Poland but kept for itself Smolensk, the eastern Dnieper bank and Kiev (166;).

European Influences.—The reigns of the tsars Michael and Alexius are closely connected in home as well as foreign policy. Moral and intellectual development was steadily influenced by the increasing intercourse with western Europe. Since the time of troubles foreigners had come in crowds to Moscow. The clergy objected to too-close relations with these foreigners as having their reflection in a change of habits and even of religion. Consequently, about 1652, foreigners mere relegated to a suburb called "the German suburb." Honever, this proved still worse for the old Russian tradition, as the European culture now formed a single and undiluted unit which strongly influenced the court and the upper social classes. Russian boyars—such as A. L. Ordyn-Nashchokin, Artamon Sergheyevich Matveyev and Prince V. V. Golitsyn—began to learn foreign languages. to acquire foreign books, to wear foreign clothes and to furnish their apartments with foreign household goods. Translations of foreign books increased in number from 24 in the first half of the 17th century to 94 in the second half. Alexius was especially accessible to the allurements of foreign comfort and pastime. going so far as to enjoy in private "English comedy" in German adaptations.

The *Raskol.*—The national religious tradition of the 16th century appeared antiquated. The patriarch Nikon found that certain rites of the national church which distinguished it from Greek orthodoxy, far from proving Russian superiority in faith, were based on ignorant distortion of ancient Greek originals of the books of service. He asked some scholars of the theological academy of Kiev (founded by Peter Moghila about 1625) to prepare a revised edition. The majority of the clergy declared this attempt sacrilegious. as the old Russian saints had saved their souls according to the old books and rites. Nikon insisted on his corrections. He invited two patriarchs (of Alexandria and Xntioch) to come to Moscow, and at a council of 1665 the schismatics were excommunicated. A long struggle began between the faith of the

Old Believers and the Nikonianism, as the official church was now generally called. Masses of the people followed the schism (*raskol*), and as hopes for reconciliation passed they began to believe that the end of the world was approaching.

Peter I the Great (1682–1725).—The reign of Alexius' invalid son Theodore (1676–82) was a sort of prologue to Peter the Great's reform. The leading part fell, under Theodore as well as during the minority of Peter (1682–89), to a well-educated boyar. Prince Vasily Vasilyevich Golitsyn. He was the favourite of Theodore's energetic sister Sophia, who broke the tradition of seclusion of Russian women. After Theodore's death Sophia, with the help of the streltsy, made her brother Ivan a second tsar as Ivan V (resigned 1689) at the side of Peter and assumed the regency. Peter (ten years old) was left to himself and amused himself in the neighbouring village of Preobrazhenskoye with technical and mechanical arts as applied to military games. He surrounded himself with boys of his age who soon became his first regular soldiers. The ill success of Golitsyn's much-vaunted expeditions to Crimea (1687 and 1689) gave Peter the chance to overthrow Sophia, to send her to a convent and to exile Golitsyn. However, as tsar, Peter continued his free life of sport. He now became a habitué of the German suburb, where he made acquaintance with many foreign specialists. A Swiss adventurer, François Lefort. initiated him into the pleasures of debauchery and became his best friend. He also encouraged Peter to extend his playing at soldiers to a real campaign against Azov. During two difficult campaigns (1695–96) Peter learned chiefly the insufficiency of his knowledge. and Lefort urged him to complete his military and naval education abroad. Peter followed the advice; he joined his embassy in the capacity of a private norkingman and visited Germany, Holland and England (1697–98). He nas forced to return speedily to Russia to stifle the new rebellion of the streltsy fostered by Sophia's agents.

He then made peace with the Porte (1699) and on the following day declared war on Sweden and invaded Livonia. This Northern War lasted until 1721, and it proved to be the chief factor in Peter's military, financial and administrative reforms. Independently from these reforms made necessary by the war. Peter directly after his return from western Europe forced his subjects to shave their beards (which was felt as an unbearable religious offense) and to dress as foreigners. The Old Believers (schismatics) especially saw in it a proof that Peter was the expected Antichrist.

Peter's army was crushed by Charles XII at Narva (1700). But while Charles was engaged in defeating Peter's allies, Denmark and Poland, Peter called up the yearly levies, created a new standing infantry, cavalry and artillery, and occupied Livonia, Estonia and the mouth of the Neva, where he founded his new capital, St. Petersburg, on May 16 (27), 1703. The "nindow to Europe" was thus opened. To cover his new and enormous expenses, he acquired the habit of taking money nherever he found it. He thus completely destroyed the old system of central administration, the *prikazy;* instead, he distributed the financial resources of Russia directly among his generals by dividing Russian territory into eight "governments." Each government (gubernya) had to pay for the upkeep of a certain number of regiments. Russia thus received in 1708–12 its first regular division into provinces.

Charles XII made the mistake of advancing from Poland to the south of Russia, instead of proceeding straight against Moscow. The Cossack hetman Mazepa (Ivan Stepanovich Mazepa-Koledinsky) promised to help him. but was unable to raise the Ukraine He joined Charles nith an insignificant force. At Poltava (June 27 [July 8], 1709) Charles was defeated by Peter and fled to Turkey. The Poltava battle produced a strong impression abroad; Russia was becoming a European state. Russian soldiers restored Augustus II on the Polish throne, drove the Swedes from Pomerania and appeared in the middle of Germany. The young Russian fleet won a naval victory over the Swedes at Hanko Head. Peter married his niece, Anne, to the duke of Courland (1710) and another niece, Catherine, to the duke of Mecklenburg (1716). He favoured Prussia at the expense of Denmark and Hanover. A Russian army landed near Stockholm (1719 and 1720). In 1721 peace was concluded at Nystad; Russia received Ingermanland, Estonia and Livonia, and parts of Karelia and Finland. After that Peter accepted the title "emperor" (imperator), which gave him a claim to equality with the Holy Roman emperor.

Peter was now free to pay more attention to internal reforms. He had to restore the central administration which he had destroyed and to bring it in harmony with his new provincial organization. In the absence of Peter, who only once a year, at Christmas, appeared in his capital (since 171 j in Petersburg), the only central institution which ruled Russia was the senate. From 1711 Peter engaged foreign advisers (Baron Johann Ludwig Luberas and Heinrich Fick) to introduce into Russia the colleges on Swedish pattern (1718–22). Three colleges managed finance: *Kammer-*, Staats- and Revision-collegia. Three others were to increase the productive forces of Russia: Kommerz-, *Manufactur-* and Berg-collegia. Three chief colleges stood above the others, on an equal footing with the senate, as they represented the tsar's prerogatives: foreign affairs, army and navy. In the provinces all the colleges were supposed to be represented, but as this proved too expensive the whole government of a gubernya was reduced to the single voyevoda of former times and to his office.

Peter was not a social reformer, but his reforms brought about great changes in the social composition of Russian society. All strata of men of service now melted definitely into one unified class of dvoryanstvo (gentry), uhich had to pass a uniform time (the 14 ranks of the "Table" of 1722) of obligatory service. Possession of landed estates lost all trace of being a remuneration for service. At the same time the different groups of land labourers, half-free and unfree, on the gentry's estates became a unified class of serfs, subject to the poll tax, introduced by Peter in 1718–22 and collected by the landlords. Peter also tried unsuccessfully to differentiate the burgesses from other classes by organizing them in merchant guilds and introducing a kind of municipal self-government under the German name of *Rathaus* and burgomaster (1699–1721).

Peter's educational reforms proved premature. There had been already founded, under Sophia, a Slavo-Greek-Latin theological academy in Moscow (168 j–87), where the influence of Kiev amalgamated with the more orthodox Greek tendencies. Peter added a navigation school, led by an English mathematician, Farquharson (1701; transferred to Petersburg as the naval academy, 1715). Both academies soon became centres of two sets of lower schools, clerical and lay, in the provinces. But they were few—about 40 of each for the whole of Russia—and they had to secure their pupils almost by force. A few hundred pupils only finished their studies there. Peter also ordered the publication of useful books—mostly translations—and he introduced the Russian lay alphabet that remained in use till the Soviet reform. But Peter's books proved too specialized for Russian readers and the language of the translations was nearly unreadable; a literary language had first to be created.

Peter's reforms did not leave untouched the sphere of religion. As the clergy was mostly opposed to his reforms, he deprived the Russian church of its spiritual head—the patriarch, a second monarch. Aided by an educated bishop, Theofan Prokopovich, Peter abolished the patriarchate and put in its place the holy synod (1721). The beheaded church was thus deprived, in the opinion of adversaries of that reform, like Stepan Yavorsky, of its legislative authority in questions of dogma.

From Peter I to Catherine II (1725–62).—Peter met with opposition in his own family; his son Alexius (Aleksey Petrovich) gre up under the influence of the clergy and obviously disapproved of Peter's reform. He fled abroad from Peter's menaces, was brought back by fraud and imprisoned on suspicion of a conspiracy against his father's life and died by torture (1718). There remained only two daughters, Anne and Elizabeth. from the second marriage of Peter with a Livonian prisoner, Martha Skovronskaya, renamed Catherine. In 1722 Peter reserved for the monarch the right to designate his successor. But at the moment of death on Jan. 28 (Feb. 8), 1725, he failed to do so. Peter's creatures, like Aleksandr Danilovich Menshikov (*q.v.*), who had everything to fear from the survivors of old nobility, resorted

to the guards and with their help proclaimed Catherine. The legitimate heir, the son of Alexius. Peter, was thus put aside. The Russian throne became "not hereditary and not elective, but *occupative*." The period from Peter's death to Catherine II's accession (1725–62) was an eclipse. Male members of the Romanov dynasty (that is to say, Peter's grandsons Peter II and Peter III, the sons of his son Alexius and of his daughter Anne of Holstein, respectively) were frail and feeble of mind. The momen—both Peter's niece Anne (Ivan V's daughter) and his daughter Elizabeth—were stronger in mind and body. But they shared their power with favourites, and their choices were not always happy. Court life flourished under these women's reigns and it became very luxurious and expensive. A special school was founded by Anne (the corps of nobles) to teach the noble guards foreign languages, dances and good manners. Balls, theatrical plays. musical entertainments—chiefly by foreign artists—became regular pastimes. The country was badly ruled; foreign policy was venal. Russia took part in European wars with little benefit for itself. From reign to reign the noble guards gained in idfluence, as they practically disposed of the throne. Catherine I (1725–27) was followed by the rightful heir Peter II (1727–30), thanks to a compromise between Menshikov and the representatives of the old nobility. His reign was fraught nith struggle between the two. But Anne, the nidowed duchess of Courland, possessed a bad title. The aristocrats offered her the throne on the condition of limiting her power by the supreme council (created under Catherine I) in questions of her marriage, succession. war and peace, taxation, military appointments, etc. Anne signed, but profiting by the guards' dissensions tore up the signed charter and reigned as an autocrat (1730–40), aided by her favourite, Ernst Johann Biron. She tried to secure the succession in the lineage of her sister, the deceased Catherine of Mecklenburg, by designating as successor under the regency of Biron the baby Ivan VI. just born to her niece, Anna Leopoldovna, duchess of Brunswick. Anna Leopoldovna herself succeeded Biron as regent. but after a fen months the guards showed their hatred of the rule of the "Germans" by overthrowing her regency and enthroning Elizabeth. Peter the Great's daughter, who was expected to return to Peter's national policy (1741–62). Indeed, the first fruits of Peter's reforms ripened during Elizabeth's reign: national poetry, a theatre and the first Russian university (Moscow, 1755), all auguring a deeper culture and knowledge for the next generation.

Elizabeth wished to secure the throne 'for the lineage of her sister Anne of Holstein, and she invited her nephew Peter, educated in the Lutheran religion and in the ideas of Prussian drill, to come to St. Petersburg to learn Orthodoxy and Russian habits. He came and was married (1745) to princess Sophia of Anhalt-Zerbst, the future Catherine II. He was no mate for her. As fast as he lost Russian sympathy by his open aversion to everything Russian, Catherine ingratiated herself by exactly opposite behaviour. After half a year of the reign of Peter III, Catherine mas raised by the guards officers to the throne. The brother of her favourite Count Grigory Orlov. Alexis, assassinated Peter as soon as he was banished to Ropsha by Catherine.

For a representation of the succession to the throne of Peter the Great see the genealogical table in the article ROMANOV. Consult also the articles on the several emperors, empresses and regents just mentioned: ANNA (Anna Leopoldovna); ANNE; BIRON, ERNST JOHANN; CATHERINE I; ELIZABETH (Elizaveta Petrovna); IVAN VI; PETER II; and PETER III.

Catherine 11 (1762–96).—The long reign of Catherine II was a turning point in Russian history. She received the fruit of half a century's evolution since Peter the Great's reforms. A prolific writer herself, in regular correspondence nith the foremost men of her age, with Voltaire, Diderot, Jean le Rond d'Alembert, Baron Friedrich von Grimm, etc.. not to speak of fellow potentates such as Frederick II, Maria Theresa and Joseph II, she nished to make her reign brilliant and herself an ideal enlightened monarch. She began her reforms by compiling from Montesquieu and Cesare Bonesana, marchese de Beccaria, an instruction (*nakaz*) on the basis of which a new code of laws was to be composed. In order to discuss it she gathered an elective assembly of 564 deputies chosen from all classes except the clergy and the serfs, and from all parts of the empire. However. she met with opposition on the part of the gentry to her schemes to fix within definite limits their power over the serfs. Far from engaging in a struggle with the ruling class she yielded to their desires; their power was increased and a number of crown estates were distributed among the ranks of her favourites, thus turning their peasant population into serfs.

Catherine then began to search for glory in foreign politics. She conceived a bold scheme: (1) to recover from Poland the western provinces with an Orthodox Byelorussian and Ukrainian population and (2) to take possession of the Black sea shore, drive the Turks from Europe and found in their place a series of new states in Moldavia and Walachia, in the Balkans and in Greece. She wished to take Constantinople and to place there her second grandson, Constantine, as the emperor of a new Greek empire. His very name was chosen to symbolize this project. Catherine was favoured in accomplishing at least a part of these designs by discords between two German states, Prussia (under Frederick II and Frederick William II) and Austria (under Joseph II, Leopold II and Francis II). In her first Turkish war (1768–74) she had Prussia on her side and Austria against her; after P. A. Rumyantsev's victories she concluded a peace at Kuchuk Kainarji, the beginning of the Eastern Question (*q.v.*), as by it Russia received the right to protect Turkish Christians. Moreover, in 1772 she took part in the first partition of Poland, proposed by Frederick II in order to consolidate his territory and to compensate Russia for its war expenditure. In the second Turkish war (1787–91) Catherine had Austria on her side and Prussia against her. She had to content herself, after the victories of Suvorov (Aleksandr Vasilyevich Suvorov, Count Rimniksky) and Prince N. V. Repnin, with the acquisition of Ochakov and the steppe between the Dniester and the Bug. But she consoled herself with new annexations from Poland (the second partition, 1793, and the third partition, 1795; *see* POLAND), while Prussia and Austria were busy fighting against the French Revolution. Catherine also annexed Courland (1795). Her numerous lovers Battered her imperial ambitions: the bold Grigory Orlov in her early years (1762–74), the ingenious Prince Grigory Potemkin in the midst of her reign (1775–91) and the young Platon Zubov, handsome but insignificant, in her declining years (1791–96).

Between her two Turkish wars (1775–85) Catherine returned to the legislative mania of her early years. Made wise by her experience with the commission of the code of 1767, she turned from Montesquieu to Blackstone and profited by the administrative knowledge of J. Sievers, a skilful adviser of German Baltic origin. She then published in 1775 her statute of provinces, a good piece of organic legislation. Here for the first time in Russian history a local unit of administration, judiciary and self-government was created. The statute introduced a regular system of courts of justice, separate financial and administrative offices and—last but not least—corporations of local gentry meeting every three years to discuss their affairs and to elect their marshals. This system lasted until the reforms of Alexander II. The reform of 1775 was completed by two charters granted in 1785 to nobility and to burgesses. The charter of nobility served to perpetuate the power of the ruling class until the liberation of the serfs in 1861, while the burgesses' charter laid the basis for real municipal self-government.

The protection extended to the gentry inevitably created a growing disaffection on the part of the serfs, who impatiently awaited their turn for emancipation. In 1773 the Yaik (Ural) Cossacks revolted under E. I. Pugachev, who called himself Peter III. He roused the Bashkirs and the serfs allotted to the factories in the Urals, assailed Kazan on the Volga and sacked it. Through the whole empire the peasants only awaited his coming to rise, but he did not feel equal to the task, nor could his bands stand against regular troops. He therefore suddenly returned to Cossack country. where he lost his army; he was extradited by his associates, tried and beheaded in Moscow.

Catherine definitely turned her back on the liberal ideas of

her youth after the beginning of the French Revolution. She began to persecute representatives of the advanced opinion which she herself had helped to create. A. N. Radishchev, the author of a spirited book, A Journey from *Petersburg* to *Moscow,* was sentenced to death as a Jacobin in 1790, but the sentence was commuted to ten years' exile in Siberia. N. I. Novikov, a freemason who accomplished admirable educational and editorial work, was sent to Schlusselburg prison in 1792.

Paul I (1796–1801).—Catherine's son and successor, Paul, mounted the throne when he was 42, barely sane and with a bitter feeling of having been deprived by his mother of his right to succeed his assassinated father Peter III. He hated Catherine's favourites and her policy, both internal and external. He stabilized the succession of the Russian throne by his imperial family statute (1797; in force until 1917). He sent Suvorov to Italy to fight against the French Revolution, and he ended his reign while preparing with Napoleon an expedition to India against England. In social questions Paul's policy was also inconsistent: he alleviated the serf's obligatory work for his landlord by reducing it to three days in a week, but he gave away the peasants of the crown to noble proprietors as serfs in an even larger number than Catherine (120,000 yearly). This did not make him, however, popular among the nobility, as his exalted idea of the divine right of the tsars caused him to treat them in a purely oriental way. He used to say that a person could be reputed of importance only as long as he was permitted to converse with his majesty. His ill-balanced mind and tyrannical proclivities inspired fear in his associates, and in the sixth year of his reign he was assassinated by court conspirators.

Alexander I (1801–25).—Paul's son and successor began his reign, as had Catherine (whom he professed to imitate), with attempts at liberal legislation (1801–05), which gave place to active foreign policy and wars (1806–09). There followed a new attempt at a constitutional reform (1809), hampered by the nationalist opposition, which urged and approved the annexation of Finland (1809) and of Bessarabia (1812). The invasion of Napoleon (1812) brought the national feeling to extreme tension. The following years (1813–18) were devoted to the assertion of Russia's influence in Europe. The last years of the reign (1819–25) mere marked by a reactionary policy, which provoked the first revolutionary movement in Russia

Alexander received a careful education at the hand of his grandmother. who wished him to inherit the throne instead of Paul, his father. The Swiss republican F. C. de la Harpe had a strong influence on him in his early years (1784–95). But this education was interrupted by Alexander's marriage (at 16) and did not go beyond imparting to him some general ideas unsustained by exact knowledge. His sentimental feelings mere cooled by the court intrigues, by the hidden enmity between his grandmother and father and finally by the harsh system of Paul's reign, which Alexander was expected to approve and obliged to share in. The consequence was that he grew up a past master in dissimulation and self-restraint. His evasiveness in face of other people's strong opinions was often taken for weakness. But he knew how to promote his own views and if impeded in his designs he was capable of violent explosions of wrath.

Initial Liberalism.—In the first year of his reign Alexander surrounded himself with a few friends of his youth—N. N. Novosiltsev. P. A. Stroganov, Prince Adam Czartoryski, Prince V. P. Kochubey—a "private committee" uhom he wished to help him in drafting large schemes of reforms. He at once cancelled a series of reactionary measures of Paul and declared his desire to abolish arbitrariness and to inaugurate a reign of law. Public opinion received him with enthusiasm. But the private committee, which met regularly for about a year, found dangerous and untimely both a formal declaration limiting the autocrat's power and the abolition of serfdom. The most important fruit of these good intentions was the introduction of ministries instead of the colleges of Peter the Great, which had been practically abolished by Catherine. A new senate statute was intended to make this institution the highest legal authority (1802). A very cautious ukase of 1803 permitted noble landowners to liberate their serfs, granting them at the same time lots of land. Only 47,000 serfs were thus liberated and became "free agriculturists" Somewhat larger measures limited the power of landowners over the serfs in Livonia and Estonia (1804–05). A new and important impulse mas given to public education, which was considered to be a preliminary condition to all substantial reforms. Three new universities were created.

Since 1801 Alexander had feared the consequences of Napoleon's ambition, and he took upon himself, although it had no relation to Russian national interest, to organize a new coalition against France. In 1805 and 1806 he was involved in wars which ended in crushing defeats at Austerlitz and Friedland. He then changed his policy and concluded an accord with Napoleon directed against England, whose commerce with the continent had to be forbidden in all countries which adhered to this continental system. At his personal meeting with Napoleon at Tilsit (1807) Alexander played a part which made Napoleon call him a "northern Talma" (a renowned actor) and a "Byzantine Greek." But he was in part genuinely under Napoleon's influence and was entangled into new wars: with Sweden, which finished with the annexation of Finland (1809), and with Turkey, which lasted for six full years (1806–12) and ended with the annexation of Bessarabia. A year later (1808) Alexander again met Napoleon at Erfurt, but Napoleon's intention to raise the Polish question did not please Alexander. while Napoleon was offended by the refusal of the tsar to give him his sister in marriage. Relations were very strained by the end of 1810.

Conservative opinion was very much incensed against Alexander's alliance with the "Corsican usurper," especially as at that very time another and more serious attempt was made to introduce in Russia a constitutional government. Mikhail Mikhailovich Speransky, a prominent statesman, whose views were favoured by the emperor at that time, prepared a scheme based on the introduction of self-government in four stages, beginning with electoral assemblies (dumas) in the cantons and ending at the top with the duma of the state. Each lower duma elected deputies to the upper one: cantonal dumas to district dumas, district dumas to provincial ones; these latter sent all their members to the state duma, a legislative assembly, deprived of legislative initiative but enjoying the right to make motions concerning the interest of the state. the responsibility of functionaries and the violation of fundamental laws. The senate retained only judicial power, while the newly reformed ministries remained organs of the executive. The council of state, composed of high dignitaries and presided over by the tsar, was to prepare drafts of lams. In fact nothing except the council of state and the reformed ministries was realized (1810). Conservative opinion, as represented by nobility and bureaucracy, was furious with Speransky, and the tsar did not choose to defend him. On a futile pretext Speransky was dismissed from his office of imperial secretary and sent to exile (1812). His successor was an extreme nationalist and conservative, Adm. A. S. Shishkov.

Nationalism and Reaction.—When the war of 1812 began, the nationalist feeling reached its pitch. It was to be a Scythian war—a war of retreat. Time and space were to be the chief allies of Russia, whose military forces were one-half or one-third the size of Napoleon's. And, indeed, the deeper Napoleon penetrated into Russia's endless plain the more equal the chances became. Alexander named another conservative, M. I. Kutuzov, commander in chief in the place of M. Barclay de Tolly, and a third conservative, Count Feodor Vassilyevich Rostopchin, general governor of Moscow, which was the final aim of Napoleon's strategy. After the bloody but undecided battle at Borodino (Aug. 26 [Sept. 7]) Moscow surrendered to Napoleon. For five weeks of his stay in Moscow he waited in vain for a peace proposal. Moscow was burned by the inhabitants. His army was in process of dissolution, and winter was approaching. Then followed the famous retreat, during which the Grand army was nearly annihilated, and the wars of liberation of 1813 and 1814, which brought Alexander and his army to the walls of Paris. At the Congress of Vienna (181j) he figured as a saviour of Europe, and he continued to play a leading part at Aix-la-Chapelle (1818),

Troppau and Laibach (1820) and Verona (1822). All these events produced an enormous impression on the sensitive temperament of Alexander. "The fire of Moscow," he said later to the German pastor R. F. Eylert, "lit up my soul, I then got to know God and became another man." Alexander now found in the Bible the proofs of his mission and proposed to his allies to establish a Holy alliance, a monarchs' league based on the precepts of the Scriptures. His intention was liberal, but Metternich made use of the idea for his policy of repressing all liberal movements in Europe.

The Revolutionary Movement.—Quite different were the impressions which the younger generation of officers who took part in the Napoleonic wars brought with them back to Russia. Many of them while abroad read political newspapers and were present at the debates of representative assemblies. They learned to quote the books of J. L. Delolme, Count Destutt de Tracy, Benjamin Constant, Gaetano Filangieri, Baron Bignon, etc. After their return to Russia they were shocked by the contrast of arbitrary rule, the abuses of bureaucracy, the venality and secrecy of the courts, the sufferings of the serfs and the indifference to popular education. Two secret political societies were formed by the most active of these officers in 1816–18: one by Pavel Ivanovich Pestel in the southern army and the second by a group of guard officers in Petersburg headed by N. M. Muraviev and Nikolay Ivanovich Turgenev. The former society—more radical—imitated the organization of the Carbonari; the latter borrowed its principles from the Tugendbund. Later on Pestel drafted a republican and strongly centralized constitution, while Muraviev composed a monarchical and federal constitution on the basis of those of Spain of 1812 and of the United States. Pestel's tactics were revolutionary, while the Petersburg group intended to help the government openly in questions of education, philanthropy, economics and improvement of justice. thus preparing Russia for a constitutional regime. They expected Alexander to sympathize with them, as in 1815 he gave a constitution to Poland and mentioned at the opening of the sejm that he was preparing one for Russia. He also acknowledged the old institutions of Finland. However, Alexander soon ceased to distinguish between "the holy principles of liberal institutions" and "destructive teaching which threatens a calamitous attack on the social order" (his expressions in the speech mentioned). He entirely agreed with Metternich (in 1820) that the liberal principles themselves were destructive. A period of reaction began in Russia. The transition to it was marked by an attempt to impart to Russia Alexander's religious enlightenment. The ministry of public education was united, for that purpose, with a new ministry of spiritual affairs, where all religions including the Russian Orthodox were treated equally (1817). Prince A. N. Golitsyn, the procurator of the holy synod and the president of the Russian branch of the Bible society founded in 1812, was made the chief of the united ministries. The consequence was that in 1819–21 the young universities recently opened were entirely destroyed—especially by the curators of Kazan and Petersburg circuits, M. L. Magnitsky and D. P. Runich. They removed the best professors and prohibited good textbooks on natural law, morals and logic, on the ground that the teaching must be based exclusively on Holy Scripture. For Russian church dignitaries even their mystical pietism was heresy: Golitsyn was forced to leave his office, after he had been anathematized by the archimandrite Photius. a fanatic protected by Alexander's favourite Aleksey Andreyevich Arakcheyev. During the last part of the reign Arakcheyev, an ignorant and brutal man, enjoyed the power of prime minister.

Under these conditions secret societies changed their character. The measures of Alexander convinced them that monarchs' promises are not to be relied upon. They were also impressed by military pronunciamentos in Spain and Naples (1820). Nikolay Turgenev recorded in his diary in 1820: "We formerly asked, every time we met the readers of newspapers in the club, whether there was a new constitution. Now we ask whether there is a new revolution." One may judge of the impression produced on the officers of the guard when they learned that they had to stifle the Neapolitan uprising, by orders of the Laibach congress.

The former secret society of welfare, imitating the Tugendbund, was officially closed in 1821, as being too moderate. Two societies appeared instead: the northern and the southern constitutionalists and republicans. The constitutionalists were losing ground; radical elements even among them (like the poet K. F. Ryleyev) began to prevail. Proposals of regicide were heard from P. G. Kakhovsky and A. I. Yakubovich but were rejected or indefinitely postponed. In any case, revolutionary tactics were considered inevitable, but no definite scheme was in preparation. Suggestions were made for forcing the tsar, at some favourable opportunity, to nominate a liberal ministry under Speransky and N. S. Mordvinov, who would convoke a great council (later, Russian revolutionaries called it a constituent assembly) which should decide on the form of the government.

A favourable occasion presented itself quite unexpectedly. Alexander died in Taganrog on Nov. 19 (Dec. 1), 1825. The order of succession happened to be undecided. Constantine, the elder of Alexander's surviving brothers, had renounced the throne in 1823, but Nicholas, the younger, did not wish to acknowledge this and swore allegiance to his brother. Constantine would not accept the throne. Nicholas threatened to leave Russia. The correspondence between Warsaw and Petersburg was thus protracted for about two weeks. The Decembrists, as they were called later, decided finally to raise the guard regiments for Constantine against Nicholas and to force Nicholas—in case he survived that day—to appoint a liberal ministry which would do the rest. The rising was a failure (see NICHOLAS I). The last of Russian palace revolutions was spoiled by too much idealism, but it served as an ominous prognostication of the coming democratic revolutionary movement.

Nicholas I (1825–55).—Nicholas was quite unlike Alexander. With a rough nature of limited understanding, he was conscious of his inferiority and sincerely disliked the idea of becoming tsar. But once tsar, he was sure that he would be enlightened from above for the accomplishment of his divine mission, and he conceived an exalted idea of his personal dignity and infallibility. But he was no mystic. Cold and reserved, he inspired fear and hatred and he consciously made use of these feelings as the instrument of his power. His aim was to freeze every germ of free thought and independent moral feeling, as disturbing agents of the order of things entrusted by God to his personal care.

Nicholas' reign is divided into three parts by two European sets of revolutions: those of 1830 and those of 1848. During the first five years (1825–30) he did not feel quite sure of himself and he appealed for help to advisers of Alexander's liberal period, such as Kochubey, Speransky and E. F. Kankrin (Count Georg Cancrin). In Dec. 1826 he even instructed a special committee to collect for him all useful hints about necessary reforms. While punishing severely the Decembrists (five of them were hanged, others sent to Siberia), he wished to make use of all their good ideas. But he reserved for himself the control over public opinion and confided to Count A. K. Benckendorff the organization of a new secret police of gendarmes controlled by the "third section" of his personal chancery. He adopted Alexander's policy of protecting the kings from their peoples, but he made an exception for Christian Turkish subjects (in the first place the Greeks). He thus carried on a war against Turkey (1827–29). By the treaty of Adrianople Greece was liberated; the hospodars of the Danubian principalities were to be appointed for life and free from Turkish interference in internal affairs. The straits and the Black sea were to be open.

Nicholas especially attended to education; he wished to clear it of everything politically dangerous and confine it to the upper class. He abolished the liberal university statutes of Alexander (1804); by the new statutes of 1835 he detached the primary education intended for the lower classes from the gymnasiums and universities, where only children of gentry and of officials were to be admitted.

The expulsion of Charles X from France and the Polish insurrection of 1830–31 determined the legitimist tendency of Nicholas' foreign policy; he wished to become a real "policeman" of Europe, and at Miinchengratz he renewed relations with Metter-

nich. But his excessive interest in the "sick man" in Constantinople finished by rousing Europe against him. In 1833 Nicholas saved the sultan from the Egyptian rebel Mohammed Ali, and by the treaty of Unkiar-Skelessi received for that service free passage for Russian ships to the Mediterranean, while to all other powers the Dardanelles were to be closed during wartime. This concession drew the attention of the European powers, and in 1841 all the five great powers agreed that the Dardanelles should be closed to warships of all nations.

Slavophils and *Westernizers*.—In sharp contrast with Nicholas' educational policy, a new generation grew up which was bred by Russian universities, especially Moscow university, between 1830 and 1848. They were not politicians or liberals of a Franco-English type. They were idealists and students of the philosophy of F. W. J. von Schelling, J. G. Fichte and G. W. F. Hegel. In Moscow literary salons they did not discuss the form of the government, but dug deep into the very foundations of Russian history and the Russian national mind. Most of them declared that Russia was unlike Europe and its type of civilization potentially far higher than the European one. They thought to discover Russia's peculiarity in its old peasants' commune (mir), which, they said, revealed the socialistic soul of Russia as unlike the individualist western soul. They execrated Peter the Great's Europeanization of Russia as a fatal deviation from the genuine course of Russian history, and they wanted Russia to come back to the forsaken principles of the Eastern Church and state—to orthodoxy and autocracy. The majority of public opinion, led by A. I. Herzen, V. G. Belinsky, Mikhail Bakunin, T. N. Granovsky and others, revolted against this Slavophil doctrine. They opposed to it their own doctrine of the western origin of Russian civilization. Herzen and Bakunin emigrated from Russia on the approach of the revolutions of 1848. They became the originators of Russian socialism, which however did not frighten Nicholas so much as Russian liberalism—an applied doctrine whose dangers he had experienced at the hands of the Decembrists.

Nicholas was not insensible to the chief social question in Russia—that of serfdom. How could he be when peasants' uprisings were steadily growing in frequency? They numbered about 41 in the first four years of his reign, and there were 378 between 1830 and 1849 and 137 during the last five years. Nicholas formed a series of secret committees which, after many failures, prepared the law of 1842 on voluntary accords, which abolished personal serfdom and fixed the amount of peasant lots and payments. Through P. D. Kiselev's energy, the same changes were obligatorily introduced in Poland (1846) and in some western provinces (1847). A real persecution of intellectuals began after the revolutions of 1848. A secret committee, presided over by D. P. Buturlin, was founded to punish press offenses. S. S. Uvarov himself was found too liberal and resigned. His successor, Prince P. A. Shirinsky-Shikhmatov. wished to "base all teaching on religious truth." The university chairs of history and philosophy were closed, the number of students limited; many writers were arrested, exiled or otherwise punished. The private circle of followers of M. V. Butashevich-Petrashevsky, a young socialist, was sent to forced labour in Siberia (including Theodore Dostoievsky) for having read and discussed prohibited literature.

The *Crimean* War.—Nicholas also wished to dictate his will to Europe. "Submit yourselves, ye peoples, for God is with us": thus ended his manifesto published on March 27 (April 8), 1848. He sent a Russian army to subdue Hungary when it had revolted against the Habsburgs. A few years later he inadvertently provoked a conflict with Turkey, because of a special question on the distribution of holy places in Jerusalem between Catholic and Orthodox priests, which he involved with the question of the general protectorate of Russia over Christian subjects of the sultan. European powers would not admit this protectorate, and Nicholas found against himself not only Napoleon III and England but also "thankless Austria." In Nov. 1853, Turkish forces attacked the advanced Russian troops in the Danubian principalities; France and England declared war on Russia on March 16 (28). 1854. The courage displayed in the defense of Sevastopol proved useless, as the whole fabric of Russian bureaucratic and autocratic government appeared incapable of competing with European technique. Corruption and lack of communication, feeble development of industry and financial deficiency deprived the valiant soldiers of the most necessary means of defense. (See CRIMEAN WAR; TURKEY: History.) Nicholas died in St. Petersburg on Feb. 18 (March 2), 1855, feeling that all his system was doomed to destruction. A wholesale change of regime was indicated to his son and successor, Alexander II.

Alexander II (1855–81).—Alexander, a man of weak character but good-natured, possessed no steadfast views on politics. During the reign of his father he had sometimes surpassed Nicholas in reactionary intentions. But the Crimean War proved too clearly the danger of Nicholas' martinet system, and public opinion was too impetuous for Alexander to resist. He swam with the current, and this period coincides with the great reforms which made his reign a turning point in Russian history. But Alexander was always conscious of his power as unlimited monarch, and his liberalism ended as soon as his reforms brought with them a revival of political or autonomous tendencies. He then began to waver; the reforms were left unachieved or curtailed. Public opinion grew impatient, extremist tendencies won the ground, and the gap between the government and advanced opinion finally became insuperable. As a consequence, the original impulse for reform was exhausted as early as 1865. There followed a period of faltering which turned into a sheer reaction as the revolutionary movement grew.

Emancipation of the Serfs.—The greatest achievement of the era was the liberation of peasants. It paved the way for all other reforms and made them necessary. It also determined the line of future development of Russia. The chief motive which decided Alexander is clearly expressed in his words to the Moscow gentry: "The present position cannot last, and it is better to abolish serfdom from above than to wait till it begins to be abolished from below." However, Alexander met with passive opposition from the majority of the gentry; their very existence as a class was menaced. The preparatory discussion lasted from 1857 to March 1859 when the drafting commissions of the main committee were formed, composed of young officials—such as N. A. Milyutin and Y. A. Soloviev and their Slavophil friends Y. F. Samarin and Prince V. A. Cherkassky—enthusiastically devoted to the work of liberation. Y. I. Rostovtsev, an honest but unskilled negotiator enjoying the full confidence of the emperor, was mediator. The program of emancipation was very moderate at the beginning, but was gradually extended under the influence of the radical press and especially Herzen's Bell. But Alexander wished that the initiative should belong to the gentry and exerted his personal influence to persuade reluctant landowners to open committees in all the provinces, while promising to admit their delegates to discussion of the draft law in Petersburg. No fewer than 46 provincial committees containing 1,366 representatives of noble proprietors were at work during 18 months preparing their own drafts for emancipation. But they held to the initial program, which was in contradiction with the more developed one. The delegates from the provincial committees were only permitted—each separately—to offer their opinions before the drafting committees. Unfortunately, Rostovtsev died in Feb. 1860. Alexander, who already feared that he had gone too far in his concessions, appointed as his successor Count V. N. Panin, a reactionary. Under his influence the proposed allotments of land to peasants were diminished and the rents were increased. However, it was impossible to change the main lines of the draft. By the law of Feb. 19 (March 3), 1861, the peasant became personally free at once, without any payment, and his landlord was obliged to grant him his plot for a fixed rent with the possibility of redeeming it at a price to be mutually agreed upon. If the peasant desired to redeem his plot, the government paid at once to the landowner the whole price (in 5% bonds), which the peasant had to repay to the exchequer in 49 years. Although the government bonds fell to 77% and purchase was made voluntary. the great majority of landowners—often in debt—preferred to get the money at once and to end relations which had become insupportable. By 1880 only 15% of the peasants had not made use of

the redemption scheme, and in 1881 it was declared obligatory. The landowners tried, but in vain, to keep their power in local administration. The liberated peasants were organized in village communities governed by elected elders.

Administrative Reform.—After the emancipation of the peasants. the complete reform of local government was necessary. It was accomplished by the law of Jan. 1 (13), 1864, which introduced the district and provincial zemstva (county councils). Land proprietors had a relative majority in these assemblies. They were given (in all Russia) 6,204 seats (48%) while the peasants were entitled to choose only 5,171 delegates and the town inhabitants 1,649 (12%). The competence of *zemstva* included roads, hospitals, food, education, medical and veterinary service and public welfare in general. Before the end of the century services in provinces with zemstvo government were far ahead of those in provinces without.

A third capital reform touched the law courts. The law of Nov. 24 (Dec. 6), 1864. put an end to secret procedure, venality, dependence on the government, etc. Russia received an independent court and trial by jury. The judges were irremovable; trials were held in public with oral procedure and trained advocates. Appeals to the senate could take place only in case of irregularities in procedure.

A little later came the reforms of municipal self-government (1870) and of the army (1874). Gen. D. A. Milyutin (the brother of N. A. Milyutin) reduced the years of active service from 25 to 16 and made military service obligatory for all classes. The only exemptions admitted were for reasons of education. Military courts and military schools were humanized.

The *Revolutionary Movements.*—The only branch of public life exempted from reform was the press. The press profited indeed by the new spirit of Alexander's reign. While in the last ten years of Nicholas' reign only 6 newspapers and 19 (mostly specialist) monthlies were permitted, during the first ten years of Alexander's there were 66 newspapers and 1j6 monthlies. The general tendency of the press, very moderate at the beginning, soon became very radical. The leading spirits were the nihilists N. G. Chernyshevsky, N. A. Dobrolyubov and D. I. Pisarev, the last of whom preached extreme individualism. As early as 1862 temporary measures were applied against radical periodicals. Instead of a law on the liberty of the press there appeared in 1865 new temporary rules (which remained in force for fully 40 years) compiled from Napoleon III's law of 1852. They set free from "previous censure" books of more than ten sheets, but the censors continued to seize printed books before their issue.

A new wave of revolutionary movement set in. It proceeded from the young generation of university students, who expected an agrarian revolution directly after the liberation of peasants. They were busy preparing for it workingmen, soldiers and peasants through popular education. Secret circles were formed, proclamations issued and even a revolutionary movement was attempted in connection with the Polish uprising of 1863. Finally, an attempt was made by a student. D. Karakozov, to assassinate the tsar in April 1866. All these attempts were extremely naive; a few young revolutionaries were executed or sent to Siberia and the nhole movement was stifled in its primary stage. But Alexander was frightened. Gradually he dismissed his liberal advisers, and conservatives took their place. The home office was given (1861) to P. A. Valuyev, who tried to paralyze the introduction of the emancipation law and formally prosecuted its faithful adherents. University troubles brought about the removal of the liberal minister of public instruction, A. V. Golovnin, the author of a model university statute of 1863. His successor was a reactionary, Count Dmitry Andreyevich Tolstoy, who found the means of salvation in the classics. The old chief of gendarmes, Prince V. A. Dolgorukov, had to give place, after Karakozov's attack, to Count Peter Shuvalov, who became the soul of reaction. The government-general of St. Petersburg was abolished and the martinet Gen. F. F. Trepov made grand master of the police. D. N. Zamyatnin, minister of justice, under whom the reform of tribunals was carried through, fell a victim to his defense of this reform against an imperial whim; he had to yield to an ignorant reactionary, Count K. I. Pahlen (1867), who nearly annihilated the reform. The same was done for the press by A. Timashev who superseded Valuyev as home minister in 1868. Two radical monthlies, the Contemporary and the Russian *Word,* were closed (1866). M. N. Katkov, a former European liberal who now inclined to extreme nationalism and reaction, became the most influential journalist.

All this contributed to uphold and to increase the disaffection of educated public opinion. About 1869 a new young generation appeared which gave expression to that state of mind. Russian emigrants in Switzerland discussed at that time a new revolutionary doctrine later called populism (narodnichestvo). P. L. Lavrov was giving it a scientific basis, but Mikhail Bakunin found this too learned and plainly invited the youth to give up the study and go straight to the people with the aim of inducing disorder. He found this easy, since Russian peasants with their communes were born socialists. The youth of Russia, chiefly the young girls who went to study abroad as there were no female institutes of learning in Russia, listened to these discussions in Ziirich and, of course, mostly preferred Bakunin's active optimism to Lavrov's learning. In 1873 they were all ordered back to Russia by the government, and they met. when at home, with many student circles which were busy distributing books and revolutionary pamphlets among their provincial branches and workingmen. N. V. Tschaikovsky, Prince P. A. Kropotkin and Sergius Stepniak (S. M. Kravchinsky) were among the leaders of that educational and (later on) revolutionary work. They decided, in the spring of 1874, to go to the people—a naive crusade by inexperienced youth, hardly out of their teens—in order both to teach the people and to learn from them their socialistic wisdom. Of course they were not acknowledged by the people, in spite of their peasant attire, and were easily ferreted out by the police; 770 were arrested and 21j sent to prison. They then decided to change their tactics. A regular secret society was founded in 1876 under the name of Land and Liberty (or "Will"). They still hoped to provoke a mass uprising according to the ideals of the people, but their village settlements proved useless for revolution while in the towns they soon got engaged in a lively conflict with the police. As a result the terrorist side of their activity came to the forefront. In the autumn of 1879 the terrorist group formed a separate party, the People's Will, while the remaining members led by G. V. Plekhanov—under the name of Black Partition (*i.e.,* agrarian revolution)—remained inactive. A series of terrorist acts then followed, beginning with that of Vera Ivanovna Zasulich, who fired on Trepov for his having flogged a prisoner and was acquitted by the jury (1878). In 1879 A. Solovyev fired five shots at the tsar. On Feb. 5 (17), 1880, a workman, S. N. Khalturin, blew up the imperial dining room at the Winter palace. The police seemed powerless against the famous executive committee which directed the blows, and the government asked the loyal elements of public opinion for support. The answer was given, in the name of the Chernigov zernstvo, by Ivan Petrunkevich: he said that no cooperation was possible with the government as long as public opinion was stifled. The Tver zemstvo, led by F. I. Rodichev, asked the tsar to "give us what he gave to Bulgaria" (*i.e.,* constitution and political freedom).

After the Winter palace explosion a supreme commission was appointed under the chairmanship of M. T. Loris-Melikov, who was given a sort of dictatorial power. Loris-Melikov's design was to isolate revolutionary elements by concessions to the liberals and, after exterminating the revolutionaries, to summon a sort of consultative assembly, thus renewing certain projects of aristocratic landowners in 1861–63. He submitted to the tsar, on Feb. 9 (21), 1881, a proposal to appoint two drafting committees for administrative and financial reforms and to submit their drafts to a general commission. where experts chosen by the zemstva and municipalities should also be heard (two from each of them). The respective laws would be issued in the ordinary way by the council of state. but 1j delegates should be admitted to its session. It did not at all look like a constitution, but it might have served as an introduction to it. Fate decided otherwise: on the very day when Alexander signed Loris-Melikov's project, on March 1 (13), 1881, he was assassinated by revolutionaries, led by Sophia Lvovna

Perovskaya, on his way back home.

Foreign Policy.—Alexander II was more successful in his foreign policy. He ascended the throne at a moment of great exhaustion and humiliation for Russia. The Paris treaty (1856) substituted European control for a Russian protectorate over Turkish Christians; the Russian fleet in the Black sea ceased to exist; the portion of Bessarabia nearest to the Black sea was given to the Danubian principalities. However, Russia did not permit Napoleon III to make an international question of the Polish uprising of 1863; Alexander then approached his relative William of Prussia and helped him against France in the foundation of the German empire. Russia made use of the Franco-German War to repudiate the provisions of the Paris treaty forbidding Russia to construct naval arsenals and to keep a fleet in the Black sea (1870). In 1872 the German, Austrian and Russian emperors met at Berlin and concluded the Three Emperors' league (uithout any formal treaty being signed; see EUROPE). However, Russia did not wish to strengthen Germany too much at the expense of France. In 1875 thanks to Russia's insistence a Franco-German conflict was averted, to the great dissatisfaction of Bismarck, who threatened the Russian foreign minister, Prince A. M. Gorchakov, with revenge. In the same year the Eastern Question was reopened by a rising of Christian Slavs in Bosnia and Hercegovina (see EUROPE and TURKEY). In 1876 (summer) began the Bulgarian uprising. Russia proposed co-operative action to the powers, but, meeting with hidden aid to Turkey from Disraeli, Alexander decided to act alone. When Serbia and Montenegro declared war on Turkey he met Francis Joseph at Reichstadt and on June 26 (July 8), 1876, concluded an agreement in which all possibilities of defeat, victory or the collapse of Turkey were anticipated. Austria was to receive Bosnia and Hercegovina for occupation and administration; Russia was permitted to take back the lost portion of Bessarabia. A last attempt to formulate a European program of pacification of the Balkans was made by the poners at the Constantinople conference (Nov., 1876). After its failure Count Nikolay P. Ignatiev visited the European capitals to discuss the possibility of war. Austria and England put as conditions of their neutrality: no attack on Constantinople; no Russian territorial acquisitions; no thrusting Serbia into war; Bulgaria, in case of its liberation, not to be under direct Russian control. Thus, Russia was in advance deprived of possible gains in case of victory; as a matter of fact, Disraeli looked for its defeat. Nevertheless, Alexander went to war (see RUSSO-TURKISH WARS). Close to the walls of Constantinople the Russian army was stopped by the British fleet, and the treaty of San Stefano (March 3, 1878), favourable to the Bulgarians, was emasculated at the Congress of Berlin (*q.v.*). Russian public opinion, ignorant of the agreements concluded before the war, was much incensed against Bismarck. "the honest broker." Russia received the lost part of Bessarabia and Kars, Ardahan and Batum in Transcaucasia. Far more important were the acquisitions of Alexander in central Asia. From 1864 his generals were active against Kirghiz and Turkmen tribesmen who raided the unprotected frontier of Siberia. Russian soldiers marched up the Syr Darya, subjugated Bukhara and from there, through the desert of Khiva, reached the Caspian shore. In 1867 the territory between Issyk-Kul and the Aral sea was constituted into a province called Turkistan, and in 1874 another province under the title of Transcaspia was formed of territories between the Amu Darya and the Caspian sea. Russia reached the frontiers of Afghanistan and Chinese Turkistan. while in the far east by the treaty of Aigun (1858) it obtained from China territory running east from the rivers Amur and Ussuri to the Pacific seaboard, and the naval base of Vladivostok was founded. Japan ceded Sakhalin in 1875 in exchange for two Kurile islands. In 1867 Alaska was sold to the United States for $7,200,000.

Industrial Progress.—Under Alexander II Russia made decisive steps toward industrialization. The length of railway increased from 644 mi. (1857) to 2.260 (1867) and to 11,070 (1876). Factory production grew from 352,000,000 (1863) to 909,000,000 roubles (1879); the number of workingmen from 419,000 to 769,000; the export of grain from 52,800 bu. (1860–62) to 125,600 (1872–74). In 18jo and 1857 Russia (for the second time since 1819) tried the experiment of free trade, but as it brought with it an excess of imports—a thing unusual in Russia—M. K. Reutern, the minister of finance in 1862–78, returned to the protectionist system of Kankrin (1823–44). He also favoured the organization, for the first time in Russia, of private credit institutions. The 10 land banks which were in existence at the end of the 19th century were all founded in 1871–73; there were also 28 commercial banks (founded 1864–73), 222 municipal banks (1862–73) and 71 societies of mutual credit (1877).

Alexander III (1881–94).—Alexander III succeeded his father and was at first expected to continue his tradition. But the quasi-constitutional scheme of Loris-Melikov, discussed in March in the Winter palace, met with the opposition of Konstantin Petrovich Pobedonostsev, the former tutor of Alexander and his most trusted adviser. On April 29 (May 11), 1881, appeared a manifesto written by Pobedonostsev without the ministers' knowledge, in which the tsar described himself as "chosen to defend" autocratic power. At the same time a promise was made to continue Alexander II's reforms. Loris-Melikov, with D. A. Milyutin, at once resigned and was replaced by N. P. Ignatiev, a friend of the Slavophils, who promised to leave untouched the powers of the zemstva and municipalities and to alleviate the burdens of the peasants. And indeed, in June and September 1881, Ignatiev summoned the experts selected by the government among liberal zemstvo men. With their help he drafted a scheme for lowering the redemption prices, abolishing the poll tax and regulating internal colonization and land rents. The new minister of finance, N. K. Bunge, assisted by opening a peasants' bank and also enacted the first factory acts (1882) and appointed special factory inspectors to enforce their application. A special commission under M. S. Kakhanov (1881–84) prepared a reform of peasant self-government based on the principle of the equality of peasants with other social classes. In May 1882 Ignatiev proposed to Alexander to summon a zemsky *sobor* in Moscow of about 3,000 representatives from all classes, on the day of the coronation.

Here Katkov and Pobedonostsev won their victory. Ignatiev resigned; the reactionary Count Dmitry Tolstoy took his place as home minister. His tool I. D. Delyanov enacted in his former ministry a new reactionary statute for the universities (1884). He now became the mouthpiece of the nobility and gentry, a decaying class that tried to preserve as much as possible of their vanishing power and property. In 1885 a special Bank for the Nobility mas opened with the aim of preserving the landed property of the gentry from final liquidation (for debt). Then Tolstoy proposed to A. D. Pazukhin—a sworn defender of noble privileges—to revise the zemstvo institution with the aim of making the nobles' influence paramount in the countryside. As a result two important laws were published. on July 22 (Aug. 3), 1889, on land captains and on June 12 (24), 1890, on zemstva. The composition of district assemblies was changed from the figures given above to 5,433 representatives of landed owners (57%), 1,273 municipal representatives (13%) and 2,817 representatives of village communities. However, the chief aim of the government was, rather than to favour the gentry, to incorporate both the land captains and the executive boards of the zemstva in its civil service by making them subordinate to the provincial governors and destroying their representative character.

An outstanding feature of Alexander III's reign was an increased persecution of everything dissimilar to the officially accepted national type. Dissenting sects, the Uniates and the Lutherans in the western provinces, Lamaist Kalmucks and Buriats and especially Jews suffered a systematic persecution. The press was definitely muzzled, revolutionary organizations were destroyed and revolutionary movement was stifled. Public opinion was silent until the great famine of 1891; from that year symptoms of a revival appeared. The new movement was entirely different from the populism of the '60s and '70s. The Russian socialists became Marxists. Russia, they argued, was becoming an industrial country and the numbers of the industrial proletariat were speedily increasing. In fact, I. A. Vyshnegradsky, minister of finance since 1887, not only continued Reutern's policy in developing the railway (14,900 mi. at the beginning, 24,000 mi. at the end of Alex-

ander's reign) and in protecting industry (prohibitive tariff, 1891), but tried to influence the foreign market and to stabilize the rate of exchange of the Russian rouble. He also resorted to foreign capital. In 1889–94 its influx was 5,300,000 roubles, as compared with 1,500,000 of 37 years before (1851–88). However, the position of the Russian consumer nho had to pay about 34% ad valorem for imported goods, instead of 13% as before the tariff of 1891, was much worsened. The peasants especially suffered, as the price of grain, their only article for sale, fell from 1.19 roubles per *pud* (1881) to 0.59 in 1894, while their allotments, which had been insufficient at the moment of liberation, further diminished (1861–1900) to 54.2%. As a result, their arrears of taxes increased more than five times compared with 1871–80. Vyshnegradsky tried to relieve the treasury by increasing enormously the customs and excise. In the decade 1883–92 taxation increased 29% while the population increased only 16%. Thus, elements of an agrarian crisis were increasing as the 19th century was nearing its end.

Alexander III's foreign policy was peaceful. He wished to be his own foreign minister; Gorchakov gave place to a submissive Germanophil, N. K. von Giers. Bismarck profited by this and, in spite of his alliance with Austria (1879) which was avowedly concluded against Russia, contrived to renew, as early as 1881, the Three Emperors' league of 1872. In 1884 it was renewed for three following years and in 1887, as Austria seceded, Bismarck concluded his famous "reinsurance" treaty with Russia. All these treaties fettered Russia in its Balkan policy but secured the country against the opening of the straits to England and even permitted to it, by a secret protocol, the military occupation of the straits in case of necessity. As at the same time the Triple alliance with Italy was concluded (1882), Bismarck's policy proved too complicated for his successor, and in 1890 a Russian proposal to prolong the treaty for the next six years mas rejected by Count Caprivi. Thus the way was opened to a Franco-Russian *rap*prockement, while Germany was courting England, Russia's competitor in Asia (where Alexander in 1885 took Merv. thus establishing Russia on the frontiers of Afghanistan). France opened to Russia its market for loans and its factories for armaments in 1889; a French squadron was enthusiastically received in Kronstadt in 1891; and the subsequent *rapprochement* culminated in a military convention worked out in Aug. 1892 and definitely ratified by the tsar in March 1894.

Alexander III died on Oct. 20 (Nov. 1), 1894, in Livadia. 50 years old. His robust constitution had been sapped by constant fear of the revolutionaries, which made him live at Gatchina like a prisoner, surrounded by a cordon of police agents.

Nicholas 11, to 1917.—There can hardly be imagined a more tragic contrast than that of the extremely complicated situation inherited by Nicholas II and the complete nullity of the man who had to solve the problem. Like his father, Nicholas was not prepared to reign: like Alexander III, he would have preferred to live as a private man in his family circle, and he hated his exalted position which clashed with his modesty and bashfulness. However, like Alexander III, he felt it a duty to bear the burden of autocratic power and, moreover, to preserve autocracy untouched for his successor. He had to wait long for this heir, as his marriage (1894) with Princess Alix of Hesse, known as the empress Alexandra Feodorovna. brought him first four daughters, and when finally a son (Alexius) was born (1904), the parents had constantly to tremble for his life, as he inherited through his mother the dangerous disease of haemophilia. In their wish to save him at any cost they put their confidence in every kind of quack, beginning with M. Philippe, the spiritist from Lyons, and ending with the famous Grigory Rasputin. Her relations with them finally brought the nervous Alexandra to a state of religious exaltation and mystic faith in her predestined mission to save the tsar and her son from evil by obeying the precepts of God's elect.

The initial hopes of the liberals that the "leaden coffin lid" of Alexander III's reign would be raised by the new tsar were soon dispelled. When messages of congratulation on his marriage were brought to the tsar by innumerable deputations at a reception (Jan. 17 [29], 1895) the delegates asked the tsar "that the voice of the people should be heard" and "that the law should henceforth be respected and obeyed not only by the nation but also by the ruling authorities." The tsar, instructed by Pobedonostsev, answered: "I am aware that in certain zemstvo meetings voices have been lately raised by persons carried away by senseless dreams of the participation of *zemstvo* representatives in internal government. Let all know that I intend to defend the principle of autocracy as unswervingly as did my father." The liberals answered next day in an open letter: "'Senseless dreams' concerning yourself are no longer possible. If autocracy proclaims itself identical with the omnipotence of bureaucracy, its cause is lost. . . . It digs its own grave. . . . You first began the struggle, and the struggle will come."

The struggle had come. In June 1896 St. Petersburg saw the first strike of 30.000 workingmen. The evolutionary wing of the Marxist socialists triumphed; here at last the masses had come forward with purely economic demands. In 1898 the Russian Social Democratic Workers' party mas formed. However, the old leaders did not approve of this peaceful and legal economism of the young generation. In their "orthodox" organ *Iskra* (Spark), published abroad, they defended the political and revolutionary side of Marxism. In 1903, at a conference in London, their tendency, represented by V. I. Ulyanov (N. Lenin), obtained the majority and bolshevism (*Bolsheviki*=majoritarians) was created. On the other hand, the People's Will party was revived under the name of Social Revolutionaries with a new program in 1898. They remained true to their two leading ideas, agrarian revolution and terrorism. Agrarian riots began two years later in southern Russia. In 1899 began also student disorders which were answered by the minister of public instruction, N. P. Bogolepov, by the menace of military service for delinquents. On Feb. 27 (March 12), 1901, Bogolepov was killed by the student P. V. Karpovich. On April 15 (28), 1902, the home minister, D. S. Sipyaghin, was killed by S. V. Balmashev. Pobedonostsev recommended V. K. Plehve for his successor. Plehve had to struggle not only against the agrarian uprisings but also against moderate elements—the zemstvo liberals and the radicals of the liberal professions (professors, lawyers, journalists, engineers, the so-called third element, officials of the zemstva, etc.). They formed a secret Union for Liberation and from July 1902 published their weekly, Liberation, abroad. The number of persons accused of political crime rose from 919 (1894) to 1,884 (1899) and 5,590 (1903). The minister of finance, Serghey Yulyevich Witte, tried to oppose Plehve's policy but mas dismissed in Aug. 1903.

Tlze Russo-Japanese War.—Witte's removal proved especially fatal for Russian policy in the far east. William II of Germany suggested to Nicholas the idea that Russia's true mission was in Asia, not in Europe. The Trans-Siberian railway (begun 1891) presented new facilities for penetration. especially when a treaty with Li Hung-chang (May 1896) secured its extension by the East China railway; and in May 1898 a new lease was received to construct a branch through Mukden to Port Arthur, which six months before had been occupied by the Russian fleet. A chauvinistic guard officer, A. M. Bezobrazov. profited by Nicholas' confidence to cover with the tsar's protection his concession for cutting wood on the Yalu river. Many "patriotic" courtiers, grand dukes and the tsar himself acquired the bonds of the Eastern Asiatic Industrial society. Japan objected to the occupation of the left bank of the Yalu. As Prince Hirobumi Ito received no satisfaction in Petersburg, he went to London and concluded (1902) a five-year alliance with England. Russia was then obliged to withdraw its troops from Manchuria and promised to do so before Oct. 8 (21), 1903. The promise was not fulfilled. The war party, led by Bezobrazov and Plehve, decided against Witte for war. They knew nothing of Japan's readiness for war and were stupefied by the famous night attack of Jan. 26 (Feb. 8), 1904, on the Russian fleet in Port Arthur (see RUSSO-JAPANESE WAR).

The Revolution of *1905*.—The revolutionary movement found new substance in Russian military defeats. Patriotic feeling began to turn against the government. The war grew extremely unpopular. Plehve, who had wished to divert public attention from the internal situation by war, was blown up with his carriage on

July 15 (28), 1904. After much wavering Nicholas appointed on Aug. 26 (Sept. 8), 1904, Prince P. D. Svyatopolk-Mirsky as successor to Plehve. Public opinion was delighted. The liberal zemstvo men met in Petersburg, on Nov. 19–22 (Dec. 2–5), 1904, in private and worked out a petition to Nicholas asking for inviolability of the person, freedom of conscience, of speech, of meeting, of press, of association and equal civil rights. The majority also asked for a regular popular representation in a separate elective body which should participate in legislation, in working out the budget and in controlling the administration. The professional groups organized banquets to support the zemstvo program. Nicholas still wavered. His ukase of Dec. 12 (25) did not go beyond general promises and kept silence over the representative assembly. The chance of peaceful compromise with moderate constitutionalists was passing by. The revolution began.

On Sunday. Jan. 9 (22), 1905, many thousand workingmen, led by the priest Georgy Gapon, marched with icons, singing religious songs, to the Winter palace to speak to "their tsar." But the tsar was absent; the troops fired on the defenseless crowd and killed about 1,000 people. Svyatopolk-Mirsky resigned. A. G. Bulyghin, a bureaucrat, was appointed his successor. As a reply, on Feb. 4 (17), Grand Duke Sergius was blown up in the Kremlin by the Social Revolutionary Ivan Kalyayev. The tsar still wavered. He issued a promise merely to summon "the worthiest persons" to share in the drafting and discussing of laws.

Public excitement was growing, fanned by the news of Tsushima (May 14–15 [27–28]). The constitutional and the revolutionary movements began to separate. Constitutionalists (zemstvo men and Liberation union) held their congresses and prepared drafts of constitutional laws. After Tsushima they sent to Nicholas a deputation which repeated the demands of the November petition of 1904 and received (June 6 [19]) the answer that the "tsar's will was unshakable." Two weeks later Nicholas promised to another delegation of the nobility that he would keep the tradition of the past. On Aug. 6 (19) a law conceded a duma of the empire. But it was to be a consultative chamber, composed of class delegates, representing peasants (43%), landed proprietors (34%) and burgesses (23%). This, "Bulyghin's constitution," provoked general indignation. Its only result was to give the upper hand to revolutionary elements. There was no end to meetings, strikes, agrarian uprisings, which finally, Oct. 10–14 (23–27), united in one general strike all over Russia. Communication with the provinces was interrupted; Kicholas was isolated in his summer residence at Peterhof. On Oct. 13 (26) a soviet (council) of workmen's delegates was formed whose vice-chairman was L. D. Trotsky. On Oct. 1j (28) the Constitutional Democratic (Kadet) party was founded, which included the radical wing of the *zemstvo* men and the moderate elements from the Liberation union. The common aim of the left wing of public opinion was a democratically elected constituent assembly leading to parliamentary government.

Nicholas thought of abdication. But he was saved by Witte, who had concluded (Aug. 23 [Sept. 5]) peace with Japan at Portsmouth, N.H., and was generally expected to become a peacemaker inside Russia. On Oct. 17 (30) Nicholas signed the manifesto prepared by Witte (now a count). The manifesto promised inviolability of person. freedom of thought, speech, meetings and associations. No law was to be enacted without consent of the duma But the word "constitution" was not used; the tsar retained his title of autocrat (samoderzhets). He openly favoured the newly formed reactionary organization, the Union of the Russian People. Then a wave of absolutist demonstrations and Jewish pogroms organized by the police followed, in a few days, the short-lived outbreak of enthusiasm elicited by the tsar's concessions.

Witte was made prime minister of a unified cabinet. But he could not persuade liberal leaders to enter his cabinet as the situation remained extremely uncertain. His minister of the interior, P. N Durnovo, was a reactionary. Pobedonostsev resigned (Nov. 1 [14]), but Gen. D. F. Trepov mas retained in proximity to the tsar. Agrarian troubles reached their height in November, and Count Witte proposed to his minister of agriculture, N. N. Kutler, to prepare a draft of law on the basis of the expropriation of the landowners. It roused against Witte the nobility, who also founded a union. On the other hand, Witte had to fight against the revolutionary movement which found its headquarters in the Petersburg soviet of workmen's delegates. The soviet published decrees and tried to play the part of a second government. Trotsky, backed by Lenin, preached a permanent revolution. However, the policy of the Socialist parties definitely alienated the sympathy of the possessing class. On Dec. 3 (16) the soviet with all its members present was arrested. Its substitutes replied by an armed uprising in Moscow (Dec. 7 [20]). Until Dec. 13 (26) there was shooting in the streets; then the guard regiments came down from Petersburg and the rebels were dispersed. There followed the so-called punitive expeditions which exterminated with ruthless cruelty what remained of the revolutionary movement.

This decisive blow at the revolution weakened also the constitutional movement. Witte was losing ground. A certain extension of electoral right, especially in the towns (Dec. 11 [24]) was his last success. The predominance of peasant deputies remained untouched as the peasantry was considered more conservative and reliable than the nobility. Witte promised to the tsar a pliant duma. He dismissed Kutler, but he refused to promise to dissolve the duma if it raised the agrarian question, a measure proposed by his competitor, the former home minister I. L. Goremykin. Nicholas was encouraged to resistance by the repression of the revolutionary movement. He assured the deputations of the Union of Russian People that "the sun of Truth will shine bright over the Russian land" (Jan. 1906) and that his "autocracy will remain unchanged as it had been of old" (March).

The First Duma.—Witte's fate was sealed when the elections, which he left comparatively free, gave the majority to the Constitutional Democrats (the Kadets) together with peasants (Trudoviki) who wanted a radical land reform. The Social Revolutionaries, who still hoped for a revolution resulting in a constituent assembly, decided to boycott the elections. Witte resigned after having rendered the tsar his last service: he concluded a loan in France, which made the tsar free to deal with the duma as he liked. Just before the duma met (April 27 [May 10], 1906) new fundamental laws were published which curtailed its power while leaving to the tsar an extensive prerogative and to the council of empire equal rights in legislation and the budget.

Under these conditions the struggle was unequal. The dissolution of the duma was assured when in its address to the throne it proposed its own program of embodying into laws and enlarging the liberal promises of the October manifesto. After much delay Goremykin declared the program inadmissible. He received a vote of censure, which was, however, of no consequence. Then a debate began on the agrarian project introduced by the Kadets, on the basis of partial expropriation of big landed estates. The government published a sort of counterproject and warned the country not to believe in the duma's promises. The duma replied by a declaration which was interpreted by the government as an illegal appeal to the country and served as a pretext for dissolution. On July 9 (22) the delegates found the Taurida palace locked and surrounded by army detachments. About 200 of them moved to Viipuri in Finland in order to protest and to invite the people to passive resistance should no new duma be convoked. On the other hand, the congress of the United Nobility demanded the changing for their benefit of the electoral law by the mere will of the tsar. P. A. Stolypin, who had dissolved the first duma and taken the succession of Goremykin, did not dare to do so. But he tried instead to solve the agrarian question by means of emergency legislation. His scheme was to increase the lots of the well-to-do peasants at the expense of the poorer ones, by dividing the communal land at the first request of the former and thus to avert the danger of expropriating the estates of the nobles (edict of Nov. 9 [22]). He also set up field courts-martial to pronounce death sentences against the revolutionaries (Aug. 19 [Sept. 11]).

The Second Duma.—The second duma, convoked Feb. 20 (March j), 1907, in spite of all pressure on electors proved much more radical than the first. The Kadets' representation sank from 179 to 123, while the Socialists, both the Social Revolutionaries and the Social Democrats, rose from 18 to 102 and the Labour group

(mostly peasants) rose from 94 to 104. Both extremist groups of urban and agrarian socialism thus nearly formed the majority, while on the right ning there were only 32 Octobrists (a party of landlords and rich merchants, formed soon after the Kadets with the government's connivance—they professed to be constitutionalists) and 63 nationalists and avowed autocratists. However, the new majority was not so confident as had been the first duma and shared the cautious tactics of the Kadets. The United Nobility was afraid of that moderation. They now induced Stolypin to prepare a new electoral law and only sought for a pretext to dissolve the duma. They found it in the duma's lack of desire to denounce revolutionary terrorism and in the propaganda of the Social Democratic party. On June 3 (16) the duma was dissolved and at the same time a new electoral law was published which partly disfranchised the nationalities (especially the Poles) and gave predominance to the representatives of the gentry.

The Third and Fourth Dumas.—Extreme pressure was used during the elections to the third duma (Nov. 1907–June 1912), as well as to the fourth (Nov. 1912–March 10, 1917). However, the government did not succeed entirely in stifling the opposition groups.

TABLE VI.—*Party Composition of the Four Dumas*

Parties	First	Second	Third	Fourth
Right wing:				
Extreme right	26	63	52	65
Nationalist	—	—	93	120
Centre:				
Conservative (Octobrist)	17	32	133	98
Progressive	—	—	39	48
Left wing:				
Constitutional Democratic (Kadet)	179	123	53	59
Peasant-Labour (Trudoviki)	94	104	14	9
Social Revolutionary (S.R.)	—	37	—	—
Social Democratic* (S.D.)	18	65	14	15
National minorities:				
Poles	51	47	18	13
Others	93	47	8	8
Total	478	518	424	435

*Including Communists; for instance, they won 4 seats in the third and 6 seats in the fourth duma.

At the beginning of the decade of duma activity Stolypin worked with the leading group of Octobrists and their leader Aleksandr Guchkov. By that co-operation Stolypin was able to pass his agrarian laws and the nationalist bills depriving Finland of the last remains of autonomy. Russian Poland was deprived of the Kholm territory. Measures were taken against the Ukrainian national movement and against the Jews, with the acquiescence of the duma. However, on the questions of the reconstruction of the army and navy Guchkov took a sharp line against the government and the grand dukes. It made Stolypin go to the side of the Nationalists—a party newly created with the pecuniary aid of the government and thus very submissive, led by Count Vladimir Bobrinsky and Pavel Krupensky. On the other hand, the Octobrists approached somewhat the Kadets and worked together on questions of foreign policy and the budget. As soon as Stolypin lost his credit with the duma he was no more needed by the tsar, who still cherished the hope of complete freedom from the duma. The assassination of Stolypin (Sept. 1 [14], 1911) by a revolutionary, Dmitry G. (Mordka) Bogrov, elicited no expression of regret from the tsar and was ascribed by rumour to a police plot.

The elections of the fourth duma were so arranged by the government as to give an overwhelming majority of Nationalists, who would then ask for the transformation of the duma into a consultative chamber. However, the results of the elections were a disappointment: the opposition increased in number and authority; the right wing of autocratists was merely equal to it; and there was no strong centre to lead the duma.

The beginning of World War I brought nearly all parties together in a patriotic cry for a sacred union. But the government did not know how to make use of this disposition of mind. It continued its exasperating internal policy and tried to do without the duma. The situation was so much the worse when the Russian retreat began and the army proved unprepared. The war minister, V. A. Sukhomlinov, and other reactionary ministers were then dismissed, and the duma was summoned for Aug. 1 (14), 1915. It was empowered to control the supply of munitions through its members in a special committee together with the Union of the *zemstva* led by Prince G. E. Lvov. The duma found finally its majority, but it was the majority of a Progressive bloc which proposed to the tsar a national coalition government "possessing the confidence of the country" and a program of reforms necessary to appease the country (Aug.–Sept. 1915). Unhappily there was no Witte to advise the tsar. Goremykin was only a courtier and he made the tsar answer by a prorogation of the duma (Sept. 3 [16]) and by the expulsion of all liberal ministers who favoured the idea of a national cabinet.

Thus the last chance of a peaceful solution was lost. The duma could no more lead public opinion. which turned to revolution. The chiefs of the army were this time on the side of the duma and public opinion, as they did not believe in the possibility of victory as long as the regime lasted. The universally hated Goremykin had to resign when the duma met (Feb. 2 [15], 1916); but his successor—the old master of ceremonies of the court, B. V. Stürmer, an ignorant and comic figure, especially when he was made successor of S. D. Sazonov in foreign affairs (July)—only helped to discredit the nhole system and to demonstrate its weakness. As the tsar had made himself commander in chief instead of the grand duke Nicholas and was absent at headquarters, the tsarina took the lead in Petrograd (the new wartime name of the capital). She surrounded herself with an adventurous crowd of irresponsible advisers. the friends of her great confidant Rasputin. The duma was at last summoned on Nov. 14 (27). She poured her wrath on Stiirmer, who had to go, and on A. D. Protopopov. her former vice-president. nho passed through the antechamber of Rasputin to get the post of home minister. Stiirmer's successor, A. F. Trepov, was hissed by the duma. On Jan. 9 (22) Prince N. D. Golitsyn became prime minister. Warning on warning came to the tsar even from grand dukes and foreign diplomats, insisting on serious concessions to the people in order to prevent revolution. But the tsar, influenced by the tsarina, would not listen. On Dec. 18 (31) Rasputin was assassinated by Prince F. F. Yusupov, husband of the emperor's niece, and V. M. Purishkevich, an extreme right deputy. Not even that blow could change the obstinacy of Alexandra Feodorovna. The duma had been postponed until Feb. 14 (27), 1917. Disorders began in Petrograd during its session, and on Feb. 26 (March 11) the duma was prorogued. The following day was the first day of the revolution.

(P. M.; X.)

D. THE REVOLUTION, 1917

The Russian Revolution of 1917 had two sharply contrasted phases. There were, indeed, two revolutions, those of February and of October in the old Russian calendar (which is preserved in the traditional historiography of the period), or of March and of November in the western calendar (which the Russians adopted on Feb. 1 [14], 1918). The former was the product of the discontent of the democratic forces with the conduct of war, the latter exploited war weariness in the interests of the international revolutionary doctrines of Marxism. The former revolution overthrew Russian tsardom and, through its liberalism, gave scope to those who were preparing for the latter.

The attack made by the Progressive bloc of the duma on the autocracy was in fact animated by its conviction of the double danger in which the country stood from defeat in the field and from revolution following on such defeat. It demanded the establishment of a government "invested with the people's confidence," and an underlying aim was to forestall more radical changes.

By the end of 1916 the attempt to bring down the government by constitutional means had obviously failed. This failure compelled the more active and impetuous of the liberal patriots to consider whether it was possible to realize their aims by a military coup d'état and a court revolution. The initiative in this matter was notoriously taken by prominent officers at the front who were in close touch with the headquarters staff. The propaganda in favour of a court revolution was started by Gen. A. I. Krymov.

The complete scheme of the Krymov conspiracy was revealed by Aleksandr Guchkov, the war minister in the provisional govern-

ment. in the evidence which he gave before the tribunal set up for investigating the criminal record of the ministers of the old regime. The idea according to Guchkov nas to seize the tsar as his train was proceeding from headquarters to Tsarskoye Selo, to compel him to abdicate in favour of the tsarevich with the grand duke Michael as regent, to arrest the tsar's ministers with the help of the Preobrazhensky guards and then to proclaim the abdication simultaneously with the names of the new duma ministers. This court revolution, planned to take place in the early months of 1917, was first postponed by the strikes and unrest which prevailed at that time in the capital and was finally rendered abortive by the success of the March revolution.

The Bolshevik party, which had been consistently against the war from the beginning, took no part in the preparations for the March revolution. Lenin and other leaders, who were at that time abroad. were formulating views as to the possibilities of revolution which were subsequently acclaimed as prophetic. But the international antiwar conferences organized by Lenin at Zimmerwald and Kienthal had no obvious effects, and as late as Jan. 1917 Lenin, then aged 46, told a Swiss audience that it was doubtful whether "we the old would live to see the decisive battles of the coming revolution." The few Bolshevik agitators remaining in Petrograd (including G. A. Shlyapnikov, the representative of the central committee of the party), were as little aware as the Mensheviks or the Liberals that the strikes, started early in March 1917, were likely to bring about the revolution. On the contrary, as far as they could, they discouraged the idea of a revolution as premature and likely to lead to disaster and gave it their official support only after it had actually broken out.

The March Revolution and First Provisional Government. — Strikes for higher wages at some of the factories had been occurring sporadically for some time, and on March 8 (21) no fewer than 130,000 men are said to have been out. To this number must be added a considerable figure to account for the women workers who were demonstrating on that day (the Women's day). But though the number of the strikers and of their sympathizers was large, and though several bakers' shops were demolished by the mob, neither the leaders of the duma on the one hand nor the government and the police on the other gave the matter any particular attention. The only precaution taken by the authorities was to prevent the demonstrators from reaching the centre of the city. The next day the strikers were still more numerous and probably amounted to 30% of all the workers in Petrograd. Some sections of the crowd succeeded in reaching the centre of the city and their mood soon became sinister and threatening. On that day, too, the university students joined the movement, and though the watchword of the strikers remained "bread," it is asserted that a few cries were raised denouncing the autocracy and the mar.

The third day (March 10 [23]) proved the critical day. The strike became general and the strikers assumed an aggressive demeanour, raiding the police stations in the Viborg (factory) district and disarming the police. In this suburb the police practically disappeared and the political demonstration began to assume the character of an armed rising. That night Gen. S. S. Khabalov, military governor of the capital, received a telegram from the tsar, then at the front, ordering him to suppress the strike movement.

The attempt to use fosce to put down the disorders in the capital was temporarily successful, but one regiment after another mutinied on March 11 and 12 (24 and 25) and the situation became clearly untenable. The duma refused to disperse on March 11 (24) when it received the prorogation order. and there were discussions among the Progressive and Labour leaders about the possibility of forming a new government. On the same day M. V. Rodzianko, the speaker of the duma, sent an urgent telegram to the tsar ending with the words "May the blame not fall on the wearer of the crown." But the tsar put it aside. Rodzianko also got into touch with the generals holding the main field commands, asking for their support.

When the tsar and his advisers at last learned that the revolt of the Petrograd troops had endangered the existence of the monarchy they immediately ordered a number of regiments from various parts of the front to proceed to the capital. The first detachments under Gen. N. Ivanov were prevented by the railwaymen from approaching Petrograd, while the picked regiments were never sent because before they could actually be moved the revolution had developed such impetus and had gained such support even at the front that the attempt to crush it by military force was recognized as hopeless.

The critical day was March 12 (25). While the city was largely in the hands of the mutinous regiments and the mob, news came to the duma that elections were in progress by show of hands for a new soviet or council of workers' delegates such as had seized power in the capital during the revolution of 1905. The leaders of the different political groups meeting in the duma building were informed that a large crowd was on its way there and that decisive action was necessary. On the initiative of V. V. Shulgin a provisional committee was set up with the leaders of all the parties presented upon it except those of the right. A. F. Kerensky, a Trudovik leader, took charge of events and improvised some kind of guard. The cabinet met during the evening and, failing to get a definite reply from the tsar to a suggestion for the appointment of a new prime minister, simply dispersed. It was only on March 14 (27), after prolonged discussions and with considerable reluctance, that the members of the duma committee made up their minds to constitute a government. It was set up on March 15 (28). Three considerations were obviously instrumental in leading them to this decision: first, a clear consciousness of the elemental force of the revolution; second, the apprehension that the Petrograd soviet might be tempted to assume power; and, third, the hope that by constituting themselves the ruling authority they might be able to cope with the increasing anarchy and to save the monarchy and even the dynasty.

The Soviet. — Meanwhile, the revolutionary workers had succeeded in setting up a soviet. Its first session opened in the evening of March 12 (25) with an attendance of approximately 250 members consisting of Socialist deputies of the duma, the Worker group of the munition committee, a number of prominent worker leaders representing the various shades of revolutionary opinion, and members of strike committees who had been active during the few previous days. It managed to appoint a strong executive committee which immediately took over the business of food supplies and the defense of Petrograd against any possible attack from the autocracy.

From this very moment, enlisting as it did the support of the workers and of the Petrograd garrison, the soviet executive committee was the depository of real power. It had its headquarters in the duma building. and one of its vice-presidents was Kerensky, who constituted a link with the duma committee and subsequently with the provisional government. Its members had been conscious of this power and probably overestimated rather than underestimated their authority. But they made no overt or covert attempt to constitute a revolutionary government, and when the duma committee decided at last to assume the responsibility of forming the new government its decision was unanimously welcomed by the leaders of the soviet. Why the Petrograd soviet refused immediately to proclaim itself the government of revolutionary Russia can only be a matter of surmise. Speaking in the first All-Russian Conference of Soviets, which was held early in April 1917, G. Steklov, one of the Bolshevik members of its first executive committee, ascribed the refusal to the prevailing uncertainty as to the attitude of the army. But this explanation scarcely covers the whole of the ground. An orderly government, representing a compromise between the insurgent masses and the bourgeois classes, was obviously the sole bulwark against counterrevolution, and the desire for the establishment of such a government must undoubtedly have constituted the main factor in the unopposed assumption of power by the duma. Still, fear of the outbreak of a counterrevolution cannot be regarded as an adequate explanation of the uillingness of the Bolshevik leaders to delegate power to the duma. Their decision to step aside and to leave the formation of a government to the bourgeoisie, the class determined to arrest the onrush of the revolution, would be unintelligible unless the fact is recalled that most of them accepted the Menshevik view that the aim of the revolution was solely to establish a democratic regime

and that any attempt to associate the movement with socialist experiments or the dictatorship of the proletariat would ruin it and so repeat the disastrous failure of 1905.

Among the members of the soviet's first executive committee were a few Bolsheviks who accepted Lenin's dictum that the Russian Revolution was the vanguard of the world socialist revolution. But so unprepared were they for taking action that when Lenin arrived in Petrograd three weeks later he found that his most difficult task was to inspire his own party with the necessary enthusiasm for deepening the revolution. The Bolsheviks, however, were in such an insignificant minority both in the Petrograd soviet and outside that their views could not possibly carry much weight.

The members of the duma committee were not only willing to form a government with the consent of the soviet but insisted on the latter's issuing an open proclamation of support. The program of the provisional government published on March 16 (29) was indeed largely dictated by the soviet leaders and was accepted in full by the duma committee. The status of the government created as a result of this compromise was necessarily precarious in the extreme. Nominally invested with full powers and sovereign authority, the provisional government—whose principal figures were Prince G E Lvov (prime minister), P. N. Milyukov (foreign affairs). M. I. Tereshchenko (finance), Aleksandr Guchkov (war) and A. F. Kerensky (justice)—was in reality powerless and the mere creature of the soviet. Its position was bound to be unstable because the basis of the compromise which established it was vague and uncertain. But the revolutionary impetus of the masses and the constant changes in the constitution of the soviet and hence in the point of view of its leaders soon combined to render this basis even more unstable. Every day fresh groups joined the soviet and new leaders replaced old ones, with the consequence that new adjustments had constantly to be made and even relative stability became difficult to maintain.

Arrest of *the Imperial* Family.—While negotiations between the soviet and the duma were still proceeding and before the provisional government formally took over the administration (March 16 [29]), the extremely delicate question of the position of the tsar and of the dynasty came up for settlement. That the tsar Nicholas could no longer remain autocrat was a foregone conclusion, but the leaders of the duma, dreading the idea of Russia's becoming a republic, mere determined to save the monarchy and even the dynasty. They accordingly dispatched Guchkov and Shulgin, two Conservative members of the duma, to the tsar's headquarters at Pskov with the mission of obtaining the tsar's abdication in favour of the tsarevich and the appointment of his brother the grand duke Michael as regent. But the tsar declared that the illness of his son made it impossible for him to contemplate being separated from him and changed the instrument of abdication so as to provide for the succession of his brother as tsar. Such a solution was unacceptable. and, when the members of the duma committee visited the grand duke on March 16 (29), Kerensky strongly appealed to him not to accept in the name of national unity. Despite Milyukov's strong pleas that he should ascend the throne, the grand duke refused. The dynasty that had ruled Russia for three centuries came to an end.

A few days later the question of the dynasty came up again in a dramatic fashion ahich incidentally demonstrated both the strength of the soviet and its determination when necessary to use it in defiance of the government. The tsar had requested the new ministers to arrange for the departure of himself and his family to Great Britain, a request which the leaders of the soviet heard of by mere accident. At once they called on the government to put the tsar and his family under arrest and gave orders to the railwaymen to stop the imperial train. The actual usurpation of power in this instance, however, proved unnecessary: the new ministers themselves proceeded to put the tsar Nicholas and his family under arrest.

The Army and the War, March–May.—The struggle for support that took place between the duma and the soviet was the paramount business of the next few weeks. The battle was fought out in the main on two planes, one the question of the new status of the army, the other the question of continuing or terminating the war. The leaders of the soviet championed the civil rights now claimed by the soldiers, while the duma appealed to them in the name of national safety. That the harsh conditions uhich had hitherto prevailed in the barracks had to be modified was obvious enough, and Guchkov was preparing an official declaration to this effect. But, while he was for confining the liberties of the soldiers within the strict limits of discipline, the leaders of the soviet declared that these liberties must be vindicated unconditionally. This resolve to gain the adherence of the soldiers by supporting their claims at all costs was responsible for the issue on March 14 (27) of the notorious *prikaz* (order) number 1[1], which helped in the disintegration of the already badly shaken Russian army.

But despite all the privileges which the Petrograd soviet had granted to the soldiers, the devotion of the army at the front and even at the capital had to be secured. At first the provisional government seemed to be the body which had won the support of the army. When the ministers proclaimed the necessity of a more vigorous prosecution of the war, the army seemed to be rallying to their support. For about a fortnight regiments stationed at Petrograd as well as delegations sent by those in the provinces and at the front marched to the duma commanded by their officers, proclaimed their readiness to serve the revolution and offered the government their allegiance and joyful support. But the army's enthusiasm for prosecuting the war soon began to cool, while the propaganda made by the soviet for the clarification of the Russian war aims as a sure promise of terminating hostilities became increasingly popular.

On March 27 (April 9) the soviet issued a manifesto to the world declaring that Russia sought no gains from the war and was ready to conclude peace on the basis of "no annexations, no indemnities." From this time onward the question of peace terms became the main bone of contention between the government and the soviet, the government adhering to the secret treaties made by the Allies, and the soviet insisting on the denunciation of these treaties and agreeing to continue the war only for purposes of self-defense. The pressure put on the government to identify itself with the principles laid down in the soviet's manifesto became at last so strong that ministers felt compelled to make a public declaration (April 9 [22]) in which Russia's mar aims were formulated as the establishment of a permanent peace on the basis of the self-determination of the peoples. This declaration was hailed as a great victory by the soviet, which thereupon demanded that the provisional government take the next step and communicate this declaration to the Allied powers, with a view to their adopting its principles. After some hesitation Milyukov on May 1 (14) transmitted the text of the declaration, but in the covering letter which he dispatched to the Russian ambassadors he asked them to reassure the governments to which they were accredited by informing them that Russia's position with regard to the war remained unchanged.

Milyukov's note became known in Russia on May 3 (16) and caused great indignation on the left. For two days Russia seemed to be on the brink of civil war, the outbreak of which was finally prevented only by the action of the soviet, which prohibited all meetings and demonstrations for three days and ordered the garrisons to remain in the barracks. The strength and discipline shown by the masses at this time finally convinced the soviet leaders that the real power was in their hands.

The Second Provisional Government.—Discredited and disheartened by this proof of ministerial impotence, Prince Lvov, the prime minister, issued a proclamation in which he expressed his conviction that a reconstruction of the government on a wider basis, with the inclusion of soviet representatives, was essential to

[1] *Prikaz* number 1 was composed by a commission of the Petrograd soviet headed by N. D. Sokolov. In the name of the Soviet of Workers' and Soldiers' Deputies it ordered that committees of soldiers were to he formed in all military and naval units in Petrograd and to send one representative each to the Taurida palace next morning. In their political actions units were to be subject to their committees and to the soviet. Orders of the military commission oi the duma were to be obeyed only when they did not contrailict those of the soviet. Arms were to he under the control of the committees and on no account to be given up if demanded by the officers. Strict discipline was to be preserved when on duty. Salutes, ets., when off duty were abolished. Special titles used in addressing officers, "Your excellency" and references to the officer's noble birth, were abolished. Officers were forbidden to use the second person singular in addressing soldiers.

the safety of the state. The soviet at first (May 12 [25]) refused to entertain the idea of making a coalition with the bourgeois parties; but after the resignations of Milyukov and Guchkov and when the danger of a complete breakup of the government seemed imminent, it reconsidered its decision and agreed to enter the government (May 18 [31]).

The soviet was allotted five portfolios in the reconstructed cabinet, those of justice, agriculture, labour, food supplies and post and telegraphs. The last-mentioned ministry was created specially to make room for Irakly G. Tsereteli, a Georgian Menshevik member of the second duma who had been banished to Siberia and was now the most popular and powerful member of the soviet. Kerensky was now promoted to the all-important ministry of war, while Tereshchenko replaced Milyukov.

The fall of the first provisional government resulted from two main reasons. The first was its assumption of responsibility without the backing of power. The second was its equivocal foreign policy of balancing between the pledged war aims of the Allies and the soviet's policy of limiting the war to a revolutionary defense with a view to an immediate peace. The new government occupied a more favourable position, for it represented both the *bourgeoisie* and the masses. It mas confronted, however, by formidable difficulties; not only had the crucial question of peace or war to be settled but also the growing unrest in the villages and the dissolution of the empire into separate national units called urgently for solutions which the government was totally unable to furnish. The consequence was that the coalition lasted only two months and was finally brought down by the resignation of four Liberal (Kadet) ministers, who adopted this method of protesting against the concessions made to the Ukrainian autonomist movement. The new government crisis coincided with the greatest crisis which the revolution had so far had to face, in the disastrous failure of the offensive in Galicia and the first Bolshevik rising in the capital.

Sound strategy demanded that, while a most determined effort should be made to increase the fighting morale of the army, it should not be submitted too early to the test of challenging the enemy on the military front. But the offensive which the Kerensky government so blindly and so enthusiastically adopted was obviously undertaken more for political than for military reasons. 'The effect of renewing the offensive, it was believed, would be either to prove in case of victory that Russia had still to be taken into account and so to compel the Germans to come forward with the offer of a democratic (nonannexationist) peace, or, in the event of defeat, to compel the German Socialists definitely to take their stand either in defense of the Russian revolution or in support of German militarism. The offensive was launched on July 1 (14). At first it proved successful; the Austrian lines were broken and many prisoners and guns were taken. But in less than a fortnight after operations opened not only were the Russian armies destroyed but Russia had ceased to exist as a great power.

Meanwhile, the Bolsheviks were becoming a major factor in the development of the situation. Lenin had arrived from Switzerland on April 16 (29) via Sweden, having travelled across Germany in the famous sealed train with the connivance of the German military authorities, who had nothing to lose, it seemed, by facilitating the movements of such a declared opponent of the Russian war effort. Lenin immediately took the view that the soviet's support of the bourgeois revolution had been overtaken by events and that the time was ripe for a proletarian revolution in Russia as the signal for a world-wide socialist revolution. Whereas he had previously vacillated on the value of the soviets in such a revolution, he now came out in his "April Theses," published in *Pravda* (the Bolshevik organ) on April 20 (May 3), in favour of the soviet as the "*one possible* form of revolutionary government." He made it clear that it was first necessary for the Bolsheviks to become the dominant element in the soviet, and that as soon as this was achieved the moment to strike mould have come.

Soviets had by now been formed all over the country, and the first All-Russian Congress of Soviets was held in June. The Bolsheviks accounted for 105 of its 822 delegates and secured 3j seats out of the 250 on the central executive committee which it set up. At the conference the Bolsheviks made it plain that they were prepared to take power as a party.

After street demonstrations in June had shown the growing influence of the party, thanks largely to its opposition to the war, a popular rising broke out in the capital on July 16 (29). This rising was a strange demonstration, the most marked characteristic of which was its lack of leadership. The members of the central committee of the Bolshevik party hesitated to identify themselves with it beforehand for fear it might prove unsuccessful. Ostensibly a demonstration in favour of the transference of power to the soviet, it was in essence an attempt to stampede that assembly, a fact which its leaders were prompt to recognize. For nearly t o days the gunmen were in occupation of the capital, but their lack of objective and of leadership perplexed them and paralyzed their efforts. The Bolshevik leaders in the capital (Lenin did not return from a convalescence in Finland until July 17 [30]) were forced to assume some kind of control of the movement and to channel it toward bringing pressure on the Petrograd soviet and the central executive committee to take power.

During the two days that the rising lasted the coalition government was absolutely quiescent. But Kerensky on the very first day proceeded to the front and procured picked troops. which arrived in the capital on the day after the movement had fizzled out. Meantime, any attempt to renew disturbances was rendered hopeless by the publication of documents which purported to prove that Lenin mas a spy and a paid agent of the German general staff. The result of the disturbances was the practical suppression of the Bolshevik party. L. B. Kamenev was arrested. Lenin and G. E. Zinoviev went into hiding, to the considerable dismay of their friends.

Kerensky's Provisional Government.— These events coincided with the failure of the Galician offensive and made yet another change of government inevitable. Prince Lvov was presented by the soviet members of the government with an ultimatum which required him, in accordance with the decisions of the Congress of Soviets, to declare Russia a republic without waiting for the convocation of a constituent assembly, to suppress finally the duma and the council of state and to accept the congress's policy of forbidding any sale of land before the meeting of the constituent assembly. The prince refused to comply with these demands, regarding them as a usurpation of the rights of the constituent assembly, and promptly sent in his resignation. The ministry was reconstructed on July 21 (Aug. 3), Kerensky becoming prime minister as well as minister of war and Tsereteli succeeding Prince Lvov as minister of the interior. With the formation of the new ministry, not completed until Aug. 6 (19), the Russian revolution entered on a new phase—a phase of inaction. The record of Kerensky is indeed singularly barren. He failed to put new vigour into the prosecution of the war. He left the question of concluding peace just as he found it. He made no attempt to settle the various difficulties involved in the labour question. And he was so incapable of handling the agrarian problem that he allowed the peasants to settle it as best they could by local initiative.

In fact, the only achievements of Kerensky's administration were the declaration of Russia as a republic and the convocation on Aug. 25 (Sept. 7) of a spectacular state assembly representing all classes in the country and all political groups. The actual purpose which this assembly was meant to serve is obscure, but its composition and the choice of Moscow for its sittings seem to show that it was convoked with some vague hope of investing Kerensky's government with that moral authority and sanction which it had hitherto conspicuously lacked. Nothing remarkable, however, resulted from its three meetings save a series of hysterical speeches in which the prime minister announced his determination strenuously to support the revolution and ruthlessly to suppress its enemies, whether they came from the right or from the left.

After the failure of the July rising, Trotsky, who had been taking an independent line since his return to Russia on May 17 (30), joined the Bolsheviks with his supporters. On Aug. 6 (19) Trotsky and A. V. Lunacharsky were arrested. The Bolsheviks themselves had recast their tactics. Lenin had decided that the soviets had proved themselves unsuitable for the task allotted to

them, and the slogan "All power to the soviets" was replaced at the sixth party congress (held in the second week of August) by a recognition that it mas the task of the proletariat and of the poorer peasantry to liquidate the dictatorship of the counter-revolutionary bourgeoisie, as the provisional government was now styled by the Bolsheviks.

Meanwhile, the generals at the front and the members of the general staff in the capital began to think that their time had come. Taking stock of the anarchy prevailing in the country and of the disorganization of the army, they began to be more and more inclined to favour the creation of a military dictatorship. Kerensky supported Gen. L. G. Kornilov, the commander in chief, in the preliminary steps for establishing one. He quarrelled with him only when he realized that the general himself was aspiring to become dictator. Suspecting Kornilov's designs, he promptly declared him a traitor and an enemy of the revolution; to which the general replied by sending on Sept. 9 (22) picked Cossack regiments under the command of Gen. A. I. Krymov against Petrograd with the object of intimidating Kerensky and forcibly suppressing the soviet. Thereupon Kerensky, turning his back on the right, appealed to the left for support, and the central executive committee of the soviets appealed in its turn to the workers to fight the threatened counterrevolution. The Bolshevik leaders, now released from prison, took up the challenge with enthusiasm and, recognizing that their opportunity had arisen, proceeded to arm the workers, in anticipation of the arrival of Krymov's troops. Deputies from the Petrograd workers and soldiers went to meet the Cossacks and persuaded them that they had been sent on a false errand. Kornilov, A. I. Denikin and three other generals were arrested and imprisoned. and Krymov shot himself after frankly avowing his hostility to Kerensky.

Just as the failure of the Bolshevik rising in July proved to be the opportunity of the right, so now the collapse of Kornilov's raid gave the extreme left its chance. The first result of this revival of revolutionary fervour was a renewal of the hatred of the officer class; a new wave of massacre swept over the country, taking peculiarly ugly form in Finland, where sailors killed their admirals and officers by throwing them overboard and beating them to death in the water. The moderates mere speedily losing their hold on the masses. Lenin's supporters were now rapidly increasing their forces, so much so that by the middle of September both the Petrograd and the Moscow soviets for the first time passed Bolshevik resolutions; while the moderate leaders, who had presided over them since their creation, were soon replaced by Trotsky at the new capital and by V. P. Nogin at the old. It now became possible for Lenin to revive the slogan "All power to the soviets."

Kerensky's last improvisation was a Democratic conference, which met in Petrograd on Sept. 27 (Oct. 10). Unlike the state assembly. this was confined to left-wing parties and organizations. The Bolsheviks took part against Lenin's wishes, but the impunity with which they were allowed to shout Kerensky down showed the weakness of their opponents, as did the failure of the latter to agree on the continuation of a coalition including non-Socialist elements. The existing central executive committee. though it continued to support Kerensky, nho formed a new cabinet including the Kadets on Oct. 6 (19), withdrew its representatives from his government. The pnited front of soviet democracy, which had seemingly been re-established by the challenge thrown out by Kornilov, was now finally broken. The Bolsheviks proceeded to declare the members of the central executive committee traitors to the revolution and at last worked openly for their overthrow and for that of the bourgeois government.

The provisional government was formally invested with full and sovereign power and was responsible neither to the Petrograd soviet nor to the recently convoked council of the republic or preparliament, which was a consultative body representing all the main parties. But actually it possessed no power at all. The real authority, then more than at another time in the revolution, was held by the soviets in the capitals and in numerous provincial towns, which openly defied the government and exercised, each in its area. legislative as well as executive powers. In many of the provincial soviets as well as in those of Petrograd and Moscow the Bolsheviks now counted on solid majorities; and in most cases the Bolshevik provincial soviets constituted themselves quasi-independent republics.

The various nationalities, which had long been clamouring for autonomy, now began openly to secede from the state and to organize their own armies by withdrawing their nationals from the army under the plea of defending their newly created frontiers and their national flags. The whole country, town and village alike, was in a state of feverish unrest which soon developed inta riots and anarchy. In the towns bread riots broke out; but the most destructive of these revolts were those of the peasants, who began to solve the land problem in their own way by expropriating the land, driving off the cattle, burning down the landowners' dwellings and barns, demolishing agricultural machinery, felling wood in the forests and wantonly destroying trees in the orchards. Landowners who delayed their flight were captured, tortured and murdered. Yet the ministers were inactive and helpless. They lacked the necessary military backing to put these disturbances down by force; even the Cossacks refused to obey orders, remembering how they had been repudiated by Kerensky in the Kornilov episode.

At the front the army still preserved on the surface a certain degree of discipline; but the mutual distrust and hatred of soldiers and officers was so profound that at any time an open clash might be expected, especially since a shortage of food and supplies, and in some cases actual famine, made the preservation of military subordination increasingly difficult. It became obvious that the army was likely to withdraw from the field either in the autumn or at any rate before the winter had passed.

Meantime, the Germans had been penetrating farther and farther into the Baltic provinces. On Oct. 12 (25), with the support of their fleet, they occupied the island of Oesel and so secured the command of the Baltic. Petrograd was now obviously menaced, and ministers declared their intention of transferring the seat of government to Moscow. To dream of continuing the war after abandoning Petrograd, the biggest arsenal in the country, was denounced as sheer treason, and the proposal furnished the Bolsheviks with an admirable lever for stirring up the masses. Another mistake which the ministers made, an attempt to replace the Petrograd garrison by more reliable troops from the front, was used by their enemies as a pretext for openly organizing military forces for an attack on them. The Petrograd soviet accordingly, under Trotsky's command, promptly came forward and countermanded the movement of troops. On Oct. 20 (Nov. 2) a body known as the "preparliament" was constituted in Petrograd; it was composed partly of delegates from the Democratic conference and partly of nonproletarian elements. On Oct. 26 (Nov. 8) the leaders of the soviet constituted a military revolutionary committee which declared itself the highest military authority in the capital and province of Petrograd. This step was ostensibly taken for the defense of the capital against the enemy, but actually it was a movement for the creation of a general staff for the Bolshevik revolution. Three days earlier, after much debate, the central committee of the Bolshevik party had pronounced in favour of an armed uprising. Trotsky openly organized his forces without meeting with the slightest interference from the government.

The November (Bolshevik) Revolution. — The Bolshevik revolution was inseparably connected with the convocation of the second Congress of Soviets. The central executive committee, which consisted entirely of Mensheviks and Social Revolutionaries, supporters of Kerensky, was reluctant to convene a second congress and postponed doing so from day to day. But when finally the Petrograd soviet threatened to convene the congress itself the committee fixed Nov. 7 (20) as the date of convocation. It was obvious that the congress would have a Bolshevik majority. The convocation of the All-Russian Congress of Soviets was preceded by the holding of a number of regional congresses, all of which declared for a terminatipn of the coalition and for the establishment of a Soviet government, the aim of which would be immediately to propose terms of peace, to give the land to the peasants, to establish a complete workers' control of the factories and to deal with the famine by expropriating the hoards of food-

stuffs supposed to have been accumulated by the capitalists and landlords.

Meanwhile, ministers waited patiently on events, believing that nothing could happen till Nov. 7 (20). But Trotsky gave battle two or three days before the appointed date. On h'ov. 3 (16) he confronted the general staff with a demand that all its orders should be countersigned by the military revolutionary committee. When the general staff refused this demand he ordered the Petrograd garrison to stand at arms in defense of the committee. On Nov. 4 (17) a meeting attended by delegates from all the troops passed a resolution refusing obedience to commands of the general staff and recognizing the committee as the sole organ of power. This resolution was immediately circulated over the government telephones to all the regiments in the capital.

To these proceedings Kerensky replied on the follorving day by issuing an ultimatum to the committee requiring it to withdraw the resolution. The ultimatum was ignored by the committee, which promptly called out parts of the garrison and organized worker detachments (Red guards) for the defense of the Smolny palace. headquarters of the soviet and of the committee. Kerensky tried to counteract these measures by adopting the traditional method of defense, the raising of the bridges, to prevent communication between the left and right banks of the Neva. He then proceeded to the Mariinsky palace, where the preparliament was holding its sessions, and demanded that it should invest him with dictatorial powers to cope with the Bolshevik revolt. They debated all night before refusing. Meanwhile, the Bolsheviks quietly and systematically took over, without firing a shot, the telegraph, the telephone and all government offices with the exception of the Winter palace and the offices of the general staff. The same night Lenin, who had been in hiding since July, appeared at the meeting of the Petrograd soviet and in glowing language congratulated the delegates on inaugurating a new era. The new regime, which established the soviet as the embodiment of supreme power in the state, was thus established one day in advance of the meeting of that soviet congress which had been proclaimed by the Bolsheviks as the sole authority competent to make such a decision. But nobody present at the meeting of the soviet seemed to care, for Lenin announced that the first step taken by the new government would be to offerall belligerents a just peace.

Early in the morning of Nov. 7 (20) Kerensky left for the front, in order to bring back troops to crush the revolt. The other members of the government decided to await his return at the Winter palace. But when they were informed that the guns of both the cruiser "Aurora" and the Peter and Paul fortress were trained on the palace, they decided to surrender. When next day the Congress of Soviets formally opened, the non-Bolshevik members and the old executive committee registered a vigorous protest against the unconstitutional methods of the Bolsheviks and withdrew from the congress to join the committee of public defense which had its headquarters at the municipal buildings.

Kerensky meantime made frantic efforts to move the troops from the front to the capital. He succeeded only in persuading the Cossack Gen. P. N. Krasnov to move. On Nov. 11 (24) Krasnov's troops were reported outside Gatchina, about 10 mi. from the capital. Encouraged by this news and definitely expecting a crushing defeat of Trotsky's Red guards, the committee of public defense gave orders to the cadets of the military schools to arrest the military revolutionary committee and to make a general attack on all the soviet strongholds. The attack was made in the morning; but by three o'clock in the afternoon the Bolsheviks, supported by some of the cruisers of the Kronstadt fleet, decisively repelled it and occupied the military schools. In the report of the events of the day which he sent to the Petrograd soviet Trotsky made the following declaration: "We hoped to establish a compromise without bloodshed. But now when blood has been shed there is only one way left, a ruthless fight." With these words Trotsky proclaimed the approaching civil war. The same night he proceeded to the Gatchina front. Next day he reported the repulse of Krasnov's advanced detachments, and a day later he announced that the Cossack forces had been completely defeated. Kerensky fled, and the Bolshevik regime was now for a time immune from military menace. (M. FA.; M. BF.)

E. CIVIL WAR AND INTERVENTION, 1917–21

The Petrograd revolution of Nov. 7 (20) swept Russia. There were a few days of street fighting in Moscow and sporadic resistance elsewhere, but by the end of the month the soviets held power throughout the country. In the urban centres the victory was won under the red flag of class warfare, with the watchword "All power to the workers' soviets." The words "land," "bread" and "peace" gave the Bolsheviks the support of the soviets of peasants and soldiers.

The soviets were the only strong political force in a social structure whose disintegration was nearly complete. They were the organs of the proletariat, upon which the Bolsheviks, taught by the Marxist doctrine of revolution, were resolved to build their state. They challenged not only the weakened capitalism of Russia but the capitalist system throughout the world. In the first days of success they exaggerated the effect of war weariness upon the masses of western Europe and underestimated the effect of war hatred. Their dream of a new proletarian utopia and their appeals to fellow workers of the world to throw off the burdens of capital and war prepared the way for the conflict that was soon to plunge the new state into a three-year fight for life.

In an all-night session on Nov. 7–8 (20–21) the Congress of Soviets in Petrograd declared the power of government to be vested in the council of people's commissars, appointed mainly from the ranks of the Bolshevik central committee, with Lenin as premier and Trotsky as commissar of foreign affairs. The first act of the Soviet government on Nov. 8 (21) was to decree that all land belonged to those who worked it, without rent or other payment. This satisfied the peasants, who had been expropriating landlords' estates for several months, and their chief political organization, the Left Social Revolutionary party, decided to collaborate with the Bolsheviks. Vigorous measures were taken to ensure a supply of food for Petrograd and other urban and industrial centres. To reinforce the victory of the industrial proletariat a universal eight-hour day was instituted on Nov. 11 (24), and the control of the factory soviets over industry was established by successive decrees in the next two months.

The peace campaign began on Nov. 9 (22), when Trotsky sent out a wireless invitation to all the belligerent powers to conclude an immediate armistice. The Allied governments at once protested, and their representatives in Russia tried to enlist the commander in chief of the army, Gen. N. N. Dukhonin, against the council of commissars. Dukhonin was replaced by N. V. Krylenko, a member of the Bolshevik central committee, by a soviet decree of Nov. 22 (Dec. 5). Soon afterward, the former commander was tom to pieces by a mob of soldiers. This deed showed that Lenin had gauged the temper of the army and that the Allied insistence that Russia should go on fighting would be fruitless.

The German government accepted the armistice proposal. After brief negotiations within the German lines a ten-day truce was signed on Dec. 5 (18), 1917. The Central Powers agreed not to transfer troops from the eastern front to the western, but they moved several divisions to France before the end of the year.

Meanwhile the Soviet government was facing serious internal difficulties. The bourgeois classes, at first stunned by the success of the revolution, began to rally, Instead of armed resistance they used the more dangerous weapon of sabotage, hoping to paralyze the Bolshevik regime. With no civil service, no personnel trained in finance, transport and the management of industry, the new government was suddenly called upon to undertake the administration.

Lenin met the bourgeois offensive with characteristic energy. Banks and some factories were nationalized, and a supreme economic council was created to manage the latter. Other decrees followed in rapid succession. Some of these were measures of immediate necessity rather than a part of the Bolsheviks' deliberate program. In a sense they were the beginnings of the later War Communism, but all the responsibility for their adoption cannot be laid upon Bolshevik shoulders. Some form of centralization was necessary to prevent economic collapse, and Lenin

had previously published a pamphlet demanding nationalization of transport and state control of the means of production to save the country from chaos.

The nationalization of industries was legalized in Dec. 1917. At first it was applied haphazardly. No entire industry was nationalized until May 1918, when a department of the supreme economic council was organized to supervise the monopoly production of sugar. The following month oil production was centralized in the same way, and various other commodities were declared state monopolies. It was not until June 28. 1918, that all industrial and commercial enterprises of more than 1,000,000 roubles capital were declared the property of the state.

The Treaty of **Brest-Litovsk.**—While the Soviet government was trying to cope with sabotage and weld local soviets into an administrative machine. relations with Germany were still unsettled. Peace negotiations began on Dec. 22, 1917 (Jan. 4, 1918), at Brest-Litovsk. On behalf of the soviet, Trotsky put forward the principles of no annexation or indemnity and self-determination of subject races. At first the Germans seemed willing to accept, with certain reservations. They demanded the independence from Russia of Poland, Finland and the Baltic states on Dec. 28 (Jan. 10) and the independence of the Ukraine Jan. 8 (21), 1918. On Feb. 10 Trotsky announced the Soviet refusal to sign a "peace of annexation," but declared the war between Russia and the Central Powers at an end—the celebrated formula "No war: no peace." A week later the German general staff ordered an immediate advance.

When the Germans advanced. Lenin at once decided for peace, but acceptance of the German terms was not reached without a struggle in the central committee. Lenin still believed that a general European revolution, as the result of war exhaustion, was not far distant. His prime object, therefore, was to gain time, a breathing space, as he called it. His associates argued that to yield mas to betray the revolution. It was only by a threat of resignation that Lenin beat down the adverse majority. On March 3 a new Soviet delegation accepted the German terms on behalf of the Soviet government. The so-called government of the Ukraine had already signed a separate peace treaty. which meant virtual German control, and this the Russians were forced to confirm. The Soviet government further agreed to pay a large indemnity or its equivalent in raw materials. Poland and the Baltic states were left in the hands of the Germans. and the armies of Count Rudiger von der Goltz and Baron C. G. E. Mannerheim soon crushed the revolutionaries in Finland.

Lenin had won his breathing space, but the agricultural and mineral resources of the Ukraine and the oil of the Caucasus were at the disposal of the Germans, and the German general staff was now free to concentrate its forces against the Allied front in France. Two days after the signature of the Brest-Litovsk treaty Trotsky approached Raymond Robins of the American Red Cross and the unofficial British representative R. H. Bruce Lockhart as to the attitude of the Allied governments should the soviets not ratify the treaty or the German advance continue for any other reason. But nothing came of the feelers. The Congress of Soviets ratified the treaty March 16 by a majority of 523.

Lenin used his breathing space to patch up the administrative and economic machine and to drill an army to defend the revolution. The fight against sabotage was not yet won. and the adversaries of the new regime were growing bolder. Trouble was brewing in the Cossack provinces and in Manchuria, where a hostile army was assembling on Chinese soil. The German threat against Petrograd had driven the Soviet government in flight to Moscow. The fact that the Allied ambassadors, instead of accompanying the government, had preferred to go to Vologda, junction of the trunk lines of escape eastward to Siberia and northnest to the coast, was no good omen for future relations with the powers they represented.

In the field of foreign affairs the Soviet government had two severe handicaps. From the first the Allies suspected complicity with Germany and were inclined to regard the peace of Brest-Litovsk as a betrayal of the Allied cause. Second, neither they nor the Central Powers believed that a Soviet government in Russia could endure. The Allies declined to recognize the treaty of Brest-Litovsk, which they held responsible for Gen. Erich Ludendorff's victory in March. Their missions in Russia reported that trainloads of war supplies, leather, copper, oil and food were being shipped into Germany. Although the Bolsheviks claimed that this was part of the indemnity imposed by the treaty, the Allies saw it as aid to the enemy. to be prevented if possible. It was suspected that some of their representatives in Russia cooperated with anti-Bolshevik elements to hamper the transfer of supplies.

The Social Revolutionary Revolt.—The breach betw-een the other political parties in Russia and the Bolsheviks had been widened by the suppression of the long-awaited constituent assembly, which met in Moscow on Jan. 18 (31), 1918. About 62% of the votes were cast for moderate Socialists of all kinds. Most of these had gone to the Social Revolutionaries, whose lists had been made up before the Left Social Revolutionaries broke away to collaborate with the Bolsheviks in Lenin's government. The Bolsheviks had got 25% of the votes and the Kadets and other "bourgeois" parties about 13%. The election of a Right Social Revolutionary, Viktor M. Chernov, as president convinced the Bolsheviks that they had nothing to gain from the assembly, and it was closed by Red soldiers on Jan. 19 (Feb. 1).

The Left Social Revolutionaries continued for a time to collaborate with the Soviet government, but broke away completely after unsuccessful opposition to the ratification of the Brest-Litovsk treaty. The strength of the Social Revolutionary party was mainly drawn from the villages, which were growing increasingly restive as the Bolsheviks developed their basic program of a workers' government, class warfare and socialism. The peasants had thought that the revolution gave the land to them. They now found it was the property of the state and that its surplus produce over their needs was required for state purposes. The bourgeois groups had become more hostile still, as they realized that their very existence was menaced by the new regime.

Led by Boris Savinkov, Kerensky's former war minister, the Right Social Revolutionaries became the pivot of patriotic and anti-Bolshevik sentiment, eager to co-operate with military representatives of the Allies to nullify the effects of the treaty of Brest-Litovsk. From attempts to blow up depots of stores, railway bridges and trains carrying supplies westward, the Social Revolutionaries proceeded to the desperate coup of assassinating the German ambassador in Moscow, Count Wilhelm von Mirbach-Harff, on July 6, 1918, in the vain hope of provoking Germany to break with the Soviets. The Social Revolutionaries then tried to incite the country to rebellion.

Savinkov captured the town of Yaroslavl. 180 mi. N. of Moscow on the railway to Vologda and Archangel. with a disciplined force which he had hoped to make the nucleus of an army of insurrection. The Red troops from Moscow and Petrograd converged on Yaroslavl too swiftly, however, and retook the town after two weeks. Savinkov escaped, but the possibility of overt resistance by the Social Revolutionaries vanished.

The Czechs.—About 30.000 Czech deserters from the Austrian forces had been formed into an army to fight for their country's freedom beside the Russians on the Austrian front. When the Russians collapsed they remained a fighting force, and plans were made in Paris to move them round the world to the western front. In early March 1918 the Soviet government agreed to provide transport across Russia, but the Czech legionaries had continual trouble with local soviets over food supplies and right of way for their trains.

By the middle of May the entire force, moving eastward to the Pacific, was strung out in detachments across 5,000 mi. of railway from Kazan to Vladivostok, a natural prey to anxiety and rumour. On May 14 one of their detachments met a trainload of Austro-German prisoners being repatriated in accordance with the treaty of Brest-Litovsk. A fracas ensued, with bloodshed which involved the local Red forces.

Moscow at once demanded that the Czechs fulfil their pledge to surrender their arms. They refused and. on May 29, forcibly resisted attempts to carry out the disarmament order. In June

they fought the Bolsheviks openly throughout Siberia, and the local soviets were powerless against their disciplined troops. At the end of the month their Vladivostok contingent overthrew the soviet there and set up an anti-Bolshevik government with the approval of the Allies. By July 31 almost all Siberia was changed from Red to White and the Czech forces were moving westward to attack the Soviet state.

Death of the Tsar.—The advance of the Czech and White Russian armies brought death to the former Tsar Nicholas II, who with his family had been held for several months at Ekaterinburg. The local soviet professed to believe that the imperial family planned to escape to Omsk, where the White Adm. A. V. Kolchak had established a counterrevolutionary government. Without a trial the soviet voted to execute "Citizen and Citizenness Romanov" and their family and did so on the night of July 16–17, 1918.

Intervention.— The month of August saw intervention in full swing. On Aug. 2 the British, who had already landed forces at Murinansk to prevent war supplies from falling into German hands, disembarked several thousand Allied troops at Archangel; they overthrew the local soviet and set up a provisional government of the north. A few days later British and French contingents landed at Vladivostok, followed by a Japanese division on Aug. 12 and by two U.S. regiments on Aug. 15 and 16. Western Siberia was already in the hands of the Czechs and a number of anti-Soviet governments. On Aug. 24 Anglo-Japanese troops crushed Red resistance in the maritime provinces in a battle on the Ussuri river. Chita was captured on Sept. 6, and organized soviet government beyond the Urals disappeared. The Czechs had seized the chief cities of the northern Volga and an anti-Soviet army was marching from the Cossack provinces of the Don.

At the beginning of the autumn the tide turned. The Bolsheviks threw back the Czechs at the end of Sept. 1918 and halted the White advance from the Don. As Germany weakened on the western front, the Baltic provinces, Finland and the Ukraine lost its support. Turkey was on the verge of capitulation, and Turkish and German control over the Caucasus was vanishing. Lenin's prediction was coming true; the Central Powers and the treaty of Brest-Litovsk were crumbling together, and the European revolution appeared to be at hand. When the German sailors in Kiel raised the red flag on Nov. 9, 1918, the Soviet government saluted the event with triumph.

The Bolsheviks had still to reckon with the Allies. The autumn of 1918 saw the reinforcement of foreign forces on Russian soil. By the end of the year there were approximately 15,000 British and U.S. troops occupying a fan-shaped area in northern Russia, at least 70,000 Japanese holding the important strategic points of eastern Siberia and the maritime provinces, 7,000 Americans protecting the Trans-Siberian and Chinese Eastern railways, and about the same number of British supporting and instructing the armies of Adm. A. V. Kolchak, who had become dictator of the so-called all-Russian government of Siberia by a coup d'état at Omsk on Nov. 18. The French had occupied Odessa with a powerful fleet and a mixed force from Salonika.

The abandonment of the campaign by the Czechs, eager for home, counterbalanced the accession of foreign anti-Soviet forces, and the Whites were not yet in a position to strike an effective blow. When the new year began neither side could show much gain, except that the revolution had reached the Baltic by the establishment of a Soviet government at Riga on Dec. 26.

The Red Terror.— During these months of pressure the Bolsheviks had hardened. Troops were called up, grain and cattle requisitioned, property confiscated. In the summer of 1918 to external dangers was added a deadlier enemy in their midst. After his defeat at Yaroslavl, Boris Savinkov revived against the Soviet the Social Revolutionary terrorist centre which he had formed years before to combat tsardom by assassination. On Aug. 30, 1918, one of his agents, a girl named Fanny (Anna) Kaplan, shot and wounded Lenin as he left a workers' meeting in Moscow. The following day M. S. Uritsky, chief of the Petrograd Cheka, was shot dead by Social Revolutionaries. The Bolsheviks met Savinkov's terrorism with their own Red terror. The Cheka had been organized in Dec. 1917 to deal with sabotage and other counterrevolutionary manifestations. (The word "Cheka" was formed from the initials of the Russian words meaning "extraordinary commission.") Its power grew to include summary arrest, judgment and execution. In revenge for the wounding of Lenin 500 of the most prominent figures of the old regime were shot that night in Moscow. The killing of Uritsky led to similar reprisals in Petrograd. A veritable reign of terror began.

War Communism.— The effects of this period were momentous. On the one hand it stamped deep into the minds of western countries the belief that Russia had relapsed into Mongol savagery. On the other it confirmed the Soviet leaders in their hatred of the non-Bolshevik world.

Intervention gave impetus and coherence to the work of nationalization, which had been proceeding sporadically. In some cases factories had been nationalized in order to fight sabotage by their owners or managers, in others to legalize confiscation already accomplished by the workers. Under the pressure of war the important industries were given control boards. The attempt to fix prices in a period of acute currency inflation had produced the inevitable flight of commodities from the market. As the situation grew more difficult it became necessary to control not only industry and transport but the supply and distribution of food. From that stage the step to the control of all production and distribution was not a long one for a Marxist government.

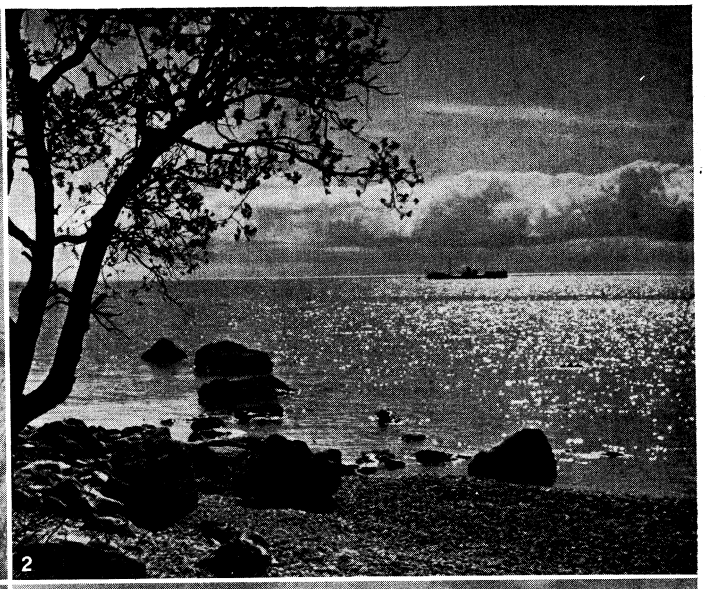
At first, in the early summer of 1918, restrictions were not so harsh as to prevent much private trade and speculation. It happened that the beginning of the Red terror coincided with the period of greatest food shortage, before the harvest. The extraordinary powers given to the Cheka to suppress internal enemies were quickly directed against speculators seeking for profits.

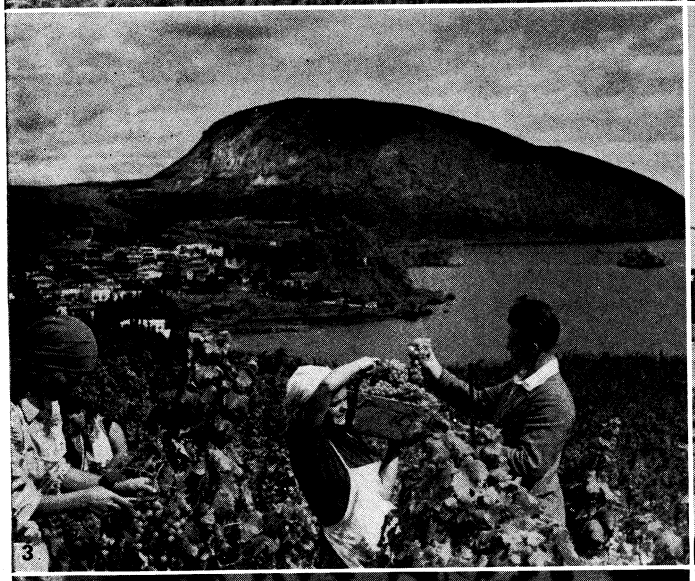
From the outset an influential section of the central cammittee of the Bolshevik party had been advocating a full Communist program rather than Lenin's more cautious policy. Circumstances were now on their side, and by Aug. 1918 the period of War Communism which lasted nearly three years may be said to have begun. Private buying and selling were prohibited by law and offenders were severely punished. Cash wages lost their importance. Workers and other employees were given cards for food, clothing and other necessities, free lodging and free transport on trams and railways. All nonworking elements of the population were disfranchised. The peasants were subjected to requisitions of all their crops save what was needed lor their households. They obtained nothing but promises in exchange, and the breakdown of distribution and the difficulties of transport in a country ravaged by war progressively diminished their return from their labour. Extreme Communists declared that money would soon be wholly abolished. This hope was perhaps a screen for the conventional motives for inflation and the unavoidable fall in the value of the currency.

Money did not become wholly worthless, and a host of bagmen and hucksters, too numerous and unimportant to be imprisoned, continued private trade. The government tried to eliminate them by entrusting distribution to the co-operatives, which had had an extensive network in Russia for many years. In spite of these efforts much of the lesser retail trade remained in private hands.

Attempts at Peace.— Representatives of every section of anti-Bolshevik Russians, from the Social Revolutionaries Kerensky and Savinkov to the grand duke Nicholas (Nikolay Nikolayevich), former commander in chief and uncle of the former tsar, went to Paris to enlist the support of the peace conference. But the Allies were chiefly concerned with Germany. They feared that circumstances might induce Germany and Russia to make common cause, and their first impulse was to neutralize the Bolshevik danger.

On Jan. 12, 1919, the commissar for foreign affairs, G. V. Chicherin, asked the U.S. state department to open peace negotiations. On Jan. 16 the representatives in Paris of Great Britain, France, Italy and the United States discussed a general truce plan for Russia put forward by David Lloyd George. Pres. Woodrow Wilson suggested that representatives of all Russian groups including the Bolsheviks should hold a meeting on the island of Prinkipo in the Sea of Marmora under the auspices of the Allies.



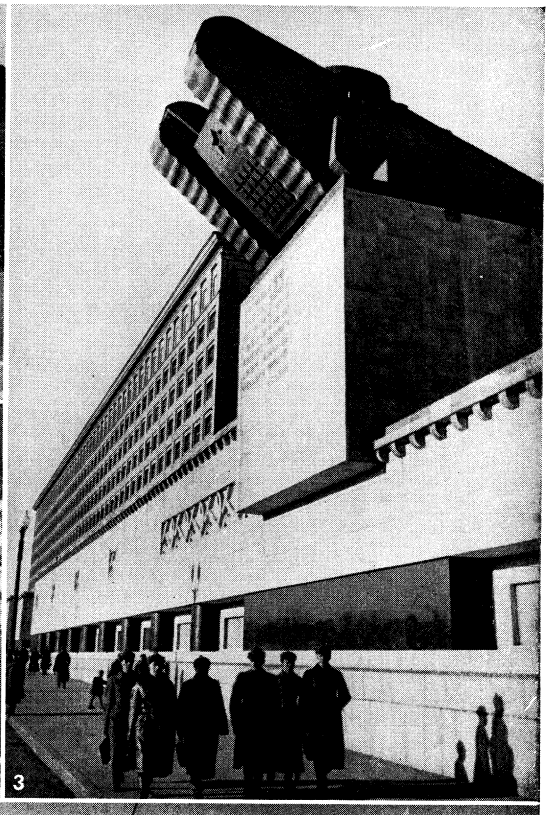


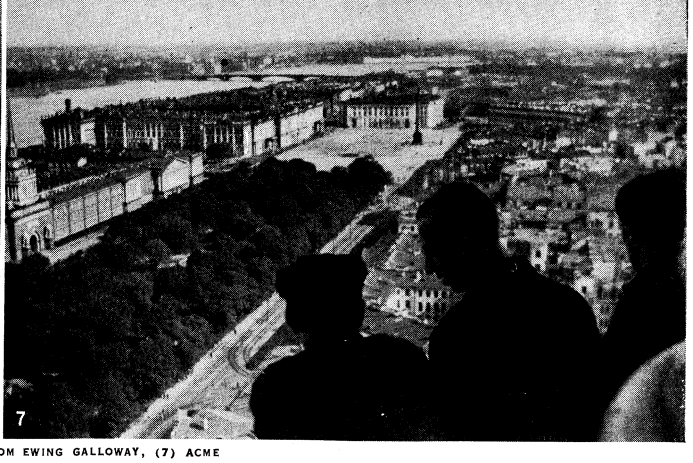
PHOTOGRAPHS, (1-3, 5, 6) SOVFOTO, (4) ACME

VIEWS OF THE CRIMEA AND NEWER INDUSTRIAL CENTRES

1. Harvesting barley on a collective farm in the Crimea
2. View along the Crimean coast
3. Gathering Crimean grapes in the vineyards of the Massandra winery, where white and pink Muskat and other wines are produced
4. A busy square In Stalingrad, site of the historic siege of 1942
5. A machine plant and school at Sverdlovsk in the Urals
6. The State Drama theatre and the Palace of Culture of Metal Workers in Magnitogorsk

RUSSIA





PHOTOGRAPHS, (1, 3, 5, 6) SOVFOTO, (2) TOPICAL PRESS AGENCY, (4) BURTON HOLMES FROM EWING GALLOWAY, (7) ACME

CITIES OF THE WESTERN U.S.S.R.

1. A winter view along the River Moskvá and the Kremlin in Moscow
2. A comprehensive view of Moscow, looking toward the Kremlin along the Moskvá with its cast-iron bridge
3. The Frunze military academy in Moscow
4. The Red Army building in Kharkov
5. Theatre square in Kiev
6. General view of Odessa on the Black sea, showing units of housing erected before the German invasion of 1941
7. A view of Leningrad taken from St. Isaac's cathedral

The anti-Bolshevik governments in Russia refused to participate and the project was dropped.

In spite of continued hostility on the part of the French another attempt was made to reach a peaceful settlement. William C. Bullitt, attached to the U.S. delegation in Paris, was sent to Petrograd in March 1919. After a week's discussion he brought back peace terms which the Soviet government pledged itself to accept if the Allies agreed not later than April 10. The most important features of this document mere a plan for the pacification of Russia on the basis of its several existing governments, a willingness by the said governments, including the Soviet. to recognize responsibility for the financial obligations of the former Russian empire, an exchange of official representatives between the Soviet government and the foreign powers and an immediate withdrawal of foreign troops. In spite of warm support by Col. Edward House and the approval of Lloyd George and V. E. Orlando this project also was shelved, perhaps because of the rapid advance of Kolchak's army, which once more strengthened the belief that the Soviet government was doomed to extinction.

Renewed Intervention. — The White armies of Kolchak in Siberia, of Denikin in southwestern Russia and of Gen. N. N. Yudenich in Estonia had been amply supplied by the Allies with money, equipment and instructors. Kolchak threatened Kazan and Samara, on the Volga, in May and planned to reach Moscow before the end of June, but strategic co-ordination was lacking; neither Denikin nor Yudenich was ready. Kolchak could not withstand the full weight of the Red army, which had now been welded into a competent fighting force. An attempt at diversion by the British in the north came too late to help him.

The next stage of the White campaign was more dangerous. Denikin made rapid progress northward in the summer, and in mid-October had taken Orel, within 200 mi. of Moscow, and was threatening the capital. Simultaneously Tudenich drove at Petrograd. His English tanks broke the weak resistance of the Reds, whose main forces were concentrated against Denikin. Yudenich's advance guard was within 10 mi. of Petrograd before the Soviet troops rallied. Then the tide ebbed. Yudenich was thrown back, and Denikin's offensive, heavily repulsed at Orel, fell to pieces. In December he was making a last stand at Novorossiisk in the Kuban, and by April he had fled to Constantinople. Kolchak lost his capital, Omsk, in November and he finally resigned command a month later. The Czechs betrayed him to the Red army at Irkutsk. He was put on trial as a traitor, condemned to death and shot on Feb. 7, 1920. The bewildering collapse of the White armies was caused by the hostility of the masses in the territory they controlled no less than by military defeat.

Kolchak's execution marked the end of the intervention period; nearly all the Allied troops had been withdrawn late in 1919. Japanese troops were still in occupation of Vladivostok and the maritime provinces. however, and Gen. P. N. Wrangel was reforming the shattered army of Denikin in the Crimea. Later, during the war with Poland, Wrangel had some successes on the mainland, but the armistice released overwhelming forces against him, and in Nov. 1920 the remnants of his army were transported by the Allied fleet to Constantinople.

The Soviet army had been progressively demobilized as the enemy weakened, but the internal economy of the country was in a chaotic state. The peasants, irritated by requisitions, had reduced the production of grain, and industry, which had been harnessed everywhere to war, had to be reconstructed on a peace basis. Trotsky, the commissar of war, proposed that the army should be utilized directly for production. The "labour army" helped to reorganize transport and some sections of heavy industry, but discontent was generated among the workers.

War with Poland. — Before the situation became critical an emergency, war with Poland, settled the problem. The Soviet government proposed peace to Poland in Jan. 1920 on terms similar to those offered Finland and Estonia. The Poles at first seemed willing to agree, but their circumstances improved as supplies of war material from France and a food loan of $50,000,000 from the United States strengthened their country. At the end of March they demanded all the territory west of the Polish frontier of 1772, a large cash indemnity and the occupation of the Russian town of Smolensk as guarantee. The Bolsheviks refused, and the Polish army occupied Kiev early in May. Within a month the Bolsheviks struck back. The Soviet cavalry retook Kiev in June, while the main force advanced from Smolensk through Vilnius and along the German border. The Red armies, marching forward almost without combat, converged upon Warsaw. The Polish retreat became a rout, and by the middle of August the Russians had reached the outskirts of the city.

France and Great Britain were appalled; a sovietized Poland would mean bolshevism in the heart of Europe. However, the Polish army under Marshal J. Pilsudski began a successful counter-offensive on Aug. 15, and almost overnight, with little fighting, the Red armies were in retreat. A great part of the troops on the German border gave up their arms. On Oct. 11, after Polish territory had been entirely cleared, an armistice agreement was concluded at Riga. On March 18, 1921, peace was signed on terms favourable to Poland, with a new frontier which placed 4,000,000 Ukrainians and Byelorussians under the Polish flag. Again the Soviet government had paid a heavy price for peace. (See Russo-POLISH CAMPAIGN.)

De Facto Recognition. — An improvement of relations with the new Baltic states followed the collapse of Denikin and Yudenich. In the autumn of 1919 M. M. Litvinov was sent by the Soviet to Tartu (Dorpat) in Estonia to negotiate peace with Estonia and Finland. Peace treaties with both states were signed early in the following year on reasonable terms. A settlement with Latvia was delayed by the Latvian claim to the province of Latgale. The Latvians refused to negotiate and in a three-week campaign, Jan. 3–24, 1920, drove the Red troops from the province. Peace with Latvia was signed on Aug. 11, 1920. In the previous January the Allied blockade had been lifted. Anglo-Russian negotiations began in the winter of 1919–20 but were interrupted by the Polish war, and it was not until March 16, 1921, that a trade agreement according de facto recognition to the Soviet was signed in London. In the same year similar agreements were made with Germany (May 6), Norway (Sept. 2), Austria (Dec. 7) and Italy (Dec. 26).

F. SOVIET AFFAIRS TO 1941

The new regime was faced with the constitutional problem of blending together the real authority of the council of people's commissars with the nominal sovereignty of the soviets. This was possible because of the prominence, in both council and soviets, of the Bolsheviks, who took the title of All-Russian Communist party (of Bolsheviks) in March 1918. The task of constitution making was fulfilled in the constitution of July 10, 1918, which remained the fundamental document of Soviet constitutionalism. It applied only to the Russian Soviet Federated Socialist Republic, which consisted essentially of the Great Russian core of the old empire together with Siberia; its federative form reflected the exploitation by the Communists of the national grievances of the non-Russian peoples embedded within it. In addition, the course of the civil war had finally resulted in the setting up of Soviet governments in the Ukraine and in Byelorussia and also in Georgia, Armenia and Azerbaijan — which were formed into a Transcaucasian federation in Dec. 1922. In form, the Ukraine, Byelorussia and Transcaucasia were independent states, linked with the Russian Soviet Federated Socialist Republic only by treaties of a peculiarly intimate kind; but their governments owed their existence to the Red army and were firmly under the control of the Communist party, which remained a single centralized unit.

Early in 1922 Joseph Vissarionovich Stalin (*q.v.*), the general secretary of the Communist party, was instructed as commissar of nationalities to draw up a plan of federation between these governments. In Dec. 1922 the first Congress of Soviets of the U.S.S.R. met at Moscow and confirmed the pact for the formation of a union. The Far Eastern Republic, a quasi-independent buffer state closely affiliated to the R.S.F.S.R., had been merged with the latter in the preceding November.

The constitution of the new state, the Cnion of Soviet Socialist Republics, was accepted by the central executive committee on

July 6, 1923, and became effective from that date.

As in other federal constitutions, the powers of government in the U.S.S.R. were nominally divided between the centre and the constituent republics. But the division of functions left to the central power not only the usual ones relating to external relations and defense but most of the major economic ones.

The centre's overriding authority was guaranteed in a number of mays. Indeed the whole process was little more than an extension of the R.S.F.S.R. constitution to cover the whole area under sovereign control. No real importance could be attached to the affirmation of the right of the republics to secede from the federation.

The most important unifying force of the new state, which contained so many races, creeds and languages. was not mentioned in the constitution. The Communist party, with its rigid discipline and centralized authority, was destined to control each of the constituent states and to cement them more firmly together.

The Peasants and the Famine, 1921–22.—War Communism pressed heavily upon the peasants. Difficulties of transport and distribution prevented them from receiving manufactured goods in exchange for their requisitioned food products, and although their contribution to the national budget decreased proportionately as the currency emission to cover deficits grew greater, their position showed no corresponding improvement. Administrative confusion, red tape and contradictory instructions made the requisitions more onerous. Gradually the peasants reduced the area sown and concealed the harvested grain. The total harvest in 1921 was only about 40% of the average yearly harvest in 1909–13.

The Bolsheviks tried to counter this passive resistance by an extension of class warfare to the villages. They divided the rural population into rich (or kulaks), middle and poor peasants. The poor were their protégés, they said, the middle their friends and the rich their enemies. In 1918 "committees of village poor" were organized to supervise the grain requisitions and to take the part in village management which had hitherto belonged to the prosperous peasants. These were soon replaced by the village soviets, over which the Bolsheviks had established control.

Events showed that the rural communities were no favourable terrain for class warfare. The ties of family and religion, a common dislike of tax collectors, towns and townsmen, and a sullen distrust of any central authority which took their young men as soldiers and requisitioned their grain and cattle proved stronger than arbitrary distinctions. Many of the middle peasants were the kulaks' young relatives, whose chief aim was to become kulaks themselves; many of the poor were dependent, ignorant and shiftless.

Peasant delegates to the eighth and ninth congresses of the Communist party in 1919 and 1920 had expressed the murmurs of the villages, and there were signs that the army, largely recruited from the middle peasant class, was growing restive. The Polish war brought a new spirit of patriotic ardour and this restiveness was for a time forgotten, but early in 1921 it burst forth. In February the garrison of the naval fortress of Kronstadt, near Petrograd, demanded the abolition of the grain monopoly, and a mutiny followed which was suppressed only after heavy fighting. Almost simultaneously the peasants of Tambov, one of the central provinces of Russia, refused to yield their grain to requisition. Troops sent to enforce obedience made common cause with the peasants. Resentment had become revolt.

Lenin realized the danger and induced the tenth Communist congress in March 1921 to sanction a decree substituting a graduated food tax for the system of requisitions. Commodities demanded by the peasants, kerosene, salt, tools and leather, were rushed to Tambov, to be sold or bartered on a free trading basis. Those measures quickly ended the revolt. The source of trouble had been economic discontent rather than political unrest or counterrevolutionary agitation.

It is significant that both these outbreaks occurred at the end of winter, when climatic conditions had caused a failure of the autumn-sown grain and the peasants, whose reserves were depleted by requisitions, mere beginning to fear one of the famines that had devastated Russia periodically. Their anxiety was well founded. A prolonged drought in the early summer ruined the spring-sown grain throughout the black earth districts of the Volga, north Caucasus and Ukraine. By the middle of July 1.000.000 peasants were in flight from their parched fields toward the centres of urban and river transport. where they were huddled in refugee camps infested with cholera and the epidemics caused by malnutrition. The crop failure was reckoned to have affected an area inhabited by 20,000,000 to 30,000,000 people. Unless help was forthcoming, at least 10,000,000 seemed doomed to die from starvation before spring.

In July the Soviet government permitted an appeal by the writer Maxim Gorky to Herbert Hoover. then chairman of the American Relief administration (A.R.A.), which had kept alive millions of hungry children in Belgium and northern France during the war and had been at work later in central and eastern Europe. Hoover agreed to help, and a method of operation was soon arranged between the A.R.A. and the Soviet authorities. This example was followed by a number of European charitable organizations. but the brunt of the work was done by the A.R.A., which at the peak of its activity. in March 1922, was giving daily rations to 10 000,000 children and adults. Altogether foreign aid fed probably 12,000,000 persons, and the Soviet Relief administration maintained at least an equal number.

It was difficult to estimate the number of famine deaths because of confusion between disease and starvation in vital statistics. Deaths from actual hunger probably did not exceed 500.000. Foreign relief for the famine rendered two other important services. It allayed much of the fear of foreigners provoked by intervention and thus paved the way for a renewal of normal relations between Russia and the outer world. It also helped the Soviet cope with the problem of disease, especially cholera and typhus, which had been epidemic in Russia for centuries; after 1922 there was no widespread recurrence of either pest.

The New Economic Policy.—It is customary to regard the New Economic Policy instituted by Lenin in the spring of 1921 as a more or less temporary abandonment of Communism to mollify the peasants. There is no question that an influential section of the Communist party saw it in that light. Lenin himself may not have shared this view. He was above all a realist. alive to the practical necessities of the moment. He had shown that he was well aware of the anomaly of an industrial proletarian revolution in a country where 85% of the people were backward peasants. By force of circumstance and the exigencies of war he had been compelled to adopt a program of socialist centralization which many of his followers welcomed as the correct and natural policy of a socialist state.

Before the Communist party reached a new decision in its protracted discussion of agrarian policy in 1920 and 1921, Lenin found himself advocating not merely a change with regard to requisitions and the grain monopoly but also a general readjustment of the economic framework. The reform of industry for peace purposes mould require effort and expenditure which the state was unable to provide, and finance and transport were also in a desperate position.

Lenin's influence and insistence won. His critics had no valid alternative to offer. The New Economic Policy (called N.E.P.) was confirmed by a decree published Aug. 9. 1921. It permitted freedom of trading within the country. sanctioned overtime and piecework payment for workers, offered encouragement to foreign capitalists and concessionaires and recognized by implication the rights of private property which had been abolished under War Communism. The state continued its monopoly of foreign trade into the N.E.P. period, but later a number of the more important trusts into which Soviet industry was divided were allowed to trade abroad directly.

During the period of civil war and War Communism the financial tools of capitalist states had been laid aside. Private banks, cheques, securities—all had gone. Money had depreciated rapidly as more and more of the national budget was covered by inflation; 85% of the 1920 budget was provided by the emission of notes.

If the New Economic Policy was to succeed it clearly had to have banking facilities and a more convenient medium of ex-

change. The shift of policy was quickly made. The state bank was established in the autumn of 1921 and given the authority to issue bank notes as well as to serve as a credit institution. On Nov. 16, 1921, it began credit operations. By a year from that time the essentials of currency reform had been prepared, and the bank began to issue notes. (See *Finance,* below.)

The reform of the currency required in turn the establishment of the state budget on a solid foundation, since the government could no longer print notes to meet the deficits. Agricultural taxation, which had been substituted for requisitions early in 1921, was again revised. In May 1922 a single tax in kind was established by decree, and the peasants were permitted to pay in specified commodities the graduated taxes imposed. In May 1923 a more extensive reform was made. Cumbrous miscellaneous taxes were swept aside, a single agricultural tax was substituted and money payments gradually replaced commodity payments. Meanwhile, urban taxation had been developed by indirect taxes and income and property taxes, so that the peasants, instead of forming the principal taxpaying body of the state. came to furnish only a small fraction of its revenue.

The most radical change involved in the New Economic Policy was the restoration of the whole internal economy of the country, industry, commerce, transport, housing and employment, to a straight money basis. Instead of the vague system of accounting prevalent under War Communism, every state enterprise was compelled to issue a regular balance sheet and to show profit and loss in the old-fashioned way. Employees received a regular wage paid in cash. Housing committees were entitled to charge rent on a graduated scale in accordance with the social position and earnings of the tenant. The railways and tram companies were allowed to charge fares for passengers and freight.

Communist critics of the New Economic Policy were perhaps justified in declaring it a reversion to capitalist methods. In any case, the Soviet government could not avoid the process of decentralization which was a phase of postwar reconstruction in all the belligerent countries of World War I. For them, no doubt, wartime centralization and control boards were matters of necessity rather than choice. For the Bolsheviks, choice and necessity coincided. But if centralization proved unwieldy in the advanced industrial countries of the west, it was a yet heavier burden upon the backward economy of Russia. Under the New Economic Policy a great many nationalized enterprises were released, not to former proprietors or private owners, but to face competition in the open market. The financing of such corporations was carried out by the Industrial and Commercial bank and by other new banking establishments.

As the New Economic Policy developed, industry was divided into "trusts," as they were called, such as the Oil trust, the Coal trust and the Flax trust, at first horizontal in character, but gradually becoming vertical also. With the trusts, which were organs of production, were associated syndicates, organs of sale and purchase, handling both foreign and internal trade. The trusts were later divided into sections; for example, the Oil trust subdivided into Azneft (Azerbaijan Oil), Grozneft (Grozny Oil) and Embaneft (Emba Oil).

The New Economic Policy stimulated the foreign trend toward establishing commercial relations with the Soviet, and in the spring of 1922 an international conference was held at Genoa, It., where the Soviet envoys for the first time met foreign statesmen on equal terms. The atmosphere was at first cordial and a proposal was made to provide financial assistance to the Soviet on condition that the debts of the tsarist government were recognized. A period of haggling followed, but on April 16, 1922, Germany and the Soviet government privately signed an agreement at Rapallo, It., shelving the debt question, affirming mutual friendship and re-establishing full diplomatic relations. This unexpected event revived fears of a Russo-German combination to upset the treaty of Versailles, and the Genoa conference ended without reaching a solution. There were obvious limits to Soviet-German co-operation in the political field; but there was henceforth a silent collaboration in military matters by which the Russians received help for the reorganization of the Red army and gave Germany facilities for circumventing the disarmament clauses of the Versailles treaty. Although a meeting of experts to discuss financial matters was held in the summer at The Hague, Neth.. prospects of a settlement were never bright and little was accomplished.

The Soviet government took the position that the western powers had tried to enforce a humiliating abandonment of the principle of the repudiation of tsarist debts and of the monopoly of foreign trade, which it had now come to regard as one of the main pillars of its economic system. If the stability of the new currency was to be maintained, rigid control over exports and imports was imperative. But in the first years of the New Economic Policy foreign trade was somewhat hampered by the attempt to force it all through the bottleneck of an untrained bureaucratic department. With growing experience there was a tendency to transfer the placing of orders and sales abroad to the trusts directly concerned, while the foreign trade department continued to act as control. Soviet trading corporations were established in London, Berlin, New York city and other centres. French and U.S. businessmen hesitated to allow long-term credits, but the English and Germans found them possible, and the volume of trade steadily increased. Some trade was still carried on by the Russian co-operatives, which, since they were a pre-Soviet organization, had been allowed by some western countries to trade with them in the pre-N.E.P. period. But it was much less important. The policy of industrial and mining concessions to foreign businesses was unproductive and not of long duration.

The growth of exports was the most striking change after the introduction of the New Economic Policy. Total trade expanded, and imports, following the Soviet policy of rigid control, fluctuated widely; but exports were multiplied two and one-half times between 1922 and 1923 and were nearly doubled again in the newly established fiscal year ending Sept. 30, 1924.

The first years of N.E.P. showed a corresponding improvement in internal trade and production. Indications that turnover was multiplied by four between the summer of 1922 and the spring of 1924 were probably not far wrong. In the autumn of 1923 prices of agricultural products fell to 60% of the prewar level. Meanwhile, stimulated by the necessity for showing profits which the New Economic Policy required, the trusts and other industrial enterprises had raised the prices of manufactured goods to 80% above that level. The disproportion was so great that the peasants refused to sell grain or buy goods. Warehouses were glutted and industrial stagnation was threatened. Trotsky used the word "scissors" to describe the crisis which followed, because the graph illustrating the ratio of industrial and agricultural prices to the prewar average had the form of opened scissors, with industrial prices forming the upper blade.

To close the scissors was imperative. It was done in six months by the sale of goods below cost price, which swept away most of the paper profits of the trusts but removed the danger of industrial stagnation, and by the progressive increase in the price of food products. Although this serious crisis was past, the task of keeping the scissors closed remained one of the major problems of the Soviet state.

The comparative liberty given to private trade under the New Economic Policy had produced a host of prosperous nepmen, as they were called. They were largely middlemen, retail traders and small manufacturers, for the state continued to hold the principal sources of production and wholesale business in its own hands. They doubtless served their purpose in getting the commercial machine back into running order and furnishing new accumulations of capital; but they were peculiarly repugnant to the extreme Communists and to the organized workers.

By thebeginning of 1924 the New Economic Policy may be said to have justified itself as a practical measure. Currency had been restored to a gold basis, production was approaching prewar standards and agriculture had recovered from the effects of the famine and civil war. Much of the improvement had been caused by the nepmen and the kulaks.

For a further discussion of the New Economic Policy see *Economic Conditions,* below.

Foreign Relations, 192428. — The outer world seemed ready

by 1924 to believe that Russia had now entered upon an evolutionary process similar to that which followed the French Revolution under the Directory and was eager to share in the development of the country's vast resources. But it misunderstood the determination of the Soviet leaders to retain their position and their conviction that the regime could not afford to allow the growth of bourgeois elements or the survival of a landowning peasantry. Nor was the ultimate expectation of the world revolution absent at any time from the calculations of Soviet leaders of any group. Such differences of policy as emerged were concerned with means rather than ends. During Lenin's lifetime his authority served to settle most issues that arose; but already during his long last illness important fissures in the Communist party revealed themselves, and his death on Jan. 21, 1924, precipitated a struggle for the succession which lasted for several years and in the course of which the remnants of democracy in the party vanished as they had already long vanished in the organs of the state.

The effect of Lenin's death had been discounted abroad because of his long illness and absence from public affairs. The growing prosperity of the Soviet state had stimulated the interest of foreign businessmen, who were beginning to feel that trade would be improved by the establishment of regular diplomatic and consular relations with Russia. Germany had taken this step two years before. The new Labour government in England had promised to do the same as one of the means of diminishing unemployment, and the Fascist government of Italy was seeking new fields for commercial expansion. France was still preoccupied with the memory of its lost loans to the tsarist government and with its own reconstruction problems, but French hostility to the Soviet had to some extent diminished.

On Feb. 1, 1924, the British government recognized the Soviet de *jure*. Other countries followed in rapid succession, and by the beginning of 1925 all the great powers except the United States had established diplomatic relations with the Soviet Union. The order was as shown in Table VII.

TABLE VII.—*Recognition of the Soviet Government*

Country	Date	Country	Date
Great Britain	Feb. 1, 1924	Sweden	March 15, 1924
Italy	" 7, "	Denmark	June 18, "
Norway	" 13, "	Mexico	Aug. 4, "
Austria	" 20, "	Hungary	Sept. 18, "
Greece	March 8, "	France	Oct. 28, "
Danzig	" 13, "	Japan	Jan. 1, 1925

Japanese recognition had been delayed by their claim to compensation for a massacre of Japanese soldiers by Red partisans in the Siberian town of Novo-Nikolayevsk (later Novosibirsk) in May 1920. Although the Japanese had evacuated Vladivostok and the mainland in Nov. 1922, they retained northern Sakhalin until their claim should be satisfied. After two failures negotiations were resumed in Aug. 1924, and recognition was granted on Jan. 1. 1925. A supplementary agreement on Jan. 20 pledged the Japanese to withdraw from northern Sakhalin before the end of May and gave them important oil and coal concessions in the Russian half of the island.

The establishment of normal diplomatic relations led to an increase of foreign trade, but the absence of a settlement of tsarist debts, war debts and private claims prevented any extension of loans to the Soviet. Nevertheless, short-term credits were soon arranged in many countries, and the regularity with which Soviet bills were met gradually overcame distrust. A number of important English firms gave terms of credit running from three to five years. In 1925 Germany provided a state-assisted credit of 300,000,000 marks for a period of three years. The French and Americans were more cautious, but heavy annual purchases of cotton in the United States on a short-term credit basis were made possible by longer credits elsewhere and by the general improvement of Russia's economic situation.

Another factor, however, hampered not only financial but political relations between the Soviet and the rest of the world. It was interference in the internal affairs of foreign countries by the Third or Communist International, known as the Comintern. Founded by Lenin in March 1919, the Third International was pledged to the cause of world revolution, which had, Lenin declared, been betrayed by the Second International of Amsterdam. Its establishment completed the split which had taken place in the socialist movements of most countries during World War I. The Russians insisted that the choice be made, and almost every advanced country came to have a Communist party looking to Moscow as well as a Socialist party still affiliated to the Second International.

The Comintern was an aggregation of Communist parties, and in theory, at least, the successful Communist party of Russia was no more than the first among a group of equals. The avowed purpose of the Comintern to overthrow their regimes and institutions by violence caused foreign powers to take a different point of view. Declining to regard casuistic distinctions, they considered the Comintern and the Soviet government as vassals of one lord, the Russian Communist party.

Moreover, the Comintern extended its activities to the colonies of foreign powers and to "semicolonial" countries or spheres of influence, such as China. This caused ill feeling between Russia and the foremost colonial power, Great Britain, and in May 1923 Lord Curzon, as foreign secretary in the Conservative government, addressed to Moscow a note on the subject so sharply worded as to be the equivalent of an ultimatum. There were a number of points at issue, but the question of Communist propaganda in Great Britain and its colonies was the principal grievance. The Soviet government acceded to the British demands, under protest; but the propaganda ghost was not laid, and it continued to trouble Anglo-Russian relations.

The British Labour government of 1924 took steps toward a friendly settlement with the Soviet Union. An agreement was reached in the autumn of 1924 whereby the Soviet promised to repay old debts over a long term of years in return for immediate financial aid. Before the accord could be signed there was a general election in England, in which no small role was played by a letter said to have been written by G. E. Zinoviev, president of the Communist International, giving instructions about the Communist attitude toward the election and Communist activities in the British army. The Labour party was decisively beaten, the Conservatives returned to power and the agreement with the Soviet was shelved. The stir caused by this incident might have been forgotten but for events in Asia and other colonial regions.

Asiatic Interests.—In 1919 Russia's influence was a negligible factor in Turkey and the near east, Persia, Afghanistan and China. England, on the contrary, had never held so strong a position and seemed on the verge of obtaining permanent control over what had formerly been the buffer states between its empire and the tsar's.

Three years later, however, the Soviet had signed treaties of friendship with Turkey, Persia and Afghanistan, as states independent of external influence, and established a virtual protectorate over Outer Mongolia. The central Asian principalities of Khiva and Bukhara were firmly under Soviet rule, and the new Russian republic was now ready to challenge Britain in China.

The Soviet government and the Comintern achieved this result jointly, under Lenin's guidance. The former disavowed unequal treaties, capitulations, treaty ports, protected areas and unilateral tariffs, while the latter devoted its energies to fostering not Communism but nationalism, by virtue of the Leninist doctrine of colonial slaves. This doctrine was Lenin's answer to the question which had long perplexed orthodox Marxists; namely, why the working masses of western Europe had failed to revolt, as Marx had predicted, against their capitalist masters. Lenin argued that the surplus profits from the exploitation of tolonies and semicolonial countries such as China had enabled the European capitalists to maintain their "wage slaves" above the starvation level which would make revolution inevitable. To free such countries from capitalist exploitation would therefore be a long step toward the proletarian world revolution. Lenin thus reconciled three apparently contradictory forces, the nationalist aspirations of colonial and semicolonial countries, the spirit of Marxist Communism and the reborn desire of new Russia for expansion.

The Mongolian treaty of Nov. 1921 caused irritation in Peking

and helped delay a full accord between the Soviet and Chinese governments until May 31, 1924. In a manifesto issued in July 1919 and formally repeated in Sept. 1920, the Soviet had affirmed in the most categorical manner its renunciation of previous pacts infringing Chinese sovereignty in any way, its abandonment of all claim to the Boxer indemnity and its willingness to treat with China on terms of full equality.

The treaty of 1924 put a Soviet ambassador, L. M. Karakhan, in the old tsarist embassy in the Legation Quarter of Peking. Meanwhile, the Communist International was at work in south China, where both Russian and Chinese Communists supported the Nationalist slogan, "China for the Chinese!" As the Nationalists advanced northward from Canton, the influence of their Russian advisers. Mikhail Markovich Borodin in political afiairs and B. K. Galen (Blücher) in the army, grew stronger. By March 192; the Nationalists were masters of south China, including the Yangtze valley, and the Chinese section of the greatest treaty port, Shanghai.

At this moment Chang Tso-lin, the anti-Nationalist dictator of Peking, raided the premises of the military attaché in the Soviet embassy there. with the knowledge and permission of the foreign diplomatic corps. A mass of documents was seized and a number of arrests made, including subordinate members of the Russian staff and Chinese Communists who had sought refuge in the embassy compound.

The documents published immediately showed a financial connection between the Soviet embassy in Peking and the Comintern or unofficial activities of Borodin and Galen in south China. A rupture of relations between Moscow and Peking followed. The foreign powers, especially Great Britain, began to realize the danger of the position.' Strong military and naval forces enabled the foreigners to retain the treaty ports and the Legation Quarter of Peking, but they were compelled to abandon their privileges at Hankow on the middle Yangtze, which for a time became the Nationalist headquarters.

In 1927, however, there was a break between the Nationalists and the Russians. The Communists were pressing for a more radical agrarian policy with which the Nationalist leadership had no sympathy. They were also trying to direct the whole force of the Nationalist drive against European and, particularly, British interests in China. By the end of the year, the Russian advisers had left, the Chinese Communists were being vigorously suppressed and relations between the Chinese Nationalists and the Soviet government had been severed.

Relations with the West, 1927–28.—Events in China had increased anti-Soviet feeling in Great Britain, already aggravated by Russian financial contributions to the British coal miners on strike in 1926; and in May 1927 the premises of the Soviet trading corporation in London, Arcos, were raided by the police. In this case no seized documents were made public, but the result was similar to that in Peking. Diplomatic relations between England and the Soviet were severed on May 24, 1927. This caused a reduction of English credits and imports and thus affected the internal economic situation, which had now come to depend in no small measure upon smooth relations with foreign capital and business.

The rupture with England did not. however, prevent the Soviet from taking part in international disarmament conferences at Geneva, Switz., in the autumn of 1927 and the spring of 1928. Disarmament had long been advocated by the Soviet government, which in the winter of 1922–23 had attempted to arrange a scheme of armament limitation in a conference with its neighbours, Poland, Finland and the Baltic states. At Geneva the Soviet government proposed to begin immediately the progressive reduction of land. sea and air forces. The other European powers were distrustful and unprepared for such sweeping action, and the conferences ended without result.

Although the Geneva conferences did little to improve the relations of the Soviet uith the leading powers of western Europe, and although the Soviet was excluded from the number of original signatories to the Kellogg World Pact of Non-Aggression signed at Versailles in the summer of 1928, there were signs in the following autumn that the United States, which had become a reservoir of capital for European postwar reconstruction, was beginning to modify its aloof or even hostile attitude toward the Soviet.

In the autumn of 1928 a contract between the Soviet trading corporation in New York city and the General Electric company in the United States, giving the former five years' credit on purchases, was the first real breach in the "credit blockade." as it was called, which had hampered business relations between Russia and the United States.

Internal Politics, 1924–28.—Lenin's death occurred at a time when the growing prosperity of the nepmen and the new *bourgeoisie* had begun to raise fears in the minds of many Communists that the New Economic Policy might become a surrender to capitalism. It was felt, moreover, that the state business organizations were now sufficiently strong to take the place of private enterprise and that the restoration of the currency to a sound basis would permit their being financed by the newly created state banking organizations. In the first half of 1924, therefore, private trade was loaded with heavy taxes and other restrictions. The nepmen were unpopular with the masses and the measures taken against them were not unwelcome, but the reduction of private enterprise in the towns led the extremist section of the Communist party to demand a similar suppression of "capitalist elements" in the villages. The struggle between the forces of capitalism and socialism thus provoked a sharper struggle within the Communist party itself. In the first part of the controversy, 1925–26, the opposition, led by Trotsky, tried to force the socializing process, which was the avowed aim of the Communist party, at too swift a pace.

In the cities the state might now hope to supplant the nepmen without economic disorganization, but in the villages it was still dependent upon the kulaks, who produced the grain surplus needed for export and to feed the urban centres. When Trotsky demanded their repression the majority of the Bolshevik leaders did not yet see how they could be replaced, and the Communist party congress of April 1925 confirmed the rights of "individual peasant producers," despite a screen of antikulak phrases to cover this compromise with Marxist principles.

A good crop in the summer of 1926, however, strengthened national food resources and brought forward a demand that the village capitalist be curbed. He was becoming dangerously strong, and the state had begun to feel, as it had about the nepman two years before, that it could do without him. The opposition platform, therefore, was in accord with prevailing Communist sentiment, and by 1927 it had attracted such prominent figures of the Bolshevik regime as Zinoviev, the president of the Third International, and L. B. Kamenev, one of Lenin's closest associates. But Trotsky's adherents declared that their arguments were perverted in the official press and that they were not given proper opportunity to state their case. They had recourse to underground methods, u-hich the majority denounced as an attempt to split the party. The adherents of Trotsky refused to abandon their tactics and, after a hot discussion at a joint meeting of the party's central committee and control commission in Nov. 1927, were expelled from the party. At the 1 jth party congress in December Zinoviev and Kamenev capitulated to the majority and asked to be readmitted into the party as rank-and-file members. Trotsky was sent into exile in central Asia in Jan. 1928 (he was later allowed to go abroad). Soon afterward, it became clear that the majority had adopted the opposition's program of repressing the "capitalist elements" in the villages.

The immediate reason for this step was the failure in the summer of 1927 of the state grain collections. This was the name given to the system of state purchases of grain to provide for the needs of the urban population and the army and for export. In the previous year the state had collected approximately 10,000,000 tons of cereals, of which more than 2,000,000 were exported, and it was planned to collect an equal amount in 1927–28. A renewal of the "scissors" disproportion between the prices of grain and manufactured goods caused difficulty. The peasants preferred to keep the grain for themselves and their stock, rather than sell it. Communist sentiment was already prepared for a drive against

"anti-socialist forces" in the villages. During the spring and summer of 1928 vigorous measures, reminiscent of the War Communism period, were employed to extract surplus grain from the richer peasants, who were described as class enemies.

The quota was attained, but the growing needs of the towns left only a small margin for export, which fell to less than 500,000 tons. This reacted unfavourably upon the foreign trade balance. which had now become most important because in 1928 the state embarked upon an ambitious five-year program of industrialization (that is, an attempt to build up a self-sufficient industrial production) which required heavy purchases of machines and raw materials abroad. The enforced collections of grain caused much discontent in the villages, and in July 1928 the central committee of the Communist party announced their abolition and promised that they should not be repeated. Once again Communist insistence upon class warfare in the villages had overemphasized the distinction between kulaks and the rest of the peasants.

For an account of the first five-year plan, introduced in 1928. see *Economic Conditions,* below. (W. DY.; M. BF.)

The Rise of **Stalin.**—Joseph Vissarionovich Stalin emerged as the outstanding leader of the Soviet regime during this period. Although he held no state office until the spring of 1941, when he succeeded his faithful adherent Vyacheslav Mikhailovich Molotov as premier, after being hitherto simply general secretary of the central committee of the Communist party, his power in every field, political and economic, was absolute and unquestioned. It became almost a matter of course to ascribe every Soviet achievement, political, military, economic or social, to his genius and initiative.

Stalin's personal power was further confirmed by the political elimination and, in many cases, by the physical execution of most of the leading "Old Bolsheviks," the men who, along with Lenin and Trotsky, had played prominent roles in the first years of the revolution. Trotsky himself had first been banished to Turkistan and then sent into exile, finally taking up residence in Mexico. There he was murdered in the summer of 1940. Meanwhile, there had been three spectacular trials of prominent revolutionaries in Russia, in Aug. 1936, Jan. 1937 and March 1938. The defendants confessed various acts of treason and sabotage. and almost 50 persons were sentenced to death. Among the victims of these trials were some of the most famous names of the revolution and of the early phases of the Soviet regime. They included a former premier, A. I. Rykov; two former presidents of the Communist International, Zinoviev and Nikolay Ivanovich Bukharin; the once-dreaded chief of the O.G.P.U. (successor of the Cheka as political police), G. G. Yagoda; and many former diplomats, cabinet ministers and prominent economic executives. Marshal RI. N. Tukhachevsky, one of the most gifted leaders of the Red army in the civil war, and seven generals of the Red army were shot after an alleged secret trial in June 1937. Throughout these years there were many secret executions, some of which were and others were not subsequently reported, and a far greater number of incarcerations in labour camps and administrative banishments.

The trials and the accompanying purge were a dark and debatable subject. Foreign critics emphasized the factual discrepancies in certain details of the trials which were subject to verification in foreign countries; they interpreted the whole purge as a method of ensuring Stalin's personal power and the confessions as the false self-incriminations of exhausted and broken men, who were influenced by threats against their families. Stalin's power certainly remained unshaken, and the regime stood up to the shock of war without the internal disintegration which had been predicted as a result of the purges. It is, of course, quite possible that the masses of the Russian people who were not involved in the purge viewed with relative indifference this ruthless destruction of one part of the ruling class by another.

The Constitution of 1936.—The All-Union Congress of Soviets adopted a new constitution for the U.S.S.R. on Dec. 5, 1936. This instrument provided for direct, instead of the formerly indirect, election to the new bicameral national legislature, the supreme soviet, with representation in one house based on population, in the other on nationality (there were at that time 11 soviet republics in the union).

Politically, the new constitution brought little if any change in practice. Stalin remained a dictator of unlimited powers. Only one political organization, the Communist party, remained legal, and its dominant role mas for the first time given constitutional sanction. Nor was any opposition permitted to manifest itself in speech or writing after the promulgation of the constitution.

Socially, however, and in everyday life, there were considerable changes in Russia after the end of the first five-year plan. There was no reversion to private capitalism, but in the overriding interests of productivity there was toleration and even encouragement of much more material inequality than would have been found during the bleak, austere period of the first five-year plan, when the acute shortage of food and consumers' goods almost enforced a kind of equality of privation. The discrepancy between the incomes of the higher members of the bureaucracy, army and O.G.P U. officers, industrial executives, popular authors, engineers, etc., and those of the masses of workers and peasants became greater, as also did the difference in wages between skilled and unskilled workers.

There were significant changes of emphasis in education, in literature, in cultural life. The state set the tone in all these fields; there was no tolerance for the dissenter. But the Soviet school, experimental and loosely disciplined for more than a decade after the revolution, became much stricter in its methods, with marks and examinations, uniforms for students and more authority for teachers. Middle and higher education, formerly free, was paid for from 1940.

Up to the middle 1930s it was fashionable and, indeed, almost compulsory to deprecate the Russian past extravagantly and uncritically. But subsequently the nationalist note was often struck in newspapers and literature: tsars of outstanding personality such as Ivan the Terrible and Peter the Great were referred to with respect, instead of being indiscriminately abused.

There was an important change of attitude toward family life. Early Soviet legislation practically eliminated all restrictions on intercourse between the sexed. Divorce could be had immediately for the asking by either partner, and there was no distinction between legitimate and illegitimate children. Abortions were frequent and permitted. In the middle 1930s there was a severe tightening of restrictions on divorce; the performance of abortions was made illegal and women were urged and encouraged to bear many children.

During the period from 1929 to 1933 there was a good deal of persecution of children whose class origin was suspect. Sons and daughters of priests, former aristocrats and well-to-do families were barred from universities and found it hard to get employment. After 1933 there was more social equality, more feeling that class lines within the state had been ironed out. It was perhaps not accidental that these changes of a moderate and conservative character coincided with the decimation of the ranks of the veteran revolutionaries who were identified with the more active destructive period of the revolution.

Foreign Relations, 1928-41.—Between 1928 and 1941 the U.S.S.R. passed through three fairly well-differentiated stages of foreign policy, as follows:

1. Collaboration to some extent with Germany, antagonism to Great Britain and France. This had been the general course of Soviet foreign policy after the revolution, and it continued until Adolf Hitler's rise to power in Germany in 1933. There were occasional variations in this policy, periods of coolness between Moscow and Berlin. But Soviet policy in the main was to support the German demand for disarmament, as opposed to the French thesis of security, to abstain from co-operation with the League of Nations, to depict Great Britain and France as the chief potential enemies. Soviet support of the British general strike and of the Nationalist revolutionary movement in China aggravated relations with Great Britain, and there was a suspension of British-Soviet diplomatic relations from 1927 until 1929.

2. Collective security, antifascism, united front. Hitler's rise to power on an outspokenly anticommunist program and the ob-

viously militarist, aggressive character of the nazi regime caused a change of orientation. Karl Radek, the publicist, who was often an unofficial spokesman for the government until his arrest in connection with the treason and sabotage trials, heralded this shift in the spring of 1933 when he wrote a series of articles about the undesirability of violent change in the territorial settlement. The U.S.S.R. joined the League of Nations on Sept. 18, 1934, the year when Germany left it. Military alliances were concluded with France and Czechoslovakia and pacts of nonaggression, elaborately worded so as to exclude every form of disguised aggression, were concluded with Russia's western neighbours—Poland, Latvia, Lithuania. Estonia and Finland. The regular Soviet representative at important sessions of the League of Nations, Maxim Maximovich Litvinov, repeatedly advocated the ideas that peace was indivisible and that security must be organized on a collective basis.

The Communist International, fully in the service of Soviet policy, changed strikingly the character of its propaganda. Extreme revolutionary demands were pushed into the background, and political alliances were sought not only with Socialists but with Liberal and Radical parties and in China with Chiang Kai-shek. One result of this policy was the formation in 1936 of left-wing popular front governments in France and Spain. During the Spanish Civil War which broke out in 1936, the Soviet government, although represented on the "nonintervention committee" in the beginning, sent a limited amount of aid in tanks, planes and military specialists to the Republicans.

3. Abandonment of the west. aggression. A tremendous change in foreign policy occurred on Aug. 23, 1939, when Stalin and Hitler signed a pact of nonaggression. There had been signs earlier in the year that the Soviet government, which had been rebuffed and cold-shouldered at the time of the Munich conference in Sept. 1938, was considering a change of policy. Stalin in his important speech to the 18th party congress in March 1939 had spoken of unwillingness to pull foreign chestnuts out of the fire. Litvinov, apostle of collective security, had been summarily dropped from the cabinet on May 3, 1939, and replaced by Molotov. The Soviet-German agreement broke upon the world at a time when the negotiations were still proceeding between the G.S.S.R. and Great Britain and France with the object of bringing the union into a common front against Germany. In the course of these the Soviet government had made demands concerning the Baltic states and Poland which the governments of those countries found unacceptable.

During this third phase, the Soviet government pursued a policy of independent aggression, endeavouring to strengthen its strategic position and to derive benefit from the war in which the other major European powers were involved. By a secret protocol (revised on Sept. 28) to the treaty of August, Germany had agreed not to oppose Russian action in the areas in which the Soviet government declared itself to be interested. Soviet troops crossed the Polish frontier on Sept. 17, 1939, and the partition of that country with Germany was effected. Finland was attacked on Nov. 30. The Finnish resistance was unexpectedly strong. but on March 12, 1940, a peace treaty was concluded which gave the U.S.S.R. the isthmus of Karelia, the naval base of Hango and other concessions. The Baltic republics, Latvia, Lithuania and Estonia. which had been obliged to accept "mutual aid" treaties with the U.S.S.R. admitting Soviet garrisons in their territory in Sept.–Oct. 1939, were annexed outright and organized as soviet republics in the summer of 1940. At the same time, Rumania was forced to cede Bessarabia, a former Russian province, and northern Bukovina. With some internal reorganization the number of soviet republics was now 16. (W. H. Ch.; M. Bf.)

By the autumn of 1940 the Soviet Union was becoming anxious at the extent of Germany's successes, and Molotov was sent to Berlin in November to attempt to strike a new bargain. But he failed to get agreement to Russian demands concerning the Balkans and the straits. The Russians had taken part in the Montreux conference of 1936, which had revised the Lausanne straits convention of 1923 much in their favour; but now they wished for physical guarantees of their security in this area. Thereafter, despite various appeasing gestures, the die was cast, and on June 22, 1941, Hitler attacked without warning. Warnings from the west that such an attack was being prepared had apparently been taken lightly.

The major success of Soviet diplomacy in the period immediately before the German attack was a nonaggression treaty with Japan, signed on April 13, 1941. By aggression in Manchuria in 1931, Japan had become a neighbour of the U.S.S.R. and of its satellite Outer Mongolia on a much wider front. The Soviet government, preoccupied by the European threat. had done its best to appease Japan by selling it in 1935 the rights in the Chinese Eastern railway that the Soviet Union had recovered in 1924 and defended against China in 1929. By helping to bring about a temporary united front of the Chinese Nationalists and Communists and by signing a nonaggression treaty mirh the Chinese Nationalists, it had also helped to stiffen Chinese resistance toward Japan. Nevertheless, there had been some fairly severe fighting—almost an undeclared war—along parts of the Manchurian frontier in 1938 and 1939. The nonaggression pact with Germany's ally thus removed some of the Soviet fear of a war on two fronts.

G. WORLD WAR II

The first five months of the war were almost fatal to the Russians. The Germans advanced rapidly, encircling great Russian forces and conquering about 500,000 sq mi. of territory. By November all southern Russia, including the Crimea except the naval base of Sevastopol, had been overrun, and Rostov had fallen. In the Ukraine Kharkov had fallen. and further north Tula was almost surrounded. The Germans mere within 20 or 30 mi. of Moscow, whence much of the administration had been evacuated, with the foreign embassies, to Kuybyshev (Samara). Leningrad was virtually encircled—the beginning of a siege that was to take a heavy toll through famine and to rob Russia of historic monuments of its past.

The winter brought relief; Rostov was retaken and a counter-offensive in December relieved the pressure on Moscow. By the time the spring thaw of 1942 came the Russians had made deep penetrations into several sections of the German front. The summer of 1942, however, was almost as disastrous as the preceding one. The new offensive in the south carried the Germans to the Don along most of its length and across it to the Volga at Stalingrad. Meanwhile Rostov. Sevastopol. Novorossiisk and the Maikop oil fields as well as the rich agricultural lands north of the Caucasus had all been lost, and the southeastward thrust of the German armies in this sector had almost reached the major oil centre of Grozny. In 15 months it was reckoned that the Red army had sustained 5,000,000 casualties.

The defense of Stalingrad marked the turning of the tide. Again winter came to the rescue of the Russians, and a great counter-offensive cut off a huge German army outside Stalingrad where it eventually surrendered in Feb. 1943. In the summer a new German offensive was defeated and the Soviet armies went over to the offensive, freeing Orel and Belgorod on the central front, liberating Kharkov and the Donets coal field. as well as Novorossiisk and the eastern shore of the Black sea. A sudden advance to the Dnieper cut off large German forces in the Crimea. By the beginning of November. the Red army was back in Smolensk, Gomel and Kiev. This offensive merged without a break into the winter offensive of 1943–44, in which, in addition to further gains in the south and centre the Russians at last broke out in the north, clearing the Leningrad area and driving on toward the Baltic states. With the reconquest of the Crimea in May, the Russians had cleared most of the pre-1939 Soviet Union.

In the summer of 1944 a series of new offensives began. Finland agreed to an armistice in September, but the Germans refused to leave the country and fighting continued. In the far north the retreating Germans were pursued over the Norwegian border. Farther south big gains were made in the Baltic republics, Byelorussia and Poland. But the Russians failed in much-debated circumstances to relieve the Polish home army which had risen in Warsaw, and both there and on the Baltic front. where the Red army had suffered a reverse, the advance came to a halt in August.

The most spectacular gains were obtained in the south. An offensive against Rumania led to the Rumanian government's accepting armistice terms and declaring war on Germany on Aug. 25; in September war was declared against Bulgaria (hitherto neutral as regards the war on the eastern front), and on Sept. 8 Bulgaria, too, changed sides and declared war against Germany. In their pursuit of the Germans into Yugoslavia. the Russians on Oct. 20 entered Belgrade simultaneously with Tito's (Josip Brozovich or Broz) partisans; in Hungary, Budapest was encircled by the end of the year and a rival Hungarian government was set up in Debrecen under Russian sponsorship. The Russians had also crossed into eastern Czechoslovakia.

A new winter offensive on all fronts began in Jan. 1945, and by the time of Germany's collapse in May, Russian armies were deep into the heart of the reich with Warsaw, Budapest, Vienna and (by inter-Allied agreement) Berlin and Prague among the capitals taken by the Red army.

In the far east the U.S.S.R. entered the war only on Aug. 8, 1945, on the eve of Japan's collapse, and rapidly overran Manchuria and northern Korea.

.Internal Affairs, 1941-45.—The war provided the biggest test to date of the capabilities and stability of the Soviet regime. But any opportunity the Germans had to exploit political discontent in the occupied areas was soon thrown away by the ruthless exploitation of their resources and by the brutality which the Germans showed toward their populations. The ill treatment of the civilian population was completed by large deportations for slave labour in the reich and by massacres of the Jews. Hatred of the invader proved a powerful welding force in adversity.

On June 30, 1941, a new state committee of defense was set up which for the period of the war was the supreme governing body under Stalin's leadership. The general line was to stress even more strongly than in the preceding period the patriotic elements in the Soviet ideology and to call upon the people to resist in the name of Russia's heroic past rather than in that of the revolution. A new measure of toleration for the Orthodox Church was part and parcel of this process. The Communist party itself, on the contrary. was allowed to fall into the background, and its ranks were widely opened to soldiers in the field and outstanding workers in the arms factories. Its membership rose from 3,876,000 in 1941 to 5,700,000 at the end of the war, despite the heavy losses in battle. The nation's gaze was concentrated on the army, of which Stalin (now commissar for defense) was in supreme control; and after the early failures of the survivors of the old guard of Communist generals, K. E. Voroshilov. S. M. Budenny and S. K. Timoshenko. new ones came to the fore: G. K. Zhukov, I. S. Konev, R. Y. Malinovsky, K. K. Rokossovsky, F. I. Tolbukhin, A. M. Vasilevsky. Until 1943 when illness caused his replacement by Vasilevsky, the chief of staff was the former tsarist officer B. M. Shaposhnikov.

In March 1944 the "Internationale" was replaced as the national anthem by a new patriotic song.

Stern measures were meted out after the German retreat to those minorities that had collaborated with them. The Volga German Autonomous Republic was abolished early in the war and its population deported into Siberia. The same fate now befell the Kalmuck, Chechen-Ingush and Crimean (Tatar) Autonomous Republics and the Karachay Autonomous Region. In 1944 the hitherto nominally independent republic of Tannu Tuva entered the Soviet Union as an autonomous region of the R.S F.S.R.

By constitutional amendments of Feb. 1944, the republics of the U.S.S.R. were given the right of entering into direct relationships with foreign countries and of having their own defense formations. For this purpose they were to have the right to set up commissariats of foreign affairs and defense. The only practical consequence of these changes seems to have been the seats allotted to the Ukraine and to Byelorussia in the United Nations.

Foreign Relations, 1941–45.—Foreign policy during the war naturally gave the same overwhelming priority to the direct defense of the Soviet Union as was manifest in every other sphere of national life. The Communist parties abroad, which only yesterday had been sabotaging the "imperialist war" against Germany, were ordered to take a patriotic line in all countries fighting the axis and henceforth devoted themselves to trying to influence Allied strategy in such a way that the maximum burden should be lifted from Soviet shoulders. This was the origin of the clamour for the second front, and Soviet diplomacy was largely directed to the same end. In a further effort to reassure foreign opinion, the announcement was made on May 22, 1943, that the Communist International had been formally dissolved on May 15.

The Soviet Union signed a number of treaties with the Allied governments (including a 20-year treaty of alliance with Great Britain on May 26, 1942) and with Allied governments in exile. It entered into diplomatic relations with certain countries for the first time: Canada, South Africa, the Netherlands. But although the prior consideration was the immediate war crisis, the Soviet government was concerned from the beginning to safeguard its own postwar position. Unsuccessful efforts were made to get from Great Britain and the United States formal recognition of its recent annexations in the Baltic. With regard to Poland, the agreement signed with the Polish government in exile on July 30, 1941, recognized the abrogation of the territorial changes resulting from the Soviet-German pact and the rebirth of an independent Polish state. There followed a brief period of apparent Polish-Soviet friendliness during which the surviving Poles who had been deported into the Soviet Union were allowed to form an army. But relations were not cordial, and between March and April 1942 most of the Poles were withdrawn from Soviet territory to the middle east. The Russians also formed a Communist Polish army which took a part in the later campaigns. Relations with the London Polish government were envenomed by constant controversy over the frontier question, and relations with it were broken off after it had appealed in April 1943 to the International Red Cross to investigate German allegations that the bodies of large numbers of Polish officers who had been interned in Russia but of whom no account had hitherto been given had been found in circumstances that pointed to the Russians' having massacred them. (A subsequent Russian commission naturally retorted that the Germans were responsible for the murders.)

Poland remained the main source of difference between the Allies until the end of the war, particularly when it became clear that the Russians were determined to have the new Poland governed by a regime chosen by themselves and ready to grant the U.S.S.R. its territorial demands in return for compensation at Germany's expense. This question, however, was only part of the general planning of the postwar world carried out by negotiations with the United States and Great Britain, in particular at the tripartite conferences of Tehran (Nov.–Dec. 1943); Yalta (Feb. 1945) and Potsdam (July 1945).

The three main questions involved were the treatment of the defeated countries; the new territorial settlement; and the nature of the new United Nations organization, planned at the Dumbarton Oaks conference in Aug.–Sept. 1944 and brought into being at the San Francisco conference in May–June 1945.

In regard to the first of these, the original Russian point of view was in favour of the partition of Germany into separate states; but this was not maintained at Potsdam, when a decision to treat Germany as a single economic unit was reached despite the quadripartite nature of the occupation. The Russian insistence on the punishment of war criminals was largely met by the Allies, and the Russians co-operated in the Nuremberg trials; but it was soon made clear, both in regard to "denazification" in Germany and "democratization" in Japan. that the Russians meant far greater transformations of the social structure of these countries than had been contemplated. Under Russian occupation, eastern Germany was rapidly sovietized. Of more immediate concern was the difference in the attitude toward reparations from Germany, which manifested itself at Yalta and was bridged neither by the Potsdam agreement nor by the subsequent conference of foreign ministers held in Moscow in Dec. 1945. The Russians held that the restoration of Russia through reparations in kind from Germany should be given absolute priority, whereas the western powers considered that nothing should be done to the German economy that would make the occupation a drain on their own

resources. No agreement was reached on Japanese reparations either. On the other hand, the Russian war against Japan, which began only on Aug. 8, 1945, enabled them to seize as war booty much of the industrial wealth that the Japanese had built up in Manchuria. The Soviet Union also made much use of the labour of prisoners of war for reconstruction purposes.

On the territorial side, the Russians achieved their demands in Europe, acquiring part of East Prussia, including Konigsberg, as well as the Baltic states, eastern Poland, Bessarabia and Bukovina. To these acquisitions a treaty with Czechoslovakia on June 29, 1945, added Sub-Carpathian Ruthenia. All independent efforts at co-operation between the eastern European states were frowned on during and after the war. In addition, of course, the Russians acquired zones of occupation in Germany and Austria and the right to garrison troops to guard their lines of communication in Poland, Hungary and Rumania. Since Aug. 1939 the effective boundaries of Russian power had shifted about 750 mi. to the west and about 600 mi. to the southwest. Russian troops in the Thuringian forest were within 100 mi. of the Rhine. There was strong pressure against Turkey for territorial concessions and for bases on the straits.

In Asia, the negotiations for Russia's entry into the war against Japan had led to the promise of concessions in Manchuria which had the effect of replacing it in the position from which it had been ousted as a result of the Russo-Japanese war of 1904–05. Port Arthur again became a Russian naval base. By a treaty revealed Aug. 14, 1945, these positions were confirmed by the Chinese government of Chiang Kai-shek, which also accepted, subject to the formality of a plebiscite, the abandonment of claims over the Soviet satellite Outer Mongolia. Soviet influence in Sinkiang, dominant in the 1930s but relaxed in the war years, was gradually reasserted.

On the side of international organization, the Russian position was that matters should be handled in the postwar world by the continued co-operation of the three great powers, as during the war. The Soviet Union was eventually persuaded to give a formal position of equality to France, with whom a treaty of alliance had been signed on Dec. 10, 1944, and to China. The special position given to the permanent members of the Security council and the demand for their unanimity on all decisions other than purely procedural ones reflected the Soviet attitude in the drafting of the charter of the United Nations.

H. POSTWAR POLICY TO THE DEATH OF STALIN, 1953

There was little change in the political structure of the Soviet Union in the years immediately after World War II. The domination of Stalin and his immediate associates in the Politburo and the council of ministers was beyond question, and apart from the death in Aug. 1948 of A. A. Zhdanov and the disappearance of N. Voznesensky there was little change in its composition. From the dozen leading figures, the names of Vyacheslav M. Molotov (whose appointment as vice-premier was announced on March 4, 1949, when he was replaced as foreign minister by A. Y. Vishinsky), of G. M. Malenkov and of L. P. Beria gradually became the most prominent. The supreme soviet and the soviets of the republics resumed the regular elections and sessions that had been abandoned in the war years. The chief task of the former was still the ratification of the annual budget. The chairman of the presidium of the supreme soviet, the elderly Mikhail Ivanovich Kalinin, died in 1946 and was replaced by N. M. Shvernik, till then head of the trade union organization.

In Oct. 1952, the 19th congress of the party met, the first such meeting since 1939. It was preceded by the publication of a booklet by Stalin, *The Economic Problems of Socialism in the U.S.S.R.*, which stressed the division of the world market between the two *blocs* and indicated that the possibility of internecine hostilities between non-Communist powers was still to be reckoned with alongside their hostility to the Soviet Union. The congress itself made certain changes in party organization and dropped the word "Bolshevik" from the party's title. The choice of G. M. Malenkov to make the principal report suggested that he was in the direct line of the succession. At this time there were a number of calls for internal vigilance, and on Jan. 13, 1953, revelations were published about the alleged activities of a group of Soviet doctors, who were said to have tried to murder various prominent Soviet personalities for the ultimate benefit of U.S. and British imperialism. Although much was made at the time of the fact that seven of the nine doctors were Jewish and though the revelations about the "plot" were accompanied by vigorous anti-Zionist propaganda, later events made it seem probable that the whole affair was part of an obscure internal struggle for power.

There was a sharp reversal, beginning even before the end of the war, of the emphasis laid on the state and on the army and its leaders at the Communist party's expense. This represented, on the top level, part of the process by which the links between east and west, built up perforce during the war, were broken down again. Anxiety was shown as to the effect that contact with the higher standards of living of central Europe might have on the Soviet troops in occupation, and propaganda for their re-education was undertaken. The party itself was subjected to a purging process to get rid of persons who had entered during the war and who did not show sufficient political aptitude for its peacetime tasks; the old standards of indoctrination were demanded once more.

A new emphasis, foreshadowed during the war, was laid on the Russian element in the Soviet Union. It became official doctrine that even prerevolutionary Russia had been a progressive force in relation to the subordinate nationalities absorbed within the Russian empire, and the histories of the latter were rewritten in accordance with this. The language policy exalting the role of Russian, for which a theoretical basis was given in Stalin's attack on the philological theories connected with the name of Nikolay Marr, must also be noted in this connection.

The most effective antidote to the survivals of "bourgeois nationalism" which were regularly castigated in the Soviet press was biological rather than cultural. The policy of large-scale population movements for economic and political reasons would tend to break up the national homogeneity of all the republics and in the long run to create a single undifferentiated Soviet type.

In cultural matters, the same general trend toward Russian self-sufficiency was seen. Much emphasis was laid on the priority of Russian scientists in discoveries in all important fields. Zhdanov began a campaign against all signs of "servility" toward western cultural models in 1946, and this continued in subsequent years. Science also was forced to conform to the dominant ideology, a high light in the process being the formal proscription in 1948 of all theories of genetics other than those of the I. V. Michurin–T. Lysenko school.

Foreign Policy, 1945–53.—The disagreements between the Soviet government and its wartime allies which had become apparent before the end of the war were soon to assume a shape that made further co-operation impossible. Although the Soviet representatives continued to take part in the work of the United Nations (except for the period Jan.–Aug, 1950 when they absented themselves as a result of the dispute over the membership of Communist China), that organization was in fact little more than a forum where the disagreements between the Soviet Union and its associates on the one hand and the rest of the world on the other could be aired. On the matter of disarmament, both conventional and atomic, no agreement was reached. The fact that the Soviet Union was experimenting with atomic bombs was admitted by Stalin in Oct. 1951; and in later developments the Soviet claimed to be keeping abreast of the west.

In Europe, a conference in Paris was held in 1946 for discussion of the draft treaties with Italy, Rumania, Hungary, Bulgaria and Finland; these were finally signed in the following year. But there was no agreement either on Austria or on Germany. Continued friction with the western powers over policy in the occupied countries, particularly in Germany, culminated in the effort to dislodge them from Berlin in 1948 through an economic blockade that was frustrated by the air lift. An attempt to deal with the outstanding issues led to a long, fruitless four-power conference of foreign ministers' deputies at Paris in the spring of 1951.

The U.S. offer of support to Greece and Turkey and of economic aid to Europe in 1947, and the refusal of the Soviet Union

to participate in the organization for its distribution or to allow either Poland or Czechoslovakia to do so marked the turning point of the postnar period The success of the European Recovery program made the triumph of Communism in western Europe unthinkable without direct Soviet aid. In eastern Europe the result was to accelerate the Soviet effort (nhich had already gone a long way) to convert the nhole area into a series of Communist-ruled satellites that would be totally dependent on the Soviet Gnion economically politically and militarily as well

The symbol of the new situation was the creation in Sept. 1947 of the Communist Information bureau or Cominform with its headquarters in Belgrade, Yugos.. linking together the Communist parties of Europe and being the successor to some extent to the defunct Comintern. Its formal and overt expression was the series of treaties between the Soviet Union and the eastern European countries Czechoslovakia. Dec. 12, 1943; Yugoslavia. June 8, 1946; Albania, July 1947; Poland Jan. **26, 1948;** Rumania, Feb. **4,** 1948; Hungary Feb. **18.** 1948; Bulgaria, March **18** 1948; Finland April 6, **1948.** Treaties between many of these states were also concluded. The eastern German government set up by the Russians in Oct. 1949 belonged to the same grouping.

In **1948** two crucial developments took place. Czechoslovakia. which (though less independent than Finland) had retained a democratic form of government. was forced in a crisis in February to accept Communist rule and rapidly began to travel the same Soviet path as its neighbours. In June the friction betneen Marshal Tito of Yugoslavia and the Russians over the methods of control adopted by the latter broke into the open. The Soviet-Yugoslav treaty was denounced by the Soviet government and Yugoslavia was expelled from the Cominform. which moved its headquarters from Belgrade to Bucharest. Rum.

For the purposes of propaganda, a Soviet-inspired world peace movement nas set up in March 1950.

The *Far* **East** — The end of World War II saw Russia entrenched in Manchuria and North Korea facing the United States as the occupying power in Japan and South Korea. The presence of Soviet troops in Manchuria was used in such a way as to give certain advantages to the Chinese Communist forces when they advanced into it from their strongholds in the north. For a long time, as the Chinese civil war developed, the Russians gave no outward indication of a change in their formal relations with the Chinese government. perhaps calculating that they could not hope for more than that the Chinese Communists should become strong enough to force Chiang Kai-shek to abandon his alignment with the United States, the country that was increasingly regarded as the Soviet Union's main enemy in the postwar world. The picture was changed by the Communist victories in 1948–49. On Oct. 2, 1949 the U.S S R. broke off relations with the Chinese Nationalists and recognized the government set up at Peking by Mao Tse-tung. The Chinese leader went to Moscow in December, and on Feb. **14,** 19**jo,** a series of new agreements was signed

Elsewhere in Asia the Russians showed full sympathy with all movements against restoring the prewar position of the main colonial powers. When national independence had been wholly or largely achieved, they expressed doubts as to its reality and gave support to local Communist movements. These Communist movements had gained ground particularly in southeastern Asia and took to open violence in Indochina, Burma, the Philippines and Malaya. When North Korea attacked South Korea in June 1950, the Russians proclaimed that the attack had in fact been launched by the South Koreans at U S. instigation; but in June 1951 they took the initiative which ultimately led to an armistice agreement two years later.

I. AFTER STALIN'S DEATH

The death of Stalin on March 5, 1953, was followed, after some hesitation, by the emergence of a new pattern of collective rule. Stalin's position as head of the government was occupied by G. M. Malenkov. while N. S. Khrushchev rapidly rose to the summit of the party hierarchy. V. M. Molotov returned to the foreign office and the veteran Marshal K. E. Voroshilov became chairman of the presidium. The "doctors' plot" was exposed as a falsehood and there were indications that the new regime intended to relax tension at home and abroad and to concentrate on the provision of a better life for Soviet citizens. On July 10, 1953, it was announced that L P. Beria had been expelled from his post at the head of the political police organizations; he was later executed. On the other hand, there were no important developments in the Soviet attitude toward concrete external problems. A series of long-range exchanges about Germany led to an abortive conference in Berlin from Jan. to March 1954. The far eastern conference at Geneva from April to July showed that the Soviet Union was determined to preserve its close links with Communist China as the basis of its Asian policies. The Soviet Union showed its increased confidence in the Chinese regime by agreeing. on Oct. 11, 1954, to return to China the naval base of Port Arthur, to give China further credits and to abandon its share of the joint stock companies set up in 1950. In November, the Soviet Union called a European Security conference in Moscow (attended in fact only by the "satellites") and this was clearly a reply to the west European London and Paris agreements. An initial burst of greater cultural liberalism had been rapidly checked, but in April **1954** the Soviet Gnion rejoined UNESCO and thereafter the promotion of cultural exchanges with the non-Soviet world became an increasing feature of Soviet propaganda.

In 1955 there was a renewed shift away from concessions to the consumer and toward concentration on heavy industry and defense. On Feb. **8** Malenkov was replaced by N. A. Bulganin as prime minister; and Marshal G. K. Zhukov succeeded the latter as defense minister, thus symbolizing the re-emergence of the professional soldiers which had begun with Stalin's death. The conclusion of an Austrian peace treaty on May 1j suggested that the Russians might be willing to try again for a united Germany, but the Geneva conference in July and its sequel, the foreign ministers' meeting in Oct.–Nov. 1955, registered no important changes. More important were Soviet moves to win over the "uncommitted countries." Relations with Yugoslavia were normalized; and with J. Nehru's visit to the U.S.S.R. in June, a Soviet propaganda offensive began in Asia, signalized by the Asian tour of Bulganin and Khrushchev in November, and Mikoyan's visit to Pakistan and India in March **1956.** In the autumn of 1955, increased activity in the middle east was noted. At the 20th congress of the party in Feb. 1956, Khrushchev showed himself to be the dominant figure in the regime; major interest at the congress was concentrated on his denunciation of the personal rule and cult of Stalin.

In foreign affairs, the attempt to create a better atmosphere in relations with the west continued. Bulganin and Khrushchev visited Great Britain in April **1956** and the French prime minister and foreign secretary visited Moscow in the following month. In neither case. however, did the Russians show willingness to depart from their essential positions in foreign policy. The British visit was chiefly notable for friction between the Russian visitors and the leader of the Labour party, Hugh Gaitskell, arising out of the latter's enquiry about imprisoned Social Democrats in eastern Europe. On June 1 Molotov resigned from his post of foreign minister on the eve of a visit to Moscow by Marshal Tito. Molotov nas succeeded by Dmitry Trofimovich Shepilov, but on Feb. 15, **1957,** Shepilov was replaced in turn by Andrey Andreyevich Gromyko.

Tito's talks with the Soviet leaders resulted in their guarded acceptance of the right of other Communist parties and countries to pursue their own paths to "Socialism."

The Soviet Union's relations with the eastern European people's democracies deteriorated seriously during the second half of **1956,** and Russian military and economic control of the area was endangered. Revolt broke out in Poland in June and in Hungary in October. Polish army tanks quelled the rioters in Poznan, but Soviet divisions had to be sent to Hungary to maintain control. In Poland an alternative Communist leadership under Wladyslaw Gomulka gained concessions while preserving the Soviet alliance. In Hungary no similar ready alternative was found.

Despite these setbacks in eastern Europe, Soviet foreign policy became increasingly active in the middle east. The supply of

arms to Egypt, which was one of the causes of the Suez crisis: was follow-ed up later by the threat to despatch "volunteers" in reply to the British-French action there. Soviet influence extended to other middle eastern countries, notably Syria. In 1957 Molotov attempted to challenge Khrushchev's party leadership while the latter was temporarily out of the country, but he was defeated and expelled from the central committee. The following year Khrushchev consolidated his position by becoming chairman (premier) of the Council of Ministers of the U.S.S.R. as well as first secretary of the party.

Soviet scientists, on Oct. 4, 1957, put the first man-made satellite (Sputnik) into orbit around the earth. It mas followed by others and in 1959 a Soviet space vehicle reached the moon and another photographed the far side of the moon.

In Sept. 1959 Khrushchev visited the C.S. where he addressed the U S general assembly on Sept. 18, and late in March and early in April 1960 he conferred with Pres. Charles de Gaulle in France.

On May 1. 1960, a U.S. high-altitude reconnaissance airplane. designated a U-2, crashed in the U.S.S.R. and its pilot was captured. This led to the revelation that the United States had been conducting photographic missions over the U.S.S.R. for at least three years. In Paris, where the heads of the U.S.S.R., Great Britain, France and the U.S. convened for a "summit" conference in May, Rhrushchev demanded that President Eisenhower apologize to the U.S.S.R. for the U-2 incident and that the U.S. punish those responsible for the flight. His demand was refused and the conference collapsed before it began. Two weeks later the UN security council rejected the U.S.S.R.'s motion to censure the U.S. for the espionage flights. On Aug. 19 Francis G. Powers, the U-2 pilot, was sentenced by a Soviet military court to ten years imprisonment for espionage.

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VI. POPULATION

The population of the U.S.S.R. is shown in Table VIII. Although the population is the third largest of any state in the world, it is small in comparison with the vast area over which it is spread. According to the census of 1939, two-thirds of the country was occupied by only 6% of the population. while 48% of the population was concentrated in 6% of the territory.

Population Trends, 1897–1956.—The first Russian census was taken on Feb. 9 (N.S.), 1897, and recorded a population of 129,800,000 (including autonomous Finland and the protected states of Khiva and Bukhara). Within the reduced frontiers of 1921, this population was estimated at 106,080,000. The Russian statistician E. Z. Volkov estimated that in 1914, within the 1921 frontiers, Russia had a population of 142,389,000, an increase of 36,309,000 or 34.3% in 17 years.

The first Soviet census of Dec. 17, 1926, revealed a population of 147,027,915, an increase of only 4,639,000 or 3.5% in 12 years. If Russia had not been involved in World War I and the revolutionary upheaval that followed, its population in 1926 would have been about 175,000,000. The deficit of 27,600,000 is explained by the following estimates: war losses 2,000,000; decrease in the number of live births during the war and revolution 10,000,000; killed during the civil war, and deaths from famine and epidemics 13,600,000; refugees abroad 2,000,000.

The results of a second Soviet census in 1937 were never published. The third census of Jan. 17, 1939, recorded a population of 170,467,186, but two Soviet statisticians, S. A. Novoselsky and V. V. Payevsky, estimated in 1934 that the expected population of the U.S.S.R. in 1939 should be about 191,102,000. The deficit of 20,635,000 can be explained only by the assumption that during the period of forced collectivization of agriculture. of rapid industrialization and of the dissolution of family life by voluntary and compulsory migrations within the Soviet Union, mortality and the decrease in live births were much higher than statisticians expected.

Nevertheless, if the U.S.S.R. had not taken part in World War II, its population in 1945, within the prewar frontiers, would have been about 190,000,000. In fact, it was about 168,500,000, because of war losses, direct and indirect. The only official estimate of the number killed in fighting was given in 1946 as 7,000,000. Gen. Augustin Guillaume. chief of the French military mission to the Soviet Union, estimated this number at 7,500,000, to which he added 3,000,000 who died from wounds; he also estimated the number of civilians killed or dead from hunger and exhaustion, as well as the decrease in live births during the war, at a total of 11,000,000. On the other hand, as a result of Soviet annexations in the years 1939–45, the total population rose, at least theoretically, by 22,780,000. In *Pravda* of Jan. 23, 1946, the total population of the U.S.S.R., in its enlarged territory. was officially estimated by G. F. Aleksandrov: then propaganda chief of the Communist party, at 193,000,000. L. P. Beria said in 1951 that for several years the annual population increase had exceeded 3,000,000. N. S. Khrushchev revealed in 1956 that between 1950 and 195j the population increased by 16,300,000. In June 1956, however, the Soviet government estimated the population of the U.S.S.R. at 200,200,000. This figure suggested that Aleksandrov's estimate of 1946 was not true and that the total population was

TABLE VIII.—*Population of the U.S.S.R. according to the Census of Dec. 17, 1926, and Jan. 17, 1939*

Republics	Rural population			Urban population			Total population			Area*	Density of population per sq mi	
	1926	1939	Increase or decrease (%)	1926	1939	Increase (%)	1926	1939	Increase (%)	1939, up to Sept (thousand sq mi)	1926	1939
Russian S.F.S.R.	76,672,807	72,620,606	— 5.3	16,785,189	36,658,008	118.4	93,457,996	109,278,614	16.9	6,374.7	14.6	17.1
Ckrainian S.S.R.	23,669,381	19,764,601	—16.5	5,373,553	11,195,620	108.3	29,042,934	30,960,221	6.6	171.9	168.9	180.0
Byelorussian S.S.R.	4,135,410	4,195,454	1.5	847,830	1 ,	61.9	4,983,240	5,567,976	11.7	48.9	101.8	113.7
Azerbaijanian S.S.R.	1,664,187	2,049,004	23.1	649,557	1,160,723	78.7	2,313,744	3,209,727	38.7	33.2	69.7	96.7
Georgian S.S.R.	2,083,012	2,475,729	18.9	594,221	1,066,560	79.5	2,677,233	3,542,289	32.3	26.9	99.6	131.8
Armenian S.S.R.	714,102	915,183	28.1	167,098	,366,416	119.3	881,290	1,281,599	45.4	11.5	76.1	110.6
Turkmen S.S.R.	861,172	837,609	— 2.7	136,982	416,376	204.0	998,154	1,253,985	25.6	171.3	5.8	7.3
Uzbek S S.R.	3,553,158	4,837,382	36.1	1,012,274	1,445,064	42.8	4,565,432	6,282,446	37.6	146.1	31.2	43.0
Tajik S.S.R.	926,213	1,233,209	33.1	106,003	251,882	137.6	1,032,216	1,485,091	43.9	55.5	18.6	26.7
Kazakh S.S.R.	5,554,995	4439,787	—21.1	519,074	1,766,150	218.7	6,073,979	6,145,937	1.2	1,059.6	5.7	5.8
Kirghiz S.S.R.	879,364	1,188,714	352	122,333	270,587	121.2	1,001,697	1,459,301	45.7	75.9	13.2	19.2
Total for the U.S.S.R.	120,713,801	114,557,278	— 5.1	26,314,114	55,909,908	112.5	147,027,915	170,467,186	15.9	8,175.5	17.98	20.85

*According to an official Soviet computation (1939).

then not 193,000,000 but about 175,000,000.

Vital Statistics. — Before World War I the rate of increase of the population in European Russia was high. However, between 1900 and 1913 the birth rate fell. although only from the high rate of 51.0 to 47.0 per thousand. The death rate also fell from 32.3 to 30.2 per thousand and the rate of natural increase therefore fell from 18.7 to 17.4 per thousand.

Between 1927 and 1938 the estimated birth rate fell from 45.0 to 38.3 per thousand. the death rate fell from 26.0 to 17.8 per thousand; but the rate of natural increase rose from 19.0 to 20.5 per thousand. The birth rate was lower than in pre-1914 Russia, but so was the death rate and the latter change was due to improvements effected by the Soviet government, particularly through the provision of medical services and of instruction in hygiene. Unsatisfactory living and working conditions helped, however, to make the death rate higher than in western Europe and North America. In 1939, for instance, the death rate was 12.2 per thousand in the United Kingdom and 10.6 per thousand in the United States. The infant mortality rate in Russia was 266 per thousand live births in the years 1909–10 and 187 in the years 1926–27; it was then still one of the highest in the world, as compared (for 1926–30) with 70 per thousand in the United Kingdom and 68 per thousand in the United States. In 1951 Beria said that between 1940 and 1951 the death rate had been halved and infant mortahty had been even more greatly reduced. In 195j the birth rate was said to be 25.6 per thousand and the death rate 8.4 per thousand, which suggested a natural increase of 17.2 per thousand.

Ethnic Groups. — In ethnographic character the population of the U.S.S.R. is remarkably varied. The Soviet Academy of Sciences represented the country as being inhabited by 169 ethnic groups, divided into ten major divisions as follows: Indo-European 36 groups. Caucasian (Japhetic) 40, Semitic 6, Finno-Ugrian 16, Nenets (Samoyed) 1, Turkic 48, Mongol 3, Tungus-Manchurian tribes 6, Palaeo-Asiatic 9 and groups of tribes from the far east with an ancient culture 4. (See Table IX.)

The 1926 census took place at a time when the official approach to the problem of nationality was unbiased, while that of 1939 was taken in an atmosphere of struggle against "bourgeois nationalism," especially in the Ukraine and the Turkic republics. This helps to explain why the number of Russians rose by 21,229,000 (from 52.9% to 58.2%) while the number of Ukrainians fell by 3,125,000 (from 21.2% to 16.5%). According to 1939 estimates, the annexation in the west increased the number of Ukrainians by 5,743,000 and, as the natural increase among them was high, their total number in 1955 was estimated at 36,657,000, 18.31% of the total. The number of Byelorussians increased as a result of the annexation by 1,458,000 (1939 est.) and their total number in 19jj was estimated at 7,067,000 (3.53%). These annexations, as well as the annexation of Estonia, Latvia and Lithuania, of Rumanian Bessarabia and northern Bukovina, resulted in a reduction of the percentage of the Russian population: in 1954 they were 52.31% of the total. The number of Poles, both Polish and Soviet citizens, scattered throughout the Soviet Union in its new frontiers, was estimated in 194j at 3,400,000; 1,503,816 had returned to Poland by June 30, 1949, when re-emigration was stopped. Including the small number of Czechs, Slovaks and Bulgars, the total proportion of Slavs among the population of the U.S.S.R. is more than 75%.

TABLE IX.—*U.S.S.R.: Population by Nationality*

Nationality	1926*		1939*		1956*	
	In 000	%	In 000	%	In 000	%
Russian	77,791	52.9	99,020	58.2	104,725	52.31
Ukrainian	31,195	21.2	28,070	16.5	36,657	18.31
Byelorussian	4,739	3.2	5,267	3.1	7,067	3.53
Polish	792	0.47	627	0.36	1,902	0.95
Finnish (Karelian)	387	0.26	396	0.23	480	0.24
Estonian	156	0.11	142	0.08	1,041	0.52
Other Finno-Ugrian†	2,749	1.87	3,068	1.8	3,824	1.91
Latvian	154	0.1	127	0.07	1,802	0.9
Lithuanian	43	0.03	32	0.02	2,402	1.2
German	1,247	0.85	1,424	0.83	1,622	0.81
Rumanian (Moldavian)	279	0.2	260	0.15	2,282	1.14
Georgian	1,821	1.2	2,249	1.3	2,763	1.38
Armenian	1,568	1.1	2,152	1.26	2,662	1.33
Turkicf	17,194	11.7	19,454	11.3	23,023	11.5
Tajik	981	0.67	1,229	0.72	1,522	0.76
Jewish	2,672	1.8	3,020	1.8	1,902	0.95
All others	3,260	2.34	3,030	2.08	4,524	2.26
Total	147,028		170,467		200,200	

*Numbers for 1026 and 1939 according to the Soviet censuses: those for 1956 are estimates for an area increased by annexations.

†Mordvinians, Udmurtians, Marii, Komi, etc.

‡Incl. Uzbeks, Tstars, Kazakhs, Azeris, Kirghiz, Turkmen, Bashkirs, Chuvashes, etc.

§Iranian nationalities of the Caucasus (Ossetians, Lezghians and 32 other groups), Mongols (Buriats, Kalmyks, etc.), Siberian nationalities (Tungus, Ostyaks, Nentsy, Chukchi and 21 other groups), as well as Greeks, Koreans, Chinese, Arabs, etc.

After the Slavs the Turkic peoples are the most numerous and important. The Turkic race (Uzbeks, Turkmen, Kirghiz, Kazakhs, etc.) is most continuous in the central Asiatic republics. The Yakuts of the Lena represent a northeastern spread of the Turkic element, now much intermingled with Slavonic blood. In 1943–44. as a result of their alleged collaboration with the Germans, the Turkic peoples of the Crimea (Tatars) and the northern Caucasus (Karachays and Balkars), numbering together about 378,000, were deported to central Asian republics. Between 1926 and 1939 the total number of the Turkic peoples rose by 2,260,000, although that of the Kazakhs decreased by 869,500. It was assumed that their percentage remained the same as in 1939 and this gave 23,023,000 as an estimated number of Turkic peoples in 19jj. (See TURKS OR TURKIC PEOPLES.)

The Finno-Ugrian aboriginal population, Karelians, Mordvinians, Udmurtians (Votyaks), Marii (Cheremis), Komi (Zyryans and Permyaks), and the allied Samoyedes or Nentsy, were increasingly pushed outward by the Slavonic settlement. Finns are to be found mainly in the north and west and also in a belt of Finnish settlement in Asiatic Russia, lying north of the main Slavonic belt and extending to the Yenisei, again much intermingled with the incoming Slavonic population. With the exception of the Finns of Karelia and of Estonians, the number of Finno-Ugrian nationalities was estimated in 195j at 3,824,000 (1.91% of the total).

The relatively high number of Rumanians (Moldavians) within the new frontiers of the Soviet Union is explained by the annexation of Bessarabia. The Volga German A.S.S.R. was dissolved on Sept. 24, 1941, and about 406,000 Germans were transferred to Kazakhstan. The reduction of Jews by 1,118,000 was the result of the extermination policy during the German occupation of the Ukraine and Byelorussia, where the Jewish population mas mainly concentrated.

The Mongol peoples were estimated in 1939 at about 450,000. The 325,000 Buriats are to be found west, south and east of Lake Baikal. They form the chief population of the Buriat Mongol A.S.S.R., as well as of the Ust-Orda and Aghin national districts included in the Irkutsk and Chita regions respectively. The 135,000 Kalmyks (or Kalmucks) who in the 18th century settled in the steppe northwest of the Caspian and south of the lower Volga were deported to Siberia in Dec. 1943 on allegations of pro-German sympathies during World War II. For similar reasons the Chechens and the Ingush, two aboriginal peoples living on the northern slopes of the central Caucasus, followed the Kalmyks in March 1944.

Movements of Population. — The institution of serfdom restricted the tendency of the people to wander and to colonize, and after the abolition of serfdom in 1861 movements of the population greatly increased. The existence of large areas that were unsettled or sparsely populated encouraged colonization, but in the 19th and early 20th centuries political discontent was so great that large numbers of non-Russians emigrated abroad. In the period 1891–1900, for instance, 594,000 Russian subjects (mainly Poles and Jews) emigrated to the United States, and between 1900 and 1909 the number rose to 1,400,000. There was also a considerable movement of people inside Russia from the more thickly populated regions of European Russia. in particular from the black earth belt and from the western and southwestern Ukraine, to the south and southeast and — beginning in the last quarter of the 19th century — to the Urals, Siberia and the far east. The government's policy of encouraging migration to the Urals, initiated at the end of the 19th century, resulted in the following increases: 300,000 in 1861–8j, 450,000 in 1886–94, 1,440,000 in 1895–190j and 3,274,000 in 1906–13.

The problem of populating Siberia was difficult. By the end of

the 19th century a policy of exile as a means of colonization had gained acceptance and, like the convicts transported to the British colonies in the 18th and 19th centuries, men were sent to Siberia for trifling offenses. Old Believers, after the great schism in the Russian Orthodox Church, the rebel palace guards under Peter the Great and. after the Northern War, Swedish prisoners of war were sent to Siberia. The Polish confederates under Catherine II, the Decembrists under Nicholas I, nearly 50,000 Poles after the insurrection of 1863 and whole generations of Socialists, including 45,000 political exiles after the 1905 revolution, were also exiled to Siberia. In the early days they were driven in herds from village to village and often left to die of starvation on the road. In the 19th century the conditions were slightly improved, but the hardships of the journey and of climatic and living conditions continued to cause many deaths. Between 1823 and 1898 no fewer than 700,000 exiles with 216,000 voluntary followers went to Siberia. In 1900 exile as a means of political persecution was abolished, but it was restored again in 1904 because of the increasing political unrest.

The Soviet government continued the policy of sending political and criminal prisoners to Siberia, but on a far greater scale than before. It was officially stated that "forced labour is one of the basic measures of punishment of Soviet Socialist criminal law" (*Bolshaya* Sovietskaya *Entsiklopedia* [The Great Soviet Encyclopaedia], vol. 47, p. 36 [Moscow, 1940]), and the Corrective Labour code of the R.S.F.S.R. of Aug. 1. 1933, provided that political opponents of the regime and "class-hostile elements" be punished by forced labour. In addition to the penal and political motives of Soviet policy there are also the economic motives. V. M. Molotov, as chairman of the council of people's commissars, stated in 1931 that forced labour was employed in "high ay construction, in the building industry, in peat exploitation, in timber works, in mining, stone quarries, gravel and stone crushing, on transportation projects." These projects resulted in the organization of large forced labour camps in regions, such as the extreme north of Siberia and the Kazakh desert, where the climate is too severe for normal colonization and the work under primitive conditions is too arduous to attract voluntary labour. Evidence on the size of the population of forced labour camps in the Soviet Union is conflicting. The British undersecretary of state for foreign affairs gave on May 3, 1949, an estimate of this population on the basis of evidence in the hands of the British government as between 5,000,000 and 12,000,000.

The Soviet policy of planned resettlement, which was a part of the intensive policy of industrialization and of collectivization of agriculture, resulted in considerable movements of population. Between 1926 and 1939 more than 3,000,000 people were resettled in the Urals, Siberia and the far east. In certain areas the population increased by 33%. In the Sverdlovsk and Novosibirsk regions the increase was 53%, while in the Khabarovsk territory the population increased by 136%. In 1926 there were 14,747,000 inhabitants east of the Urals, excluding the central Asian republics; by 1939 their number had risen to 21,891,000. (See also SIBERIA.)

Simultaneously with the settlement of the east there was a flow of people to the industrial regions. In the period 1926–39 about 3,500,000 moved to the Moscow region, 1,300,000 to the Leningrad region and 350,000 to the Gorki region. In the Ukraine the population of the Staliqo region increased by 91% and of the Voroshilovgrad region by 37%. The republics of central Asia received about 1,700,000 settlers, thus increasing their population by 38%.

The third migratory stream in the Soviet period flowed north. Though on a smaller scale, this settlement of the extreme north, where in the past the population had been negligible, was important. The Murmansk region up to 1917 had a population of about 10,000; in 1928 it was about 22,000 and in 1939 it was 291,200. This growth of the population in the north was accompanied by industrial development.

Following World War II the continued policy of intensive industrialization in the Moscow region, the Ukraine, the Urals and Siberia undoubtedly led to further increases in the urban population and to further movements of population to industrial areas, particularly in the east. Figures were not, however, available after 1939.

Towns and Settlements. — The census of 1926 showed that there were 30 towns with populations of more than 100,000. All these had grown considerably since the census of 1897, with the exception of Odessa. which had declined because of the diminished trade in the Black sea and the loss of Bessarabia to Rumania. Two cities had more than 1,000,000 inhabitants according to the census of 1926: Moscow (2,029,425) and Leningrad (1,690,065). Kiev, Baku, Odessa and Kharkov had more than 400.000 inhabitants, while Gorki (Nizhny-Novgorod), Tbilisi (Tiflis), Dniepropetrovsk, Saratov, Tashkent and Rostov-on-Don had more than 200,000 inhabitants.

The census of 1939 showed that 11 cities had a population of more than 500,000. In 1956 it was estimated that there were 21 cities with a population of more than 500,000. (See Table X.)

The growth of the town population in Russia in the 20th century was striking. Between 1897 and 1914 it increased from 15,825,600 to 24,686,600; *i.e.*, from 14.8% to 17.7% of the total population. From 1926 to 1939 it rose from 26,314,100 to 55,909,900; from 17.9% to 32.8% of the total. In 1956 the total population of 3,991 cities and towns of more than 10,000 inhabitants was estimated at 87,000,000 (43.5%).

The most rapid growth took place during the first two five-year plans (1928–32 and 1933–37) when the number of towns with 50,000 or more inhabitants increased almost four and one-half times. The number of towns with a population of 100,000 or more increased almost six times, while 10 new towns with a population of more than 100.000 and 20 with a population of more than 50,000 appeared.

The source of this new urban population between 1926 and 1939 was estimated as follows: from country to town, 18,500,000 (62.5%); natural growth of population, 5,300,000 (17.9%); villages converted into towns, 5,800,000 (19.6%).

In certain areas the growth of the town population was especially noteworthy. The Donets basin in 1926 contained a large number of small mining settlements and only 8 towns. By 1939 the region had about 60 towns, of which 13 had more than 50,000 inhabitants and 5 more than 100,000. Similarly, in the Urals the town population in 1926 was 1,251,000, concentrated in 27 towns of which only 3 had more than 50,000 and 2 had more than 100,000 inhabitants. By 1939 the town population had grown to 3,513,200, living in 47 towns of which 11 had more than 50,000 and 5 more than 100.000 inhabitants.

The rate of colonization of Siberia is illustrated by the growth of the towns. The population of Novosibirsk, for instance, was 5,000 in 1897 and had grown to 405,589 by 1939 and 731,000 in 1956; Omsk increased from 37,470 to 280,716 in 1939 and 1005,000 in 1956, and Vladivostok from 28,896 to 206,432 in 1939 and 265,000 in 1956. An even more striking illustration was the creation of new towns in the Kuzbas coal basin, some of which had populations of more than 100,000 in 1956: Stalinsk (Kuznetsk) 347,000, Kemerovo 240,000 and Prokopyevsk 260,000. Karaganda and Magnitogorsk did not exist in 1926, but in 1956 had 350,000 and 284,000 inhabitants, respectively.

The pattern of the old Russian towns reflected something of the long struggle against invaders, particularly against Asiatic nomads. This pattern was concentric with radiating streets and at the centre a *kreml,* kremlin or fort, built originally of timber, but later of stone. Another feature of Russian towns was the low wooden house on the outskirts of the same type as the peasant *izba* or hut. The smaller towns were distinguished by a single broad main street which in spring and autumn was a sea of mud. A few of the cities in the west, notably Kiev in 1499, obtained the Magdeburg rights (a civic constitution) under Polish rule and traces of western influence still remain in some towns. The influence of Byzantium was, however, far stronger throughout European Russia, and evidence of it may be found in all the older towns. The modern Soviet towns were planned with a water supply, electricity and sanitation. In the centre, at least, of these towns roads are laid and the houses no longer follow the old Russian pattern but are of brick and are severely utilitarian in design. But in both new and old towns the overcrowding is serious and the living con-

TABLE X.—*Population of Major Cities in the U.S.S.R. by Censuses of 1897, 1926, 1939 and 1956**

City	Population			
	1897	1926	1939	1956
Moscow (Moskva)	988,614	2,029,425	4,137,018	4,389,000†
Leningrad (Petrograd, St. Petersburg)	1,267,023	1,690,065	3,191,304	3,176,000‡
Kiev	247,432	513,637	846,293	991,000
Kharkov	174,846	417,342	833,432	877,000
Baku	112,253	453,333	809,347	901,000§
Gorki (Nizhny-Novgorod)	95,124	222,356	644,116	876,000
Odessa	405,041	420,862	604,223	607,000
Tashkent	156,414	323,613	585,005	778,000
Tbilisi (Tiflis)	160,645	294,044	519,175	635,000
Rostov-on-Don	119,889	308,103	510,253	552,000
Dniepropetrovsk (Ekaterinoslav)	121,216	236,717	500,662	576,000
Stalino (Yuzovka)	..	174,230	462,395	625,000
Stalingrad (Tsaritsyn)	55,967	151,490	445,476	525,000
Sverdlovsk (Ekaterinburg)	55,488	140,300	425,544	707,000
Novosibirsk (Novo-Nikolayevsk)	..	120,128	405,589	731,000
Kazan	131,508	179,023	401,665	565,000
Kuybyshev (Samara)	91,672	175,636	390,267	760,000
Saratov	137,109	219,547	375,860	518,000
Voronezh	84,146	121,612	326,836	400,000
Yaroslavl	70,610	114,277	298,065	374,000
Zaporozhye (Aleksandrovsk)	..	55,744	289,188	381,000
Ivanovo (Ivanovo-Voznesensk)	53,949	111,460	285,069	319,000
Archangel (Arkhangelsk)	..	76,774	281,091	238,000
Omsk	37,470	161,684	280,716	505,000
Chelyabinsk	..	59,307	273,127	612,000
Tula	111,048	155,005	272,403	320,000
Molotov (Perm)	45,403	119,776	255,196	538,000
Astrakhan	112,880	184,301	253,655	276,000
Ufa	49,961	98,537	245,863	265,000
Irkutsk	51,434	108,129	243,380	314,000
Makeyevka	..	79,421	240,145	311,000
Minsk	91,494	131,803	238,772	412,000
Alma-Ata (Verny)	..	45,395	230,528	330,000
Zhdanov (Mariupol)	31,772	63,920	222,427	273,000
Kalinin (Tver)	53,477	108,413	216,131	240,000
Voroshilovgrad (Lugansk)	..	71,765	213,007	251,000
Vladivostok	28,896	107,980	206,432	265,000
Krasnodar (Ekaterinodar)	65,697	161,843	203,946	271,000
Erivan (Yerevan)	29,033	64,613	200,031	385,000
Khabarovsk	..	52,045	199,364	280,000
Krivoy Rog	..	38,228	197,621	322,000
Krasnoyarsk	26,600	72,261	189,999	328,000
Taganrog	51,965	86,444	188,808	189,000
Izhevsk	..	63,211	175,740	252,000
Chkalov (Orenburg)	72,740	123,283	172,925	226,000
Grozny	..	97,087	172,468	226,000
Stalinsk (Kuznetsk)	..	3,804	169,538	347,000
Vitebsk	65,871	98,857	167,424	128,000
Nikolayev	92,060	104,909	167,108	206,000
Karaganda	—	—	165,937	350,000
Nizhny Tagil	..	38,820	159,864	297,000
Penza	61,851	91,924	157,145	231,000
Smolensk	46,889	78,520	156,677	131,000
Shakhty	..	41,043	155,081	180,000
Barnaul	29,408	73,858	148,129	255,000
Dneprodzerzhinsk (Kamenskoye)	..	34,150	147,829	163,000
Magnitogorsk	—	—	145,870	284,000
Gomel	33,846	86,409	144,169	144,000
Kirov (Vyatka)	..	62,097	143,181	211,000
Simferopol	48,821	87,213	142,678	159,000
Tomsk	52,430	92,274	141,215	224,000
Shcherbakov (Rybinsk)	25,223	55,546	139,011	162,000
Samarkand	54,000	105,206	134,346	170,000
Kemerovo (Shcheglovsk)	..	21,726	132,978	240,000
Poltava	53,060	91,984	130,305	129,000
Ulan Ude (Verkhne-Udinsk)	..	28,918	129,417	158,000
Ordzhonikidze (Vladikavkaz)	43,843	78,346	127,172	159,000
Ashkhabad (Poltoratsk)	..	51,593	126,580	142,000
Tambov	48,134	72,256	121,285	150,000
Kostroma	41,268	73,732	121,205	156,000
Kursk	52,896	82,440	119,972	179,000
Murmansk	..	8,777	117,054	168,000
Sevastopol	50,710	74,551	111,946	133,000
Orel	69,858	75,968	110,567	128,000
Semipalatinsk	26,353	56,871	109,779	136,000
Gorlovka	..	23,125	108,693	240,000
Prokopyevsk	..	10,717	107,227	260,000
Kerch	28,982	35,690	104,471	..
Dzerzhinsk (Rastyapino)	..	8,910	103,415	147,000
Chita	..	61,526	102,555	162,000
Ulyanovsk (Simbirsk)	43,298	70,130	102,106	183,000
Kirovograd (Elizavetgrad, Zinovievsk)	61,841	66,467	100,331	115,000

*Figures for 1897 shown only for cities with more than 25,000 population in that year. †Excluding suburbs. ‡2,814,000 without suburbs. §598,000 without suburbs.

NOTE: In addition to the above-mentioned there were in 1956 54 cities with a population of 100,000 or more, including 8 cities in the territories annexed in 1940.

Sources: S. S. Balzak, V. E. Vasyutin and Y. G. Feigin, *Economic Geography of the U.S.S.R.* (1949) and, for the 1956 estimates, *Narodnoye Khozyaystvo* **S.S.S.R.** (Moscow, 1956).

ditions of the people are often primitive.

VII. EDUCATION

In tsarist Russia schools were few and education was possible for only a small proportion of the population. Illiteracy was widespread: in 1897 about 76% of the people could neither read nor write. Successive governments had paid scant attention to the improvement of education. In 1895 there were in Russia only 9 universities with 13,976 students and 29,241 primary schools with 1,937,076 pupils.

During 1895–1904 some development of educational facilities, mainly in technical training, took place. These were years of industrial expansion, and the new industries created a need for technicians who could handle machinery. The plentiful unskilled peasant labour which had served Russian needs in the past was no longer adequate. In this period the numbers of medium and primary technical institutes increased from 51 to 93, of handicraft schools from 91 to 237, of communal schools from 6 to 139. But these and other developments directly concerned the technical needs of the new industries and did not greatly affect the general problem of illiteracy in Russia. The Soviet government found itself confronted with this problem and achieved in many respects remarkable success toward solving it.

By 1955 there were in the U.S.S.R. 213,000 primary (four- to seven-year) and secondary (ten-year) schools with a total of 30,070,000 pupils and 1,733,000 teachers. In 1939, within the frontiers of 1921, there had been 31,517,000 pupils. In 1914, within the same frontiers, there had been 7,260,000 pupils in 93,311 elementary and 764,600 in 459 secondary schools. The totals for 1955 included about 3,757 secondary technical schools with 1,960,500 pupils. In 1914 there had been only 295 schools of this type with a total of 35,800 pupils.

There were, by 1956, 31 universities and 734 other institutions of higher education (V.U.Z.), including 375 teachers' colleges, with 1,867,000 students, including 639,000 taking correspondence courses. The teaching staff numbered more than 100,000. In 1938 there had been 23 universities and 727 V.U.Z. with 602,900 students. In 1914 there had been 10 universities and 81 institutions of higher education with a total of 112,000 students. A further illustration of the Soviet government's achievement is to be found in the figures for illiteracy: the percentage of illiterates had been reduced to 48.9% by 1926 and to 18.8% by 1939. This latter figure was further reduced after 1939, universal education at least to the extent of the elementary four-year school being achieved.

Early **Soviet** Measures.—The Bolshevik revolution of 1917 was followed by the destruction of all tsarist institutions and systems. The old ministry of education was replaced by two new bodies, the people's commissariat for education and the state commission for education, the latter being headed by Anatoly V. Lunacharsky. Within a week of the revolution Lunacharsky summarized the tasks in education as folloxvs: abolition of illiteracy as quickly as possible; introduction of universal, compulsory and free education; establishment of institutes and seminaries for the train-

ing of "people's teachers." A fourth point might have been added concerning the association of the church with education. Militant atheism was proclaimed by the Communist leaders as part of their policy. In Dec. 1917 the people's commissariat for education issued an ordinance bringing under its authority all church schools, seminaries and academies, and on Jan. 21 (Feb. 3), 1918, a decree of the council of people's commissars disestablished the church and introduced secular education. Another important innovation was the introduction of coeducation by decree dated May 31, 1918.

A decree of Oct. 16, 1918, codified the educational measures introduced after the revolution. The declaration of the state commission for education attached to this decree gave the name "united labour school" to all schools under the people's commissariat for education. The new school was divided into two grades: grade I for children 8 to 13 years of age, and grade II for children 13 to 17 years of age. Education was free and compulsory, although in practice the great shortage of schools and of qualified teachers made it impossible for more than a small proportion of children to attend. Further innovations were the abolition of the old forms of discipline and punishment, of homework and examinations. Schools were to be run by school soviets in which senior pupils took part. Teachers were to be known as school workers and were to concentrate on breaking away from the old tsarist methods and on practising Communist methods of teaching.

The "liquidation of illiteracy" was recognized by the new regime as one of its basic tasks, and on Dec. 26, 1919, the council of people's commissars directed that "the entire population of the republic between the ages of 8 and 50, unable to read or write, be obliged to become literate in either their native or the Russian language, according to their preference." But implementation proved difficult, particularly in a country rent by civil war. Finally on Jan. 26, 1930, the central executive committee of the party and the council of people's commissars issued a joint ordinance setting up special local committees for the liquidation of illiteracy to be attached to each regional and district executive committee.

University education also received close attention. On Aug. 2, 1918, a decree of the council of people's commissars opened all institutions of higher education to all citizens over 16. In Sept. 1919 universities were directed to provide special courses, known as "worker's facilities," to prepare workers and peasants for higher education.

The Educational Reform.—It was soon found that most of these innovations were unsatisfactory. Teachers were unable to enforce discipline, and conditions in schools were chaotic. Nor were the new teaching methods found to equip the young Russian or non-Russian citizen to assist in the reform and development of the country along the lines laid down by the party.

An order of the central committee of the party issued on Sept. 5, 1931, contained the first suggestion of change. The order pointed to "certain serious defects" in Soviet education and specified changes to be made in the syllabus for schools. An order of Aug. 25, 1932, called for a recasting of the programs of schools and a revision of the syllabuses. The brigade system of teaching was abandoned and teachers were directed to give individual instruction. Examinations and discipline were revived.

An order of May 16, 1934, replaced the united labour school with the general educational school, divided into three stages. The elementary school contains four classes and is known as the four-year school. Until the ordinance of the council of people's commissars on Sept. 8, 1943, compulsory education began in the four-year school at the age of eight years, but the ordinance changed it to seven. The second stage is the seven-year school or the incomplete secondary school, containing seven classes. The third stage is the secondary school proper, knoan as the ten-year school and containing ten classes. The government in its attempts to achieve universal compulsory education was faced with many difficulties, particularly the shortage of teachers and of school accommodation. It was nevertheless claimed by Stalin at the 16th party congress in 1930 that compulsory education had been introduced throughout the G.S.S.R. It would seem, however, that only four-year education, the equivalent of European elementary education, had been introduced. The 18th party congress, held in 1939, proclaimed that the aim must be to achieve ten-year or complete secondary education in towns and workers' settlements and seven-year education in the country. World War II prevented the realization of this aim and it was made one of the tasks of the fourth five-year plan (1946–50). The Soviet government released little factual information after World War II on the success or failure of these plans, but an announcement on Aug. 17, 1949, stated that the school year 1949–50 would see in the R.S.F.S.R. "seven-year education on a very wide scale." This suggested that even in the towns of the most highly developed of the republics the ten-year school was not common, while in the less well-developed areas even the seven-year school was not always found.

An important amendment to the strongly proclaimed Communist principle of free education as a right of all citizens was the introduction in 1940 of fees in the senior classes of secondary schools and in higher educational establishments of the U.S.S.R. The fees were made payable in the three senior classes of the complete secondary school and in higher educational establishments. Free education and stipends were allowed in these grades only to students of outstanding ability. Subsequently students in military academies, in national theatrical. musical and ballet schools, children of noncommissioned members of the army and navy and, in certain circumstances, children of persons drawing invalid pensions were also exempted. The reasons for this change in the government's policy were not clear. It was suggested that it was due to anxiety to divert the younger generation from higher education to factory work and to military training and to meet the urgent need for medium-grade experts. In his report to the 20th congress of the Communist party in 1956, Khrushchev announced that it had been decided to abolish these fees, beginning with the school year 1956–57.

Mention should also be made of the abolition of coeducation by the ordinance of July 16, 1943, which called for separation of the sexes in secondary schools as rapidly as facilities would permit.

Higher *Education*.—The educational system includes the specialized secondary educational establishments and the higher educational establishments. The former serve to train technicians and specialists of the middle grade, which includes elementary school teachers. Pupils who have completed the seven-year school are eligible for these establishments, at which they receive stipends, free training and subsistence allowances.

The higher educational establishments comprise the universities and certain institutes which train top-grade specialists. These institutions are charged uith the task of training intellectuals and in particular technicians whom the party can entrust with the carrying out of its policies and above all its policy of intensive industrialization. The two most important pronouncements affecting higher education were the resolution of the party central committee of July 17, 1928, on improving the training of new specialists and the joint ordinance of June 23, 1936, issued by the party central committee and the council of people's commissars on the work of the higher educational establishment. The former devoted considerable attention to the development of new cadres and specified that by 1932 the number of engineering and technical specialists in heavy industry should be doubled. The ordinance of 1936 in many respects produced a reorganization of higher education. Students to be eligible for higher educational establishments had to complete the full ten-year school and also to pass a special entrance examination. The ordinance then laid down the conditions applying to the professorial staff, the examining of students and the granting of grade I and grade II diplomas.

A further change nas made by a joint ordinance of Dec. 1935 abolishing the ban against the admission of people of undesirable social origin and of the children of parents with "limited social rights" to higher educational establishments. This reform was part of the general abolition of proletarian class privileges which came with the introduction of the new Stalin constitution of 1936.

In 1956 Khrushchev revealed that during 1951–55 more than 1,120,000 specialists graduated from institutions of higher education, as compared with 651,000 during 1946–50. In addition, 1,561,000 specialists graduated during 1951–55 from secondary technical schools. He added, however, that quantity was not enough and the

quality of specialist training was not always adequate. A big shortcoming was that the institutions of higher education were "divorced from practical work, from production, and lagged behind the present-day level of technology." He also mentioned that the time had come to put some of these institutions, particularly agricultural colleges, in the centres of production instead of in big cities.

The Content of Education. — All education in the Soviet Union is permeated by the ideology and directed by the needs of the Communist party. The Communist party program laid down that the task of Soviet education was to "transform the school from being a weapon of bourgeois class rule into a weapon of Communist society." The *Bolshaya Sovietskaya Entsiklopedia* (Great Soviet Encyclopaedia, 1st ed., vol. *44)* said: "Pedagogy is a true science only if it is based on the teachings of Leninism-Stalinism." In the special volume devoted to the U.S.S.R. (1948), it defined the tasks of Communist education as follows:

To develop in children's minds the Communist morality, ideology and Soviet patriotism; to inspire unshakeable love toward the Soviet fatherland, the Communist party and its leaders; to propagate Bolshevik vigilance; to put an emphasis on atheist and internationalist education; to strengthen Bolshevik will-power and character, as well as courage, capacity for resisting adversity and conquering obstacles; to develop self-discipline; and to encourage physical and aesthetic culture.

Such a creation of a new man is brought about not only by the teachers in the course of the schooling period, but also by the whole system comprising the Pioneer and Youth organizations, as well as by the Pupils' and Parents' committees. Of basic importance are: good conduct of the pupils; observance of a strong discipline; respectful attitude of the pupils toward the teachers; good comradeship; protection of public property and energetic suppression of every manifestation of hooliganism and anti-social behaviour among the children.

An important development was foreshadowed in Khrushchev's statement that it was desirable to start building, in picturesque suburban localities, boarding schools at which children should be enrolled only at the request of their parents and which should be staffed by teachers equal to the high calling of "engineers of the souls" of the growing generation. Fees should be graded according to the parents' earnings.

VIII. RELIGION

The Orthodox Church. — Under the tsars the Orthodox Church was the established church to which the vast majority of the people belonged. Other religions were permitted but did not enjoy the same freedom as the established church, and adherents of certain religions, as, for example, the Uniate rite of the Roman Catholic Church, Islam and Judaism, were at times actively persecuted. At no time, however, had religion in Russia been subjected to such organized persecution as under the Soviet regime. The reason for this is that the Communist party is based on an ideology materialistic in character and militantly atheistic in action.

Both World War I and the democratic revolution of March 1917 produced a certain revival among the Russian Orthodox followers and also a tendency toward independent enquiry. On Nov. 1, 1917, the holy synod of 12 principal hierarchs suppressed the office of chief procurator, a layman described as the "tsar's eye" in church affairs. The patriarchate. which had been abolished by Peter I in *1721,* was restored and Tikhon (Vasily Belyavin, 1865–1925), the archbishop of Moscow, was enthroned on Dec. *4, 1917,* with the historic title of patriarch of Moscow and all Russia. The Soviet government reacted strongly and their first campaign of persecution lasted until 1923. On Feb. *j, 1918,* the Orthodox Church was disestablished; church property was seized and confiscated; divine service was allowed only under certain highly restrictive conditions; religious instruction was prohibited in schools and for groups of children under the age of *18* years. In an attempt to weaken the Orthodox Church the government sought to create a schism by supporting a new religious organization, the so-called "Living Church," but this collapsed through lack of popular support. In May *1922* the patriarch was imprisoned, with a large number of bishops and priests; his release in June 1923, the result of popular protests, marked the end of the first campaign.

The second period of persecution lasted from 1923 to 1930. It differed from the first period in that direct attacks on the clergy more or less ceased and the party concentrated on antireligious propaganda. A special publishing house called Bezboahnik ("The Godless") had been set up in Feb. *1922* to print and disseminate antireligious material. An antireligious seminary was opened. and the celebration of Christmas and Easter in 1923 was marked by mock processions and services designed to hold religion up to ridicule. The foundation of the League of Militant Atheists on Feb. 7, *192;*. which became the centre of violent antireligious propaganda, was the most important step in the government's campaign. When Tikhon died on April *7, 1925,* his funeral was made the occasion for an immense demonstration of popular affection. Metropolitan Pyotr Krutitsky took over as locum tenens (temporary patriarch) but he was soon exiled to Siberia. He was succeeded in *1926* by Metropolitan Serghiy (Ivan N. Stragorodsky, 1867–1944). As the holy synod was forbidden to elect a successor to Tikhon, Serghiy mas only the acting patriarch.

In the third period the persecution took the form of a renewal of attacks on churches and on the clergy. Hundreds of priests were arrested and many were sent to the dreaded Solovetsky concentration camp on the White sea. But despite the innumerable restrictions, the imprisonment of the clergy and the wide use of antireligious propaganda, the church retained its large following, and it was apparent that the campaign for atheism had failed. The persecution seems to have been most intense in 1937 and *1938,* when the church leaders were denounced officially as "the implacable enemies of social reconstruction" and arrested in large numbers.

During World War II Stalin evolved a new religious policy. At home it was necessary to exalt the spirit of national solidarity; abroad the new policy was expected to bear fruit not only in English-speaking countries but also in the areas of eastern and southeastern Europe where the Orthodox religion predominated, areas which — it was hoped — were soon to come under Soviet control. In Sept. 1943, the acting patriarch Serghiy was officially installed as patriarch of Moscow and all Russia. He died on May 15, 1944, and was succeeded in Feb. *1945* by Aleksey (Serghiy V. Simansky, *1877–*), who assured Stalin of the "feelings of profound love and gratitude" with which all "church workers," guided by him, were inspired. Under his guidance the Moscow patriarchate took active part in--forcing all Uniates in the annexed western territories and the people's democracies to renounce their allegiance to Rome and to join the Orthodox Church. The Soviet government on Oct. 8, 1943, re-established the chief procurator's office in the form of a Committee for the Affairs of the Orthodox Church with Grigory G. Karpov as its head. In 1949 the *Journal of the Moscow Patriarchate* declared that in supporting the foreign policy of the Soviet government the Russian Church was fulfilling "a holy duty of religion and love." At the beginning of Sept. 1950 Aleksey sent a telegram to the U.N. Security council to protest against "U.S. aggression in Korea" and gave full support to the Soviet "peace" campaign.

Nevertheless, the profession of atheism continued to be a condition of membership of the party. Religious instruction continued to be prohibited in schools, although antireligious propaganda formed much of the teaching — a situation in accordance with article *124* of the constitution; namely. "In order to ensure to citizens freedom of conscience, the church in the U.S.S.R. is separated from the state, and the school from the church. Freedom of religious worship and freedom of antireligious propaganda is recognized for all citizens." The party continued to pay particular attention to the promotion of atheism in the Young Communist league. The party's policy was summed up in the injunction published in June 1947 in the *Komsomolskaya Pravda,* the official organ of the league: "Young Communists must be not only convinced atheists and opposed to all superstitions, but must actively combat the spread of superstitions and prejudices among youth."

New antireligious propaganda was launched by *Pravda* on July *24,* 1954. The editorial of the chief party organ urged the "agitators" to wage an "unrelaxing and persistent struggle against religious prejudices." In a few weeks many antireligious excesses were committed. On Nov. *11,* 1954, however, Khrushchev directed that some of the cruder forms of attack on religion and the clergy should cease, although atheistic propaganda was to be continued more subtly.

In 1914 there were in Russia 55,173 churches and 29,593 chapels, 112.629 priests and deacons. jjo monasteries and 475 nunneries with a total of 95,259 inmates. By 1933 there were 4,225 churches with 5,665 priests. 28 bishops and 37 monasteries. By 1955 the Russian Orthodox Church maintained two training academies and 10 seminaries with about 1.500 theological students; there mere about 100 bishops, 32,000 clergy, 20,000 churches and jo monasteries and nunneries.

Other Religions.— In 1954 the number of Roman Catholics was estimated at about 4,400,000 and that of Protestants at 5,000,000. The Roman Catholics were mainly Lithuanians and Poles; Protestants (Lutherans) were mainly Latvians, Estonians. Germans and Finns. The Roman Catholic hierarchy in Lithuania suffered much by arrests and deportations. Information about the Roman Catholics outside Lithuania is much scarcer than about any major Christian group in the U.S.S.R. The Lutheran bishops of Estonia and Latvia were Soviet-appointed.

The Evangelical-Baptist movement. led in the 1950s by Y. I. Zhidkov, was encouraged as an opposition to the Lutheran churches.

The Georgians have their own autocephalous Orthodox Church, although after the death of Patriarch-Katolikos Kallistrat (1869–Feb. 3. 1952) no successor was elected. The Gregorian Armenians were more fortunate, for when their Patriarch-Katolikos Gheorg VI (Cheorekchian) died in May 1954, they had to wait only 16 months to see a new katolikos, Vazghen I (Baldjian). a Rumanian subject, elected by the ecclesiastical synod (Sept. 29, 1955).

The largest religious group after the Orthodox is that of Moslems which was estimated in 1955 at about 24,500,000. They are overwhelmingly Sunni and only those of Azerbaijan are Shia. Administratively they are divided into four muftiates: Tashkent. with jurisdiction covering the five central Asian republics; Ufa. with jurisdiction for the R.S F.S.R.. except for Daghestan, for which there is a mufti at Buynaksk; Baku, with jurisdiction in Azerbaijan.

Judaism is the next largest non-Christian religion after Islam, although between 1939 and 1945 the number of Jews in the U.S.S.R. was reduced by German massacres from 3,020,000 to 1,902 000. Religious Judaism. however, received another serious blow through Russification of Soviet Jewry and through half-voluntary, half-compulsory migration from the Ukrainian. Byelorussian and Lithuanian ghettos to the industrial centres of the interior.

There were also in 1954 about 500,000 Lamaist Buddhists. mainly Buriat Mongols and Kalmucks. Many small Siberian nationalities, the largest among them being the Takuts, are nominally Orthodox but in fact pagan.

IX. GOVERNMENT AND ADMINISTRATION

The Constitution.— The first Soviet constitution was adopted in 1918 by the All-Russian congress of the soviets. At that time the official name of the whole state was the Russian Soviet Federated Socialist Republic. Between 1920 and 1922 treaties of incorporation were concluded between the R.S.F.S.R. and the Byelorussian and Transcaucasian S.F.S.R.'s and on Dec. 30. 1922, Russia, the Ukraine. Byelorussia and Transcaucasia formed together the Union of Soviet Socialist Republics. On July 6, 1923, the central executive committee (or Ts.I.K.) of the C.S.S.R. promulgated a new, federal constitution. In its first article it reserved to the competence of the central government the conduct of foreign policy. the direction of foreign trade, the planning of state economy. the administration of public finance, transport and justice as well as the organization and direction of the armed forces. Article 3 added that the "sovereignty" of the united republics was restricted only within the limits stated in the constitution, and article 4 stipulated: "Each republic retains the right of free withdrawal from the union." The supreme organ of authority of the U.S.S.R. was the congress of the soviets, a kind of parliament composed of delegates elected by the provincial congresses. During the intervals between sessions of the congress of the soviets the supreme authority was represented by the central executive committee consisting of the council of the union (Soviet Soyuza) and the council of nationalities (Soviet Katsionalnostiey). The council of the union was composed of 371 members elected by the congress of the soviets? in proportion to the population of each republic. The council of nationalities was formed of representatives of four allied republics as well as autonomous republics (A.S.S.R.) of the R.S.F.S.R., five delegates from each. and of representatives of autonomous regions (A.O.), one delegate from each. The executive organ was the council of the people's commissars.

TABLE XI.—Elections to *the Supreme* Soviet *of the U.S.S.R.*

Item	1950	1954
Number of registered electors	111,116,373	120,750,816
Electors who went to the polls	111,090,010	120,727,826
Percentage of the total electorate	99.98%	99.98%
Electors who voted against the official candidates	300,146	247,897
Percentage of electors who so voted	0.27%	0.21%
Number of deputies		
Council of the union	678	708
Council of nationalities	638	639

The 1923 constitution was replaced on Dec. 5, 1936. by the so-called Stalin constitution. This changed the name of the congress of the soviets to that of supreme soviet (Verkhovny Sovietj and gave it a formally democratic character. Thenceforward all citizens over 18 who were not insane and had not been deprived of their civil rights were entitled to vote in the election of deputies, to take place every four years. Citizens over 24 were eligible for election as a deputy.

The Supreme *Soviet.*—The supreme soviet consists of two chambers, the council (soviet) of the union and the council (soviet) of nationalities. Election to the council of the union is by electoral districts on the basis of one deputy for every 300.000 of the population. At the elections of March 14. 1954. there were 700 territorial electoral districts and 8 special military constituencies. Election to the council of nationalities is by union republics, A.S.S.R., A.O. and N.O. (national districts) on the basis of 25 deputies from each union republic, 11 deputies from each A.S.S.R., five deputies from each A.O. and one deputy from each N.O. At the 1954 election there were 631 territorial electoral districts and 8 military constituencies.

The supreme soviet is not a parliament in the western sense, nor does the periodical election correspond to western democratic practice. Candidates are picked by the central committee of the Communist party. There is only one official candidate in each electoral district and the only way for citizens to express dissatisfaction is to vote against him. According to the published results, only 0.81% of all electors who went to the polls in 1946 voted against the official candidates; in 1950 this percentage was reduced to 0.27% and in 1954 to 0.21%. The percentages of registered electors who went to the polls were: 96.8% in 1937, 99.7% in 1946, 99.98% in 1950 and 1954. (See Table XI.)

The Presidium of the *Supreme* Soviet.—The two chambers of the supreme soviet have equal rights and all bills must be passed by a majority in both chambers. Amendments to the constitution require a two-thirds majority. The legislative power of the supreme soviet is, however, so widely delegated that it can only be regarded as nominal. The supreme soviet is convened twice yearly by its presidium, which is elected at a joint session of the two chambers and which exercises the supreme authority between the sessions. The presidium consists of a chairman, whose position is similar to that of a president of the republic, 16 vice-chairmen, a secretary and 1j members.

The functions of the presidium, as defined by article 49 of the constitution, are that it

(1) convenes the sessions of the supreme soviet of the U.S.S.R.; (2) issues decrees; (3) gives interpretations of the laws of the U.S.S.R. in operation; (4) dissolves the supreme soviet of the U.S.S.R. in conformity with article 47 oi the constitution of the U.S.S.R. and orders new elections; (5) conducts nation-wide referendums on its own initiative or on the demand of one of the union republics; (6) annuls decisions and orders of the soviet of ministers of the U.S.S.R. and of the soviets of ministers of the union republics if they do not conform to law; (7) in the intervals between sessions of the supreme soviet of the C.S.S.R. releases and appoints ministers of the U.S.S.R. on the recommendation of the chairman of the soviet of ministers of the U.S.S.R., subject to subsequent confirmation by the supreme soviet of the U.S.S.R.; (8) institutes orders and medals and titles of honour of the G.S.S.R.; (9) awards orders and medals and confers titles of honour of the U.S.S.R.; (10) exercises the right oi pardon; (11) institutes military titles, diplomatic ranks and other special titles; (12) appoints

and removes the high command of the armed forces of the U.S.S.R.; (13) in the intervals between sessions of the supreme soviet oi the C.S.S.R. proclaims a state of war in the event of military attack on the U.S.S.R. or when necessary to fulfil international treaty obligations concerning mutual defense against aggression; (14) orders general or partial mobilization; (1;) ratifies and denounces international treaties of the U.S.S.R.; (16) appoints and recalls plenipotentiary representatives of the U.S.S.R. to foreign states; (17) receives the letters of credence and recall oi diplomatic representatives accredited to it by foreign states; (18) proclaims martial law in separate localities or throughout the U.S.S.R. in the interests of the defense of the U.S.S.R. or of the maintenance of public order and the security of the state.

The Council of Ministers.—At its first session after election the supreme soviet appoints the council of ministers (until March 1946 called the council of people's commissars). It consists of a chairman, a number of vice-chairmen, the ministers of the U.S.S.R. and the chairmen of some state committees. Members appointed to the council of ministers need not necessarily be deputies of the supreme soviet.

The council of ministers is the highest executive and administrative organ in the Soviet Union and is answerable only to the supreme soviet or, when it is not in session, to its presidium. The ministries of the Soviet Union are of two types: all-union ministries and the union-republican ministries. The all-union ministries are common to all federal republics. The union-republican ministries junction in Moscow and in the capitals of the federal republics. Both types are almost annually merged, divided or suppressed by decrees of the presidium of the supreme soviet, the supreme soviet approving the changes and Promulgating the necessary amendments to the constitution. By May 10, 1957, therewere 11 all-union ministries, 14 union-republican ministries and j state committees. With few exceptions the heads of both types of ministry were Russians. In Moscow, capital of the C.S.S.R. and of the R.S.F.S.R., many union-republican ministries existed in duplicate, one Soviet and one Russian. There were. however, no Russian ministries of internal affairs, defense or foreign affairs.

Article 68 of the constitution (revised in May 1957) defines the functions of the council of ministers as being that it

(1) co-ordinates and directs the work of the all-union and union-republican ministries of the U.S.S.R. and of other institutions under its jurisdiction and governs the economic councils of the economic administrative areas through the council of ministers oi the union republics; (2) adopts measures to carry out the national economic plan and the state budget and to strengthen the credit and monetary system; **(3)** adopts measures for the maintenance of public order, for the protection of the interests of the state and for the safeguarding of the rights of citizens; (4) exercises general guidance in the sphere of relations with foreign states; (5) fixes the annual contingent oi citizens to be called up for military service and directs the general organization of the armed forces of the country; (6) sets up, whenever necessary, special committees and central administrations under the soviet of ministers of the U.S.S.R. ior economic and cultural affairs and defense.

Soviet Federalism. — The constitution of 1936 says that "the U.S.S.R. is a federal state, formed on the basis of a voluntary union of equal soviet socialist republics." It repeats the stipulations of the 1923 constitution that the "sovereignty" of the union republics is limited only in certain spheres. These are enumerated in article 14 and include all the matters stipulated in the first article of the 1923 constitution, adding state security and decisions on the basic principles of education. "Outside these spheres (says article 15) each union republic exercises state authority independently." Article 17 stipulates again that "the right freely to secede from the U.S.S.R. is reserved to every union republic."

The union republics and the X.S.S.R. have parallel organs of government and administration. Each has a constitution which contains little that is not already included in the constitution of the U.S.S.R., each has a supreme soviet and a council of ministers. From Feb. 1, 1944, the union republics acquired a nominal right to have foreign ministers and defense ministers of their own. It was known that most of them had a minister of foreign affairs, but he had no direct contact with foreign countries. Two of them, the Ukraine and Byelorussia, are members of the United Nations, but no answer was received when the British government in 1947 asked the Soviet government to transmit to the governments of these two republics a proposal that the United Kingdom should exchange diplomatic representatives with them. The 1944 amendment to the constitution regarding union-republican ministers of defense and the creation of national military units was never put into effect. Most of the ministries of the union republics and the A.S.S.R. are local agencies of the central administration. The autonomous regions have a special statute adopted by the regional soviet and confirmed by the supreme soviet of the republic to which they belong. The national districts generally cover huge but sparsely populated areas. (See Tables II, III and IV above.)

TABLE XII.—*Communist Party and Government of the U.S.S.R.**

Members of the key bodies oi the central committee		Council of Ministers†
Party Presidium	Party Secretariat	
Members: K. E. Voroshilov (1926) A. I. Mikoyan (1935) N. S. Khrushchev (1939) N. A. Bulganin (1948) A. I. Kirichenko (1955) M. A. Suslov (1955) A. B. Aristov (1957) N. I. Belyayev (1957) L. I. Brezhnev (1957)‡ E. A. Furtseva (1057) N. G. Ignatov (1957) F. R. Kozlov (1957) O. V. Kuusinen (1957) N. M. Shvernik (1957) N. A. Mukhitdinov (1957) Candidate members: J. E. Kalnberzins (1957) A. P. Kirilenko (1957) D. S. Korotchenko (1957) A. N. Kosyghin (1957) K. T. Mazurov (1957) V. P. Mzhavanadze (1957) M. G. Pervukhin (1957) P. N. Pospelov (1957)	First secretary: N. S. Khrushchev (1953) Secretaries: M. A. Suslov (1948) A. B. Aristov (1955) N. N. Belyayev (1955) L. I. Brezhnev (1956) E. A. Furtseva (1956) N. G. Ignatov (1957) A. I. Kirichenko (1957) N. A. Mukhitdinov (1957) O. V. Kuusinen (1957)	Chairman of the council: N. S. Khrushchev (1958) First Deputy chairmen: A. I. Mikoyan (1940) F. R. Kozlov (1958) Deputy chairmen: A. N. Kosygin (1958) A. F. Zasyadko (1958) I. I. Kuzmin (1958) D. F. Ustinov (1958)

*As of April 1, 1958. Years of appointment in parentheses.
†In addition there were 19 ministers, 9 chairmen of committees of the council of ministers, 4 vice chairmen and 3 department heads of the state planning commission, a chairman of the commission of state control of the council, the chairman of the board of the State Bank of the U.S.S.R., and the chief of the Central Statistical board. In addition, from May 10, 1957, the chairmen oi the councils of ministers of the union republics are members of the council of ministers oi the U.S.S.R.
‡Also chairman of presidium of supreme soviet of the U.S.S.R., or nominal head of state.

The Communist Party. — Article 126 of the constitution describes the All-Union Communist Party of the Bolsheviks (renamed in 1952 the Communist Party of the Soviet Union. *Kommunisticheskaya* Partia Sovietskogo *Soyuza*) as both "the vanguard of the working people" and the "leading core" of all its organizations. Because all real or potential opposition was removed after the Communist coup d'état of Nov. 7 (20). 1917, the party has the monopoly of political power. The freedoms formally guaranteed by the constitution — of speech. of the press, of assembly — exist only in theory. The party wields its powers through its central committee and through the Politburo (renamed presidium in 1952) and the secretariat. The central committee is elected at the party congress and its membership is constantly increasing. The 20th congress. which assembled in Moscow in Feb. 1956, elected a central committee of 133 members and 122 candidates. The central committee meets on an average three times a year when it receives reports from the presidium on past and future work. The presidium exercises power over every aspect of public policy, including foreign affairs: it governs the Soviet Cnion. (See Table XII.)

From Oct. 1917, when the first Politburo was constituted, to June 1957, 34 Communist leaders had at one time or another been full members. Of these, Y. M. Sverdlov, Lenin, V. V. Kuybyshev, M. I. Kalinin, A. A. Zhdanov and Stalin died naturally; S. M. Kostrikov-Kirov and Trotsky were assassinated (allegedly on Stalin's orders); M. P. Tomsky (Yefremov) and G. K. Ordzhonikidze committed suicide to avoid trial and probable death; G. E. Zinoviev. L. B. Kamenev, Y. E. Rudzutak, N. I. Bukharin, A. I. Rykov, S. V. Kossior, V. Y. Chubar, N. A. Voznesensky and L. P. Beria were sentenced to death and shot (all but Beria on Stalin's orders); A. S. Bubnov and G. Y. Sokolnikov were deported; A. A. Andreyev and A. N. Kosyghin were dismissed; and the remaining 11 (in order of seniority: K. E. Voroshilov, V. M. Molotov, L. M. Kaganovich, A. I. Mikoyan, N. S. Khrushchev, G. M. Malenkov, N. A. Bulganin, M. G. Pervukhin, M. Z. Sahurov, A. I. Kirichenko. M. A. Suslov) were until June 1957 the rulers of the Soviet empire.

The secretary-general (renamed first secretary in 1953) is the

most powerful member of the presidium. Stalin occupied this position from 1924 to his death. On March 6, 1953, Malenkov became secretary-general, but eight days later had to yield that position to Khrushchev. On Feb. 27, 1956, the central committee increased the number of secretaries from 6 to 8; it also elected 6 candidate-members of the presidium. the most significant among the last-named being Rfarshal G. K. Zhukov. A far-reaching change in the composition of the presidium was announced on July 3, 1957, when Molotov. Kaganovich and Malenkov were excluded from the presidium and central committee. They were accused of "factional activities." At the same time Saburov was not re-elected to the new presidium. while Pervukhin was downgraded to the rank of candidate member.

The Communist party greatly increased in size, although its membership was limited. From 240,000 members in July 1917 it had grown by its 18th congress in March 1939 to 1,588,852 members and 888.814 candidates. The 19th congress assembled in Oct. 1952. At that time the party had 6,013,259 members and 868,886 candidates. On Feb. 14. 1956, Khrushchev reported to the 20th congress 6,795,896 members and 419.609 candidates. While the 1939 rules had described the party as "a section of the Third International, a shock detachment of the working class of the U.S.S.R.," the 1952 rules defined it as "a voluntary militant union of like-minded Communists consisting of people from the working class, the working peasants and working intelligentsia." The nursery of the party rank and file is the All-Union Lenin League of Communist Youth (Vsesoyuzny Leninsky Kommunistichesky Soyuz Molodezhi or Komsomol) which by July 16, 1954, its 30th anniversary, had a membership of 18,829,327.

The Police. — The task of eliminating political opposition to the Communist party in the Soviet Union was originally in the hands of the All-Russian Extraordinary Commission for Repression of the Counterrevolution and Sabotage (V.Ch.K. or Cheka). On Feb. 6, 1922, the Cheka became the United General Political administration (O.G.P.U.). On July 10. 1934, the people's commissariat of internal affairs (N.K.V.D.) replaced the O.G.P.U.

The first chief of the Cheka and later of the O.G.P.U. was Felix E. Dzierzynski (Dzerzhinsky) ; in 1924 he was succeeded by Vyacheslav R. Menzhinsky, who died in 1934; the next chief of the N.K.V.D. was G. G. Yagoda, who mas dismissed in Sept. 1936 and shot in March 1938; N. I. Yezhov was the chief of the N.K.V.D. until Dec. 1938 when he, too, was shot and L. P. Beria was appointed his successor.

On Jan. 31, 1941, the N.K.V.D. was itself divided, the N.K.V.D. to deal mith internal affairs and the N.R.G.B. mith state security. In March 1946 the commissariats became ministries and Beria supervised both the ministry of the interior (M.V.D., headed by Serghey N. Kruglov) and that of state security (M.G.B., headed by V. S. Abakumov). On March 6, 1953. the two ministries were reunited under Beria; in July, after Beria's arrest, Kruglov became minister of the interior. The two component parts of the ministry were again separated. and on March 14, 1954, a committee of state security of the council of ministers was formed with Ivan A. Serov as chairman.

As head of all the forces of the interior, 700,000 strong, excluding 400.000 frontier guards and 350,000 militiamen (or ordinary policemen), Beria was extremely powerful. He was disliked by his colleagues of the presidium and the army leaders resented the fact that the forces of the interior, although (together with the frontier guards) part of the armed forces, were not under the ministry of defense. Whatever the truth, he was accused of having acted as an agent for the western powers and was tried by a special tribunal presided over by Marshal Ivan S. Konev. On Dec. 23, 1953, he was sentenced to death and shot. His friend Vsevolod Merkulov, minister of state control, suffered the same fate; Abakumov, another Beria man, was shot on Dec. 19, 1954. In July 1953 Kruglov became minister of the interior but it was announced on Feb. 1, 1956, that he had been replaced by N. P. Dudorov.

In April 1956 the presidium set up a committee to check the activities of Soviet security organs, and abolished their powers to deal with sabotage and terrorism, powers deriving from two decrees issued in 1934 and 1937, which authorized the political police to conduct trials or pass sentence without trials. For this purpose a special judicial and punishment department (Osob) was created within the old N K V D. It was abolished in 1953, shortly after Stalin's death, but this decision was not publicized at the time.

The Bureaucracy. — The structure of the Soviet state rests on three pillars — the leadership of the Communist party, the bureaucracy (*chinovniki*) and army, and political police.

Under state ownership and management, a large civil service is unavoidable. The rapid increase in the number of state employees — or *sluzhashchiye*, as they are called — mas a by-product of industrialization. In 1926 there were 2,500,000 civil servants. in 1939, 10,916 000. By 1956 their number was estimated at 15,000,000. In his report to the 20th congress of the Communist party (1956) Khrushchev said that since 1954 the administrative and managerial staffs had been reduced by 750,000.

There were about 500.000 top executives of the federal, republican and regional state administration. about 400.000 directors and other executives in state-controlled industry, collectivized agriculture. transport and trade. and about 100,000 party leaders in key positions. This new Clite was more numerous than were the high *chinovniki* and army officers under the tsarist regime.

The **Judicial** System. — An early result of the revolution was the decree of Dec. 7, 1917, abolishing all existing general legal institutions and sweeping away the imperial legal system. Two new types of courts were created in their place. the ordinary courts and the revolutionary tribunals. The ordinary courts had jurisdiction in civil and criminal cases. The revolutionary tribunals had special jurisdiction in matters of counterrevolution. sabotage, abuses of officials. etc. This system proved unsatisfactory and was replaced in 1922 by a new hierarchy of courts headed by a supreme court in each republic and with the supreme court of the U.S.S.R. at the apex. Article 104 of the constitution charged the supreme court of the U.S S.R. "with the supervision of the judicial activities of all the judicial organs of the U.S.S.R. and of the union republics."

The ordinary courts in the new hierarchy fall into four groups: (1) the people's courts; (2) the regional, provincial, territorial courts, the courts of the autonomous regions and the supreme courts of the autonomous republics; (3) the supreme courts of the union republics; (4) the supreme court of the U.S S.R. The judges in all courts are either permanent judges or people's assessors. Judges of the people's courts are elected by all the citizens within the jurisdiction of that court. The respective soviets of the autonomous republics or other areas appoint the judges to the courts of the second group. The supreme soviets of the union republics and of the Soviet Union appoint the judges to the courts in groups 3 and 4.

Article 112 of the constitution states that "judges are independent and subject only to the law," but this does not mean that they are independent of government policy; in practice they must follow and seek to enforce that policy whether explicit in published laws or not. Judges may be relieved of their duties if recalled by their electors. An appeal lies from all courts, except from the supreme courts of the U.S.S.R. and of the union republics, to the court next above.

A judicial office of great power is that of the procurator-general, which was established in June 1933. Article 113 of the constitution states that "supreme supervisory power to ensure strict observance of the law by all ministries and institutions subordinated to them, as well as by officials and citizens of the G.S.S.R. generally. is vested in the procurator-general of the U.S.S.R." It is noteworthy that the procurator-general, who is appointed for a term of seven years by the supreme soviet of the U.S.S.R., and the procurators, appointed by him for a five-year period throughout the republics and regions of the Soviet Union, are independent of the supreme court and of other courts.

Certain special courts exist in addition to the ordinary courts referred to above. These include the military tribunals, which have jurisdiction over criminal matters in the Soviet armed forces, and the water-transport courts and railway-transport courts, which deal with crimes involving obstruction of the efficiencv of the service or of labour discipline. There are also comrade's courts

set up primarily in large industrial undertakings at which fellow workers sit as judges in cases of petty crimes. (I. GY.; K. SM.)

X. DEFENSE

The prerevolutionary Russian army was strong in manpower but otherwise reflected all the weaknesses of the political, social and economic order of the imperial regime. Although traditionally the Russian soldier is a hard fighter. with exceptional powers of endurance. the quality of the recruits was lowered by the fact that four in five were illiterate. Despite some progress in industrialization at the end of the 19th and at the beginning of the 20th century, the country in 1913 produced only 30 kg. of pig iron per capita as compared with 254 kg. in Germany; the army had only 60 batteries of artillery against Germany's 380; the extent of the railway system in European Russia alone was 1 mi. of railway to 60 sq.mi. of territory, or one-tenth the German figure. Though there was no lack of talented generals and patriotic officers, both alike were helpless under a system undermined by corruption and nepotism. Participation in World War I led to appalling losses and ultimately to the complete collapse of the old army. Imperial Russia had a peacetime army of 1,100,000 and 42.000 officers; from 1914 to 1917 it mobilized 12,000,000 men. of whom 1,700,000 were killed, 4,950,000 wounded and 2,500,000 taken prisoners of war.

The revolution of March 1917 in the midst of war resulted in a rapid dissolution of all fundamental institutions. The minister of war in the provisional government, Aleksandr Guchkov, strove to stop the decline of discipline in the army but in May resigned in despair. He was succeeded by Kerensky, an eloquent speaker who assumed that by personal magnetism he mould be able to counteract the progress of defeatist Communist propaganda (see *History,* above). The Communists alone were unequivocally against the continuance of the war, and this attitude greatly contributed to the success of their revolution of Nov. 1917.

Formation of the Red Army.—On Jan. 15 (28), 1918, the council of people's commissars issued a decree creating a Workers' and Peasants' Red army on a voluntary basis. The first units distinguished themselves against the Germans at Narva and Pskov on Feb. 23. 1918, which became the Soviet Army day. By April 22, 1918, the Soviet government felt strong enough to decree compulsory military training for workers and peasants who did not employ hired labour. This was the beginning of the Red army. Trotsky, from March 1918 people's commissar for war, was its founder and Mikhail Frunze, Mikhail Tukhachevsky and S. M. Budenny were among the most successful of its commanders in the field. It was an army based on the class principle; people who belonged to the *bourgeoisie* were ineligible for combatant service.

The problem confronting every revolutionary army, that of creating a competent and reliable officers' corps. was solved by Trotsky by mobilizing former officers of the imperial army, allowing them tolerable material conditions and warning them that their families would be held as hostages in the event of treason or desertion. Altogether about 50,000 such officers served in the Red army up to 1921 and the overwhelming majority remained loyal to the Soviet regime. To ensure the officers' reliability a political adviser, *politichesky rukovoditel* or *politruk,* was attached to every unit. These officials. who were Communists, not only kept the officers under observation but also carried out political propaganda in the ranks to stimulate morale. As the war went on, a more reliable type of young officer began to emerge from the short-term officers' training schools that were set up.

After the Riga peace treaty with Poland the Red army was demobilized and reduced to a more efficient and manageable force. At the end of 1920 it had 5,300,000 effectives; the number was reduced to 1,800,000 by Sept. 1921 and to 825,000 a year later. In 1923 the permanent strength of the Soviet armed forces was 562,000, and for nine years it remained at this level. Trotsky, losing his contest for power with Stalin, had to resign as people's commissar for war in Nov. 1924 and was succeeded by Frunze. On the latter's death Oct. 31, 1925, K. E. Voroshilov, trusted friend of Stalin, became commissar for war, remaining in this post until May 8, 1940.

Between 1925 and 1933 the percentage of All-Union Communist party members among the ranks increased from 19% to 49%; the percentage of party members among the officers was much higher. By this time only a few officers from the imperial army remained on active service. All the commanders nere graduates from Soviet military academies and officers' training schools, where only candidates recommended by the Komsomol or Communist Youth league, by the Communist party and by the security services could be accepted as pupils.

The fight against all who were critical of Stalin's leadership extended also to the army, where a drastic purge took place in May 1937. On June 12 Marshal Tukhachevsky. first deputy people's commissar of war, and seven other prominent generals of the Red army were shot, having been accused of spying to betray the Soviet Union to the Japanese and Germans. Gen. Ian Gamarnik, second deputy people's commissar in charge of political education, was said to have committed suicide. Many other generals were either sent to forced labour camps or cashiered.

Gen. B. M. Shaposhnikov, a graduate of the Imperial academy of the general staff. who had served in the Red army from May 1918 and been chief of the general staff in 1929–31, was again appointed to that position in 1937. The Japanese intervention in China and the German rearmament compelled the Soviet Union to increase its peacetime armed forces; it had 940,000 men in 1934, about 1,300,000 in 1936 and about 1,600,000 under arms at the beginning of 1939. The country nas then divided into 13 military areas and the army was composed of 87 infantry divisions and 32 cavalry brigades.

The Red Army in World **War** II.—When the German armies attacked the Soviet Union on June 22, 1941, their early successes caused general surprise. By October they had covered three-quarters of the distance separating Moscow from the German frontier and had taken more than 2,050,000 prisoners of war and a vast haul of war material. A hard winter, as well as Russian heroism, halted them at the gates of Moscow. Nevertheless, in 1942 they were able to push as far as Stalingrad. The epic resistance of Stalingrad should not hide the fact that when the Soviet armies started their counteroffensive there were 800.000 Soviet citizens, former prisoners of war, serving in the German army, the most prominent of them being Lieut. Gen. Andrey Vlasov, one of the two army commanders (the other being K. K. Rokossovsky) who had stopped the Germans before Moscow but who, defeated by the Germans east of Leningrad, had surrendered in Aug. 1942. Although for years Soviet propaganda had denounced them as "fascist beasts," the Germans were welcomed as liberators in many parts of the Soviet Cnion, especially in those with a non-Russian population. Without underestimating the resilience of the Soviet regime and of the Soviet army, it should be recorded as a historical fact that one cause of the German defeat in Russia was Hitler's blunder in maintaining the *kolkhozy* ("collective farms") detested by the peasants, and in discouraging the non-Russian nationalisms, in particular that of the Ukrainians.

By the end of World War II the Soviet armed forces were estimated at 11,000,000 men and 360 divisions. According to N. A. Voznesensky, they had 5 times as much artillery, 1 j times as many tanks and 5 times as many aircraft as in 1941. Demobilization started by the end of 1945, but by 1952 the postwar armed forces were about three times as strong in numbers as they were in 1939. On Oct. 3. 1946, the word "Red" was officially discarded from the title of the Soviet armed forces.

Allied Aid to the Soviet Union.—The Soviet government was always unready to acknowledge the extent of Allied aid in weapons, munitions of war, strategic raw materials and foodstuffs received from the United States and Great Britain during World War II. Voznesensky maintained that the Allied deliveries were only 4% of the domestic production during the war. Lend-lease to the Soviet Union amounted to $10,982,089,000 from the United States and to £428,000,000 from Great Britain. From Oct. 1941 to Aug. 1945 the United States delivered 375,883 trucks, 51,503 jeeps, 7,056 tanks, 8,075 tractors, 35,170 motorcycles, 2.328 ordnance service vehicles. 14,795 aircraft, 189,000 field telephones with 670,000 mi. of wire, considerable railway equipment (1,900

steam locomotives, 66 diesel locomotives. 9,920 flatcars, 1,000 dump cars. 120 tank cars and 3j heavy machinery cars), 4,478,116 tons of foodstuffs. 2.670,371 tons of petroleum products and quantities of boots, aluminum, copper, explosives, etc.

Great Britain likewise, between Oct. 1941 and March 1945, shipped 7 410 aircraft. 5,218 tanks. ram materials, machinery, industrial plant, foodstuffs and medical supplies, which mere sent to the U.S.S.R. in 40 convoys by the northern route. Despite considerable risks and hardships involved, 92.6% of the supplies arrived safely in Russian ports.

The Soviet Forces after World War 11.—A British estimate of July 1951 placed the Soviet armed forces at 4.600 ooo men. The army comprised 2,100,000, the forces of the interior 1,100,000, the air force and antiaircraft defense 800.000 and the navy 600,000. There were 17j divisions, excluding 40 artillery and antiaircraft divisions.

In his report (*NATO:* The First Five Years *1949–1954,* Paris. 1954) Lord Ismay, secretary-general of NATO, stated that since 1947 the numerical strength of the Soviet ground forces had remained fairly constant, but their mobility and fire-power had greatly increased through mechanization and modernization of equipment. There were 6j armoured and mechanized divisions; many infantry divisions had been motorized and equipped with modern tanks and additional artillery and the Soviet potential in airborne troops was considerably enlarged. In addition, the number of divisions of the European satellite states had almost doubled. It was estimated that in spring, 1956, there were 87 satellite divisions.

During 19jj the Soviet and the satellite governments announced that they had reduced their armed forces. In the U.S.S.R. this reduction amounted to 640,000. Including the satellites, the total reduction nas 808,000, but the armies of the Soviet bloc remained the world's largest military force. A collective treaty of mutual assistance was signed on May 14, 1955, in Warsaw, Pol., by the premiers of the U.S.S.R. and of the seven European people's democracies, and a joint command under Marshal Ivan S. Konev was established. (See Table XIII).

In May 1956 the Soviet government announced that it would reduce the armed forces by a further 1,200,000 men within 12 months, demobilize 63 divisions and brigades of the land army, 3 air divisions and take 37j ships of the Soviet navy out of active fleets. There was every indication that Soviet tactics and strategy were in transition. The government and general staff mere apparently veering away from the use of great masses of infantry; they were equipping their forces nith modern arms, including atomic weapons, nhich would permit a reduction of armed manpower without diminishing military strength. Another reason for this "disarmament" was lack of manpower for building new industrial plants in Asiatic Russia.

The armed forces of the Soviet Union in the 1950s were divided into the army, the air force, the antiaircraft defense, the navy and the forces of the interior. The army was composed of four types of division: (1) the infantry division. consisting of three rifle regiments on foot, one horse-drawn artillery regiment of 72 guns and howitzers and one tank regiment (full strength, 11,000 men); (2) the motorized division, that is, an infantry division with truck-borne infantry and motorized artillery; (3) the armoured division, designed for short-range combat in co-operation with infantry, consisting of three mediuin tank regiments of about 200 tanks, one mixed regiment of about 50 heavy tanks and 25 heavy self-propelled guns, and a motorized rifle regiment (full strength. 10,500 men); and (4) the mechanized division, designed for more independent action, comprising three regiments of motorized infantry. two tank regiments (medium and heavy), one howitzer regiment and rocket. antiaircraft and reconnaissance battalions (full strength, about 13,000 men). There were also mountain and cavalry brigades. The typical Soviet artillery division (150 guns and howitzers, 10,000 men) was controlled directly by army headquarters.

TABLE XIII.—*The Armed Forces of the Soviet Bloc, April 1956*

Country	Effectives		Reductions announced in 1955	Effectives after the reductions	Divisions	
	Armed forces	Forces of the interior			1947	1956
U.S.S.R.	3,500,000	1,100,000	640,000	3,960,000	175	175
Poland	370,000	100,000	47,000	423,000	16	24
Czechoslovakia	180,000	50,000	34,000	196,000	8	14
German Dem. Rep.	85,000	50,000	—	135,000	—	7
Rumania	280,000	50,000	40,000	290,000	8	15
Hungary	175,000	40,000	20,000	195,000	4	12
Bulgaria	200,000	40,000	18,000	222,000	8	12
Albania	31,000	8,000	9,000	30,000	2	3
Total	4,821,000	1,438,000	808,000	5,451,000	221	262

The air force in the Soviet organization was not an independent arm but was divided between the army and the navy, about 88% of the first-line air strength belonging to the former.

The numerical strength of the Soviet air force after 1947 was constant at about 20,000 aircraft, excluding 3 ooo naval aircraft. In 1951 about 20% of Soviet fighters were jet types. By 1956 all of their fighters nere jets. In 1951 jet light bombers had not been introduced into operational units: by 19j6 all this bomber force was jet-powered. Moreover, the medium and heavy bomber units were equipped with jet aircraft. Up to 1951 the combat value of the satellite air forces was insignificant, and their aircraft mere obsolete. By 1956 the five satellite states. German Democratic Republic and Albania excepted, had 32 tactical air divisions, that is. about 3,500 aircraft, all jets. The highest formation of the Soviet air force was an air army composed of a number of air divisions, each division being three regiments of three squadrons of 11 aircraft. A fighter division comprised 110 aircraft. During 1951–54 the number of major airfields in eastern Europe had almost trebled and special attention mas being directed to the provision of long runways. There were two air armies. each of about 1,000 operational aircraft, attached to each of the army group headquarters of Leningrad, Minsk, Odessa, Tbilisi, Tashkent and Chita. In addition, there were air divisions in eastern Germany and an independent long-range air force.

The antiaircraft defense or P.V.O. (Protiv-Vozdushnaya Oborona) was an independent arm composed of antiaircraft artillery divisions and fighter divisions.

The Workers' and Peasants' navy was created by a decree of the council of people's commissars on Feb. 14, 1917. Until Dec. 31, 1937, the navy was administered by the common people's commissariat for war and navy. On that date a navy commissariat was created; but on Feb. 25, 1946. it disappeared when by a decree of the presidium of the supreme soviet a people's commissariat of the armed forces was organized. (In March 1946 the name "people's commissariat" was dropped in favour of "ministry.") Although *Pravda* commented that this decision emerged from the whole experience of World War II, a navy ministry was restored on Feb. 25, 1950. Adm. I. S. Yumashev, the first minister, was succeeded on July 23. 1951, by Xdm. N. G. Kuznetsov. who had been people's navy commissar from 1937 to 1946. In March 1953 the navy ministry was again absorbed by the ministry of defense. In April 1956 it was reported that Kuznetsov had been dismissed and replaced by Adm. S. G. Gurshkov. The Soviet navy consisted in 1956 of 3 old battleships, 31 cruisers, 140 destroyers, 200 frigates and escort vessels and about 450 submarines, mostly modern and ready for immediate service. The annual production of submarines was estimated at 85.

There were also remarkable developments in nuclear and guided missiles research. On Aug. 20, 1953, the Soviet government announced the successful explosion of a hydrogen bomb; on Sept. 27, 1955, another announcement claimed an explosion of a hydrogen bomb set off at a high altitude.

The forces of the interior were divided into frontier guards and security troops administered by the ministry of the interior. They were not intended for the front. although equipped in every way, down to tanks, artillery and aircraft.

Military service extended for two years in the army (three years for noncommissioned officers), three years in the air force and antiaircraft defense, four in the navy and 27 mcnths in the forces of the interior. Conscription age was 18 for men with secondary education and 19 for all others. From 1946 about 1,200,000 men were conscripted yearly.

Up to Oct. 1946 described as "Red army man" (*krasnoarmeyets*), a Soviet soldier was afterward termed a "ranker" (*ryadovoy*). Discipline in the Soviet army was strict and punishments were severe. transgressors being sent to penal battalions, which in World War II were set almost suicidal tasks. Pay and privileges rose rapidly with rank. Thus, while in the U.S. army a general's pay was in the ratio 1 j to 1 to a private's, in the Soviet army a marshal's pay was in the ratio of 114 to 1 to a private's. The officer's corps was a separate caste. and the times when a private could address a colonel simply as *tovarishch* ("comrade") were long forgotten; he would now say *tovarishch polkovnik* ("comrade colonel") and give the once-outlawed salute not only to officers but also to noncommissioned officers.

Until Sept. 1951 there existed three organizations for premilitary training. one for the army. one for the air force and one for the navy. It was then announced that the three organizations had merged into one All-Union Association for Voluntary Assistance to the Army, Air Force and Navy (D.O.S.A.A.F.) ; this provided military training from the age of 1 j.

The proportion of the total estimated expenditure allocated to defense decreased between 1952 and 1956 from 23.641, to 18%. This declared expenditure was. however, not the whole picture; a great proportion of the military expenditure mas detectable under the guise of investment in national economy, while the cost of military academies and schools was included in expenditure on education.

The nominal head of the Soviet land and air forces was the minister of war. After K. E. Voroshilov had ceased to be people's commissar in May 1940, this post was occupied by Marshal S. K. Timoshenko (May 8. 1940–July 20, 1941), Marshal Joseph Stalin (July 20, 1941–March 3, 1947), Marshal N. A. Bulganin (March 3, 1947–March 24, 1949) and Marshal A. M. Vasilevsky (from March 24. 1949). On March 6. 1953, Marshal Bulganin was appointed minister of defense. When he became premier on Feb. 9, 1955, he was succeeded as minister of defense by Marshal Gheorghy Konstantinovich Zhukov. The minister had under his command the chief of the general staff. After B. M. Shaposhnikov's resignation in the summer of 1940 on the ground of ill health, the post was occupied for a few months by Marshal Kiril Meretskov, then by Marshal G. K. Zhukov (Feb. 24–Oct. 31. 1941), then again by Shaposhnikov till he was replaced in Nov. 1942 by Marshal Vasilevsky. From Nov. 12, 1948. Gen. Serghey M. Shtemenko was chief of staff, but in Feb. 1953 he was succeeded by Marshal Vasily Danilovich Sokolovsky.

There were six deputy ministers of defense, each in charge of an arm or a service. The post of commander in chief of the air force was occupied during World War II hy Marshal A. A. Novikov, from 1946 by Marshal K. A. Vershinin and from July 1950 by Chief Marshal Pavel F. Zhigarev.

XI. ECONOMIC CONDITIONS

Russia is richly endowed with natural resources, one of the three basic elements of economic development. the others being manpower and capital. Until state-planned industrialization began under the Soviet government. the country had large reserves of unskilled manpower in the overpopulated countryside. It was, however, poor in capital equipment. Vast areas were either too cold or too dry for human settlement, coal reserves were often hundreds of miles from the nearest deposits of iron ore, the navigable rivers ran in directions unsuitable for trade and forests were far from populated areas.

Before World War II it was estimated that the U.S.S.R. had at its disposal 1,654,000,000,000 metric tons of coal or 21% of known world reserves; 267,000,000,000 tons of iron ores or 53% of world reserves; 55% of world reserves of manganese. 23% of phosphates and 85% of potash salts (18,400,000,000 tons). It also had sufficient supplies of copper, zinc, lead. mercury, cobalt and, probably, uranium. It was, perhaps, short of nickel. tin and wolfram; it had no natural rubber. and the insufficient wool and cotton it produced were not of the best quality. Russia ceded its premier place as producer of crude petroleum before World War I on the discovery of rich oil fields in the Americas and the middle east. Before World War II it was believed that the G.S.S.R. possessed about 3,877,000,000 tons or 56% of world reserves of crude petroleum, but in 1955 it was estimated that the middle east alone had about 30,600,000,000 tons or 75% of world reserves outside the Soviet empire. Russian potentialities in hydroelectric power, always great. began to be harnessed only before World War II.

Until the 1930s the Russian economy was predominantly agrarian. According to the 1926 census, only 15% of the population was supported by industry, transport and trade. Agriculture was organized on a low level of efficiency. Of the immense Russian territory only about 5% (on the average 107,360,000 ha. in 1909–13) were lands under cultivation. The amount of grain harvested from 1 ha. amounted to 730 kg. as compared with 2,912 kg. in Denmark and 1,322 kg. in France. In 1909–13 only 6.9 kg. of artificial fertilizers per 1 ha. of sowed land was used in Russia, as compared with 57.6 kg. in France and 236 kg. in Belgium. Russian peasants were using in 1910 about 7,800,000 primitive plows called sokha, 2,200,000 wooden plows, 4,200,000 iron plows and 17,700,000 wooden harrows. Among other agricultural implements used in Russia there were 752,400 horse-driven reaping machines, 323,700 horse-driven sowing machines and only 27,000 steam threshing machines.

Before World War I Russia was a classic example of a country with an over-populated countryside. This halted economic development, reduced almost to nothing any possibility of savings. kept the standards of living low and discouraged the introduction of more efficient techniques in rural economy. Emigration, land reform and industrialization began to be applied in Russia in the second half of the 19th century, albeit haphazardly and inadequately, as methods of combating rural overpopulation. As the remaining virgin lands in the southern part of European Russia were occupied, there was the possibility of a massive internal colonization of Siberia and Turkistan, but it only began to be encouraged in the last decade of the 19th century. The building of the Trans-Siberian and Tashkent railways helped migration. Emigration to the United States and Canada in the years 1897–1913 was estimated at about 1.740,000: this excluded Poles and Finns but included 1,072,000 Jews. (For the slow progress of land reform see *Agriculture,* below.) The number of industrial workers in Russia in 1913, within the existing frontiers (that is, including the Polish industrial areas) was 2,282,000 or 1.41% of the total population, including 918,200 workers in the textile industry, but only 325,000 in the extraction of fuels. 171.800 in the extraction of other minerals and 150,900 in metallurgy. (See Table XIV.)

TABLE XIV.—*Russian Heavy Industry in 1913 Compared with that of Three Major Industrial Powers*

	Coal		Pig Iron	
	Total (Million tons)	Per capita (Kg.)	Total (Million tons)	Per capita (Kg.)
Russia	29.1	209	4.2	30
Germany*	173.3	2,872	12.3	
United Kingdom	292.0	6,396	10.4	
United States	516.8	5,356	31.5	

*In post-1921 frontiers.

There was little capital equipment in the form of manufacturing industries, transport and modern agricultural implements. Of the two ways of increasing it, either by a planned economy or by help from abroad, the first was unthinkable under the tsarist regime. Politically an autocracy, tsarist Russia, especially from the second half of the 19th century, was to some extent a country of free enterprise. This, however, was hampered by a vexatious bureaucracy whose interference, in turn, was tempered by the fact that corruption was rife. The privileged classes either invested their money in light industries or spent it abroad.

Foreign investments. therefore, were encouraged. French, British. German, Belgian and U.S. capitalists found it profitable to invest in Russian coal, iron, oil and other heavy industries. After the conclusion of the Franco-Russian alliance in 1891. Russian loans, state and municipal, found a ready market in France. In the years 1900–13 the annual inflow of foreign capital in Russia was estimated at 200,000,000 gold roubles ($102,400,000). On the

eve of World War I the total capital invested in Russian stock companies amounted to 5,000,000,000 rb. of which 34% was foreign; 37.2% of foreign capital was invested in mining. 17.5% in metallurgy, 11.5% in real estate and 10.6% in banking. Between 1887 and 1913 the dividends paid abroad from these investments amounted to 1,783,000,000 rb. ($912,900,000). The national debt of Russia. state or state-guaranteed, amounted on Jan. 1. 1914, to $6,568,000,000, of which from 44% to 50% was in foreign holdings. Of the total interest, about $199,000,000, paid annually on the external part of this debt, from 62% to 79% was remitted to France. Dividends and interests paid abroad were a heavy burden on the Russian balance of payments; but foreign investments stimulated the pace of industrial advance.

Although the Russian economy was growing, the outbreak of World War I found it wholly inadequate. Help from the western Allies was made exceedingly difficult by the inaccessibility of the Baltic and the Black sea Russian ports. Russian industries and the transport system could not support a long war and an army which, at the beginning of 1917, had 11,000,000 in its ranks. The production of pig iron in 1916 was 10% smaller than in 1913 and only 115 blast furnaces out of 151 were working. Industrial production for civilian use declined sharply and about 80% of the output of textile mills was earmarked for the armed forces. Inflation set in and the note circulation between July 1, 1914, and Oct. 1, 1917, rose from 1,600,000,000 rb. to 17,000,000,000 rb. While Russia was normally self-sufficient in staple foodstuffs and exported large quantities of cereals to western Europe. overloading of the railway system and the tendency of the peasants to hold back products from the market as they found that they could not buy a normal equivalent in manufactured goods led to food shortage in the towns, where the population had swelled because of the growth of the munitions industry. Food riots in Petrograd were the beginning of the overthrow of the imperial regime in 1917.

The national economy deteriorated rapidly during the eight months between the March revolution of 1917 and the Bolshevik revolution of Oct. 25 (Nov. 7). The bases of social and economic order were shaken to their foundations. The peasants began to seize the land of the larger owners. There were continual workers' strikes and demonstrations, partly political. partly because of a continual rise in the cost of living. A good deal of class hatred entered into the strikes and in some cases unpopular employers and engineers were driven away from the factories, which the workers undertook to operate themselves. The council of people's commissars immediately nationalized the land and expropriated all large holders. A decree of Nov. 14 (27) subjected industry to a system of workers' control. The banks were nationalized on Dec. 14 (27).

War Communism. — It was not the immediate purpose of the Bolsheviks to nationalize all industry and trade. Lenin recognized Russia's technical backwardness and the difficulties of abruptly instituting full-fledged socialism in a land where the peasants constituted the great majority of the population. For a few months after the conclusion of the treaty of Brest-Litovsk with the Central Powers on March 3, 1918, Lenin was inclined to emphasize the necessity for labour discipline and skilled management.

But as the civil war became more intense, the Soviet government found itself driven to establish complete control over industrial plant, manpower and labour. The factory owners were naturally hostile to the new regime; many of them fled. The sugar industry was nationalized on May 2 and the petroleum industry on June 17, 1918. Decrees of June 28, 1918, and Nov. 29, 1920, provided for the nationalization of all enterprises that employed more than ten persons, or more than five if motor power was employed.

Foreign trade was nationalized (it practically ceased to exist during the years of civil war and blockade) and on Nov. 21, 1918. private trade within the country was forbidden. In theory, Russia was supposed to live under a gigantic rationing system, with city dwellers receiving food products and manufactured goods on ration cards and the peasants delivering up their surplus produce in exchange for manufactured goods from the towns. In practice, this system could not and did not work because the government lacked both the goods and the technical organization to make it function. There was a good deal of surreptitious barter between city and village, and town dwellers obtained about as much food from theoretically illegal operations as on their ration cards.

Sen organizations came into existence to administer this new system. One of the most important was the supreme economic council. established on Dec 5 (18). 1917. Originally, it had been conceived as a body which would supervise the nhole economic life of Russia. but its functions were gradually restricted to the management of industry.

The council of labour and defense (S.T.O.) assumed considerable powers; it may be described as a kind of war economic cabinet. The food commissariat, which took charge of the distribution not only of food but also of manufactured goods, occupied a key position in the scheme of War Communism. The commissariat of transport operated the railways and waterways on semimilitary lines; the commissariat for agriculture, especially in the later phases of the War Communism period, tried to direct the peasants as to their selection of crops and their sowing.

Money tended to lose all value under this system. The rouble had declined considerably in buying power when the Bolsheviks came into power. Cnchecked use of the printing press and the fact that the distribution of both food and manufactured goods was supposed to be on a rationed basis soon led to an inflation as sweepingly destructive as that of Germany. A new currency had to be built up when a new policy was adopted. Toward the end of the period of War Communism. such things as housing, transport and public services were supposed to be free for all citizens. Another feature of the period was the attempt of 1920 to use armies, under military discipline, for labour tasks. This was a pet idea of Trotsky, who believed that the terrific jam in production could he broken by mobilization of labour under conditions of stern discipline, accompanied by fiery emotional appeals. The labour armies, however, proved a fiasco.

Considered as an economic experiment, War Communism was a disastrous failure. There are few parallels in history for the collapse that overtook Russia's productive forces. By 1920 the big industries were producing 18%, the small industries 43%, of their prewar output. The prostration was most complete in the heavy industries. Pig iron was down to 2.4%, iron ore to 1.7%, of the prewar figure. The output of copper ceased entirely. The railways, which suffered from the depredations of both sides during the civil war. crawled along with an ever-increasing percentage of damaged and disused locomotives and freight cars. In Jan. 1917 there were 537.328 freight cars in the country, of which 4.2% were out of use; by the end of 1919 the number of freight cars had diminished to 244,443, of which 16.6% were damaged. There were 20,394 locomotives (16.5% out of commission) in Jan. 1917 and 8,955 (47.8% unfit for use) at the end of 1918.

Wages and productivity of labour declined tremendously. while a large part of the city workers dispersed to the villages in search of food. The average wage of the Russian worker during these bleak years was little more than one-third nhat it had been under the tsars. Productivity of labour in 1920 was only 26% of the average of 1913.

Agriculture was also hard hit by the crisis, although the peasants, until actual famine devastated a great area of the Volga valley and of the Ukraine in 1921–22 (see History, above). suffered less from hunger than did the city dwellers. The grain harvest declined by 37.5% to 50,300,000 metric tons in 1922. The tendency of the peasants was to concentrate on food crops and to cease planting other market crops. or at least to cut donn the acreage substantially. By 1920 the area under flax had declined by 50% as compared with the prewar average, that under sugar beets by 74%, that under cotton by 87% and that under tobacco by 90%.

The cities of northern and central Russia lost more than one-third of their population between 1916 and 1920. Many Russian town dwellers, especially among the labouring classes, had friends and relatives in the country, and there was a widespread impulse to go back to the villages, where, in spite of the requisitions, there was more chance of getting food.

The effect of War Communism was temporarily to frustrate the realization of almost every Communist economic ideal. Lenin

and his associates believed in a state order based on the industrial proletariat as the ruling class and were eager to see Russia overtake and surpass the leading capitalist countries in quantity and efficiency of production. They were also convinced, as Marxists, that large industrial units would supplant small and medium ones. The actual circumstances of life under War Communism tended to contradict all these ideals. The working class was dispersing and a good many of the workers who remained in the factories turned into small speculators, making little objects of daily use which could be sold or exchanged for food. The big factories in many cases stood idle or worked at a fraction of their normal capacity for lack of machinery and raw material. The Communists in theory were worshippers of modern efficiency. of the machine. But the storm of social revolution and civil war had destroyed most of what little efficiency and mechanization had formerly existed in Russia and threatened to throw the country back into extremely primitive forms of economic life.

It would be incorrect to regard War Communism as an experiment undertaken entirely for its own sake. Many of its features were almost inseparably associated with the hard exigencies of civil war. It was impossible, for instance! for the Soviet government to give the peasants any adequate supply of manufactured goods when the factories, often cut off from sources of raw material, a-ere unable to work at normal capacity and when war needs took precedence over everything else. Requisitioning evoked much bitterness in the villages and was accompanied by many abuses. But the army and the cities could not have been given even a minimum food ration without requisitioning.

The New Economic Policy.—An uprising of sailors in the important naval base of Kronstadt in March 1921 sounded the doom of War Communism. There had already been sporadic peasant revolts in the Ukraine, in Tambov province, in Siberia. But the Anarchist revolt at Kronstadt, a fortress so close to Petrograd, a fortress which had always been considered a stronghold of Communism, was interpreted by Lenin as a definite warning that other economic methods must be tried. The tenth congress of the Communist party, which met in Moscow in March 1921, adopted without opposition Lenin's proposal that a tax in kind, of about one-tenth of the peasant's produce. should be substituted for the former arbitrary requisitioning of all the peasants' surplus. This was the cornerstone of the New Economic Policy, or N.E.P., as it was generally called; a number of other changes inevitably followed.

Since the peasant was given the right to sell his produce, private trade within the country automatically became legal. A whole new class of so-called nepmen, shrewd and cunning speculators who had survived all the rigours and repressions of War Communism, emerged from hiding and began to play a conspicuous part in Soviet life. Small private business was again permitted. The slack accounting and financial methods of War Communism were revised, and the trusts or organs of management for the state industries were required to balance their budgets and, if possible, show a profit. Payment of rent and taxes and charges for public services were restored. The rouble was stabilized at its old value of U.S. 51.2 cents and for a short time this new Soviet currency was freely interchangeable for foreign currencies. This situation soon came to an end, however; both export and import of roubles were forbidden and the Soviet currency remained strictly reserved for internal use. There was a vast discrepancy between the official value of the rouble and its quotation on the black market.

The adoption of the New Economic Policy, coinciding with the end of the civil war, broke the many vicious circles in which Soviet economy had become entangled. The curve of industrial production, of agricultural output, of wages and of productivity turned upward. Houses were repaired and made habitable. The cities again filled up. The light industries which produced goods for everyday use were first to recover; but in time the coal and iron mines of the Donets basin and Krivoy Rog, the oil wells of Baku, the metal and machine factories of Leningrad and Kharkov and other industrial centres were again able to set their wheels in motion to work up to normal productivity.

The chief economic organizations of this period were the trusts and the syndicates. **A** trust, which was entirely state-owned, administered an industry or part of an industry. and in some cases a number of trusts combined and vested selling functions in a syndicate. The supreme economic council continued to function as a general state board of direction for industry. A body that began to acquire more importance in the late 1920s was the Gosplan, or State Planning commission. Originating as a commission attached to the council of labour and defense, it assumed the function of endeavouring to plot the graph of the national economic development by publishing so-called control figures, in which the output of the coming year in every branch of national economy mas laid down. There mere distinct limits to this planning under the N.E.P., because the peasants, the private traders and small businessmen were outside its scope. But it acquired increased significance in the third phase of Soviet economic life, that of planned economy.

It had been a part of the New Economic Policy to grant concessions to foreign capitalists and businessmen. While the Soviet government. by a decree issued on Feb. 3, 1918, repudiated all the internal and foreign debts of its predecessors, and refused either to restore the properties of foreign business firms which it had seized or to pay compensation for their seizure. it came to realize that foreign capital could be useful if the devastations of war, revolution and civil war were to be quickly repaired. The government therefore professed willingness to lease to foreign concessionaires various mines and factories which, lacking resources, it was unable to operate itself.

A decree of the council of people's commissars of Nov. 23, 1920, contained elaborate regulations concerning these concessions. The government guaranteed that property invested by a concessionaire in an undertaking within the territory of the Soviet Union would not be subject to nationalization, confiscation or requisition. By Oct. 1, 1927, 2,200 applications for concessions from different foreign countries were received, but only 144 agreements were concluded, and only 99 were in operation. At that time the total amount of foreign capital invested in concessionary enterprises amounted to $101,400,000. Almost half of the investments were in mining. 36% in manufacturing and the rest in forestry, trade, transport, fishing and other concessions. The two largest concessions were that for the exploitation of the Lena gold fields obtained by an Anglo-U.S. group and that of the manganese mines at Chiatura, Georgia, obtained by the Averell Harriman interests. During the N.E.P. period these concessions flourished, but they never played an important part in Soviet economic development. They mere all wound up and liquidated during the first five-year plan. Russia's industrialization was financed entirely by sacrifices imposed on the Soviet peoples.

Although the New Economic Policy was a period of industrial and agricultural progress and of a rising standard of living after the appalling depression of War Communism, it contained some features that were disquieting to the Communist party. There was a feeling that capitalism was undermining the bases of socialist economy. Elbowed out in the struggle for power that went on behind the scenes after Lenin's death, Trotsky directed criticism against the alleged compromising of socialist principles by Stalin, who emerged more and more as the outstanding leader of the Communist party and, consequently, of the Soviet regime.

While the New Economic Policy was an immense improvement, from the peasants' standpoint, over War Communism! it did not prove able to adjust satisfactorily the relations between city and village. The theoretical buying power of the peasant was considerably increased, for two reasons. With the recent memory of inflation and worthless paper money, he had little incentive or desire to save. He could not use his money to buy land and enlarge his farm, for the purchase and sale of land remained forbidden. Consequently, the peasant's instinct was to spend his surplus money for consumers' goods. and the light industries were never able to satisfy his needs. Shortage of manufactured goods, high prices and poor quality became constant peasant complaints, and by 1928 there was already a tendency for the peasants to carry out a kind of slowdown strike, to raise less for the city market, which did not seem able to give them a fair equivalent in exchange.

Perhaps the basic cause of the liquidation of the N.E.P. was the fundamental incompatibility between socialist industry for the towns and small peasant proprietorship in the villages. One system or the other had to be greatly modified. and Stalin decided that it would be possible both to cut the ground from under the feet of his critics within the party and to find a way out of the economic crisis by driving toward the double goal of a highly industrialized state and an agriculture that would be mechanized and placed under strong state control. (For a political account of the N.E.P. see *History* above.)

Pre-World War II Five-Year Plans.—Industrialization and collectivization of agriculture dominated Soviet life during the first five-year plan. which was shortened to four and a quarter years and ran from Oct. 1928 until the end of 1932. The task which the government had set was a formidable one and could probably only have been realized by a regime which possessed absolute political power and the will to use that power with utter ruthlessness. Labour under the N.E.P. had been free and there were between 1,000,000 and 2,000,000 unemployed who received state and local relief. The effect of the first five-year plan. with its new factories and tremendous demand for labour, was to create a labour shortage. This led to a growing tendency to attach the worker or the engineer to his job. to forbid him to leave under threat of legal penalties. Forced labour on a large scale was introduced for the classes which were doomed to economic extinction under the new policy. the *kulaki* (or rich peasants) and the nepmen. The political police were constantly carrying out round-ups of suspected elements in the cities, a familiar penalty being an administrative sentence to work on one of the new enterprises; and there were mass deportations of kulaks and their families from their native villages to timber camps and new industrial plants, where they were set to work at unskilled labour for bare subsistence rations.

A marked characteristic of Russia throughout the first five-year plan was the acute shortage of foodstuffs and of manufactured goods. There were several reasons. Agriculture was in a state of turmoil and upheaval. The dispossessed kulaks. being the better farmers, had produced a larger than normal share of food and other crops. Their elimination left a vacuum that was not immediately filled. Moreover, everything was subordinated to the needs of the heavy industries. Foodstuffs that were very short in Russia were shipped abroad to obtain foreign exchange to finance the purchases of machinery and equipment for the new industrial plants. Transport was under a heavy strain. and food products were often not equitably distributed. There was a vast influx of peasants into the cities and new industrial towns, and this meant an increased demand on all sources of supply.

Rationing, unknown since the end of the civil mar, was reintroduced. Money became devalued. The insufficient supplies in the state and co-operative shops were distributed on a rationed basis and a system grew up under which every institution or factory had its own shop or its own restaurant. exclusively for the use of its own employees. Private trade again became illegal. in fact if not in law, the supply of goods in the private markets diminished and prices soared. The purchasing power of the rouble in free trade shrank by 90% or more. How much money a man earned became less important than what type of shop or restaurant he was permitted to patronize.

However, the Soviet planned economy developed under more favourable auspices than the primitive experiment of 1918–21. There was no distraction by war and all the mobilized energy of the country could find expression in new industrial construction. A younger generation had grown up under the influence of the Soviet schools and the Young Communist league. willing to endure hardship and to smash pitilessly any opposition. The Soviet Cnion was no longer blockaded and cut off from the outside world. It was possible to engage the services of thousands of foreign engineers and technicians, mostly Americans and Germans, to direct the building and the first stages of operation of the factories, mines and electrical power plants which were part of the scheme of industrial development.

So, although the human and material costs of this experiment in planned economy were prodigious (there were millions of deaths from famine and related diseases in the Ukraine and in the northern Caucasus in 1932–33, and the casualties among the deported kulaks and other "class enemies" of the Soviet regime mere considerable). the political structure successfully withstood the strain. By the time the first plan was completed a considerable stride had been taken toward the goal of making the Soviet Union industrially self-sufficient.

TABLE XV.—*Industrial Production of the U.S.S.R.*
(In million metric tons, electricity in thousand million kw hr)

	1913*	1920	1928	1932		1937		1940 (actual)
				(actual)	(plan)	(actual)	(plan)	
Coal†	29.1	8.5	35.5	64.3	75.0	128.0	152.5	165.9
Crude petroleum	9.2	3.8	11.6	21.4	22.0	28.5	47.5	31.1
Electricity	1.9	0.5	5.0	13.5	22.0	36.2	38.0	48.3
Pig iron	4.2	0.1	3.4	6.2	10.0	14.5	18.0	14.9
Crude steel	4.2	0.2	4.3	5.9	10.4	17.7	19.0	18.3
Cement	1.5	...	1.9	3.5	...	5.5	...	5.7

*Russia before World War I in 1921 frontiers.
†Hard coal, anthracite and lignite on a ton-for-ton basis.

Some industries that had been nonexistent or negligible before the five-year plan, such as the manufacture of tractors, automobiles and motor trucks. were put on a mass production basis. Indeed, the advance of the tractor and agricultural machinery industries was intimately bound up with the Soviet scheme for the collectivization of agriculture.

The degree of realization of the first five-year plan was mixed and spotty. Heavy industry certainly received a powerful impetus and the ground had been prepared for further progress by the erection of such large factories and hydroelectric power installations as the Magnitogorsk iron and steel works, the Kuznetsk iron and steel plant, the tractor factories at Stalingrad and Kharkov, the Moscow and Gorki automobile plants, the agricultural machinery works at Sverdlovsk, the chemical plants at Berezniki and Stalinogorsk and the Dnieper dam and power plants, which mere designed to supply power to several newly built factories. On the other hand. the desired figures of agricultural production were not realized and the parts of the plan which had provided for an increased standard of living. even specifying the increased amounts of meat, eggs and butter which should be available. were entirely unfulfilled. General iiving conditions during the first five-year plan were bleak and hard, more suggestive of war than of peace.

The second five-year plan, covering the years 1933–37, was followed by a third plan for 1938–42 which was interrupted by World War II. During the first five-year plan, 1; new blast furnaces. 4; open-hearth furnaces and many rolling mills were built. During the second five-year plan, 20 blast furnaces, 86 open-hearth furnaces and 49 rolling mills were built. Although, except in coal production, none of the aims of heavy industry was fulfilled, the U.S.S.R. began to appear as a major industrial power. (See Table XV.) In 1937 it extracted 949 kg. of coal per capita as compared with 2.716 kg. in Germany. 3,476 kg. in the United States and 5,198 kg. in the Cnited Kingdom. In the same year the Soviet production of steel per capita amounted to 108 kg. as compared with 281 kg. in the United Kingdom, 294 kg. in Germany and 399 kg. in the United States. Speaking in Moscow on Feb. 4, 1931, Stalin said: "We are 50 or 100 years behind the advanced countries. We must make good this distance in 10 years. Either we do it, or they crush us." From the point of view of defense and also in order to establish a necessary base for light industry, it was sound to insist that heavy industry should be developed first. The existence of heavy industry, especially in the Urals and in the Kuznetsk basin, was an important contributory factor of the successful Soviet resistance when the U.S.S.R. was attacked by Germany. (W. H. CH.; K. SM.)

Collectivization of Agriculture.—The position of the peasantry in the tsarist empire was anything but idyllic, but after 1861 it began to improve. Personal serfdom was abolished and the gentry were compelled to sell half their lands to the peasants. The peasants received the land for which the state advanced the money to the country squires or *pomeshchiki* and in turn expected to recover it from the peasants by payments extending over 45 years. Progress was slow, however, The government did little

to improve agricultural production, the country squires showed little initiative, and no enlightened activity could be expected from illiterate peasants.

On the eve of World War I, the total agricultural land in Russia was 367,200,000 ha., of which 152,500,000 ha. (41.7%) belonged to about 30,000 country squires (each having on the average 2,530 ha.). to the church or to the crown, and 214,700,000 (58.3%) belonged to the peasants. Of the latter land about 84,000,000 ha. belonged to 3,400,000 rich peasants or *kulaki*. There were about 18,600,000 poor (biedniaki) and medium (*serednіaki*) peasants who possessed together 130,700,000 ha. of land, an average of 7 ha. per household. In addition there were about 11,000,000 landless agricultural workers or *batraki*. Among the latter and the poor peasants land hunger was great and this was a major reason for the success of the Communist revolution. Lenin's explosive slogan "Land to the peasants" was enough to disrupt the front and to provoke immediate chaos. A few hours after he seized power. Lenin published his decree of Oct. 26 (Nov. 8), 1917, "socializing" all the land; which meant that it became state property. The peasants had only one thing in common with the Communists, namely, their dislike for the landed gentry. They seized the land of the *pomeshchiki* and parcelled it among themselves, and by 1920 there mere in Russia about 24,200,000 peasant holdings. This situation was "illegal," but it lasted until 1929. The Communist propaganda for collective farms or kolklzozy (kolkhoz, short for *kollektivnoye khozyaystvo*) had little effect and at the beginning of 1929 only 1.7% of peasant holdings joined them.

In 1929 Stalin started to enforce the collectivization of agriculture and by 1932 there were 211.100 kolkhozy grouping 14,900,000 (61.5%) individual peasant holdings and 77.7% of the agricultural land. By Jan. 1939 about 215,000 kolkhozy included 18,800,000 (93.5%) peasant holdings occupying 370,800,000 ha. of land. There were also 3,998 state farms or *sovkhozy* (*sovkhoz*, short for sovietskoye *khozyaystvo*) occupying 51,100,000 ha. of agricultural land.

As a result of the civil war the production of grain had fallen from 80,100,000 tons in 1913 to 50,300,000 tons in 1922, but in the years preceding collectivization it was nearly as high as before World War I. When starting the second agrarian revolution (the signal for the first having been Lenin's decree of Nov. 8, 1917), Stalin wrote in Pravda on Nov. 7, 1929, that Soviet agriculture was expected to display "miracles of growth," for, instead of individual farms, "large grain factories" were to be created. In fact, the production of grain declined. While in 1928 the grain harvest amounted to 73,300,000 tons with 490 kg. per capita, the 1932 harvest was 66,400,000 tons with 410 kg. per capita. An even more dramatic outcome of collectivization was the mass slaughter of livestock. The peasants preferred to eat their cattle, pigs and sheep, or to sell them on the black market, rather than to hand them over for collective ownership. This explains why between 1928 and 1932 the number of cattle fell from 66,800,000 to 38,300,000, the number of pigs from 27,700,000 to 10,900,000 and the number of sheep and goats from 114,600,000 to 47,600,000. This catastrophic fall in turn caused severe famine. The famine and the deportation of recalcitrant peasants to Siberia brought about a loss of population estimated at 5,500,000.

However, Stalin continued to enforce collectivization. On Feb. 17, 1935, the council of people's commissars approved the model statute of the kolklzoz prepared by the second congress of shock *kolkhoz* workers, the only concession to the peasants' attachment to private property being that every household was entitled to possess a small plot from 0.25 ha. to 0.5 ha. with some livestock. This private household plot was later guaranteed by the 1936 constitution.

The constitution created two forms of property, state and collective. The kolklzoz was an inalienable unit and its boundaries could not be changed. The main work of the collective farmers was to be for the collective farm and they were paid, partly in kind, partly in cash, on the basis of the quantity and quality of the work performed. The chairman of the kolklzoz was theoretically elected by the members, but the local Communist organization picked the right candidate. The larger machines, tractors, harvesting combines, threshing machines, were not sold directly to the kolklzozy. They were placed in machine-tractor stations (M.T.S.), state-controlled organizations which undertook to cultivate the land of the kolkhozy within a given radius. Between 1934 and 1938 the number of M.T.S. rose from 2,900 to 6,350, when they had together 394,000 tractors, 153,500 harvester combines and 195,800 lorries (trucks). Payment for the M.T.S. was made in kind. Receipts from the M.T.S., and from the fixed quantity of grain, cotton, sugar beet and other produce as well as of livestock, were supposed to ensure the food supply of the cities, industrial centres and the armed forces. The state resold the foodstuffs at a great profit by adding the so-called turnover tax, which during 1951–55 constituted about half the budget revenue.

Reporting on March 10, 1939, to the 18th congress of the C.P.S.U., Stalin boasted that Soviet agriculture was the most mechanized in the world. To hide the inadequacy of grain crops, he ordered in 1933 that in published statistics these crops should appear not in actual barn yield, but in "biological" estimates determined in the field prior to harvest. However, because of inevitable harvest losses, crops available for use were at least from 16% to 20% less than the estimates. The numbers of livestock increased, but were smaller by one-fifth in 1938 than in 1928, while the total population rose during the period from an estimated 150,000,000 to 167,000,000. (For agricultural production and the livestock position between World Wars I and II *see* Tables XVI and XVII.)

TABLE XVI.—*Agricultural Production* of the *U.S.S.R.*

		1913*	1922	1925	1928	1932		1937		1940†	1942
						(actual)	(plan)	(actual)	(plan)		(plan)
Total area sown (million ha.)		105.0	77.7	104.3	113.0	134.4	141.3	135.3	140.0	150.4	147.4
Under grain (million ha.)		94.4	66.2	87.3	92.2	...	...	104.5	...	110.5	...
Grain‡ (million tons)		80.1	50.3	72.7	73.3	66.4	105.8	95.9§	110.6	95.2§	130.0
Crops	of which per ha. in kg.	850.0	760.0	835.0	800.0	...	...	913.3	...	865.4	...
	Potatoes (million tons)	23.6	...	38.6	...	45.9‖	...	57.41	...	84.2	...
	Cotton, unginned (million tons)	0.74	...	0.6	0.8	1.3	1.9	2.6	2.3	2.2	2.8
	Sugar beet (million tons)	10.9	...	8.8	10.1	6.6	19.6	21.6	27.6	21.8	30.0

*Russia before World War I in 1921 frontiers. †Including the annexed territories in the west. ‡Bread grain and coarse grain. According to Soviet statistics in 1938, for example, 67% of all grain produced was bread grain (wheat 39%, rye 24.5%, buckwheat 1.1%, millet 2.1% and rice 0.3%). §From 1933 the figures given for Soviet grain crops represented not the actual amount harvested but a "biological" estimate determined in the field prior to harvest. Data for 1937 and 1940 are in estimated barn yield. Harvest losses of one-fifth are assumed in a poor year and of one-sixth in a good year. ‖Annual average 1928–32. ¶Annual average 1933–37.

TABLE XVII.—*Livestock* in the *U.S.S.R.*

(In million head, Jan. 1)

	1916*	1920	1928	1932		1937		1941†
				(actual)	(plan)	(actual)	(plan)	
Cattle	51.7	38.6	66.8	38.3	80.9	47.5	65.5	54.5
of which cows	24.9	...	33.2	22.3	35.5	20.9	...	27.8
Pigs	17.3	15.1	27.7	10.9	34.8	20.0	34.8	27.5
Sheep and goats‡	88.7	58.2	136.6	47.6	160.8	53.8	94.8	81.6
Horses	35.8	24.5	36.1	19.6	36.9	16.7	21.8	21.0

*Russia before World War I in 1921 frontiers. †Including the annexed territories in the west. ‡Number of goats (in millions of head) was 8.2 in 1916, 6.8 in 1922, 13.4 in 1928 and 11.7 in 1941.
Source: *Bolshaya Sovietskaya Enisiklopedia: S.S.S.R.* (Moscow, 1948) and *Narodnoye Khozyaystvo S.S.S.R.* (Moscow, 1956).

World War II and **the Soviet Economy.**—Soviet economic losses during World War II were staggering, for the German armies rapidly overran the most productive areas of the country. According to figures given by N. A. Voznesensky, head of the State Planning commission, about 40% of the population of the Soviet Union lived in the areas overrun by the Germans in 1941; these areas also accounted for about 66% of Soviet heavy industries, 38% of its grain and 30% of its cattle. In the following year, the loss of the Maikop area involved an important centre of high-grade fuel ex-

traction, and in general it was estimated that the output of oil fell from 31,000,000 tons to 18,000,000 tons between 1940 and 1942. Between one-fifth and one-quarter of the capacity of the heavy and light mechanical industry and 40% of the capital equipment of the food industry were also reckoned as lost.

According to Voznesensky the number of workers in the occupied areas was reduced by the end of the war to 17% of the former figure and the number of industrial plants to 13%. Almost two-thirds of the cattle and four-fifths of the horses had been lost. Productive resources destroyed included 31,850 factories employing 4,000,000 persons, 98,000 collective farms, 137,000 tractors, 49,000 combines, 13,000 railway bridges. In addition, the homes of perhaps 25,000,000 people, together with schools, hospitals, cultural and scientific establishments and every form of material wealth. had been totally destroyed; in all, about two-thirds of the entire capital of the-occupied areas.

The evacuation at high speed of much industrial plant to the eastern regions away from the war fronts was a fundamental factor in the Soviet war achievements. The population evacuated to work in the new and expanded industries, which may even have numbered more than 12,000,000 persons, suffered terrible hardships from the severe climatic conditions and from the lack of housing as well as from food shortages. Such, however, was the lot of the civil population throughout the U.S.S.R. The industrial and agricultural output in the Urals, Siberia, central Asia and the Volga area rose sharply.

Postwar Five-Year Plans.—The major task of the Soviet Union in the postwar years was that of reconstructing its internal economy. The advances made in the eastern areas were not abandoned and were indeed extended, much importance being attached particularly after 1950 to new projects for hydroelectric works and irrigation. But the overrun European provinces of the Soviet Union had also to be restored. During the postwar period the methods of economic organization pursued were not substantially different from those of the 1930s. A new five-year plan (1946–50) was adopted by the supreme soviet in March 1946.

TABLE XVIII.—*Industrial Production of the U.S.S.R.*
(In million metric tons; electricity in thousand million kw.hr.)

Item	1940	1945	1950		1955		1956 (actual)	1960 (plan)
			(actual)	(plan)	(actual)	(plan)		
Coal	165.9*	149.3†	261.1‡	250.0	391.0§	372.0	419.0	593.0
Crude petroleum	31.1	19.4	37.9	35.4	70.8	70.0	83.8	135.0
Electricity	48.3	43.3	91.2	82.0	170.1	163.0	192.0	520.0
Pig iron	14.9	8.8	19.2	19.5	33.3	34.0	35.8	53.0
Steel	18.3	12.3	27.3	24.4	45.3	44.0	48.6	68.0
Cement	5.7	1.8	10.2	...	22.5	22.7	24.9	55.0

*Including 26,000,000 tons of lignite. †Including 49,900,000 tons of lignite. ‡Including 75,900,000 tons of lignite. §Including 114,900,000 tons of lignite.

After the Allied victory of 1945, and after the destruction of the German and Japanese war machines, there were many people even in the Soviet Union who hoped that the postwar five-year plans would insist less on armaments and military preparedness and more on reconstruction and on increasing the standard of living. But the stress was still on heavy industry and national defense. In a speech of Feb. 9, 1946, Stalin directed that in the shortest possible time the Soviet Union must heal the wounds inflicted by the enemy and not only recover the prewar level but even surpass it in the near future. "We must," he said, "achieve a situation wherein our industry is able to produce annually up to 50,000,000 metric tons of pig iron, up to 60,000,000 tons of steel, up to 500,000,000 tons of coal, up to 60,000,000 tons of oil. Only under such conditions can we regard ourselves as guaranteed against any accidents. This will require perhaps three five-year plans, if not more. But this task can be accomplished, and we must accomplish it."

Home propaganda insisted that the fatherland was still encircled by the capitalist enemies preparing for aggressive war. The fourth plan was followed by the fifth (1951–55) with similar aims. After the death of Stalin (1953) under Malenkov a "new course" was introduced in industrial policy, aiming at a greater production of consumer goods and the slowing down of the expansion of heavy industry. Malenkov's replacement by Bulganin in Feb. 195; meant the abandonment of the "new course." In July 1955, Bulganin referred with contempt to certain Soviet economists who maintained that the time had come to fix equal rates of growth for heavy and light industries. "Such anti-Leninist views." Bulganin went on, "if applied in practice, would disarm the Soviet Union facing the enemy capitalist camp and would weaken the defensive power of our fatherland."

As can be seen from Table XVIII, Soviet progress in heavy industry after World War II was rapid and spectacular. The Soviet Union in 1955 produced 11 times more coal, 6 times more crude petroleum, 27 times more electricity and 10 times more steel than in 1928 when planned industrialization began. In addition, there was the industrial production of the seven Soviet-controlled European people's democracies where the pace of industrialization was directed by the Council for Mutual Economic Aid (C.M.E.A., *Soviet Ekonomicheskoy Vzaimnopomoshchi*), which was created in Moscow in Jan. 1949 with Bulgaria, Czechoslovakia, Hungary, Poland, Rumania and the U.S.S.R. as original members, joined by Albania in February and the German Democratic Republic in Oct. 1950.

The year 1955 was a turning-point in eastern European plan-

TABLE XIX.—*Eastern Europe's Industrial Production*
(In million metric tons; electricity in thousand million kw.hr.)

	Coal		Lignite		Electricity		Crude petroleum		Steel		Cement	
	1938	1955	1938	1955	1938	1955	1938	1955	1938	1955	1938	1955
Poland	38.1*	94.5	—	6.0	4.0	17.7	0.5	0.3	1.4	4.4	1.7	4.0
Czechoslovakia	16.7†	22.1	17.9†	43.0	4.1†	15.0	0.02†	0.2	2.3†	4.5	1.4†	2.5
German Dem. Rep.	3.5	3.5	101.1	200.0	13.9	28.8	—	—	1.4	2.5	3.0	3.0
Hungary	1.0	2.0	8.3	20.3	1.4	5.4	0.04	1.6	0.7	1.6	0.4	1.2
Rumania	0.3	0.4	2.1	5.9	1.1	4.3	6.6	10.6	0.3	0.8	0.5	2.0
Bulgaria	0.1	0.4	1.9	9.2	0.2	2.1	—	—	—	0.02	0.2	
Albania	—	0.2	—	0.2	0.02	0.12	0.14	0.3	—	—	—	(
Total	59.7	123.1	131.3	284.6	24.72	73.42	7.3	13.0	6.1	13.82	7.2	1;

*Production in pre-1939 territory. Estimated production within post-1945 territory was 69,360,000 tons. †1937.

TABLE XX.—*Eastern Europe's Role in Soviet Economy*
(In million metric tons; electricity in thousand million kw.hr.)

		1938	1949	1955
Coal*	Eastern Europe	97	146	207
	U.S.S.R.	133 } 230	230 } 376	391 } 598
Electricity	Eastern Europe	25	39	73
	U.S.S.R.	40 } 65	70 } 109	170 } 243
Crude petroleum	Eastern Europe	7	6	13
	U.S.S.R.	32 } 39	31 } 37	71 } 84
Steel	Eastern Europe	6	7	14
	U.S.S.R.	18 } 24	20 } 27	45 } 59
Cement	Eastern Europe	7	7	14
	U.S.S.R.	7 } 14	9 } 16	23 } 37

*Including lignite. Coefficients used for eastern Europe (quantities of lignite per ton of coal): German Democratic Republic 4.5; Czechoslovakia 1.7; other countries 3.0. Soviet totals are simple sums of coal, anthracite and lignite extracted.

TABLE XXI.—*Great Industrial Powers of the World*

A. Production of 1955 in absolute figures
(In thousand metric tons; electricity in million kw.hr.)

	United States	United Kingdom	E.C.S.C.*	Eastern Europe†	U.S.S.R.	Japan
Coal	448,980	225,132	246,127	206,500‡	391,000	42,420
Electricity	546,408	80,148	184,872	73,420	170,000	63,492
Steel	106,176	20,184	52,585	13,820	45,000	9,612

B. Production per capita
(In kilograms; electricity in kw.hr.)

Coal	2,721	4,414	1,519	2,230§	1,955	477
Electricity	3,312	1,571	1,141	793	850	714
Steel	644	395	325	150	225	108

*European Coal and Steel Community comprising the German Federal Republic, France, the Saar, Belgium, the Netherlands, Luxembourg and Italy.
†Poland, Czechoslovakia, the German Democratic Republic, Hungary, Rumania, Bulgaria and Albania.
‡Including lignite in terms of coal.
§Poland alone produced 3,436 kg. per capita.

ning. It marked the completion of the fifth Soviet five-year plan as well as of the Polish six-year plan and of the German Democratic, Rumanian and Albanian five-year plans. The Czechoslovak five-year plan ended in 1953 and the Bulgarian five-year plan was claimed to have been completed in 1952; after that these two countries worked on the basis of annual plans, marking time in order to start a series of co-ordinated and synchronized five-year plans for 1956–60. During 1955, under the supervision of the C.M.E.A., the experts of the U.S.S.R. and seven people's democracies were preparing their plans for industrial development and still closer integration of the whole area. The chief Communist planners said that, whereas in the past the satellite countries were developing their industries without sufficient co-ordination within the "camp of Socialism." now the whole planning would be based on "a new international Socialist division of labour." The solution to the problems facing the area lay in the further development of heavy industry, particularly of the machine-building industries, and the general use of advanced techniques and modern equipment. As can be seen from Table XIX, there were considerable increases in industrial production in eastern European countries between 1938 and 19*jj*. Table XX shows that in 19*jj*, for every 100 tons of coal and lignite produced by the U.S.S.R., the people's democracies added *53* tons to the pool; for every 100 tons of steel they contributed *31* tons; for every 100,000 kw.hr. of electric power generated in the U.S.S.R. the satellite states produced 42,940 kw.hr., and for every 100 tons of cement they added *64* tons.

These achievements, even if the additional production of the Soviet satellites was taken into account, were still behind those of the free world in general and of the United States in particular, especially if output per capita is taken into consideration. (*See* Table XXI.)

Soviet Agriculture After World War II.—To the Russian, Ukrainian, Turkic and other peasants of the U.S.S.R. the idea of collectivization was obnoxious and it mas opposed in many ways with great ingenuity. Already before World War II, instead of working the land by big "brigades," collective farm workers preferred the smaller "links," consisting of members of one household, which to a certain extent meant the restoration of the individual farm within the collective. During World War II some relaxation of agricultural collectivism was inevitable and in many cases the peasants "illegally" increased their private plots to the detriment of the *kolkhoz* property. At the end of 1949 measures were taken not only to restore the prewar system, but also to transform the collective farms into "large grain factories." Khrushchev was made responsible by the Politburo for carrying out the enlargement of *kolkhozy* by amalgamation. At that time, as the collectivization of agriculture was completed in the western annexed lands, the number of *kolkhozy* had increased to 254,000 and that of *sovkhozy* to 4,540. By Dec. 1950 the number of the former had been reduced to 121,400. In Dec. 1955 there were 85,700 *kolkhozy* and 5,134 *sovkhozy*.

Not only were the small *kolkhozy* merged into bigger ones, but also "agro-towns" *(agrogorody)*, or barracks for proletarianized peasants, were planned and a few were actually built. All this was being done with a triple aim: first, to crush the passive resistance of the peasantry who were undermining "Socialist construction" by their "slowdown" methods; secondly, to release more manpower for industry; and, thirdly, to increase agricultural production by new methods. However, resistance to *agrogorody* within the Communist party must have been great because all propaganda for them had ceased by spring 1951.

The fifth five-year plan (1951–5*j*) fixed the production "target" for grain at 186,700,000 tons, still "biologically" estimated. However, the actual annual barn yield of grain harvested in 1951–53 averaged only 103,700,000. In Feb. 1954 Khrushchev produced an entirely new proposal for dealing with the problem. This mas to form new *sovkhozy* in northern Kazakhstan and western Siberia, where there were millions of hectares of virgin or neglected, but fertile, land. In the' following two years about 500,000 skilled and unskilled young workers were sent to the virgin lands, equipped with tractors and modern agricultural implements. On Jan. *20*, 1956, Rhrushchev revealed that *30,000,000* ha. of land had been reclaimed in Kazakhstan and Siberia and 33,000,000 ha. in the country as a whole. There were *j61* new *sovkhozy*, including 425 in Kazakhstan and Siberia.

The sixth five-year plan called for a total grain crop of 180,000,000 tons in *1960* and this figure was almost certainly based on barn yield; it was therefore up to one-fifth higher than that of 1955. However, the actual crop in 1955, a good year, was 129,000,000 tons *(see* Table XXII). The sixth five-year plan also stated that livestock would be extensively developed but no absolute figures were published. In animal husbandry the achievements of the postwar plans not, on the whole, reach the standards fixed *(see* Table XXIII).

The reclamation of virgin lands was a bold and imaginative

TABLE XXIII.—*Livestock in the U.S.S.R.*
(In million head, Jan. 1)

	1941	1945	1950 (actual)	1950 (plan)	1953*	1953	1955 (actual)	1955 (plan)
Cattle	54.5	47.0	58.1	65.3	56.6	63.0	67.1	68.6
of which cows	27.8	...	24.6	27.2	24.3	26.0	29.2	...
Pigs	27.5	18.0	22.2	31.2	28.5	47.6	52.2	36.2
Sheep and goats	91.6	69.4	93.6	121.5	109.9	135.8†	142.6‡	160.4
Horses	21.0	10.5	13.7	15.5	15.3	16.2	16.4	16.4

Sources: Annual plan fulfilment reports published by the Central Statistical Administration of the U.S.S.R. Council of Ministers.
*This set of data is taken from the report to the central committee of the C.P.S.U. by N. S. Khrushchev (*Pravda*, Sept. 3, 1953). The following set of data is supposed to represent the Soviet livestock numbers as on Oct. 1, 1953. The discrepancy between these two sets of figures, especially that concerning the number of pigs, was not explaincd.
†Including 21,021,000 goats. ‡Including 17,654,000 goats.

TABLE XXIV.—*Soviet Agriculture and Animal Husbandry: Balance-Skeet 1909–55*

	1909–13 Total	1909–13 Index	1925–28 Total	1925–28 Index	1951–55 Total	1951–55 Index
Population (in millions)	135.0	100	152.0	112	192.0	142
Total area sown (million ha.)	107.4	100	110.0	103	167.0	156
Under grain " "	92.6	100	91.9	99	112.0	121
Grain harvest (million tons)	67.6	100	72.6	107	109.0	161
of which per ha. in kg.	730	100	790	108	973	133
of which per capita kg.	500	100	477	95	568	113
Cattle (million head)	58.6	188	66.8	115	67.1	115
per 100 inhabitants	45		44	98	35	78
Cows (million head)	29.5		33.2		29.2	99
per 100 inhabitants	22		22		15.2	68
Pigs (million head)	20.9	100	27.7	132	52.2	248
per 100 inhabitants	15	100	18	120	27	180
Sheep (million head)	113.0	100	101.2	90	124.9	110
per 100 inhabitants	84	100	67	80	65	77
Horses (million head)			36.1	101	16.4	46
per 100 inhabitants	25.8	100	24	90	8.5	31

Note.—While for agricultural production annual averages were calculated for the years mentioned, in the case of livestock the figures are those of 1913, 1928 and 1955 respectively.

TABLE XXV.—*Distribution of Soviet Livestock According to Property*
(In million head)

	1932 Cattle	1938 Cattle	1941 Cattle	1941 Pigs	1954 Cattle	1954 Pigs	1954 Sheep
State farms	3.6	6	2.2	1.7	4.1	2.9	9.7
Collective farms	10.1	18.3	20.0	8.2	33.0	18.6	70.1
Industrial and office workers	13.6	38.5	32.3	17.6	27.8	29.6	37.7
Individual peasants	13.4	1.8	—	—	—	—	—
Total	40.7	63.2	54.5	27.5	64.9	51.1	117.5

TABLE XXII.—*Agricultural Production of the U.S.S.R.*

	1940	1945	1950 (actual)	1950 (plan)	1951	1952	1953	1954	1955	1955 (plan)
Total area sown (million ha.)	150.4	104.3	146.3	159.9	...	156.4	...	166.1	185.9	169.0
Under grain (million ha.)	110.3	85.5	102.9	105.8	...	107.8	...	112.0	126.4	...
Crops: Grain (million tons)	95.2	53.5	99.7	101.6	97.0	113.0	101.0	105.0	129.0	186.7
of which per ha. in kg.	805.0	623.0	968.0	958.0	...	1,046.0	...	937.0	1,024.0	...
Potatoes (million tons)	84.2	...	87.0	...	...	...	...	...	...	147.8
Cotton, unginned (million tons)	2.2	1.3	3.4	3.1	3.6	3.6	3.7	4.0	3.7	6.0
Sugar beet (million tons)	21.8	8.9	21.4	26.0	24.4	22.9	23.8	20.3	31.4	39.4
Flax, fibre (million tons)	0.56*	...	0.72	...	0.55	0.60	0.36	0.61	1.07	...
Sunflower seed (million tons)	...	...	2.8	...	2.7	3.4	4.1	3.0	5.8	...

Note.—Data for grain are in estimated barn yield, *Annual average 1933–37.

enterprise, the results of which would be known only after a few years. But if a balance-sheet of Soviet agriculture up to 1955 (see Table XXIV) is analyzed. two things are clear: first, that the annual production of grain per capita in 1951–55 was only slightly higher than in tsarist Russia or under the Soviet regime in the precollectivization period (500 kg. per capita in 1909–13, 477 kg. in 1925–28 and 568 kg. in 1951–55); secondly. that in 1955, apart from pigs, there mas proportionately less livestock in the Soviet Union than in tsarist Russia in 1913 or in the Soviet Union in 1929 (for instance, there were 22 cows per 100 inhabitants in 1913, as compared with 15 in 1955).

The Soviet Union is the largest state of the world and its area covers 15% of the land surface of the earth, but its population was only 8% of the world total. Only about 19.4% of the Soviet territory was in agricultural use (436,000,000 ha. in 1955) and only about 10% was arable land. The total area sown amounted in 1955 to 84% of the Soviet territory and that under grain to 5.7%. The amount of arable land could, of course, be increased, not only by reclaiming virgin lands, but also by irrigation. Both ways nere applied, but both were slow and costly. Among the decisions of the central committee of the C.P.S.U. and the council of ministers published on March 10, 1956, one of the most far-reaching recommended the reduction of the private plots to the size of small vegetable gardens and also a reduction in the amount of privately owned livestock. As can be seen from Table XXV, in 1954 almost 43% of all Soviet cattle. 58% of pigs and 31% of sheep were privately onned by the collective farmers, industrial workers and office employees.

Forestry. — The Soviet Union has the largest forest reserves in the world It has been estimated that in 1952 forests covered about 655 300,000 ha. or 29.3% of the country's area. They mainly extended across the northern half of European Russia and almost the whole of Siberia south of the Arctic circle, but there uere no forests east of Okhotsk, except in the southern part of Kamchatka. Four-fifths of the forests are coniferous. Siberia contains about 78% of the U.S.S.R.'s forests but its population

TABLE XXVII.—*Foodstuffs Production*
(In ooo metric tons; beverages in ooo hectolitres)

	1913	1938	1940	1950	1955 (plan)	1955 (actual)	1960 (plan)
Meat	3,040*	3,607	1,150†	1,275	2,550	2,219	3,950
Sausage products	...	...	400	480	850	830	...
Fish, catch	1,018	1,542	1,404	1,755	3,190	2,740	4,200
Dairy produce:	2,300	5,600	6,500	8,500	...	13,500	25,000
Butter§	104	199	226	336	560	459	680
Cheese	...	...	37.1	48.2	135	105.3	...
Margarine	...	...	118	194	450	364	...
Vegetable oil	...	495‖	709	775	1,500	1,115	1,840
Sugar	1,347	2,520	2,151	2,523	4,800	3,419	6,530
Macaroni products	...	...	370	442	1,030	994	...
Reer.	...	...	11,200	12,900	23,200	...	...
Wine	...	...	1,650	1,440	3,448	3,450	...

*Estimated. †From 1940 state industry only. ‡In *kolkhozy* and *sovkhozy*, in whole milk equivalent. In 1938 the total milk production amounted to 28,861,000 tons. §Excl. home-produced butter. ‖1937.

was estimated in 1955 at 12% of the total. The marketable timber production rose between 1940 and 1955 from 119,000,000 cu.m. to 197,000,000 cu.m., and samn timber during that period increased from about 30,000,000 cu.m. to 58,000,000 cu.m.

Fisheries. — Under the Soviet regime the fishing industry was developed and, like agriculture, collectivized. In 1913 the total catch amounted to 1,018,000 metric tons, including 662,700 tons (65.5%) from the Caspian sea. 107,200 tons (10.5%) from far eastern waters and 77,800 (7.6%) from the Arctic. In 1937 the total catch was 1,608,900 tons; the Caspian share fell to 369 600 tons (25%), but that of the far east rose to 404,800 tons (25.2%) and that of the Arctic to 335.800 tons (22.1%). On the eve of World War II the fishing industry employed 220.000 fishermen and about 130,000 workers in freezing and canning plants. After World War II the fishing industry made further progress. In 1955 the total catch rose to 2,740,000 tons and it was planned to increase it to 4,200 000 tons by 1960.

Hunting. — Hunting in the Soviet Union was regulated by a decree of Feb. 11. 1930. Trading in furs was state-controlled. While in 1913 furs represented 1.8% of Russian exports, by 1928

TABLE XXVIII.—*Textile and Shoe Production*
(In million metres; shoes in million pairs)

	1913	1937	1940	1950	1955 (plan)	1955 (actual)	1960 (plan)
Cotton fabrics	2,582	3,448	3,954	3,899	6,267	5,904	7,270
Linen fabrics	...	...	270	420	406	305	556
Woollen fabrics	103.0	108.3	119.7	155.2	271	251	363
Silk fabrics*	42.6	58.9	76.6	129.7	573	525.7	1,074
Knitwear†	...	...	187	213	470	431	580
Leather shoes	60	182.9	211	203.4	318	274.5	455

*Including artificial fibres.
†Underwear and outerwear, in million units.

TABLE XXIX.—*Light Engineering (Machine-making)*
(In ooo units)

	1940	1950	1955 (plan)	1955 (actual)	1960 (plan)
Bicycles	270	640	3,450	2,880	4,230
Sewing machines	120	490	2,620	1,610	3,780
Washing machines	—	—	196	87	528
Refrigerators	1	...	200	151	635
Wireless sets	200	1,050	3,770		
Television sets	—	30	760	3,530	10,200
Cameras	40	260	1,000	1,490	...
Clocksandwatches.	2,600	7,600	22,000	19,700	33,600

TABLE XXX.—*Prices, Wages and Purchasing Power of the Population*

Date of price reduction	Average real wage of workers (1948=100)	Alleged increase of purchasing power	State loans Boated in the same year
		(in million roubles)	
1947, Dec. 14	...	86,000	25,700
1948, none	100	—	23,900
1949, March 1	112	71,000	22,900
1950, March 1	129	110,000	27,000
1951, March 1	142	34,500	32,600
1952, April 1	152	28,000	36,300
1953, April 1	167	53,000	17,300
1954, April 1	175	20,000	15,900
1955, none	180	—	30,500
1956, none	...	—	34,305

this percentage had risen to 15%. Between 1921 and 1935 furs to a total value of 1.000.000.000 rb. (in the 1926–27 prices) were exported. Furs of greatest importance in order of export value were Siberian squirrel, skunk, hare, fox, Arctic fox, sable and marten.

XII. SOCIAL CONDITIONS

Foodstuffs and Consumer Goods. — The progress of industrialization caused a considerable increase in urban population. By 1955 this population was estimated at about 87,000,000, leaving the rural population at about 113,200,000. In normal conditions these country dwellers would produce enough food for a population at least five times as large. Seven million farmers fed the U.S. population of 165,000,000 and produced a surplus, while about 50,000,000 collective farm workers and workers on the state collective farms were needed to supply the Soviet population of 200,200,000 little above the pre-1914 level. (See Table XXVII.)

The standard of living of the Soviet peoples considerably improved in comparison with conditions in 1945, but on the whole was only slightly better in the late 1950s than before World M'ar II. Assuming that the population of the U.S.S.R. in 1933 was 165,000,000, the annual per capita production of cotton fabrics for clothing and household goods rose between 1937 and 1955 from 20.86 m. to 29.5 m. The production of woollen fabrics rose from 64 cm. to 1.25 m. per capita, the latter being one-fifth of the amount supplied in Great Britain for the home market. Annual production of leather shoes was one pair per inhabitant in 1937 and 1.5 pairs in 1955, as against three pairs a person in the United States. (See Table XXVIII.)

In 1955 about 151,000 refrigerators were produced and it was planned to produce 635,000 in 1960. For washing machines the respective figures were 87,000 and 528,000. By 1960 then one refrigerator would be produced for about 71 households and one washing machine for 85 households. (See Table XXIX.)

Wages and Prices. — No reliable statistical data concerning wages and prices in the Soviet Union are published and figures occasionally given must be accepted with reserve. According to Voznesensky, the average monthly wage of industrial workers in-

creased between 1940 and 1944 from 375 rb. to 573 rb. By 1955 monthly wages in industry, in Moscow and nine other towns, varied from 450 rb. earned by a factory sweeper to 1,200 rb. earned by a foreman; a factory manager earned 5.000 rb. or more.

During World War II rationing of foodstuffs and consumer goods had been introduced. This officially ended on Dec. 14. 1947, simultaneously with the introduction of the monetary reform (see *Finance,* below); retail prices in state shops were reduced. Other reductions followed and by 1955 the average real wage of workers was said to have increased by 80% as compared with 1947. *(See* Table XXX.) Every reduction in prices mas accompanied by an estimated amount which would be "saved" by the consumers as a result of the cut during the year following its introduction. The price cuts did not, however. imply that goods were available in state shops. There was also a "free" market for agricultural and dairy produce supplied by the collective farmers from their private plots and sold at higher prices. Since consumer goods of daily use were still scarce in the late 1950s, there was a flourishing black market. The necessity to buy commodities on all three markets severely reduced the alleged increase in real wages.

National income, which in the Soviet Union means simply net material product, is said to have risen between 1929 and 1940 from 28,900,000,000 rb. to 128,300,000,000 rb. In 1955 it allegedly amounted to 359,240,000,000 rb. These figures suggested that the national income per capita, expressed in the so-called 1926–27 prices, rose between 1929 and 1955 from 190 rb. to 1,796 rb.

Knowing that the supply of foodstuffs and consumer goods was inadequate, every year the government was reducing the amount of money in the hands of the population by floating a more or less compulsory state loan.

TABLE XXXI.—*Medical Personnel and Hospital Beds*

	1913	1941	1955
Medical personnel	19,800	130,400	294,200
Inhabitants per one medical aid	7,071	1,477	681
Hospital beds: In towns	93,223	491,543	...
Hospital beds: In the countryside	49,087	169,888	...
Hospital beds: Total	142,310	661,431	1,110,000
Inhabitants per bed	986	291	180

In spite of seven successive price reductions after World War II, rye bread in Moscow was dearer in 1955 than in 1940 (1.24 rb. instead of 1.00 rb. per kg.); the respective prices of butter were 29.40 rb. and 23.00 rb. per kg.; the price of a man's suit in the autumn of 1955 in Moscow was from 1.000 rb. to 1,800 rb.; that of a pair of shoes was from 550 rb. to 775 rb., and a woman's silk dress was from 400 rb. to 725 rb.

Social Insurance and National Health. — In pre-1914 Russia a rudimentary social insurance legislation covered only sickness and employment injuries and only about 10% of workers and employees participated in the benefits. The Soviet Labour code promulgated on Nov. 9, 1922, introduced a comprehensive system of social insurance comprising medical aid, sickness and maternity benefits, old age and disability pensions, and family alloaances covering all persons gainfully employed. Insurance contributions were to be paid by employers only. A decree of April 12, 1923, fixed the social insurance contributions at 16% to 22% of earnings, according to the degree of danger or detriment to health of the work. On Aug. 25, 1925, new rules on pensions were issued for (1) persons incapacitated at work or by occupational diseases, to receive the full amount of previous earnings; (2) persons over 50 years of age with a working record of at least eight years, to receive not less than 50%; (3) dependents, to receive between one-third and three-quarters of the insured and deceased person's previous earnings. All this legislation was generous mostly on paper. The state was too poor to carry the burden of social security, and state enterprises mere either unable or unwilling to pay their contributions in full and punctually. A decree of Dec. 28, 1927, while reaffirming the payment in full of all the benefits granted previously, added a proviso "except in cases of acute shortage of insurance funds."

Article 120 of the 1936 constitution declared that the citizens of the Soviet Union have the right to old-age pensions and also to sickness and disability benefits. Under the budget for 1951 state expenditure on social security, social insurance and family allowances amounted to 40,000,000,000 rb.; in 1956 this sum was 53,600,000,000 rb.; *i.e.,* 9.1% and 9.4% of the total expenditure, respectively. A new law on state pensions published on May 9, 1956, provided 100% pensions for persons earning 350 rb. monthly, 85% for those earning 350 to 500 rb., 75% for salaries of 500 to 600 rb., 65% for salaries of 600 to 800 rb., 55% for 800 to 1,000 rb. and 50% for 1,000 rb. and more. The new law applied chiefly to 60-year-old men after 25 years' service and jo-year-old women after 20 years' service.

Medical assistance improved considerably under the Soviet regime. In 1955 the medical personnel (*i.e.,* physicians, dentists and pharmacists) was said to be 14.8 times bigger than in 1913, while the number of beds in hospitals, maternity homes and sanatoria increased 7.8 times during the same period. The number of 180 inhabitants per hospital bed in 1955 compared with 86 inhabitants per bed in the United Kingdom. *(See* Table XXXI.)

Housing. — The housing situation in the Soviet Union remained in the 1950s the most acute problem of social policy. Between 1923 and 1939 housing floor space in towns decreased from 6.4 sq.m. per capita to 4 sq.m. (42 sq.ft.). Of 2,567,000 dwelling houses in German-occupied towns, 1,209,000 were destroyed or badly damaged. In 1950, when wartime destructions had been made good, the amount of living-space was estimated at 41 sq.ft. for each member of the urban population. The 1955 figure was 46 sq.ft. By 1960, if the sixth five-year plan were fulfilled, Soviet citizens could look forward to 56 sq.ft. each of housing space. In 1951–55 about 46,500,000 sq.ft. of floor space (the equivalent of 130,000 one-, t o- and three-room flats) were built in Moscow. In 1956–60 it was planned to build 102,258,000 sq.ft. which would amount to about 270,000 to 300,000 flats, that is 360 sq.ft. per flat on the average. In fact, only a minority of Soviet families could enjoy the exclusive use of a bed-sitting room.

Labour Conditions. — On Oct. 29 (Nov. 11), 1917, the council of people's commissars published a decree stipulating a maximum of 8 working hours a day and 48 hours a week; night work was banned for women and juveniles under 18; overtime for male workers over 18 was permissible only in exceptional cases and it was not to exceed 4 hours in 2 days for each worker. On Jan. 19 (Feb. 1), 1918, another decree, issued by the people's commissariat of labour, banned all strikes. On Oct. 15, 1927, the government replaced the 7-day week of 8-hour days by a 6-day week of 7-hour days. This was described as a measure against "slavish habits and a slavish tempo of work." The truth was that at that time there were 1,374,000 unemployed out of a total labour force of 11,800,000 and the 6-day week of 7-hour days was devised as a means to fight unemployment. Instead of having Sunday as a day of rest, Soviet workers were resting every sixth day.

By 1930, however, Soviet industry had begun to experience a shortage of manpower. From 1932 onward "intensification of the working day" became a regular feature of home propaganda. During Sept.–Oct. 1935 great use was made of the achievement of Aleksey Stakhanov, a miner who allegedly in one night-shift dug 102 tons of coal. A Stakhanov movement of "Socialist emulation" was organized and an All-Union Conference of Stakhanovites was held in Moscow. Addressing it, Stalin said on Nov. 17, 1935, that the movement was destined to produce a "revolution in Soviet industry." It was necessary to work hard and he who worked well and gave society his best was a hero: The 1936 constitution declared work not a right but "an obligation and a matter of honour." The constitution maintained the 7-hour day. In practice, however, the workers had to put in an extra hour "in order to improve their technical proficiency." On Dec. 20, 1938, to stop workers from moving from place to place seeking better conditions and pay, compulsory labour books were introduced. Without such a book, lodged with the management, no one could get new work anywhere. On June 26. 1940, the 7-day week of 8-hour days was reintroduced. At the same time strict "labour discipline" was promulgated. Absence from work without a valid reason meant trial before a people's tribunal and sentence to correctional

labour, to be performed at the ordinary place of work, for up to six months. with a 25% reduction of salary. If absenteeism were repeated the culprit could he sent to a forced labour camp.

This system was maintained after World War II. On July 23, 1951, Vasily V. Kuznetsov, chairman of the All-Union Central Council of Trade Unions, said that 90% of workers were taking part in the movement of Stakhanovist "Socialist emulation." Payment by piece-work was the basic form of wage because this permitted the checking of the workers' performance and stimulated working intensity. The trade unions. which by 1955 had an estimated membership of 33,000,000, were an instrument of state coercion and not of protection of workers against employers.

On March 8. 1956. the working week was cut from 48 hr. to 46 hr. On April 25, the government revoked some of the most stringent labour regulations, including the prosecution of workers for ahsenteeism, but factory and office managers retained the right to take disciplinary action against absentees.

Between 1930 and 1940 the number of workers and employees in the national economy outside agriculture rose from 14,500.000 to 31.500,000; these figures included respectively 3,900,000 (26.7%) and 11,370,000 (36.1%) women. By 1950 the total number was 39,900,000 and in 1955 it averaged 48,400,000. In 1960 it was expected to increase to 55,000,000.

Forced Labour Camps.—As early as May 1919 the Soviet government published its first decree on organization and administration of the forced labour camps. They were in the hands of the Cheka and later of the N.K.V.D. Their organization varied. but from 1934 there existed a Main Administration of Labour Camps (*Glavnoye Upravlenye Lagherey* or GULAG), an all-union organization subordinated to the N.K.V.D. From 1930 Soviet planners formally incorporated work performed by forced labour into the five-year plans. Forced labour was used in the gold mines. in the coal mines. especially those in the far north, in the construction of new canals, railways and highways, and in timber cutting.

In a report published in 1953 by the Ad *Hoc* Committee of Forced Labour, set up jointly by the United Nations and the International Labour organization. it was said that the Soviet penal legislation constituted "the basis of a system of forced labour employed as a means of political coercion or punishment for holding or expressing political views." In the committee's opinion. the system of forced labour also constituted "an important element in the economy of the country." An independent committee set up under the authority of the I.L.O. confirmed in 1956 the continued existence of forced labour camps in the Soviet Union and the satellite countries. According to official British and U.S. estimates, there were in 1953 between 8,000,000 and 14,000,000 people in Soviet forced labour camps.

TABLE XXXII.—*Foreign* Trade, *1909–13 and between* World Wars I *and II*
(In millions of roubles)

Item	1909–13	1921	1924	1930	1938
Exports	6,514	89	1,476	4,539	1,332
Imports	4,994	923	1,139	4,637	1,423

Note.—The average for 1909–13 and the figures for 1921 and 1924 in 1913 prices; figures ior 1930 and 1938 in current rouhles.
Source: I. Zhlobin in *The Finances of the* U.S.S.R. (Moscow, 1947).

TABLE XXXIII.—*Estimated Distribution of* the *Soviet* Trade *Turnover*
(Exports plus imports. in millions of U.S. dollars)

Trading partners	1937	1948	1952	1953	1954
German Democratic Republic	35	105	670	940	1,100
Czechoslovakia	10	240	610	660	720
Poland	5	230	530	540	660
Hungary	—	55	280	330	280
Rumania	—	100	290	300	330
Bulgaria	—	120	160	190	200
Total with eastern Europe	50	850	2,540	2,960	3,290
Other eastern countries";	15	400	1,560	1,790	1,610
Total with all the eastern group	65	1,250	4,100	4,750	4,900
Western Europe†	510	545	640	660	830
Overseas countries	205	705	460	340	520
Total with western group	715	1,250	1,100	1,000	1,350
Trade with all countries	780	2,500	5,200	5,750	6,250

*Communist China, Mongolia, Northern Korea and Albania.
†According to trade statistics of western European countries.
Source: United Nations, *Economic Surveys of* Europe, 1954 and 1955.

XIII. FOREIGN TRADE

Between World Wars I and 11.—The management of foreign trade, a state monopoly, is in the hands of the Soviet government. When not yet a developed country. the Soviet Union had little to export. Early in the 1930s, when it was necessary to pay for machinery and heavy equipment imported from the United States, Germany and other industrial countries of Europe. the U.S.S.R. exported crude petroleum and products, but, with the progress of industrialization. home consumption increased and the exportable surplus became negligible. Other main items of export were timber, grain, furs, flax and caviar. From its great forest wealth the Soviet Union theoretically could export any quantity of timber, but there was acute domestic need of this, the shortage being caused by lack of essential machinery, of skilled lumberjacks and of transport.

Even in 1930, when Soviet exports reached the highest level, their value was only 3.5% of the total Soviet production: in 1938 the proportion fell to 0.8%. Imports were strictly limited to raw materials and machinery necessary to equip expanding industry. Items described as machinery, apparatus and parts, nonferrous metals and goods, iron and steel goods and electrical equipment formed 34.7% of imports in 1929, 66.1% in 1933 and 57% in 1938. (*See* Table XXXII.)

Among the trading partners of the U.S.S.R., Germany was predominant up to 1933; in that year it supplied 42.5% of Soviet imports and took 17.3% of Soviet exports. In 1938 the chief suppliers were the United States (28.5%) and Great Britain (16.9%). The latter was also the best customer, taking 17.6% of Soviet exports in the year 1933, 32.7% in 1937 and 28.2% in 1938.

After World War 11.—After World War II the Soviet Union was able to exploit the economic resources of the annexed territories and of the satellite states, buying frorn them at cheaper rates and selling to them at higher rates than the world market prices. The Soviet and the satellite governments declared the statistics of foreign trade a state secret: presumably because publication of the value of exports and imports by every trading partner of the "Socialist market" would inform the world at large about Soviet home shortages and would tell the Soviet people that Soviet grain was being sold to foreign countries. when they themselves were short of food. Such data would also expose erratic Soviet purchases and sales and erratic price policies practised for political purposes. Moreover, they would illustrate the degree to which the satellite countries were being exploited.

Table XXXIII gives the estimated distribution of the Soviet trade turnover for the vears 1937–54, based on data published bv the U.N. Economic Commission for Europe. It shows that, while in 1937 Soviet trade with the countries of eastern Europe, then independent, amounted to only 6.4%, in 1948 it was 34% and in 1954, 52.8% of the total turnover. Soviet trade with the so-called capitalist countries, which amounted in 1937 to 91.7%, fell by 1954 to 21.6%.

In 1954 Soviet foreign trade represented only about 7% of world trade; this proportion was 16% for the whole Socialist market; *i.e.*, including the European satellite countries and Communist China. Excluding trade among the Communist countries, their exchanges of goods with the rest of the world amounted in 1954 to about $3,500,000,000; *i.e.*, 3.9% of the total world trade.

The trade turnover of the Socialist market (that is, of one-third of the world's population) with the free world was about 75% of that of Belgium and the Netherlands together; the similar trade turnover of the U.S.S.R. alone was about 84% of that of Italy.

On April 10, 1956, at the session of the U.N. Economic Commission for Europe, Ivan G. Kabanov. Soviet minister of foreign trade. said that in 1955 the Soviet trade turnover was more than 25,000,000,000 rb., almost double that of 1950. He offered glittering opportunities to western Europe if it would overcome its

fears and suspicions and take off the "strategic" controls on trade with the Socialist market. When dollar aid ended, he said. western Europe could turn eastward to feed its growing industrial production.

One member of the Socialist market. namely China, was still an industrial infant. Its production was less than that of Poland. although its population was 22 times larger. The U.S.S.R. and other European satellites were under political obligation to help China. They therefore needed more modern machinery and industrial equipment from the west and they were also short of rubber. nool, high-quality cotton and nonferrous metals. This explained the allegation that great commercial opportunities behind the "iron curtain" were being neglected.

XIV. TRANSPORT AND COMMUNICATIONS

Railways. — The vast and generally flat surfaces of European and Asiatic Russia lent themselves to railway construction which, however, began later than in western Europe. Although the first railway from St. Petersburg (later Leningrad) to Tsarskoye Selo (later Pushkin) was laid in 1837, it was not until 1851 that the first main line, from St. Petersburg to Moscow, was completed. The two great periods of railway expansion were 1868–74 and 1891–1900. Many trunk lines were built in European Russia, the most important being: St. Petersburg–Warsaw (1862), Moscow–Nizhny-Novgorod (later Gorki) (1862), Moscow–Kozlov (later Michurinsk) (1864). Moscow–Kursk (1868), Moscow–Minsk–Warsaw (1871), Moscow–Vologda (1872) and Moscow–Riga–Vindava (Ventspils) (1904). The Moscow–Kozlov line was extended to Rostov (1870) and that from Moscow to Kursk was extended to Kharkov and Sevastopol (1870). The two last-named lines passed through the Donets basin (Donbas) and promoted the development of the coal industry. In 1884 Donbas was connected with the rich iron ore deposits at Krivoy Rog, thus giving impetus to the development of metallurgy. Many smaller branches were constructed in the Donbas which in the 1890s was also linked with Tsaritsyn (Stalingrad) on the Volga. The Urals metallurgical line Perm (Molotov)–Ekaterinburg (Sverdlovsk), built in 1878. was joined with the rest of the Russian network only in 1896, when the first section of the Trans-Siberian trunk line, from Samara (Kuybyshev) to Ufa and Chelyabinsk, was laid.

The first railway built in Asiatic Russia mas, however, the Trans-Caspian, from Krasnovodsk to Samarkand (1888) and later to Tashkent (1899). It was joined to the main system in 1905 when the Tashkent–Orenburg (Chkalov) trunk line was completed.

The construction of the Trans-Siberian. the most important Russian railway and the longest railway in the world, began in 1891 but was completed only in 1916, when the Chita–Khabarovsk section was open to traffic.

On the eve of World War I the total length of Russian railways within the pre-1914 frontiers was 70,500 km.; but within the frontiers of 1921 it mas only 58,500 km. The density of network averaged 0.28 km. per roo sq km. of territory, as compared with about 12 km. in Germany. The length per 100.000 inhabitants was about a quarter of that of central and western Europe. The weakness of railway transport in tsarist Russia was revealed during World War I nhen on many trunk lines forced to carry exceptionally heavy loads, piles of freight accumulated at railway junctions, paralyzing the national economy.

TABLE XXXIV.—*Volume of Freight Traffic by Types of Transport*
(In million ton-kilometres)

Type	1940		1950		1955	
	Total	%	Total	%	Total	%
Railways	415,000	85.92	601,860	85.28	969,000	84.62
Motor transport	9,000	1.85	20,700	2.93	43,470	3.80
Inland waterways	36,000	7.47	45,360	6.42	66,679	5.82
Sea transport	23,000	4.76	37,950	5.37	66,033	5.76
Total	483,000		705,870		1,145,181	

Sources: *Bolshaya Sovietskaya Entsiklopedia* (1948) for the year 1940 and estimates calculated from percentages given in the reports of the fulfillment of the fourth and fifth five-year plans.

After the revolution and civil war the Soviet government concentrated on developing and extending the railway system while modernizing its rolling-stock and equipment. By 1937 the total length of the Soviet network increased to 85,000 km. Goods hauled amounted to 517,000,000 tons, almost four times as much as in 1913; 1,143,000,000 passengers were carried, 6.5 times as many as in 1913. Among the most important trunk lines built before 1937 were: a double-track Moscow–Donbas line, a Kazan–Sverdlovsk line and a Petropavlovsk–Karaganda line with branches to Balkhash and Dzhezkazgan, as well as the Turkistan–Siberian (Turksib) railway completed in 1930, linking Novosibirsk with Alma-Ata and Tashkent. Many shorter railway links were built in the Urals, especially the Troitsk–Orsk–Chkalov line: with a branch from Kartaly to hlagnitogorsk (a new steel centre)! while the Trans-Siberian line was double-tracked from Ufa to Omsk.

After 1937 the construction of a new South–Siberian (Yuzhsib) line was begun; the difficult section crossing the southern Urals was still under construction in the late 1950s. The total length of Soviet railways in 1950 amounted to 112.530 km. By then the whole of the Trans-Siberian was double-tracked, and some shorter lines were electrified.

During the fifth five-year plan (1951–55) 3,100 km. of new railways were built, including the Akmolinsk–Artyshta (near Stalinsk) section of the Yuzhsib; 4,700 km. of second track were laid and 2.300 km. were electrified. The sixth five-year plan (1956–60) comprised the construction of 6,500 km. of new railway track, mainly in eastern Siberia: the laying of 6,600 km. of second track and the electrification of a further 6.100 km. Nothing was said of the North Siberian railway planned before World War II which, passing north of Lake Baikal. was to link Tayshet with Sovietskaya Gavan. By 1945, however. the last-named port on the Sea of Japan was linked by rail with Komsomolsk-on-Amur and with Khabarovsk.

In 1955 the Soviet railway system averaged 0.52 km. per 100 sq. km. of territory and 54 km. per 100,000 inhabitants. These figures compared with 4.7 km. of rail per 100 sq.km. and 222 km. per 100,000 inhabitants in the United States. In 1940 Soviet railways carried 415,000,000,000 ton-km. of goods; and in 1955 an estimated 969,000,000,000 ton-km. of goods. (See Table XXXIV.) This compared with 910,428,000,000 ton-km. of goods carried in 1955 by L.S. railways, but with two differences: first, the area of the United States was slightly more than one-third of the U.S.S.R., which meant that Soviet goods had to cover longer distances and thus increase production costs; secondly, the proportion of the railway goods traffic in the United States represented 52% of the total, while in the U.S.S.R. the proportion was 84.62%. It was estimated that in 1955 steam locomotives consumed about 30% of the year's coal production; only 10% of traction was by electric or diesel locomotives. In 1955 the Soviet railway system employed about 2,300,000 railwaymen.

Roads.—Before World War I Russia had 23,500 km. of hard-surfaced roads. The situation improved under the Soviet regime and in 1938 there mere 87,500 km. of roads. There was only one modern motor highway from Moscow to Minsk; there were good hard-surfaced roads from Moscow to Leningrad, from Moscow to Kiev, and from Minsk to Kiev; all these were strategic roads. Other strategic roads were the Georgian military highway from Vladikavkaz (Ordzhonikidze) to Tbilisi and Erivan, and the Pamir highway running from Osh. Kirghizia, to Khorog. Tajikistan. There were also 936,400 km. of dirt roads, impassable during thaw or heavy rains.

Through the 1939–45 annexations in the west the Soviet Union more than doubled its length of hard-surfaced roads. Under the fourth five-year plan (1946–50) 16.000 km. of hard-surfaced roads were built and the Moscow–Simferopol motor highway was opened. In the period 1951–55 the ?.loscow–Minsk motor highway was extended to Brest (Brzesc) on the Polish frontier, and the Kiev–Kharkov–Rostov–Ordzhonikidze motor highway was completed.

There were 8.800 motor vehicles in Russia in 1913, 19.000 in 1929 and 760,000 in 1938. By mid-1953 there were about 2,500,000 motor vehicles in service. including 300.000 passenger cars. In 1940 the Soviet motor industry produced 147,000 motor vehicles. in 1955 the output was 445,000 and it was planned to produce

650,000 by 1960.

Waterways. — In 1937 the Soviet Union had 320,000 km. of waterways of which two-thirds were usable only as rafting routes. The two main disadvantages of Soviet river transport were that all the rivers are frozen for from four to six months of the year, and in Asiatic Russia even from five to seven months, and that the most important rivers, especially in Siberia, flow in economically unsuitable directions.

The Soviet government did much to improve the capacity of the waterways by the construction of new canals and dams, generally linked nith irrigation and hydroelectric schemes. Before World War II two great canals were completed. In 1933 the Baltic–White Sea canal was opened. It extends from Povenets on Lake Onega to Byelomorsk (Soroka) on the shore of the White sea. This canal, however, freezes from November to May.

In 1937 the Moscow–Volga canal was opened to traffic. The Soviet capital became a major river port accessible to self-propelled barges with a load capacity of 22,000 tons.

After the construction of the Moscow–Volga canal the reconstruction began of the Volga–Baltic route allowing small vessels to pass from the Volga to Leningrad. The reconstruction of this waterway was interrupted by World War II but resumed in 1947.

After World War II the Volga–Don canal mas opened to traffic in July 1952. It is only 101 km. long but because the Don at Kalach is from 33 m. to 39 m. (according to the season) higher than the Yolga at Stalingrad, and because the divide between the tno rivers rises to 80 m. above sea level, it was necessary to build 13 navigation locks. Besides the ship canal. accessible to sea vessels of 2.000 tons, the Tsimlyansk hydroelectric station was built and schemes for irrigating 100.000 ha. of arid land in the Rostov region were carried out.

In Sept. 1950, the Soviet government decided to build the Great Turkmenian canal linking the Amu Darya river with the Caspian sea, a more formidable project than the Yolga–Don canal Its total length was to be 1,100 km. and it was expected to irrigate 1,300 000 ha of desert. Work on it was stopped after Stalin's death in 1953.

Three great Siberian rivers, the Irtysh, the Ob and the Yenisei. are navigable almost throughout their entire course within the U.S S R All three are crossed by the Trans-Siberian railway, at Omsk. Novosibirsk and Krasnoyarsk, respectively. Until the late 1950s no railway reached the Lena and the only access to this river was a highway built before World War II from Nizhneudinsk to Ust-Kut Under the fifth five-year plan (1951–55) work started on a railway from Tayshet to the upper Lena and a new river port was being built at Osetrovo.

Pipelines. — The oil pipelines in use by 1955 were: Baku–Batum (two one laid in 1906 and another in the 1930s), Grozny–Tuapse (1928), Makhachkala–Grozny–Donbas (1936). Orsk–Guryev (1936), Ishimbay–Ufa (1936). Tuymazy–Ufa (1947) and Reni–Odessa (1947). There were also natural gas pipelines Saratov–Moscow (1946), Buguruslan–Kuybyshev (1947), Dashava–Kiev (1947), Kohtla Jarve–Leningrad (1948) and Kohtla Jarve–Tallinn (1953). In 1955 the annual capacity of all these pipelines was estimated at 13,800,000,000 ton-km. In Dec. 1956 the natural gas pipeline Stavropol–Moscow was completed.

Maritime Transport. — Although about two-thirds of the Soviet boundaries are sea coasts, the country is the most continental among the great powers of the world. Only Murmansk in the Kola peninsula and Yladivostok in the far east are ice-free throughout the year. Navigation between them is possible along the shores of the Arctic ocean for only from 70 to 90 days and at a great cost, because the help of icebreakers and aircraft for ice observation is indispensable. With the exception of Odessa, Nikolayev and Kherson, the Black sea ports are ice-free all the year; and in the Baltic so too are Liepaja (Libava) and Kaliningrad (Konigsberg). The Caspian ports of Astrakhan and Guryev are icebound for more than three months.

Climatic conditions and geography combine to explain why neither tsarist Russia nor the Soviet Union were able to use maritime transport to any great extent.

In 1914 Russian merchant shipping totalled 1,770,000 gross registered tons, but by 1927 the tonnage fell to about 300,000 gross registered tons. A reorganization of the merchant navy started in 1928 and by mid-1939 it comprised 716 ships with a total tonnage of 1,315,766 (1.89% of the world total). By Dec. 31, 1954, the Soviet merchant navy had 664 ships totalling 2,247,000 g.r.t. This total represented 2.5% of the world total, but it included 83 U.S. lend-lease vessels of 518,000 tons. Sea transport was responsible for 4.76% of total goods traffic in 1940 and was estimated at 5.76% in 1955.

Air Transport. — Immense distances and a relatively poor system of rail, road and river transport favoured the development of air transport. It started in 1921 with the creation of the Deruluft (*Deutsch-Russische Luftverkehrsgesellschaft*) whose aircraft flew between Berlin and Moscow, and later between Konigsberg and Leningrad. This company ceased to operate in 1936. The Soviet air transport corporation. the Aeroflot (official name: *Grazhdansky Vozdushny Flot* or Citizen's Air Fleet), began in 1928 a series of unconnected air lines of which the most important were: Moscow–Rostov–Tbilisi; Chardzhou–Tashkent–Frunze–Alma-Ata; Irkutsk–Yakutsk; Tashkent–Kabul. Afgh.; and Verkhne-Udinsk (Ulan Ude)–Ulan Bator, Mong. In 1929 the Moscow–Sverdlovsk–Irkutsk line was opened; in 1930 the Moscow–Chkalov–Tashkent line was inaugurated; Leningrad was linked with Moscow by air in 1931, Stalingrad in 1933 and Kiev and Minsk in 1934. In 1938 the total length of air lines was 106,100 km. and in that year the Aeroflot transported 234,000 passengers and 28,050,000 ton-km. of cargo and mail.

After World War II the Soviet air transport system was considerably extended and by 1955 the total length of regularly operated lines was 1; 5 000 km . the longest being that of Moscow–Yladivostok (8,200 km.). All the capitals of the European and Asiatic people's democracies were linked with Moscow by Soviet aircraft, but until 1956 no foreign air line was allowed to fly to Moscow.

Until 1949 aircraft employed by Aeroflot were two-engined IL-12 and four-engined IL-18, similar in design to the U.S.-built DC-3 and DC-4 respectively. From 1949 the TU-70, a four-engined aircraft, was also in service; in 1956 a two-engined jet TU-104 began to serve Soviet air lines.

XV. FINANCE

The different economic system of the Soviet Union makes the national budget distinct in character and far wider in scope than the budgets of countries where private enterprise prevails. Investment in the national economy, that is. in industry, collectivized agriculture, transport and communications, is the heaviest item of expenditure.

During the first five-year plan (1928–32) the budget revenue totalled 90,200,000,000 rb. of which 59.7% was used for the development of heavy industry, mechanization of agriculture and construction of new railways.

During the second five-year plan (1933–37) the budget revenue totalled 369,800,000,000 rb. and investment in the national economy absorbed 48.9% of this sum. The biggest item of revenue was the turnover tax, levied on the proceeds of retail trade in grain, fats, sugar, meat, alcohol, cotton fabrics, petroleum products and other commodities. In 1931–34 this tax averaged 57% annually; in 1935–37 it rose to 69.5% and in 1938–40 it was 61.1%.

After World War II the pattern of Soviet budgets remained the same, but, during the period 1951–55, the turnover tax averaged annually 46% of all revenue, while dividends from profits by nationalized industry increased. In 1935–37, for instance, the latter brought 6.4% of the total revenue; in 1955 their part amounted to 21%. Investment in the national economy remained, of course, the main item of expenditure and in the period 1951–55 it averaged annually 39.6%. Defense expenditure allegedly amounted to 12.7% in the years 1933–37, to 26.2% in the years 1938–40 and to 21.2% in the period 1951–55. It was not possible, however, to estimate even approximately what percentage of the Soviet national income this represented, since real expenditure on defense (see *Defense,* above) was not confined to the ministry of defense. *See* also ROUBLE.

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RUSSIAN ARCHITECTURE. The recorded history of Russian art and architecture may be divided into four main periods: the Byzantine, from the 10th to the beginning of the 16th century; the National or Muscovite, from the 16th to the 18th century; the Petersburgian or European, from the 18th to the beginning of the 20th century; and the Soviet, from 1918 to the present. The centre of artistic and architectural activities shifted several times, generally following the political fortunes of the land—moving from Kiev, via Novgorod and Vladimir-Suzdal, to Moscow; from Moscow to St. Petersburg; and from St. Petersburg again to Moscow.

Materials and Style.—The vast forests. which for many centuries were the setting of Russian life, profoundly influenced the development of Russian architecture. For generations the entire utilitarian and artistic environment of the Russian peasant was fashioned of wood, and it was this constant, close contact with the forests that contributed so much to the arts of woodcraft and the great skill of the Russian carpenter. Building in wood acquired a very special place in the history of Russian architecture; its distinctive and most typical forms were closely bound up, in their origin, with the characteristic virtues and limitations of wood. Because of these limitations the old palaces of the tsars, the mansions of the boyars and the churches never attained the imposing dimensions of the castles of France or England and the Rhenish cathedrals.

In the masonry architecture of Russia, which was mostly brick, the architect utilized the lay and bond of the brick, or stucco and polychrome-tile revetments, for decorative effect. The brick patterns and the coloured tiles and faience paneling of the 17th-century Moscow region form a bright chapter in the history of Russian architecture.

Because of the geological formation of Russia's vast plains, stone was relatively scarce and, in the architecture of pre-Petrine Russia, was used mostly for decorative purposes. It was only after the 18th century, when the rich quarries of Siberia, Finland and the Ukraine became available, that stone architecture began to flourish. Variegated marble, fine-grained granite, glistening labradorites, malachites and porphyries were used with dazzling effect in the construction and interior decoration of the great cathedrals and imperial palaces.

In the formation of its architectural style Russia mas subjected to many foreign influences. The Russians borrowed much from the east and the west, but always showed discrimination in selection, proving themselves to be clever adapters and thorough assimilators. The borrowed elements were consciously and unconsciously modified and transfigured, resulting in a style distinguished by a quality of monumentality, vertical continuity, picturesqueness of mass and rich decoration. The heritage from the Greco-Roman world through Byzantium was merged with the native building tradition, and this proved itself capable of diverse expression, from naked functionalism to the fantasy of the Church of St. Basil in Moscow and the multidomed churches of Kizhi and Vytegra in the north.

THE BYZANTINE PERIOD

With the Christianization of Russia in 988. Byzantine thought and art—permeated with the proselytizing spirit of its missionaries, artists and architects—soon spread throughout the Kievan, Novgorodian and Suzdalian principalities. The emphasis of the Byzantine church on the physical splendour of its edifices was a cardinal factor in determining the characteristics of ecclesiastical architecture. Everything connected with the design and decoration of the new churches in Russia followed the Byzantine pattern; and the standard scheme of the Greek church—the cross inscribed in a rectangle, and the dome supported on piers or on pendentives—became the accepted type for Orthodox churches. The design and support of the central dome or cupola, together with the number and disposition of the subsidiary cupolas, remained for a long time the principal theme of Russian architecture. (See BYZANTINE ARCHITECTURE.)

Kiev.—The main monuments of Kiev were the Desiatinnaia church (989–990), the Cathedral of St. Sophia (1037) and the Church of the Assumption in the Monastery of the Caves (1073–78). All of these churches were built in the Byzantine tradition, though certain influences which came from Bulgaria, Georgia and Armenia can be discerned. The Cathedral of St. Sophia. the mother church of Russia, is the only structure of the Grand-princely period which still stands and retains, at least in the interior, something of its original form. The central part of the cathedral was in the form of a Greek cross. It had a nave and four aisles terminated in semicircular apses, and 13 cupolas (symbolizing Christ and his apostles). It nas reconstructed and enlarged at the end of the 17th century when the vogue of the Ukrainian, or so-called Cossack, phase of the baroque style nas at its height. It was later obscured by additional bays and stories to its lateral galleries, a new tower and many bizarre baroque cupolas. Only five apses and the central interior portion survive from the 11th century.

Novgorod and **Pskov.**—Novgorod was the centre of a unique and quite original Russian art that lived on long after the political death of the city; it was there that the fundamental features of Russian architecture were developed. As in Kiev, the ecclesiastical architectural history of Novgorod began with the Cathedral of St. Sophia. It was built in 1045–52, replacing a nooden 13-dome church of the same name. The new cathedral followed its Kievan namesake in plan, but the divergences from the Byzantine pattern are quite apparent; it has double aisles but only three apses. Externally the church differs even more from its southern prototype. it has only five cupolas, its walls are austere. the buttresses are flat and bare and the windows are small and narrow. There is something genuinely Russian in the silhouette of its helmeted cupolas and in the vigour and verticality of its masses.

The churches of the 12th century resemble St. Sophia only in the general tendency toward simplicity and verticality; they were small, cubic in form and modest in decoration. The severe climate and heavy snowfalls of the north necessitated various modifications of the Byzantine architectural forms. In the course of time windows were narrowed and deeply splayed; roofs became steeper; and flat dome profiles assumed the bulbous form which, in different varieties, eventually became the most notable feature of Russian church architecture.

The churches of Pskov were relatively tiny and squat and usually had three low apses. The cupolas. roofs and decorative elements were similar to those of Novgorod. Because these churches were too small to contain interior columns for the support of the cupola. the Pskov builders developed the structural device of recessive rows of corbeled arches for the support of cupola drums and cupolas. This feature—the *kokoshnik*—was to become a favourite Russian structural and decorative element. The church porches, the exterior mailed-in galleries and the arcaded bell towers were Pskov's other outstanding contributions to Russian architecture.

Vladimir-Suzdal.—Vladimir, as a centre of early Russian culture, was a iactor in a creative fusion of Byzantine, Roman-

esque and Caucasian influences. The 12th- and early 13th-century structures were a further modification of the earlier Byzantine style, leading toward the innovations at Moscow in the 15th century.

Among the outstanding monuments are: the Cathedral of the Assumption (1158–89) which was to serve as a model for its namesake in the Moscow Kremlin; the Church of the Intercession on the Nerl, one of the loveliest creations of Grand-princely Russia (1165); and the Cathedral of St. Dmitri (1194–97). These churches as a group represent the continuation of the Kievo-Byzantine tradition in their ground plan, but the old scheme was given a new interpretation. From Byzantium the Suzdalians adopted the general features of the square plan with semicircular apses, and the four columns supporting a cupola with its circular drum. But instead of brick, so characteristic of Byzantine and Kievan ecclesiastical architecture, they used cut stone and instead of polychrome revetments they used carved stone embroideries. The treatment and decoration of the walls, the deeply splayed portals and windows suggest the articulation of Romanesque architecture; the character of the carved ornament is analogous to that of the Caucasus; hut the organization and arrangement of the forms and patterns is unmistakably Russian.

THE MOSCOW PERIOD

With the fall of Constantinople (1453), Byzantine influences gradually subsided, and the hegemony in the world of Orthodoxy shifted to Muscovite Russia. Moscow, having become the new city of Constantine — the "third Rome" — and aspiring to rival the older centres of culture, launched a building program commensurate with her international importance. The Kremlin, the Acropolis of Moscow, and two of its important churches were rebuilt by invited Italian architects between 1475 and 1510. These churches. the Cathedral of the Assumption and the Cathedral of Archangel Michael, were largely modeled after the churches of Vladimir. The Italians were required to incorporate the basic features of Byzantine planning and design into the new cathedrals. It was only in the exterior decoration of the Archangel that the architect succeeded in introducing Italian decorative motifs. The Archangel cathedral thus marked the beginning of a new art form: the contribution of Italian-Renaissance to Russian architecture. A third church, the modest Cathedral of the Annunciation (1484–89) with its warm beauty, was the work of Pskov architects. There the kokoshnik was introduced in the treatment of the roof. This element, similar in outline to the popular Russian ogee-shaped (bochka) roof, foreshadowed a tendency to replace the forms of the Byzantine arch by more elongated silhouettes. Ecclesiastical architecture began to lose the special features associated with the Byzantine heritage, becoming more national in character and increasingly permeated with the taste and thought of the people. The most important change in Russian church design of the 16th century was the introduction of the staged tower and tent-shaped roof developed by Russia's carpenters in her wooden age. Next was the substitution of the tent spire for the traditional Byzantine cupola. This affected the design of masonry architecture by transforming its proportions and decoration and even its structural methods. The buildings acquired a dynamic, exteriorized articulation and specifically Russian national characteristics.

The boldest departures from Byzantine architecture were the churches of the Ascension at Kolomenskoe (1532), St. John the Baptist at Diakovo (c. 1532) and, above all, of the Cathedral of St. Basil on the Moscow Red square (1555–60). In St. Basil the academic architectural concepts, as understood by the western world, were ignored; the structure is uniquely medieval Russian in content and form, in technique, decoration and feeling. St. Basil, like its predecessors the churches at Kolomenskoe and Diakovo, embodies the characteristic features of the wood churches of northern Russia, translated into masonry.

An effective finishing touch was given to the ensemble of the Kremlin's Cathedral square by the erection of the imposing bell tower of Ivan the Great, begun in 1505. The colossal white stone "column of fame," with its golden cupola gleaming above the Kremlin hill, was the definite expression of an era, reflecting the tastes and grandiose political ambitions of the rising Russian state.

The basic types and structural forms of the Russian multi-columned and tented churches were fully developed in the 16th century. It remained for the next century to concentrate its efforts on the refinement of those forms and on the embellishment of the façades. The tent spires degenerated into mere decoration; they were used as exterior ornamental features set loosely in numbers over gabled roofs and on top of roof vaulting (Church of the Nativity in Putinki street, 1649–52). This decorative use of the formerly functional element was combined mith the liberal employment of the kokosknik. The latter, in converging and ascending tiers and in diversified shapes and arrangements, was used as a decorative screen for the drumlike bases of the spires. and sometimes as parapets over the cornices. At the same time the formerly large expanses of unbroken wall surfaces (of the Novgorod-Pskov architectural traditions) were replaced by rich decorative paneling. Polychromy asserted itself: coloured and glazed tile and carved stone ornament, used in combination with brick patterns, were employed extensively. This was especially evidenced in a large group of Yaroslavl churches.

The baroque appeared on the Russian scene toward the end of the 17th century. But again the Russians imaginatively transformed its modes into a clearly expressed national style which became known as the Naryshkin baroque. A delightful example of this style is the Church of the Intercession of the Virgin at Fili (1693) on the estate of Boyarin Naryshkin, whose name had become identified with this phase of the Russian baroque. *See* also BAROQUE ARCHITECTURE.

THE PETERSBURGIAN PERIOD

The founding of St. Petersburg (1703) marked the beginning of a new era in Russian art and architecture; it was at this city, later renamed Leningrad, that the spirit of western-European art broke through in a decisive manner. The heavy influx of foreign influences — Dutch, German, Italian and French — markedly affected architecture because the new capital offered a fresh field in which the wealth and adamant will of Peter the Great made it possible to obtain the best professional talent from abroad for the realization of his ambitious projects.

The western Europeans brought over the prevailing baroque art characteristics of their own countries, but the very different artistic and physical setting produced a new expression, embodying Russia's peculiar sense of form. scale. colour and choice of materials. The transformed baroque spread all over Russia and, with its vast register of variations. developed many regional idioms.

In the second half of the 18th century the baroque gave way to the rococo, and then to the rediscovered beauty of classicism, initiating a trend toward restraint and refinement. The new architectural current entered the stream of Russian art from different directions: from France. Italy and Germany. Its beginning practically coincided with the founding of the Academy of Fine Arts in 1757. and it lasted for nearly a century. It continued its existence largely through a number of foreign and foreign-trained Russian architects, who brought the classicism of the 18th century to maturity, culminating in the Russianized empire style and producing an architecture notable for its monumentality, integration of mass and space, use of colour and sculptured decoration.

The three long reigns of Peter I, Elizabeth and Catherine II denote the main successive stages of an intense architectural activity which, though principally concentrated in St. Petersburg and its vicinity, radiated from there to many parts of Russia. The impulse continued into the reign of Alexander I, especially after 1812, during the postwar years of awakened national pride. Baroque, rococo, classicism and neoclassicism all came to he represented at St. Petersburg by striking examples in close proximity to one another. Among the best are: the Cathedral of the Smolny convent (1748–64) and the Winter palace (1732), both designed in a rich Russian high-baroque style by Bartolomeo Rastrelli; the Academy of Fine Arts (1764–88) by Vallin de la Mothe and A. F. Kokorinov, a masterpiece of the so-called "Louis XV classique"; the Admiralty (1806–23), designed by Andreian Zakharov in the

empire style with a strong Russian flavour; the Synod and Senate buildings (1829–34), by K. Rossi; and the new Hermitage (1840–50) by the neoclassicist Leo von Klenze.

Moscow went its own way architecturally; it yielded to St. Petersburg in range and scale of construction but outstripped St. Petersburg in picturesqueness, originality and intimacy. At a time when St. Petersburg was engaged mainly in building monumental palaces and public and government buildings, Moscow more often was building private residences and small palaces. Classicism in Moscow was less severe and more homely; the forms of the empire style was softened by giving them a freer and more colourful treatment. Outstanding examples are the old building of the Moscow university (1817–19) by D. Gilardi and the Bolshoi theatre (1821–24) by O. Beauvais.

In the 1830s classicism began to seem something foreign, or imported. Official nationalism and the growing tide of Slavophilism were instrumental in turning the Russian architect away from alien classicism toward the interrupted development of national art. Official nationalism found its expression in the projects of K. Thon, who sought to create a genuine Russian style based on old motifs derived from Russian-Byzantine architecture (the Church of Christ the Saviour, 1837, razed in the 1930s; and the Grand Kremlin palace, 1839–48). The Slavophiles' nationalism was based on the artistic activities of 16th- and 17th-century Russia and on the originality of the construction methods peculiar to that period (*e.g.*, the Historical museum in Moscow, 1875–81, by V. Sherwood). The tendency to revive the forms of the Russian past and to rework old traditions in the spirit of a neo-Slavonic age continued for several decades. At the beginning of the 20th century the new western-European trends—the art *nouveau,* the "Vienna secession" and the "international style"—made their appearance and Russian architecture became increasingly affected by all that was extreme and modern in western architecture.

THE SOVIET PERIOD

In 1918, after a lapse of two centuries, Moscow resumed its role as the capital of Russia and once more became the political and artistic centre of the land. The Bolshevik revolution occurred at a time when the ferment of the international style and other avant-garde architectural theories was already widespread in Russia. During the early years of militant Communism (1918–22) the left school of Soviet architecture, in its desire to embody the dynamic of the revolution in plastic forms, resorted to a symbolism supposedly inherent in the geometrical or engineering forms of architecture. Afterward it was carried away, first by Constructivism, and later by Functionalism and the theories of the German Bauhaus school. The echoes of these theories showed themselves in the works of K. Melnikov, P. Golosov, A. Gintsberg, the Vesnin brothers (Leonid, Viktor and Aleksandr) and others. Experimentation with the modern idiom continued into the 1930s, but without any conspicuous success. The chief handicap of modernism was that its strangeness and cold, functional look were distasteful to those in power and incomprehensible to the masses, whose tastes had been formed by the examples of the Russianized baroque and empire styles. A return to classicism was preferred because it was felt that the dramatization of the ideals of the new life could be best expressed by a humanized architecture based on native traditions of classical forms. The official emphasis on classicism initiated a trend toward monumentalism and florid ornamentation which affected almost every type of building. In Moscow the classic expression showed a leaning toward Palladianism (especially in the works of Ivan Zholtovsky and Zinovi Rozenfeld); in Leningrad it acquired a freer, more modernized look (as in the works of E. Levinson, I. Fomin and N. Trotsky); while in Kiev, Minsk and other cities of the various republics it was tinged with local traditions. On the whole its qualities were those of an architecture in search of forms to express the idea of socialist realism—the uniqueness of the new society.

With the growth of Russian nationalist sentiment in the late 1930s came a perceptible shift toward the expression of nationalism in architecture. The emphasis on the Russian heritage was intensified at the time of the drive against cosmopolitanism in the second half of the 1940s. Extensive use was made of national forms in some of the Moscow subway stations and especially at the All-Union Agricultural exhibition at Moscow (1939–40), where the pavilions of the Uzbek, Georgian, Armenian and Ukrainian Soviet Socialist republics were among the most attractive. The originality of form and richness of ornament reflected the architectural traditions as well as the folk arts of the various republics.

After World War II.—The mania for the monumental and for lavish decoration reached its peak in the last six or seven years of the Stalin era. It was during these years that eight skyscrapers were erected in Moscow. Since they were conceived as "prestige" buildings in the ambitious program for rebuilding and beautifying the capital, their architectural requirements were formulated by government decree; their design was to be in harmony with Moscow's historically developed architecture, and therefore modernistic tendencies were to be shunned. The buildings included the new Moscow State university, two hotels, several office buildings and apartment houses. In the general scheme of their distribution each building was to be the focal point and main theme in the composition of its immediate neighbourhood, either reflecting the architectural features of the nearby historical monuments or setting the tone for the neighbourhood to be developed around it. Rising 20 to 32 stories, they were strategically located in various districts, along the principal boulevards, squares and river embankments, so that their height and bulk would bring into greater relief the beauty of the natural terrain and affect the skyline for a distance of many miles. All of them are adorned with conventional trappings and carry tall, slender, star-topped spires. The decorative motifs are strongly reminiscent of those of the Kremlin.

The massive ensemble of the Moscow State university (Lev Rudnev, chief architect), located on the summit of the Lenin hills, is the largest and tallest of the Moscow giants. It overlooks the city and the great Lenin Central stadium, with its recreation fields, and is the dominating structure in the southwestern district of Moscow. The main building, whose central tower reaches a height of 32 stories, is flanked to the right and left by two 18-story wings. The colonnade to the main entrance is almost pure classic, while the connecting wings to the right and left of the main building have an English Renaissance flavour. The design of the entrance hall, staircases and principal auditoriums is reminiscent of the interiors of the Russian imperial palaces with their classical columns, rich marbles and mosaics, producing an impression of grandeur and opulence.

The university and the other skyscrapers can be seen for miles around and, although deceptive in scale, they are tremendously impressive. On close inspection their decorative details may seem Victorian to western eyes but, as elements in the city landscape, Moscow's skyscrapers have an undeniable dramatic impact.

The Transitional Period.—The end of the Stalin regime (1953) ushered in a period of limited liberalism in Russian artistic life. A number of rigidly Stalinist "socialist-realist" officials in the Union of Architects were replaced by less doctrinaire and more cosmopolitan leaders, who wanted to rid Soviet architecture of the classical clichés of the Stalin era and re-enter the contemporary European and international field. hforeover the vast demand for buildings of all types and the increasing tensions between the building industry's engineers and administrators on the one hand and the architects and theoretical aestheticians on the other, resulted in a widespread demand for a re-examination of the approach to style. In 1955 the government launched a program for revising the design of every type of building with a view to industrializing and standardizing the building industry. The problems posed by the need for economy, standardization and prefabrication both of components and complete buildings forced a thorough reformation in architectural practice.

Particular attention was given to the development of new building materials, especially synthetic plastics and light metals; to exploiting the full structural potential of reinforced, precast and prestressed concrete elements; and to exploring the decorative possibilities of the unconventional shapes that can be achieved

FROM (TOP LEFT) G. K. LUKOMSKII, "L'ARCHITECTURE RELIGIEUSE RUSSE," (TOP RIGHT) I. M. SNEGIREV, "USPENSKII SOBOR V MOSKVE," (BOTTOM LEFT) "MOSKVA V EIIA PROSHLOM I NASTOIASHCHEM" (BOTTOM RIGHT) "MOSKVA, SOBORY, MONASTYRI I TSERKVI"; PHOTOGRAPHS, (TOP LEFT, TOP RIGHT, BOTTOM LEFT, BOTTOM RIGHT) FROM THE COLLECTION OF ARTHUR VOYCE, (CENTRE LEFT) SOVFOTO

THE BYZANTINE TRADITION

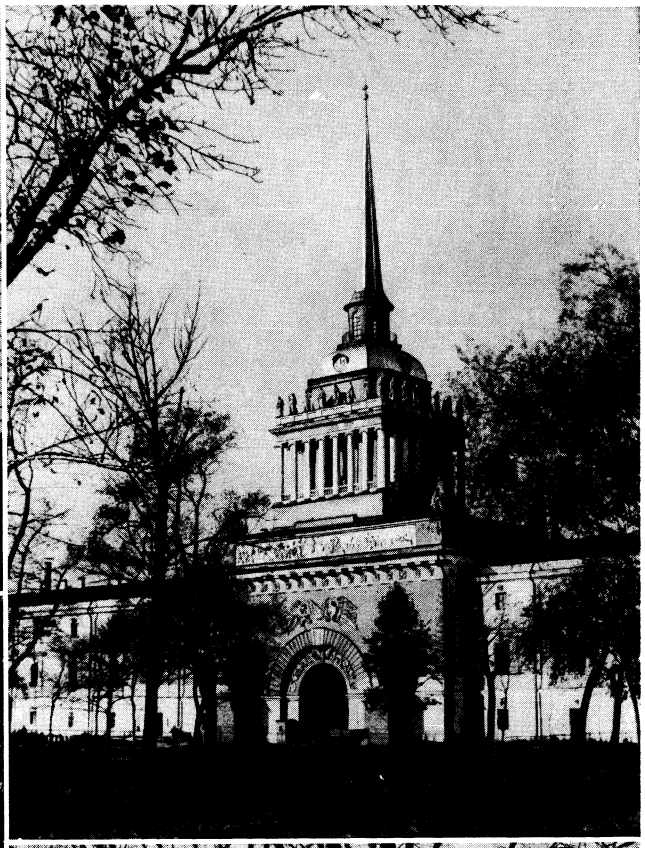
Top left: St. Sophia cathedral, Kiev, **1037**
Top right: Cathedral of the Assumption, the Kremlin, Moscow, **1475-79;** Fieravanti, arch.
Centre left: St. Sophia cathedral, Novgorod, **1045-52**
Bottom left: Cathedral of the Annunciation, Moscow, **1482-90;** the work of the Pskov architects
Bottom right: Cathedral of the Archangel **Michael,** the Kremlin, Moscow, **1494;** Alevisio **Novyi** the Milanese, arch.

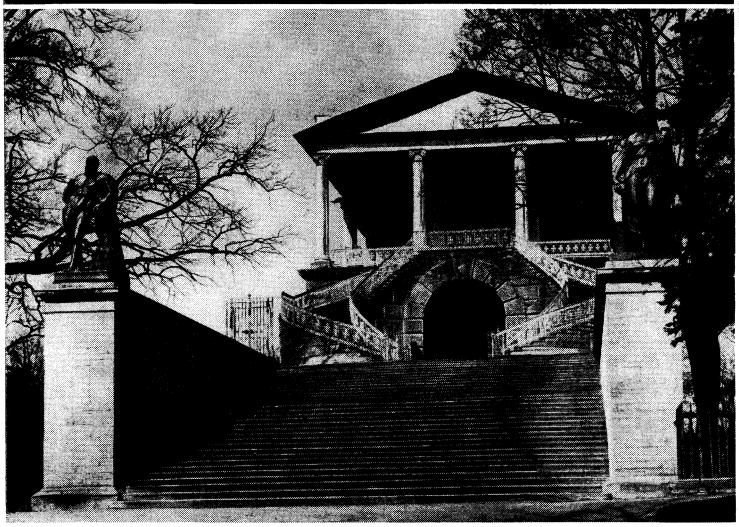
RUSSIAN ARCHITECTURE

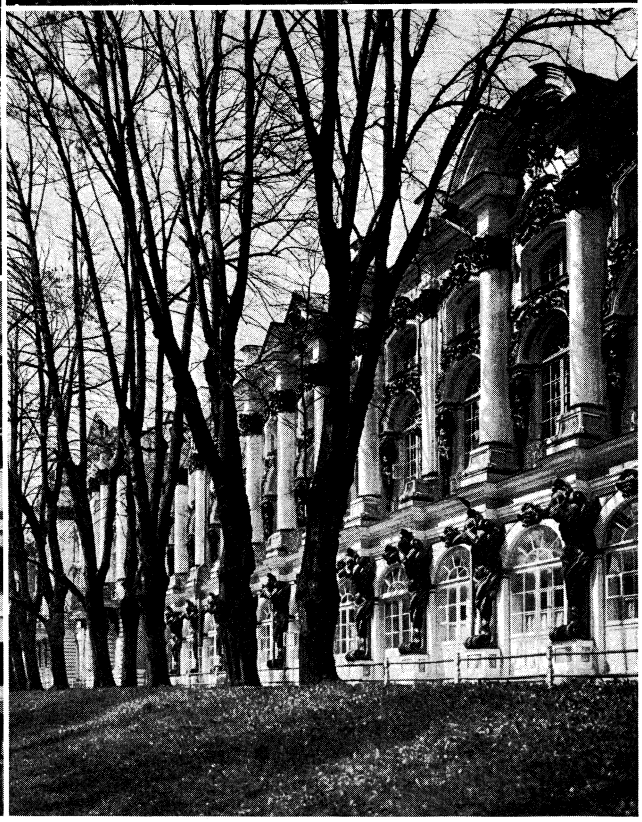
BY COU TESY OF (CENTRE RIGHT) IGOR GRABAR; FROM (TO? LEFT, TO? RIGHT) A. MARTYNOV, "ENVIRONS DE MOSCOU, ANCIENS MONUMENTS," (TOP CENTRE) V. V. SUSLOV, "PAMIATNIKI DREVNIAGO RUSSKAGO ZODCHESTVA." (BOTTOM LEFT BOTTOM CENTRE. BOTTOM RIGHT) M. RZIANIN "PAMIATNIKI RUSSKOGO ZODCHESTVA; PHOTOGRAPHS (TOP ROW, BOTTOM ROW) FROM THE COLLECTION OF ARTHUR VOYCE, (CENTRE LEFT) JAMES SAWDERS

THE NATIONAL PERIOD

Top left: Church of the Ascension, Kolomenskoe (near Moscow). 1532
Top centre: Church at Una, Archangel oblast, 1501
Top right: Church of St. John the Precursor, Diakovo (near Moscow), about 1547
Centre left: Church of St. Basil the Blessed, Red Square, Moscow, 1555–60; Barma and Postnik, arch.
Centre right: Church of the Holy Virgin, Fili (near Moscow), 1693
Bottom left: Church of John the Baptist, Tolchkovo, 1671–87
Bottom centre: Belfry of Ivan the Great, the Kremlin, Moscow, 1600. At left is the Cathedral of the Assumption
Bottom right: The twenty-two cupola Church of the Transfiguration at Kizhi cemetery, Lake Onega, early 18th century







BY COURTESY OF (TOP LEFT) SCANDINAVIAN AIRLINES SYSTEM. PHOTO BY GEORG ODDNER; FROM (TOP RIGHT, CENTRE LEFT, BOTTOM LEFT) M. RZIANIN, "PAMIATNIKI RUSSKOGO ZODCHESTVA. (BOTTOM RIGHT) A. BENOIS, "TSARSKOE SELO; V TSARSTVOVANIIE IMPERATRITSY ELISAVETY PETROVNY"; PHOTOGRAPHS (ALL EXCEPT TOP LEFT) FROM THE COLLECTION OF ARTHUR VCYCE

THE EUROPEAN OR PETERSBURGIAN PERIOD

Top left: The Winter palace, St. Petersburg (Leningrad), 1754–62; B. Rastrelli, arch.

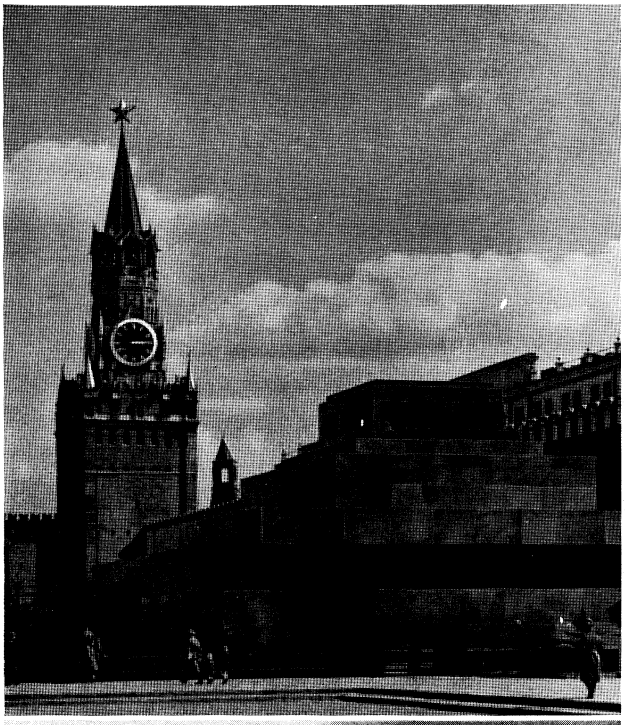
Top **right:** The Admiralty, St. Petersburg, 1806–23; A. Zakharov, arch.

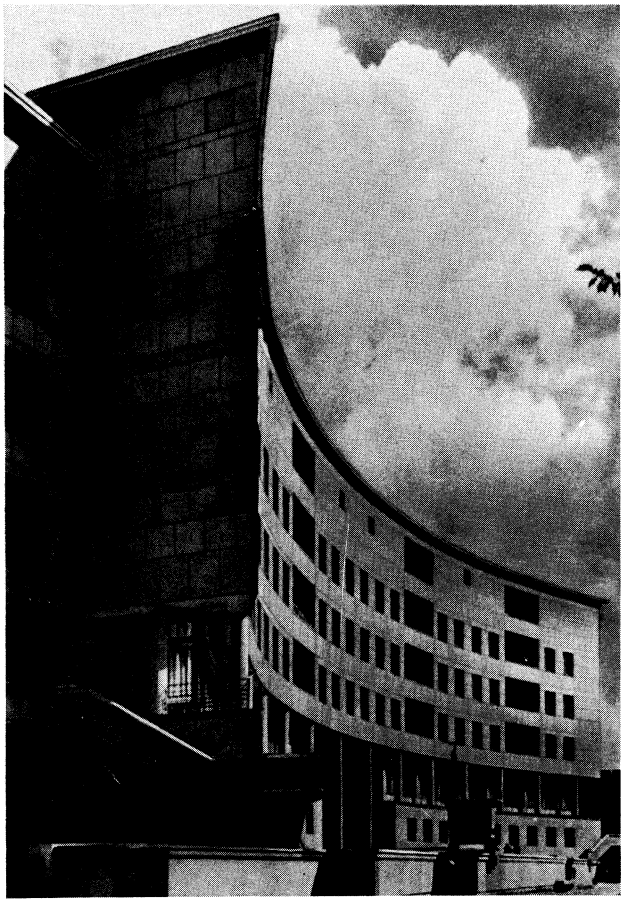
Centre left: Cameron gallery. Tsarskoe Selo (Pushkino), 1783–86; C. Cameron, arch.

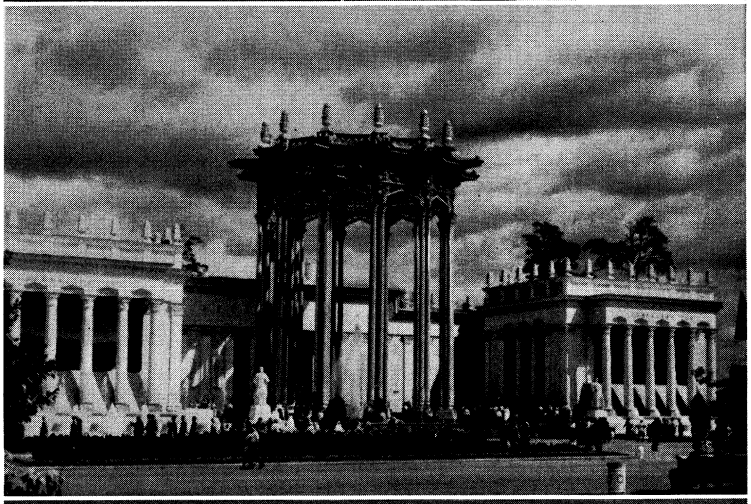
Bottom left: Senate and Synod buildings. St. Pefersburg, 1829–34; C. Rossi, arch.

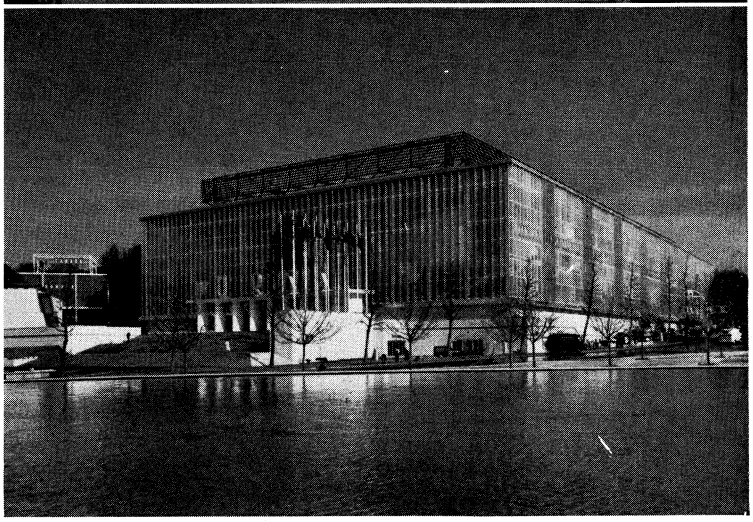
Bottom right: Garden elevation of the Grand palace, Tsarskoe Selo, 1747–56; B. Rastrelli, arch.

RUSSIAN ARCHITECTURE









BY COURTESY OF (TOP RIGHT) SCANDINAVIAN AIRLINES SYSTEM. PHOTO BY GEORG ODDNER; FROM (TOP LEFT) M. RZIANIN, "PAMIATNIKI RUSSKOGO ZODCHESTVA," (CENTRE RIGHT) U.S. LIBRARY OF CONGRESS. (BOTTOM LEFT) V. A SHKVARIKOV, ED., "SOVETSKAIA ARKHITEKTURA"; PHOTOGRAPHS (TOP LEFT. CENTRE RIGHT, BOTTOM LEFT) FROM THE COLLECTION OF ARTHUR VOYCE, (BOTTOM RIGHT) AUTHENTICATED NEWS

THE SOVIET PERIOD

Top left: Lenin mausoleum, Moscow, 1930; A. V. Shchusev, arch.
Top right: Lomonosov State university, Moscow, 1953; Rudnev, arch.
Centre right: Uzbek pavilion at the All-Union Agricultural exposition, Moscow, 1939–40; S. N. Polupanov, arch.
Bottom left: Apartment house, Leningrad, 1934; E. Levinson and I. Fomin, arch.
Bottom right: U.S.S.R. pavilion, Brussels (Belg.) International exhibition, 1958; V. Doubov et al, arch.

with these malleable and expressive materials. Much research was devoted to the problem of reducing building weight and to saving steel and wood by replacing them with precision-engineered, prefabricated concrete and plastic elements.

In the light of their new experience Soviet architects ,began to reinterpret the principles of modern architecture, reconciling the old and the new. Evidence of the changing outlook is most noticeable in the planning of the satellite towns for both Moscow and Leningrad; in the fresh and imaginative approach to the design of the experimental residential blocks in the Moscow suburb of New Cheremushki; and particularly in the design of the U.S.S.R.'s hangarlike pavilion at the 1958 Brussels Universal and International exhibition, with its glass walls and trussed cantilevers. See also MODERN ARCHITECTURE: *20th Century.*

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RUSSIAN ART may be divided into four historical periods: the Byzantine, from the 10th to the early 16th century; the Moscow or h'ational, from the 16th to the 18th century; the Petersburgian or European, from the 18th fo the beginning of the 20th century; and the Soviet, from 1918 to the present.

THE BYZANTINE PERIOD (988–1530)

From the 10th century until the end of the 17th century painting in Russia was virtually confined to icon painting: an art introduced to the newly converted nation in the 10th century in the form of models sent to Kievan Russia from Byzantium. This art limited itself to the reproduction of traditional representations of the deity, the saints and scriptural events without ever using the living model.

The conversion of Russia (988) took place during the Byzantine Renaissance, and therefore the two distinct sources of Byzantine art traditions — the classical and the eastern — became the basis of early ecclesiastical art in Russia. The style and manner of Byzantium, once established at Kiev, spread from there to the northern centres and their influence persisted for several centuries.

The art of the Kievan period is revealed especially in the mosaics and frescoes of the Kiev cathedrals and in the applied arts such as filigree and enamels. Of the icons of that period few are preserved. All outstanding example that has survived is the mid-11th-century Vladimirskaia Bogomater ("Our Lady of Vladimir") brought to Russia from Constantinople in the 12th century. It played an important role in the development of the Russian iconographic type of the Virgin known as Umilenie ("Our Lady of Tenderness"), depicting the Virgin and Child as an intimate group radiating the warmth of motherly love.

The Novgorod School. — The civilization of the Kievan epoch was swept away in all of central Russia by the Mongol invasion about the middle of the 13th century. But in the northern regions of Russia — in Vladimir-Suzdal and particularly in the Novgorod district — the end of the 13th century and the whole of the 14th were marked by important developments in architecture and painting.

The city of Novgorod, free from subjugation to the Asiatic hordes, became virtually the metropolis and cultural centre of Old Russia after the fall of Kiev (1240). Together with the city of Pskov and other northwestern communities it harboured many Greek artists, most of whom were monks. They were instrumental in preserving the traditions of Byzantium. But though the latter were also zealously guarded by the Russian church, the evolution of icon painting — in Novgorod, Pskov, Suzdal and other centres — was manifesting local tendencies and characteristics. The rigid Byzantine patterns, the dark colours and the austere lines gradually became graceful, bright and less solemn. As early as the second half of the 12th century Novgorod's own style, which combined the severity of Byzantium with a folkish picturesqueness, was reflected in the frescoes of the Church of St. George in Staraia Ladoga (c. 1180) in the Church of Nereditsa (1199). The frescoes give an idea of the tendencies in the pictorial art of that period. The draftsmanship is spirited, the brush strokes are incisive and the general effect is vivid and sparkling.

The influence of Byzantine models continued to be felt more in the icons than in the frescoes. However in the course of the 13th century Novgorod's style of icon painting gradually strengthened and took shape: the severity of faces was softened, composition was simplified: the silhouette became bold and ever more important and the palette was lightened by bright cinnabar, snow-white, emerald-green and lemon-yellow tones.

The final brilliant stage of Byzantine art — the Palaeologus Renaissance — reached its highest point in the last quarter of the 14th century and is reflected, in works at Novgorod and Moscow, by the highly gifted Theophanes the Greek, a Byzantine emigrant from Constantinople, who seems to have assimilated the characteristics of the country of his adoption. His paintings, though marked by a close adherence to Byzantine standards, show the features that distinguish Russian art: notably, elongated proportions, delicacy of detail and rhythmical composition. These features can be seen in his Novgorod frescoes and especially in the central part of the *deesis* range of the iconostasis in the Cathedral of the Annunciation in the Moscow Kremlin.

Among the immediate followers and collaborators of Theophanes was Xndrei Rublev (c. 1360–1430)—the creator of religious types with a new spiritual expression in them. He painted the frescoes of the cathedrals of the Annunciation at Moscow (1405) and of the Assumption at Vladimir (1408). But his best-known work is the icon "The Old Testament Trinity" painted (c. 1410) for the Trinity-Sergiev monastery near Moscow. The subject—popular in Byzantine iconography — is the visit of the three angels to Abraham and Sarah. But the severe symbolism of the old Byzantine tradition is transformed into something new, more humanistic and intimate; even more important is the novel, peculiarly Russian mood of dreamy sublimation. It is one of the great creations of medieval Russian painting.

Another inspired artist of the 15th century was Dionisi (c. 1440–1508). He left an outstanding monument in the frescoes of the Ferapont monastery in the Novgorod district, and there are several icons ("The Metropolitan Aleksei." "The Crucifixion" and others) attributed to him. His art is marked by the extreme elongated stylizing of his figures combined with a subtle and glowing colour scheme. He and his predecessor Rublev succeeded in expressing the essence of the Russian icon as a reflection of a spiritual otherworldliness—the icon's highest merit.

THE MOSCOW OR NATIONAL PERIOD (1530–1700)

With the fall of Constantinople (1453) the hegemony in the world of Orthodoxy had shifted to Muscovite Russia. Profound changes began to take place in Russian icon painting, leading to the birth of a national art. This evolution first became noticeable in the gradual elimination of the Hellenistic setting of the icon—landscape and architecture. Greek basilicas with their porticoes and atria were replaced by Russian churches with their cupolas, "tents" and *kokoshniki.* Russian saints and episodes from their lives furnished subjects for the Russian artists; Muscovite types and native costumes began to appear in icon painting. The palette acquired an extraordinary brilliance and the emphasis on outline was particulary stressed. Thus the Russian icon gradually became the great national art form of medieval Russia.

Close ties between the Novgorod and the early Moscow schools were maintained for a long time, since many of the great icon and fresco painters in the 16th century worked first at Novgorod and later at Moscow; thus the features characteristic of Byzantine and Novgorodian traditions appear interwoven with the Moscow trend. The literary movement of the 16th century strongly influenced contemporary painting. New subjects appeared: some illustrated the mystical interpretation of the church dogmas or ex-

pressed the rites of the church in symbolic images; others represented parables and legends.

At the end of the 16th century the Stroganov school made its appearance introducing a particular manner of icon painting in diminutive size. Its masters became famous for the elegant attitudes of their figures, the eastern flavour of their colouring and elaborate treatment of detail. Some of them—Prokofii Chirin, Nikofor and Istoma Savin—were later to join the ranks of the icon-painting studios in the Kremlin armory in Moscow.

Moscow icon painting of the 17th century forms the last chapter in the history of Russian painting prior to the Petersburgian period. At the beginning of the century the majority of the icons still retained a strong national feeling and elements of real style. But by about 1650 little remained of what had once been so distinct in the Russian icon; not only had the original style disappeared, but also the character. By the end of the century western European influences began to spread rapidly over Russia, and Russian art entered upon a new historical period.

THE PETERSBURGIAN OR EUROPEAN PERIOD (1703–1917)

The foundation of St. Petersburg (1703) by Peter the Great marked the beginning of a significant change in Russian art—the substitution of western for Byzantine influence. The trend toward westernism was incipient before Peter was born, and went on after his death, but the turning point—when the outlook and taste of the upper classes ceased to be Muscovite and became European—took place during the reign of Peter the Great. Foreign artists and architects began to come to Russia in increasing numbers, while groups of young Russians were sent to Italy, France, Holland and England to study painting and architecture. The influx of Western influences affected all spheres of Russian cultural life and determined the character of its art for more than two centuries.

The art of Peter's age shows almost no trace of Byzantine influence. Only in iconography did the old style persist for some time. Early in the 18th century religious painting began to give way to secular painting, and the church prohibition of sculpture in the round became ineffective.

The reign of Elizabeth (1741–62) ushered in an era of aristocratic culture and art. The empress had French inclinations and a taste for luxury. In her reign a great number of vast and luxurious rococo-style palaces were built; painting was primarily devoted to their interior decoration—ceilings and walls—while sculpture was employed to adorn the gardens and parks. The work was carried on mostly by Italians and Frenchmen.

In 1757 the Academy of Fine Arts was founded in St. Petersburg, and foreign artists—mostly French—were invited to direct the new school. These trained some remarkable native portraitists such as Ivan Argunov (1727–97), A. P. Losenko (1731–73) and Fedor Rokotov (1735–1808). Their works reflected the ceremonial character of Elizabeth's tastes, but showed little evidence of native Russian sensibility.

The advent of classicism in Russia is identified with Catherine the Great (1762–96), whose cultural interests were infinitely wider and more refined than those of Elizabeth. She was not only a prolific builder but a great art collector; much of the credit for the fabulous art treasures of Russia belongs to her. The number of foreign artists that she brought to Russia or encouraged—by ordering their paintings, statues and all sorts of art objects—is truly impressive; and though she mostly favoured foreign artists and architects. principally French and Italian, Russian art profited indirectly.

Russian painters extended their range during the latter half of the 18th century, adding genres of interior decoration and landscape to that of portraiture. At the same time. however, they devoted increasing attention to portraiture. Dmitri Levitsky (1735–1822) painted the aristocratic ladies and gentlemen of the court and the eminent men of letters. as well as the adolescent schoolgirls of the Smolny institute. His portraits are largely of an intimate nature, concentrating on the psychological character of the model. Vladimir Borovikovsky (1757–1825) also painted aristocratic society figures and members of the imperial family. His early work is permeated by a romantic melancholy mood. Later his portraits acquired a realistic quality

Napoleon's invasion of Russia (1812) had far-reaching consequences. It marked the revival of national consciousness and the beginning of a widespread cult of Russian separateness from Europe, thus precipitating the long controversy between "westerners" and "Slavophiles" which ran through so much of Russian 19th-century literature and thought. At the same time Russia shared the European romanticism which marked the era of the Napoleonic Wars. This is reflected in the works of Orest Kiprensky (1782–1836) and Vasili Tropinin (1776–1857). The most notable contribution to the romantic spirit was made by Karl Briulov (1799–1852) with his monumental painting "The Last Days of Pompeii" (1833). A completely different trend appears in the work of Alexander Ivanov (1806–58), the first Russian painter to express religious emotions in the western manner. Other outstanding artists of that period were the painters Alexei Venetsianov (1780–1847) and Paul Fedotov (1815–52), the forerunners of realist painting in Russia, and the sculptors I. Martos (1752–1835), I. Vitali (1794–1855) and F. Tolstoi (1783–1873), representatives of Russian classicism.

The second half of the 19th century marked the coming of age of realism in Russia. A popular outlook and a sympathetic attitude toward the hard life of the people is reflected in the works of most of the painters and sculptors of that time. The new trend in art had as its basis the populist revolutionary ferment prevalent toward the end of the 1850s and the beginning of the 1860s, much of it inspired by the writers Nicolas Dobrolyubov (1836–1861) and Nikolai Chernyshevski (1828–1889). Chernyshevski's dissertation *The Aesthetic Relations of Art to Reality* (published in 1855), the main thesis of which mas that art must not only reflect reality but also explain and judge it, provided a starting point for the contemporary artists.

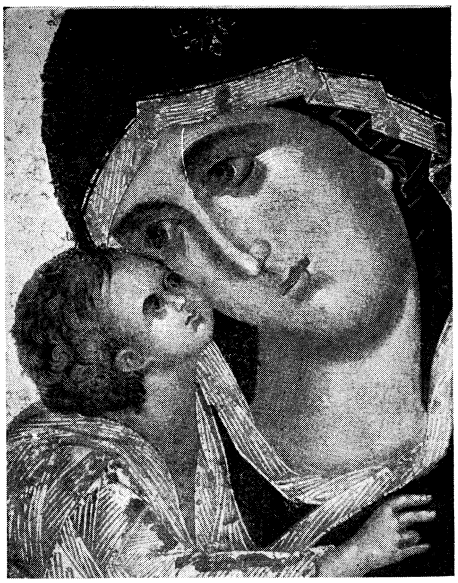
From the last third of the 19th century onward the history of Russian art is the history of a series of school struggles: the Slavophiles against the westerners; the Academy against the Peredvizhniki ("Society of Wandering [or Traveling] Exhibitions"); and later the joint effort of the last two against a new movement. born in the 1890s and directed by the art review *Mir Iskusstva* ("The World of Art").

The Peredvizhniki society was formed in 1870 by a group of realist artists who seceded from the Academy in 1863 in protest against alien dogmatic formulas and the constricting programs of the Academy's annual competitions. Most prominent among the members of the Peredvizhniki were Ivan Kramskoy (1837–87), Ilya Repin (1844–1930), Vasili Surikov (1848–1916), Vasili Perov (1833–82) and Vasili Vereshchagin (1842–1904) The society attached far more importance to the moral and literary aspects of art than to aesthetics. Its artistic creed was realism. national feeling and social consciousness. Art was to be placed at the service of humanitarian and social ideals; it was to be brought to all the people. The society therefore organized mobile (*peredvizhnye*) exhibitions, hence the name.

The outstanding paintings by the members of this society are: "The Morning of the Execution of the Streltsy" (1881) and "Boyarina Morozova" (1887) by Surikov; "The Volga Bargemen" (1873) and "The Arrest of the Propagandist" (1878) by Repin; "After Igor's Battle with the Polovtsi" (1880) by Victor Vasnetsov (1848–1926); "The Hermit" (1889) by Mikhail Nesterov (1862–1942); and "Still Waters" (1892) and "Golden Autumn" (1895) by Isaak Levitan (1861–1900). In sculpture the best-known norks are "Ivan IV" (1870), "Peter the Great" (1872) and "Mephistopheles" (1882) by Mark Antokolski (1843–1902).

The influence of the Peredvizhniki spread throughout the country and it dominated the scene for nearly 30 years. But by the end of the century (1898). when the *Mir Iskusstva* made its appearance under the editorship of Sergei Diaghilev (1872–1929), Konstantin Somov (1869–1939) and Alexandre Benois (1870–1928), the prestige of the Peredvizhniki had greatly declined. The infatuation with problem pictures and civic themes was over.

Mir Iskusstva did not proclaim any new theories, but it attacked the low artistic standards of the Peredvizhniki, as well as

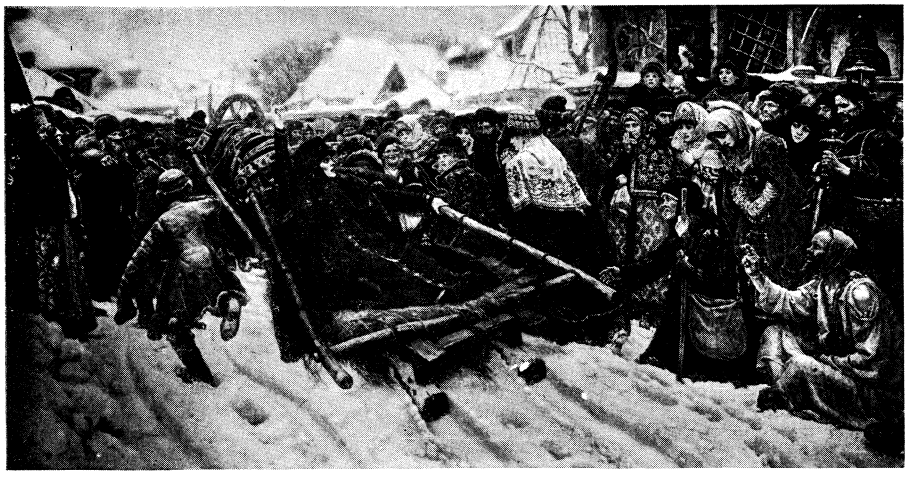


"Our Lady of the Don." Artist unknown: about 1380

"St. John the Baptist." From the school of Andrei Rublev; first half of the 15th century

Portrait of A. S. Pushkin by Orest Kiprensky (1782–1836)

Portrait of Madame Naryshkina by Vladimir Borovikovsky (1757–1825)

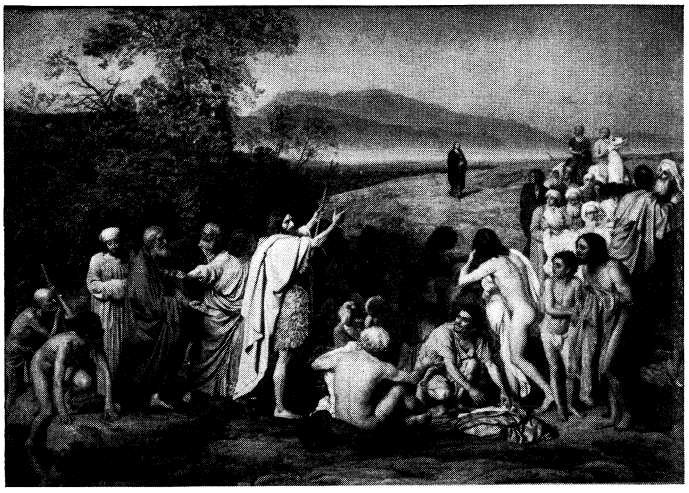


"Boyarina Morozova" by Vassily Surikov (1848–1916)

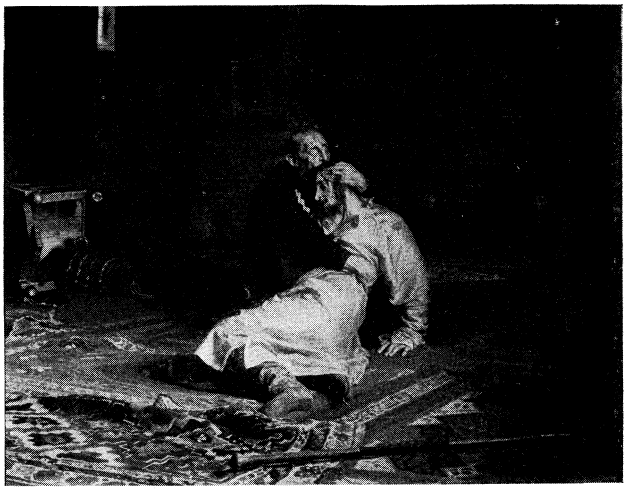
ICONOGRAPHY AND PAINTING

BY COURTESY OF (CENTRE LEFT, CENTRE RIGHT BOTTOM) THE SOCIETY FOR CULTURAL RELATIONS WITH THE U.S.S.R., LONDON; PHOTOGRAPHS (TOP LEFT, TOP RIGHT) FROM THE COLLECTION OF ARTHUR VOYCE

RUSSIAN ART



"Christ's First Appearance to the People" by Alexander Ivanov (1806–58)

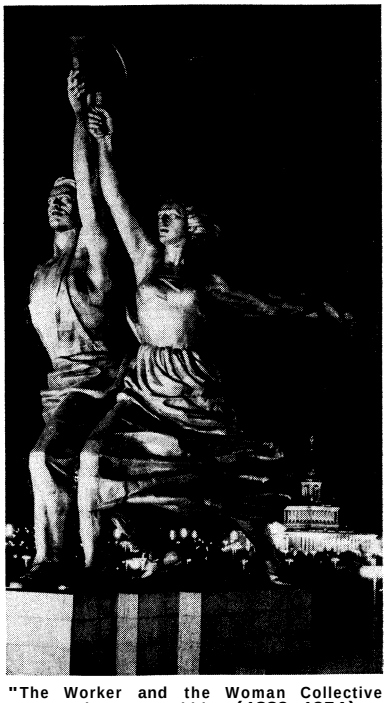


"Ivan IV and His Son" by Ilya Repin (1844–1930)

"The Grain" by T. N. Yabionskaya (1917–). Stalin prize, 1949

"Daughter of Soviet Kirghizia" by S. A. Chuikov (1902–)

"Valley of Ararat" by M. S. Saryan (1880–)



"The Worker and the Woman Collective Farmer" by Vera Mukhina (1889–1954)

19TH and 20TH CENTURY PAINTING AND SCULPTURE

BY COURTESY OF THE SOCIETY FOR CULTURAL RELATIONS WITH THE U.S.S.R., LONDON

the deadening influence of the Academy. Individualism and artistic personality were placed first, regardless of any school. Much of the creative work of this group tended to be based on historical themes. Such artists as Benois, Somov and Leon Bakst (1866–1924) were under the spell of the 18th century and the romantic 1830s. Others like Nikolai Roerich (1874–1947), Vasnetsov and Ivan Bilibin (1876–1942) were attempting to evoke the spirit of ancient Russia. They all aspired to achieve a synthesis of new western-European trends and certain elements of traditional Russian folk art.

The important achievements of the *Mir Iskusstva* were in the fields of the artistic book (format and illustrations) and stage designing. But perhaps the greatest contribution of this group to Russian art was the revival of the sense of tradition. It is noteworthy that nearly all that Russia exported to western Europe in the way of artistic values during the early part of the 20th century (ballet, opera, stage scenery, costume and graphic arts) was the work of this group.

In the European artistic ferment of ideas of the early 1900s Russia played a significant role. A large part of ultramodernism was born and developed there during the second decade of the century. The new ideas were taken up by the group called Bubnovyi Valet ("The Jack of Diamonds"), the work of whose members—Peter Konchalovsky (1876–1956), Ilya Mashkov (1881–1944), Aleksandr Ruprin (1870–1935), Aristarkh Lentulov (1882–1943) and others—once regarded as followers of the extreme French trends, made itself felt in Soviet Russia. This group was succeeded by several "leftist" groups, consisting of Cubists, Constructivists, Suprematists and Expressionists—all of them attempting to combine the native and foreign theories under the slogan "pure form," and most of them professing to serve the Revolution with the higher forms of abstract art.

THE SOVIET PERIOD (1918–)

The Bolshevik Revolution broke out at the time when Russia had at last caught up with western Europe in the artistic sphere. At first the Soviet regime appeared to look favourably upon avant-garde art. Extreme modernists like Vasili Kandinsky (1866–1944), Kasimir Malevich (1878–1935), Marc Chagall (1887–), Vladimir Tatlin (1885–), Naum Gabo (1890–) and El Lissitzky (1890–1941) were given official positions. But the teachings of these Abstractionist and Nonobjective artists—their professed indifference to subject matter and their hostility to popular ideas—soon proved to be their undoing, thus changing the direction of Soviet art.

The intellectuals who had any appreciation of modern art represented only a small minority of the population. Lenin himself had no sympathy for the extreme forms of modernism. He and a number of his latter-day disciples apparently sensed that the Suprematist paintings of Malevich or those of the Expressionist Kandinsky were addressed not to the common man but rather to a small coterie of connoisseurs and dilettanti, and that modernism, with its rarefied atmosphere of pure aesthetics, was incomprehensible to the masses. The hostility toward the abstract and nonobjective schools of art—accused of "capitalist cosmopolitanism"—was further intensified by the desire to establish a "people's" art answering, both in form and in content, the strivings of the new political and economic system.

To accomplish its objectives the Soviet regime adopted a program of measures aimed at the democratization and humanization of art. The extreme-left art groups (the "formalists," as they were labeled) were dissolved, and their conflicting aesthetics mere replaced with the aesthetics of "socialist realism." Art was to be realistic enough to be comprehensible to the people without being merely a copy of external reality—an art socially useful and educational. This implied the exclusion of "subjectivism," "abstractionism" and all the other "antihumanistic" trends in art as practised by those who seemed not to care whether they mere understood or not. The ban on formalism (a term that covered all nonobjective art) and the insistence on representational realism led to a frank revival of the "purpose" painting of the *Peredvizhniki* epoch, which soon developed into a lifeless academicism dominating every phase of art throughout the regime of Joseph Stalin.

The active role in the promulgation of socialist realism was played by the writer Maksim Gorki (1868–1936), whose views on aesthetics were based on the principles enunciated by Nikolai Chernyshevski; the doctrine was introduced by Gorki in a speech before the first congress of the Union of Soviet Writers held in 1934; shortly afterward it spread to all the other arts. According to Soviet art theoreticians. socialist realism permits of an infinite variety of stylistic methods, of the use of many expressive forms. The term "socialist" in the designation signifies that realism in Soviet art is based on the principles of philosophic materialism, appraising all phenomena of the past and present from the standpoint of that ideology. This view of the substance of art implied thematic painting and sculpture, but also implied that art is a part of the socialist dynamic. The artist therefore should not dwell on the negative, static characteristics of society, but must portray the positive, revolutionary-romantic side of socialist life by representing the inner world and the deeds of its outstanding workers and leaders: *i.e.,* by bringing into salient relief a deliberately magnified image of the "typical."

An outstanding part in the development of Soviet art was played by Lenin's "plan for monuments," the purpose of which was to honour the memory of the great revolutionists, the men of science, art and literature by monuments, paintings and statues. Aside from portraying Soviet leaders, the artist was urged to select his subject matter from the drama of daily life and toil of the country, stressing the theme of the "new Soviet man." As a result many statues and paintings were produced depicting scientific and industrial workers and farmers—singly or in groups, at labour or at rest—in homely realism, but often tinged with imagination. Examples of socialist realism are the sculptured stainless-steel group "Worker and Farmerette" by Vera Mukhina (1889–1954), and the paintings "Steelworker of the Hammer and Sickle Factory" by Gavriil Gorelov (1880–), "Farm Festival" by Sergei Gerasimov (1885–) and "Supper of the Tractor Drivers" by Arkadi Plastov (1893–).

Another feature of this trend was the scope it gave to monumental art works in which sculptors and painters collaborated with the architect. Hundreds of artists, associated with different genres, contributed to the decoration of the new buildings—the concourses of the Moscow Subway, the halls and auditorium of Moscow university and the pavilions of the Agricultural exposition—tying in the substance of genre activities with the architecture of the structure. Some of these works are distinguished by a sense of composition, monumentalism and a sense of history; very often they display technical virtuosity and fine workmanship but they suffer from an excess of realism.

The end of the Stalin era (1953) ushered in a more liberal climate in the arts. The pressure of the tutelage system imposed from above was considerably relaxed, with the result that the artist regained a measure of freedom of expression. *See* also Index references under "Russian Art" in the Index volume.

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RUSSIAN LANGUAGE. The Russian language has more than 110,000,000 speakers, a majority of the population of the Soviet Union. It is the chief administrative language of that country. It is sometimes called Great Russian to distinguish it from the closely related Byelorussian or White Russian and "Little Russian" (an obsolescent term) or Ukrainian, with which it makes up the eastern branch of the Slavonic languages (*q.v.*).

The slavonic scripts devised by Saints Cyril and Methodius and disseminated among the West and South Slavs in the 9th century must have found their way to the East Slavs quickly. Russian

chronicles preserve in later copies treaties made by Kievan princes with Byzantium in 911, 944 and 971, but it was only after the official baptism of Prince Vladimir in 988 that schools were opened and writing began to flourish. The chronicles mention intensive cultural activity under Yaroslav the Wise (1036–54), and the oldest surviving dated manuscript, the opulent Ostromir Gospel of 1056, was quickly followed by a number of other texts which testify to a high cultural level. Epigraphical materials, including graffiti and inscribed objects (whorls, bricks, jars), demonstrate a general knowledge of writing at the same epoch. In 1951 archaeologists working in the ancient north Russian city of Novgorod unearthed a hitherto unknown type of source — short texts, mostly private letters and agreements, written on birchbark. Several score grancoty of this type came to light, the oldest from the late 11th century; their importance for the history of language and culture is comparable with that of papyri for the classical studies.

The overwhelming majority of the writing represents Church Slavonic (Ch.Sl.) of the Russian recension, that is, a standardized written language based on a South Slavonic type of speech but adapted to local conditions. This is the language of the church and the culture connected with it, and the texts are mostly translations from the Greek. The Ch.Sl., although differing in many particulars from the local speech, was probably readily comprehensible to the East Slavs in the early centuries and not too difficult for them to master. Present knowledge of the everyday language comes chiefly from the scanty birchbark granzoty and the occasional slips made by scribes who undertook to add notes or colophons in the Ch.Sl. manuscripts they were copying. Original compositions such as the chronicles and law codes survived in later copies in which it is not easy to distinguish older and newer linguistic habits. It seems, however, that the business language of the laws and letters used more of the East Slavonic elements, particularly in vocabulary, than did annalistic and hagiographic works which had some literary pretensions. This is a common phenomenon; diffe'rent genres are usually couched in diflerent linguistic styles and it is natural that everyday matters are treated in everyday terms. The annalists made skillful stylistic use of the various linguistic elements; the contentions of Soviet critics that there were two different written languages, the foreign ecclesiastical Ch.Sl. and the vernacular secular Russian, are clearly exaggerated.

A number of the earliest texts exhibit some evidence of a difference between a northern and a southern dialect, but on the whole the language until the 13th century is best described as Old East Slavonic. The conventional term Old Russian, which is too firmly established to be discarded, is to be understood as referring to the language of Rus', the whole East Slavonic area, and not to the modern national group called Russians.

Specifically southern dialect features warrant the identification of some texts from the late 13th century as Ukrainian, but it was not until the 16th and 17th centuries that Byelorussian became clearly defined.

The use of local business languages for practical purposes in different areas long had no effect on the pre-eminence of Ch.Sl., which remained a unifying literary language for centuries. In the early period it had adopted consistently a number of East Slavonic features, but during the 14th century it was reformed as a result of the prestige of Bulgarian and Serbian scholars who fled to Russia when the Turks overran the Balkans. This "second South Slavonic influence" (which also affected literary style, art and architecture) was decisive in establishing an archaic and partially foreign type of spelling and grammar as the only suitable vehicle for literary composition. Not until the 17th century, a time of turmoil and incipient change in all realms of Russian life, did this authority weaken. The business language of the Moscow chancelleries, which had steadily gained influence with the growth of the political power of the Muscovite state, then began to be used in more and more significant works; like the Code (*Ulozhenie*) of 1649, which was particularly important for the development of a linguistic standard because it was one of the first printed secular books.

At the same time the beginnings of a style intermediate between Ch.Sl. and business usage can be discerned, and some texts in real colloquial Russian appeared (especially the autobiography of the dissident priest Avvakum, 1673).

The radically westernizing policies of Peter I (1682–1725) and his successors made necessary new means of expression. At first the effort to catch up with Europe was manifested by a flood of translations, chiefly of practical works. Foreign words were introduced into Russian almost indiscriminately, despite the efforts of such talented writers as V. Trediakovskii (d. 1769) who preferred to create new words from Russian and Slavonic materials. Persistence of the traditional view that the vernacular was not suited for literature clashed with a recognition of the fact that Ch.Sl. was too foreign a vehicle for the new culture. The problems were most clearly posed by the brilliant scientist and writer Mikhaylo Lomonosov (d. 1765), who distinguished three styles: a predominantly Ch.Sl. type was to serve for the most "elevated" literature (ode, tragedy), strictly colloquial Russian for the "low" genres (fable, comedy) and an intermediate type for other writings. His suggestions were largely followed, at least in principle, but there was a steady process of rejecting the most unfamiliar and archaic words and constructions of Slavonic and constant imitation of French and German models. About the beginning of the 19th century journalists and educators had elaborated a flexible intermediate style in writing about science and practical affairs, an exemplary moderate form of high style was used by N. Karamzin in his History of the Russian State (published 1818), and hitherto despised colloquial elements were made respectable by the comedies of Fonvizin (esp. The *Minor,* 1782) and the fables of Krylov (1809–20). But there was still an appreciable distance between the different types of language, and influential voices were still to be heard vigorously insisting on a Slavonic purism. It remained lor Alexander Pushkin (1799–1836) to achieve a final synthesis.

Pushkin's poetry ranged from playful romance to the serious epic, from Byronic narratives to classical epigrams, from imitations of folk-songs and fairy tales to poignantly personal lyrics and high tragedy. In prose he wrote history, literary criticism, travel accounts, stories and novels. Whatever the genre, Pushkin's language remained throughout essentially the spoken Russian of an educated man, flavored by pungent peasant proverbs or elegant allusions to French classics, by solemn Slavonic phrases or official chancellery clichés as demanded by the subject matter and tone of his approach. The brilliant success of Pushkin's works put an end to the linguistic controversy, and the history of the Russian literary language subsequently is an account of the refinement of details, of the extension of special types of vocabulary, and of the elaboration of special styles in keeping with changing literary fashions.

In modern times three groups of Russian dialects are distinguished: the northern. which stretches from Leningrad all across Siberia. the southern, including most of central and southern Russia, and a central group occupying a relatively narrow band between the other two. There is no clear boundary between Russian and Byelorussian or between the latter and Ukrainian, for the major dialect types are everywhere united by zones of transition. It is only in the east, where relatively recent settlers brought Ukrainian from the south and Russian from the north, that there is a fairly distinct linguistic frontier. Viewed historically, it seems that in the Old Russian period the chain of dialects from south to north represented closely related types. with a broad intermediate area separating the extreme north from the extreme south. The southernmost dialects soon (13th–14th centuries) became sufficiently differentiated to be identified as Ukrainian, while the central belt, first developing along the same general lines as the north, gradually split into an eastern and a western sector.

The central west, though maintaining some close contacts with Ukrainian, established its identity as Byelorussian (16th–17th centuries), while the central east eventually became southern Great Russian.

Great Russian dialects differ from one another in an enormous number of details, and yet they have retained an overall struc-

tural similarity which makes them on the whole mutually comprehensible. A major difference between the northern and southern (and also Byelorussian) types is in vocalism; the northern (called o-dialects) have on the whole ,maintained all vowel distinctions regardless of position, while in the southern (called a-dialects, with *akanie*), unstressed vowels have changed quality; *o* > a, and often there are complex further changes. This akanie is reliably attested from the 14th century. The oldest northern texts have a confusion of the letters *č* and c, reflecting a typical feature of the north, where there is no functional difference between the two sounds. Ukrainian, Byelorussian and south Russian have a fricative γ (velar) or *h* (laryngeal) for Common Slavonic and northern *g;* this doubtless is a prehistoric change.

The basis of standard Russian is the dialect of Moscow, the cultural centre from the 15th century. The city was originally within the northern dialect zone, but as the mutual influences between north and south created a growing central dialect type, Moscow found itself in the central zone. Thus it has on the whole the consonants of the north (though keeping separate *č* and *c*) and the vowels of the south. The word for "mountain!" spelled *gorá* and so pronounced in the north, is *gará* in standard pronunciation and yard to the south.

The comparative table at the end of SLAVONIC LANGUAGES illustrates some E.Sl. characteristics. In the oldest texts some Common E.Sl. features already appear: *č ž* < C.Sl. *tj *dj; l* < **tl* *dl; u < **ǫ;* a < **ę;* the extra vowel developed in words like *zóloto* "gold" < **zolto* (O.Ch.S. zlato) and *molokó* "milk" < **melko* (O.Ch.S. *mlěko*), initial *o-* for *je-* (R. *ózero* "lake" < **jezero*), and initial *u-* < **ju-* (OR. *ugŭ* "south" has been displaced by the Ch.Sl. form *jug*). In the early historical period the reduced vowels *ŭ ĭ* were lost in "weak position" and became *o* e in "strong position." C.S. *ě* merged with e in R. and BR., but became *i* in Ukr. All E. Sl. languages oppose a series of palatalized consonants to plain (or labialized) corresponding series, although the details vary from language to language. BR. has no palatalized labials before j or in final position (R. *s'em'* "seven," *p'ju* "I drink," BR. *s'em, pju*), no soft *r* (R. *kur'ú* "I smoke," BR. *kurú*), and soft *t'* and d' have become affricates *c'* and *dz'* (R. *d'ét'i* "children," BR. dz'ec'i).

Byelorussian, spoken by about 7,000,000 persons, has two major dialect groups, northeast and southwest. Since Minsk. the capital, is on the latter's territory, the modern literary language, essentially a creation of the Soviet period, is southeastern in character.

A great many variations in phonology and morphology are still permitted, however, for usage has not yet been stabilized. BR. uses a strictly phonetic system of spelling which makes it look a great deal more different from R. than it sounds when spoken.

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RUSSIAN LITERATURE. The natural divisions in the history of Russian literature are formed by the two great landmarks of the reforms of Peter I and the effects of the Soviet Revolution. There are thus three main periods, though these inevitably overlap. They are: old Russian, from the conversion to Christianity of St. Vladimir in 988 to the foundation of Peter the Great's new capital in 1703; modern Russian, from 1703 to the October Revolution of 1917; and the postrevolutionary literature of the U.S.S.R. For historical reasons, including particularly the relative isolation of Russia from western Europe until the 16th century, the middle ages lasted for Russian literature until Peter's time (so that the old Russian period might almost as well be called mediaeval), and many of those features which are commonly associated under the term Renaissance do not begin to appear in Russia till the 17th century. The Russian language, too, largely because of the prolongation in it of Church Slavonic elements, did not assume its modern character till well on in the 18th century. The fundamental changes in mental climate wrought by the October Revolution are in themselves sufficient to explain the beginning of a third literary period with that event.

OLD RUSSIAN LITERATURE (988–1703)

Historically this may be subdivided conveniently into four main epochs: (1) Kievan, with Kiev in the Ukraine as its cultural centre, from the earliest documents of the 11th century to the Mongol conquest in 1240; (2) regional, during which a number of cultural centres such as Novgorod, Pskov and Tver were variously dominant, to the end of the Tatar suzerainty in 1480; (3) Muscovite, in which the Moscow grand dukes became tsars of a strong centralized Russian state which caused Moscow to become the vital literary centre, to the beginning of the "time of troubles" with the death of Ivan the Terrible's son Theodore I in 1598; and (4) transitional, in which the first marked contacts with and influences from the west prepared the way for the beginnings of modern Russian literature, from the end of the "time of troubles" with the accession of Tsar Michael Romanov in 1613 to the beginnings of St. Petersburg in 1703.

Kievan Period (988–1240).—In the days of its greatness, Kiev had a heterogeneous culture, intellectually and aesthetically advanced and powerful. It drew its inspiration from Byzantine Christianity, but was from the outset modified and vitalized by native Slavonic impulses. At the same time it had real contacts with western Europe, and yet had already assimilated something from the culture of contiguous and often closely associated Asian peoples. It had too something of that special quality which runs all through Russian literature expressed by the Russian word *narodnost* (roughly to be translated as "peopleness"), an element which makes a literature retain some intimate and vital relationship to people and soil despite foreign influences and urban sophistication. Kiev of the late 10th century was a peak of European culture, sharing the most valuable developments of east and west, of Byzantine and Latin civilization.

As a result of the Mongol devastations of the 13th century, much was lost and much preserved only in manuscripts of the 16th century. There were the usual types of early Christian religious literature—lives of saints, homilies, books of instruction. There were, too, the expected kind of translated works from Byzantine Greek. But there were also creative writings which, while employing the artificial Church Slavonic of the old Rus, show genuinely literary qualities as well as throw light on the life of the times. Such were the chronicles, for example The Tale of *Bygone* Times (*Povest vremennykh* let) with its account of the beginnings of Rus; and the *Instruction* (Pouchenie) of Vladimir Monomakh in which the early 12th-century revered ruler of Kiev sets down his wisdom and practical experience. *The Discourse on Law and Grace* (*Slovo o zakone i blagodati*) by the metropolitan Ilarion shows intellectual ability as well as rhetorical skill. The probably 12th-century

adaptation of the Byzantine romantic tale of *Digenis Akritas* (*Devgenievo Deyanie*) reveals marked native folk elements which give it something of the air of a Russian heroic prose epic.

Though these short, balladlike heroic pieces in unrhymed verse for singing by trained minstrels have not survived in manuscripts of earlier than the 17th century. this most important type of poetry of oral tradition evidently arose in the Kievan epoch. Much of its subject matter concerns the doings of the Kiev princes and their noble retainers, treated in a truly heroic yet natural style, in which the work of court poets has been handed down in the mouths of the people. Some of these *byliny* or pieces of the olden days (more traditionally termed *starmy* till the folklorists coined *byliny* in 1830) were copied donn for the first time by the Englishman Richard James early in the 17th century in a manuscript preserved in the Bodleian library at Oxford. They are the finest representatives of Russian oral poetry, and this tradition of an oral poetry independent of books has lasted into the 20th century, in which pieces of the *bylina* type continue to he composed and recited on contemporary happenings in parts of northern Russia. Those fairy folktales and collections of vivid proverbs which are a marked feature of Russian popular literature throughout its history also began to appear in the Kievan age.

But the supreme literary achievement of the Kiev period was the heroic poem in rhythmic epic prose known as *The Lay of Igor's Campaign (Siovo o polku Igoreve),* composed. very soon after the events it makes so memorable. to celebrate the glories of a tragic expedition made by Prince Igor of Novgorod-Seversk against the Polovtsy (Cumans, or Kipchak Turks) in 1185. This poem survived in an early 16th-century manuscript discovered in 1795 by Count Aleksey Musin-Pushkin and published in 1800, but it perished in the Moscow fire of 1812. It is the one old Russian work that clearly merits a place among the world's masterpieces. Its heroic spirit harmonizes perfectly with the sheer poetic beauty of its language and nith its blending of Christian and pagan feeling.[1]

Regional Period (1240–1480).—The fall of the Kievan state and the Tatar conquest of so much of Russia led naturally to the regionalization of culture, and the Eurasian cultural atmosphere was not propitious to literature in general. Much the same chronicles and lives of saints and sermons continued to be produced as in the previous age, with many translations of well-known European works of edification and adventure; but the isolation, not only from western Europe but even from Bysantium. was unfavourable to literary progress, and the output of original writing was small. Much of this latter was of the quality of the *Petition of Daniel the Captive (Molenie Daniila Zatochnika),* in which an unknown exile begs aid and patronage from the prince of Pereyaslavl in a fantastic medley of varied learning and rhetoric while voicing a practical complaint against the boyars; interesting to social historians, it scarcely reaches the level of literature. To Suzdal belongs the stirring and warlike *Life of Prince Alexander Nevsky,* with its forceful account of the famous victory of 1242 on the ice of Lake Peipus over the Teutonic Knights. Each centre had its regional chronicle, and there was a good deal of narrative and lament over the Mongol wars. Quite entertaining is the curious and imaginative *Tale of the Indian Empire (Skazanye ob indizskom tsarstve)* with its picture of a mighty Christian Indian ruler, Ivan. who goes into battle with vast armies led by a huge wooden crucifix and vaguely suggests Prester John.

But there are two works of the 15th century which are, in different ways. on a more strictly literary plane. the *Zadonshchina* or *Deeds Across the Don* of the early part of the century, and the *Travels Beyond the Three Seas (Khozhdenie za tri morya)* of Afanasy Nikitin. The *Zadonshchina* celebrates the glorious victory of Dimitri (Demetrius) Donskoy of Moscow over the khan Mamai on Kulikovo plain (1380); it has heroic vigour of a somewhat highly wrought kind. The travel narrative of Nikitin, a merchant of Tver, on the other hand, is colloquial and simple, without the usual Church Slavonic adornments though often introducing oriental words for effect. He describes his own journey for trading purposes to Persia and India which lasted for nearly six years (1466–72), giving a vivid and naïve picture of his life in India especially. Nikitin's *Travels* is the first European account of India.

Muscovite Period (1480–1598).—The 16th century was especially a period of the written expression of the organization of the Muscovite state as it steadily and consciously consolidated itself. The discovery that Moscow was a "third Rome" at its beginning was followed by the production of numerous and often effective encyclopaedic works aimed at a combined religious and secular teaching which would form the kind of society desired by Moscow. Ivan the Terrible, himself no mean polemical letter writer, took a hand in setting out his own kind of political philosophy. His chief epistolary opponent, Xndrey Kurbsky, a descendant of Kievan princes. defended the rights of the oppressed nobility with even greater literary skill. Ivan's principal literary apologist, Ivan Peresvetov, with his western political training, produced a remarkable kind of allegorical historical defense of Ivan's terror in his *Tale of Sultan Mahomet (Skazanie o Magmete Saltane),* in which the cruel severities of the Ottoman conqueror of Constantinople are lauded as an implied justification of the tsar's conduct. Books such as the *Hundred Chapters (Sto glav),* which sets out a kind of *disciplina clericalis* by ecclesiastical conciliar authority. and still more the *Ordering of the Household (Domostroy),* are valuable as social documents throwing often clear light on modes and manners which remained the Orthodox Russian way of life for centuries.

This period also marked the beginnings of that kind of western contact which later was to change the whole pattern of Russian literature. Queen Elizabeth I had many dealings with Tsar Ivan which went beyond the mere opening up of active trading. Printing began in Moscow in 1564, though it was little used save for religious. legal and didactic books till the time of Peter the Great. A new impetus was given to the study of learning and theology by the coming of Greek scholars and accomplished men of letters such as Maxim the Greek. There was some interest in literary or rhetorical style stimulated by contacts with Poles.

But native Russian features began at this time also to grow into new life. This is indicated, for instance: by the composition of historical pieces of the *bylina* type on the events of the time. Heroic pieces were written in poetic prose in honour of Ivan the Terrible's conquests; at least one such work, the *Story Concerning the Empire of Kazan (Istorya o kazanskom tsarstve),* contains passages of poetic quality reminiscent of ballad or *bylina.*

Transitional Period (1613–1703).—The literary tendencies begun in the 16th century became increasingly powerful in the 17th. As the century advanced. it became ever more clearly an age of transition. though Peter's reforms greatly hurried and enforced developments which otherwise mould have been much slower. Especially notable was the development of prose in secular directions such as satire. romance (though mostly only through translations) and the use occasionally of spoken Russian side by side with Church Slavonic. There were significant developments too in poetic style and metre through Polish and Ukrainian influences. But most marked of all was the increasing multiplying of western literary contacts of all kinds, though the tangible results of these were for long not visible.

The "time of troubles" which filled the period between what have been termed the Muscovite and transitional periods (1598–1613) showed many conflicting tendencies. It was rich in popular literary expressions (including *byliny*) of the miseries of the times, but its chief significance lay in the greatly increased foreign influences which it let into Russia. Ivan the Terrible had often encouraged foreigners; but Boris Godunov (1598–1605) went much farther at times: and the Polish rule in Moscow which followed his reign brought in a whole host of Latin western influences from Poland and from the Ukraine, which was then part of Poland. Kiev, too, was once more becoming a source of literary influence which, as in its ancient glory, blended Latin with Byzantine culture. This Ukrainian, hence partly Latin, influence was greatly reinforced wher. in 1654 much of the Ukraine was united with

[1] In his book Le *Siovo d'Igor* (Paris, 1940) André Mazon, professor at the College de France and director of the Institut d'Études Slaves of Paris, considered that the *Slovo* was a forgery and that Musin-Pushkin produced it. Roman Jakobson defended the authenticity of the *Slovo* in the composite volume edited by H. Grégoire, La *Geste du Prince* Igor (New York, 1948).

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REPRESENTATIVE RUSSIAN WRITERS, 18TH–20TH CENTURIES

1. Mikhail Lomonósov (*c.* 1711–65)
2. Ivan Krylov (1768–1844)
3. Mikhail Lermontov (1814–41)
4. Alexander Pushkin (1799–1837)
5. Nikolai Gogol (1809–52)
6. Fëdor Dostoevski (1821–81)
7. Nikolai Nekrasov (1821–77)
8. Ivan Turgenev (1818–83)
9. Leo Tolstoy (1828–1910)
10. Anton Chekhov (1860–1904)
11. Maxim Gorki (Alexey Peshkov, 1868–1936)
12. Dmitri Merezhkovsky (1865–1941)

Russia. It was thus that Simeon Polotsky came to bring his syllabic metre (an entire innovation) from the then recently Polish Kiev to Moscow, and though this was not in the long run the most suitable metre for Russian poets, its introduction undoubtedly served as a stimulus.

It was toward the close of this traditional period that the crude beginnings of a Russian theatre appeared. under the influence of the learned Simeon Polotsky and of Johann Gottfried Grigory (Gregori), a German Lutheran pastor in Moscow. Polotsky introduced didactic drama of the Renaissance grammar-school type, and Grigory inspired the production of biblical narrative and of a morality play on Adam and Eve in a manner reminiscent of English "coniedies" in which serious and edifying matter is made to alternate with the buffoonery and clowning of fictitious characters interpolated from low life. The first wooden theatre was built in 1672. but it served merely the court circle of Tsar Alexius. Polotsky's play on the *Prodigal Son,* with its humane and dignified speeches, has a good deal of vitality. But the treatment of *Judith* from the scriptural story is a mixture of exaggeratedly rhetorical declamation with crude comic relief from such characters as a frightened soldier of Holofernes and Judith's maidservant. Theatre proper had to wait for Peter I.

The outstanding achievement of this period was in Russian prose, in the vivid and masterly use for the first time of colloquial Russian as distinct from Church Slavonic in the pioneering *Life* of *the Archpriest Avvakum* written by himself (*Zhitie Protopopa Avvakuma*) in 1672–73. Avvakum (a form of Habbakuk) was the fanatical but inspiring leader of the Old Believers, who opposed all the major reforms of the patriarch Nikon and all the modern changes which they foreshadowed in the days of Tsar Alexius. Combining intense spiritual pride with the fiercest realism in style, he sought to bring the church and its people back to the ancient traditional piety. In a life of suffering and material hardship which his rebelliousness against the church and state brought upon him, culminating in his being burned at the stake. he exalted with a vivid fury of plain speaking all that the reforms were, as he thought, seeking to obliterate in the loved ancient ways of "Holy Russia." Keeping the Church Slavonic for scriptural citation and formal compliment, he wrote the details of his life in a dynamic colloquial Russian of the people he loved which hitherto had been unknown (except for occasional passages) in any educated writing. As he says of the *Life:*

> And if it be plainly told, do not, for God's sake, condemn our plain speech, for I love my natural Russian, and am not accustomed to ornament my talk with the poetry of philosophers; for God does not hearken to fine language, but looks to the matter in hand.

Polemical political and religious writing had been developed in the previous century. but the naturalness and air of spontaneity of Avvakum's descriptions of Russian daily life, in language which springs from a natural genius. make the *Life* a landmark in the history of Russian as well as its leading literary masterpiece of the 17th century.

Avvakum's *Life* was the first Russian autobiography, and indeed the 17th century was essentially a time of first products in new ways of writing, a time of experimental preparation. Rhyme first came to be used (apparently through the influence of the Polish-dominated Ukraine) at its beginning, and the efforts of Polotsky and his disciples combined rhyme with a syllabic pattern with feminine endings as in Polish, in a way which; though not destined to flourish among the best Russian poets. yet did much to prepare the way for more truly Russian creative metres. Satires and moral fables in prose. too, distinctly foreshadowed Radishchev and Krylov. in such pieces as *The Tale of the Trial by Judge Shemyak (Povest o Shemyakinom sude)* and *The Tale of the Cock and the Fox (Povest o kure i lisitse),* which are both versions of traditional legendary and folk material retold with Russian 17th-century life in view. Avvakum, with his vivid blend of iconoclasm and conservatism, is perhaps the most typical as well as the most important figure of this transitional period.

In an appraisal of the whole extent of old Russian literature in its four periods, it can be realized that literary output throughout was continuous, though varying much in value. From a strictly literary point of view only a few masterpieces stand out: the *Slovo,* the *Travels* of Nikitin, the writings of Kurbsky and of Peresvetov. Avvakum's *Life* and the best of the *byliny.*

MODERN RUSSIAN LITERATURE (1703–1917)

With the building of St. Petersburg and the strongly conscious and determined beginning of the process of assimilation into Russian literature of all the knowledge and potentialities of western Europe ahich this "window into Europe" symbolized. modern Russian literature is usually held to begin. The flood of foreign influences which consciously were sought by the authorities and men of letters alike in the 18th century mas more definitely formative than the sporadic western influences of the 17th; and. equally, the national consciousness seen in the writings of Avvakum and others of his time was something far less "literary" than the deliberate seeking to make the Russian language a great literary vehicle, uhich was characteristic of Lomonosov a century later. It is also true that western contacts were beginning to be noticeable as early as the reign of Ivan the Terrible; and, indeed, even under the Tatar yoke Italian merchants formed a slender cultural bridge betneen Russia and the west. Some again would call the modern Russian period by some such name as the "St. Petersburg age," in view of the central influence of Russia's modern capital and the fact that Moscow once again became the metropolis after the October Revolution when all are agreed that a new period must be taken as beginning. The pioneers of modern Russian in the 18th century, Lomonosov and Karamzin. were conscious and deliberately formative artists, whereas Avvakum. who did so much for Russian as a vivid vehicle for realism and controversy and thus prepared the ground for the modem period, was not consciously concerned with literature at all. He was, in a sense. a gifted barbarian with a dynamic power of language. There was plenty of native virility renascent in the 17th century; and it has been proposed by a Soviet writer to begin the contemporary period with the new consolidation of the Russian state and the resurgence of patriotism after the "time of troubles" with the accession of Tsar Michael Romanov in 1613 But, as has been shown, the 17th century is best regarded as an epoch of transition which prepared the way for modern Russian literature rather than began it.

It was in the 18th century that the chief literary genres. already experimentally or crudely handled in the previous century, first took on shapes that can be recognized as modern. Polotsky and others had combined rhyme with syllabic verse in the preceding epoch, but it was Vasily Tredyakovsky (1703–69) uho first proposed the replacing of the syllabic metres imitated from Poland and France by those tonic and accentual measures which have been the accepted mediums of all Russian poetry (except the *byliny,* which retained the intonation of the people) ever since. Polotsky and the German Grigory had made beginnings with artificial and foreign-type plays. but it was Aleksander Sumarokov (1718–77) and Denis I. Fonvizin (1745–92) who first made plays that had some claim to be accounted literature. Tsar Alexius had a little wooden theatre built for the court circle. but it was not till 1756 that Russia had its first regular theatre. with Sumarokov as director. Avvakum and others had written keenly satirical prose, but it was not till the reign of Catherine II (1762–96) that literary satire made its appearance in the periodicals edited by Nikolai I. Novikov (1744–1816) and in Aleksander N. Radishchev's (1749–1801) powerful social satire of the *Journey From Petersburg to Moscow (Puteshestvye iz Peterburga v Moskvu)* which was published in 1790 (and burned by the hangman in the same year). There had been much translating of western romances. and popular fiction of the chapbook variety in the 17th century; but Karamzin's sentimental tale *Poor Liza (Bednaya Liza),* which was the first that can be called something like a novel proper, did not appear until 1792. Avvakum had appealed for natural colloquial Russian as against pomposity and Church Slavonic for secular writing; it was Lomonosov who wrote the first *Russian Grammar* (1757), and discussed the question of forming truly Russian literary styles suited to various and differing literary compositions.

Inevitably, as modern and more complicated times are ap-

proached, the attempt to divide and classify Russian literary epochs becomes more difficult and less effective, and there is far more continuity and overlapping than before. The 19th century stands out as Russia's great classical period of literature. It is primarily the work of this century (with a little in the 20th) that has caused Russian literature to be recognized as among the greatest. It seems best therefore to divide the modern Russian period into two parts: the 18th century, which was especially a time of the deliberate cultivation and imitation of the classicism of the French and those they influenced most; and the 19th century and first years of the 20th, in mhich Russia produced its greatest creative literature. It was the age of the great Russian classics of literature. Krylov's *Fables* did not appear in volume form until 1809, and he is the first. chronologically. of the Russian classics; so that 1809 is a convenient year to mark the line between the period of classicism, as the 18th century may be termed and the period of the classics.

Period of Classicism (1703–1809).—This was the period of constructive foreign influence, of literary imitation of French and other foreign models, and latterly to some extent of that assimilation of foreign types which was to lead to the full and creative self-realization of Russian literature in the 19th century. Peter I was mainly utilitarian in his reforms, but inevitably the spate of translating and importation of foreign techniques and the sending of Russians abroad for study opened the may to the influences of the west, and especially of the literature of France. Antiokh Kantemir *(see* CANTEMIR) (1708–44), a Rumanian by birth, an aristocratic and leading poet in the earlier part of the century, was a deliberate imitator of French models. Saturated with classical and French literature, he wrote the best of the poems of the fashionable French type, combining rhyme with syllabic metre, though he sympathized with the reform of Lomonosov which a little later was to make Russian poetry adopt the more natural method of tonic accent. So great became the French influence in fashionable culture that French continued to be the language of fashion among the upper classes till far into the next century. But, in addition to the German influence that was to be expected. English literature also had an important role in this period. Pope was translated and strongly admired, the periodical essayists Joseph Addison and Richard Steele were followed by Moscow works imitative of the *Spectator,* and Laurence Sterne's *Sentimental Journey* and the cult of "sensibility" found favour. as did Samuel Richardson's *Pamela,* which was not without its influence on Karamzin's *Poor Liza.* Shakespeare's *Hamlet* was adapted in French classical style, and the social satirical comedies of Fonvizin owed something also to English Restoration comedy as well as to Molière. The influence of classical Greek and Latin, which had begun with Polotsky in the previous century, now became potent, and was so well assimilated that it brought to birth the best work of the greatest Russian poet of the 18th century. G. R. Derzhavin (*q.v.;* 1743–1816). His best poems show solemn baroque splendour blended with some simple realism. He was far more of a poet proper than Lomonosov. whose reforms he followed.

From the point of view of literary history. hon-ever. the greatest names of this epoch are Lomonosov and Karamzin. though neither is of such intrinsic literary quality as Derzhavin. Mikhail V. Lomonosov (*q.v.;* 1711–65) absorbed all the then obtainable knowledge and became poet, grammarian. scientist, literary critic and reformer, all in a comparatively short life. His *Russian Gramnznr* was a landmark in the development of the language and in the criticism of style; his poetry gave effect lastingly to the metrical reform of Tredyakovsky; his heroic poem *Peter the Great* is a fine piece of rhetoric no longer read; his eulogy of the Russian language (in his *Grammar*) is characteristic of the man and shows the literary breadth of his approach, as compared with. say, the simple praise of Avvakum cited above. Lomonosov wrote:

> The Ruler of the Holy Roman Empire, Charles V, used to say that Spanish was fitted for speech with God, French with friends. German with enemies. and Italian with women. But if he had known Russian, he would certainly have added that it mas fitted for speech with all of these. For he would have found in it the magnificence of Spanish, the vivacity of French, the vigour of German, the tenderness of Italian and moreover the copiousness and forceiul succinctness of expression characteristic of Greek and Latin.

Nikolai M. Karamzin (*q.v.;* 1766–1826), the other important figure of the period (whose work overflowed into the 19th century in which he achieved his greatest fame as the first scholarly writer of a history of Russia), carried on the task of literary and social periodical editing begun by Novikov and Radishchev Alive to every classical and foreign influence he marks something like the beginning of the Romantic movement in Russia, but also significantly carried a stage farther the reforms in Russian literary style planned by Lomonosov. Besides his *Poor Liza,* he scored something like a triumph with his *Letters* of *a Russian Traveller* (*Pisma russkago puteshestvennika*) in 1790, in which Sterne's *Sentimental Journey* is imitated but in an attractive and quite Russian manner.

The period of classicism was a time of artificial and imitative literary development. but beside the following of everything French by men of letters there was at the same time a growing pride in things Russian which found expression in the frequent satire on bogus French behaviour in the comedies of Fonvizin Under the guidance of Lomonosov and later of Karamzin, prose developed a freer and more natural variety of styles and liberated itself from most of its remaining traces of Church Slavonic. Poetry, by the close of the period. was ready for the "Golden Age" which was to follow. A beginning had been made with social comedy and less successfully with tragedy, and a national theatre had been established. Comic opera too made a notable start with Aleksander O. Ablesimov (1742–83). whose opera *The Miller, Wizard, Quack and Matchmaker* (*Melnik, koldun, obmanshchik i svat*) was written in 1779. Satire. especially under the influence of the French Encyclopaedists Voltaire and Rousseau. had established itself, and in the hands of Radishchev terrified the formerly liberal Catherine II into sending its author to Siberia for his violent exposure of serfdom and autocracy. (Radishchev was sentenced to death in 1790, but the sentence was commuted to ten years' deportation.) The influence of Shakespeare, which later was to become so effective, began in this epoch. Karamzin's translation of *Julius Caesar* (1787) marked its beginning, though it was not until 1806 that an authentic translation (Vasily Velyaminov's *Othello)* was acted in St. Petersburg freed from the French classical adjustments which had become the rule.

The 18th century was indeed Russia's great formative period in literature. It was also the time when Russian literary figures such as Derzhavin and Karamzin became known in Europe generally. It was a time in which Russia responded, though only through a small educated class, to every literary movement abroad; but, save for a few outstanding poems such as some of Derzhavin's odes, it was not a great creative period.

Period of the Classics (1809–1917).—This period is characterized by the growth of that typically modern Russian class, the intelligentsia (the word seems to have been first used by the Poles and then taken over by the Russians). After Pushkin, the literary lead seemed to be passing from the hereditary upper class to this new intelligentsia, which perhaps had found its beginnings as a literary force with Novikov. who is often said also to have first made for literary journalism a reading public in the 18th century. In the age of Pushkin, poetry was at its very greatest. Later in the 19th century prose, in the form of the novel especially, was Russia's special contribution to world literature. At the close of the epoch, beginning with the 1890s, there was something like a rebirth of poetry under the inspiration of the French Symbolists and their followers Though they were far from numerous, the epoch had its great dramatists in Griboyedov, Gogol, Ostrovsky and Chekhov. Indeed all the principal forms of literature became of European importance.

Poetry.— *At* the beginning of this "Pushkin's Golden Age," the conflict between the conservatives of letters (led by Adm. Aleksander Shishkov, 1754–1841) and the Romantic westernizers who followed Karamzin was at its height; into this, Krylov had entered with satiric force by mocking at the critical Slavophils in some of his fables, such as *Parnassus.* Yet I. A. Krylov (*q.v.;* 1768–1844) was a lover of the virtues of Russian peasant life. He began by adapting some of La Fontaine's *Fables,* but even in these he had added to the French originals a peculiar folk quality which

was to become one of the chief delights of Krylov's Fables (Basni). He had the gift to exploit to the full the realist possibilities of blending the technique of traditional fabulists (he had had several Russian predecessors in the 18th century) with something of that rich fairy tale folk element which is especially characteristic of Russia. Much of the charmingly natural and freshly childlike wisdom and wit of the Fables has passed into proverbial speech, and children have never ceased to memorize and enjoy them. Historically, the Fables are important as in some sense anticipating that blending of Europe with the Russia of its own people which was to be the glory of Pushkin.

A considerable poet was V. A. Zhukovsky (*q.v.;* 1783–1852). In addition to writing romantic poems and imitations of older ballads, he translated in verse from German and English especially, as well as from Homer. His version of Gray's "Elegy Written in a Country Churchyard," published first in 1802 in Karamzin's literary periodical Vestnik *Evropy* (Messenger *of* Europe), is a magnificent poem and perhaps comes nearer to conveying the qualities of its original than any other known translation.

Though the long struggle between Slavophils and westernizers was to continue indefinitely in political and international matters, the best of the two points of view, so far as the literary language was concerned, were superbly and finally reconciled in Aleksander Pushkin (*q.v.;* 1799–1837). His early love for the French Encyclopaedists, for French classical drama as well as for Shakespeare and Byron. shared his heart with the native linguistic vitality and folk wisdom he had learned from his peasant nurse. In his Evgheny Oneghin he makes Tatyana, the girl who had lived only in a country house, confess: "I did not read our journals, I knew Russian badly, and I expressed myself with difficulty in my own native language." Such was the "Frenchifying" of the upper classes. Yet Pushkin made the Russian language do everything with assured inspiration and naturalness, both in prose and verse. In his short and tragic life he showed the "myriad-mindedness" which has been attributed to Shakespeare, and the Greek economy of words and lyric restraint of a truly great poet. His best lyrics are unequalled in their kind since the ancient Hellenes; yet his prose shows almost as much mastery, and he never loses the power of structural beauty. His heroic social long poem of contemporary Russian life, *Evgheny* Oneghin (1823–31), has all the virtues of Byron's Don Juan but lacks its unevenness and many lapses of style. His narrative poems, such as *Mazepa* and The Caucasian Captive (Kavkasky *plennik*), far outdo Byron in poetic quality of the same kind. His prose tales, such as The Captain's Daughter (*Kapitanskaya* dochka), are a landmark in the art of Russian prose. They have become the subjects for all kinds of artistic performance. His verse play Boris Godunov, which is markedly influenced by *Hamlet,* has much Shakespearean quality. Pushkin is at once the most Russian of modern poets and the most European, the simplest and the most moving, the most natural and the most artistic. His influence as the supreme Russian classic has remained and widened with time.

At this time St. Petersburg was a veritable "nest of singing birds," among them Evgheny Baratynsky (1800–44) (see BARATYNSKI, YEVGENIY ABRAMOVICH), the metaphysical lyric poet especially liked by Pushkin; Nikolai Yazykov (1803–46), the master of startlingly vivid rhythmic and visual effects; and, above all, Mikhail Lermontov (*q.v.;* 1814–1841). Like Pushkin, Lermontov wrote'narrative prose, notably his *A* Hero of Our Time (Gheroy nashego *vremeni*), published in 1840, which is one of the most vivid psychological studies of a frustrated "superfluous man" ever written. Its hero, Pechorin, like Pushkin's Oneghin, owes something to Byron as well as to the poet's own violent life, but Lermontov never reached anything like that spiritual harmony which at his greatest moments one perceives in Pushkin. His narrative poem Demon has never lost its appeal because of the wonderfully musical quality of its verse and the descriptions of that magical Georgian scenery which has inspired Russian poets from Pushkin to Pasternak.

After the middle of the 19th century, poetry, though continuing even more plentifully, generally ceased to be original or creative till it was revitalized by the Symbolist movement and kindred trends toward the close of the century. Yet it may be said that a simple and profound realism, the outstanding gift of Russian poetry to the world. went on putting forth new growths; and always while Russian soil was watered by western movements—*i.e.*, Romanticism, the work of Edgar Allan Poe (who has been a markedly potent influence) or Symbolism—the resulting poetic plants have been essentially Russian. It is particularly in this last respect that the 19th century contrasts with the mainly imitative poetic qualities of the 18th.

One new type which flowered in this era, though first discovered in the 18th century, was the literary folk song or *pesnya,* which has affinities with the bylina and the ballad, yet is sweeter and more profoundly musical. Aleksey V. Koltsov (1808–42) was the first master of this art of Russian song, and he is the nearest thing to Burns of his country. Lermontov's "Cossack Cradle Song," with the exquisite, untranslatable, onomatopoeic refrain bayushki bayu, is perhaps the most widely known of this kind. The most representative poet of the century, and probably the greatest after Pushkin, was Fyodor Tyutchev (1803–73), whose lyrics are among the most beautiful. It is characteristic of the upper classes of the time to which Tyutchev belonged that all his nonpoetical writings, often brilliant and critical, were in French. But the intelligentsia had become too interested in social problems to produce works of pure poetry, or they sought to build a Slavophil poetic philosophy as did Aleksey Khomyakov (1804–60) and Ivan Aksakov (1823–86) (see AKSAKOV, SERGEI TIMOFEYEVICH). And from the middle of the century poetry began to produce "realism" and "naturalism" in the form of descriptions of the lives of the peasants and passionate pleas in verse for their betterment. Tyutchev, however, with outstanding originality, produced his "Dream at Sea" (Son na more), which has something of the weird, profoundly fantastic qualities of Coleridge's "Ancient Mariner."

Of the "poetic realists," the best in literary quality was Count Aleksey Konstantinovich Tolstoy (*q.v.;* 1817–75); the most moving Ivan Nikitin (1824–61), in such poems of the people's lives as his "Kulak"; but the most truly creative and original was Nikolai A. Nekrasov (*q.v.;* 1821–77), who combined real *narodnost* with vigour and vividness in descriptions of the lives of the Russian people. His greatest long poem, Who gets the Good Life in Russia? (Komu *na* Rusi *zhit* khorosho), with its folk-song style, its truly Russian humour and its varied descriptions of Russian types met on a journey through the country in search of the man who gets the "good life," has been loosely compared with Chaucer's Canterbury Tales. His realistic idealization of the Russian peasant woman, Red-nose Frost (Moroz krasny nos), and his Pedlars (Korobeynzki) are unsurpassed for poetic realism; and he was a master of the literary folk song. Count Aleksey Tolstoy, besides his poems of realism, wrote well in many other genres, including the ballad, as evidenced by his haunting "Prince Mikhaylo Repnin" which describes the slaying in a moment of temporary fury of a faithful prince by his master Tsar Ivan the Terrible. M. E. Saltykov (*q.v.;* 1826–89), a prominent satirist, also belongs to this generation of writers.

In poetry, the conflict between westernizers and Slavophils was to some extent paralleled in the latter half of the century by one between aesthetes or "art for art's sake" poets and those who sought to make their work have primary social relevance. Of these aesthetes, or poets in the stricter sense. the greatest was A. A. Fet or Foeth (*q.v.;* 1820–92). His conservative ways of thought and his following of the poet's craft, often far away from the lives of the people, produced an excellence of form and sometimes a serene tranquillity which offended many of the revolutionary intelligentsia. Yet he could write love lyrics at times as moving as those of Tyutchev. Even in the period of poetic decline, when Fet was long silenced by adverse criticism, the song held its own; so that a now almost forgotten poet like Dimitry N. Sadovnikov (1846–83) could write the balladlike poem on the 18th-century Cossack rebel "Stenka Razin" which has never ceased to be overwhelmingly popular and to be sung in Russia among all types of people.

During this century much of the poetry appeared first in literary periodicals or miscellanies, such as the famous Sovremennik (the

Contemporary), first edited by Pushkin and later resuscitated by Nekrasov. This method of publication enabled some of the more philosophical poetry to appear. There was a strong tendency to express philosophic doubts and beliefs in verse. Tyutchev's nature poems are at times a reminder of Lucretius, and Khomyakov was often more a philosophic theologian than a poet. Beside the personal lyric of love and subjective emotion there thus developed types of short poems of philosophic meditation called *dumy*. This poetry of thought was a parallel to the realistic poetry of life.

In the last decade of the century there began something like a renaissance in Russian poetry with the coming of the Symbolists, followed by minor movements such as the Imaginist, Acmeist and Futurist. With these searchings for a new poetry and the resultant creative experiments came many poets who lived on into the 20th century; and some of those who soon followed, such as Boris Pasternak and Vyacheslav Ivanov, continued to write long after the results of the October Revolution had become settled. Indeed the period between the accession of Tsar Nicholas II in 1894 and the revolution of 1917 was one of a creative strength and variety comparable in several respects with the Golden Age. This poetic renaissance continued to show outstanding results well into the postrevolutionary period.

The decline to mere popular versifying of sentimental nostalgia or the like. represented by successful poets such as Semen Nadson (1862–87) and Aleksey Apukhtin (1841–93), was relieved in the years before this revival by only two things: first, the humorous and nonsense verse inaugurated by Count Aleksey Tolstoy with the creation of his imaginary comic literary author Kuzma Prutkov. followed by the brilliant occasional light versifying of Soloviev; and, second, some reflective or philosophical religious poetry of which the mystical poems of Soloviev were again the best exemplars. In this time of weakened poetic creativeness and lowered intellectual vitality which was to herald the renaissance, Vladimir Soloviev (*q.v.;* 1853–1900), as thinker. literary humorist and poet, was the most permanently important Russian writer. It was to some extent the force of his Neoplatonic visionary poetry which gave tone and vitality to the Symbolists, notably Blok, who now suddenly gave a new life to Russian poetry. Philosophers were turning in dissatisfaction from materialism and artists from mere imitation to the recovery of past values of sheer beauty and at the same time the freeing of the artist to be frankly modern. In poetry, whose revival was closely linked with that of painting, the Symbolist movement, led by Konstantin (Constantine) Balmont (1867–1943) and Valeri Yakovlevich Bryusov (1873–1924) (*qq.v.*), sought to use all that seemed best in the French Symbolists and visionary or fantastic English poets to find a new technique and a new meaning and aim for Russian poetry. Balmont's first poems and Bryusov's pioneer collection *The Russian Symbolists* both appeared in 1893; there followed a series of outstanding poets and poetic impulses which in some measure retained their vitality for some time after the October Revolution. both in Russia and among poets in exile.

But the greatest Russian poet of this Symbolist renaissance was undoubtedly Alcksandr (Alexander) Blok (*q.v.;* ISSO–1921). His mystical experiences carried him at his best into a poetry in which inspiration and form fused in a way unmatched since the days of Tyutchev. His poem "The Twelve." which symbolically celebrates in the guise of vivid realism the first flush of the 1917 Revolution. somehow combines rhythmical genius with the language of the people in a realistic picture of revolutionary soldiers who yet have symbolic significance related to a mystical vision. This truly great poem was written in 1918. and with it the period of modern Russian prerevolutionary poetry may be said to close.

One of the poets who began work at this time, at first as a Futurist, was Vladimir Mayakovsky (1893–1930), who was to become the idol of the Communist Revolution and its official poetic exponent. Another, perhaps the most profound and intellectually and spiritually developed of the Symbolists. was Vyacheslav Ivanov (1866–1949), who continued to write in Rome (though some of his best work remained unpublished till after his death). But Boris Pasternak (1890–1960) began as a Futurist, absorbed all that was best in the various movements, and had produced outstanding poetry by the time the Revolution began. Alone among the greater poets he remained in Russia, though after 1932 his published work was largely restricted to translations. With Pasternak. as with Anna Akhmatova. who also remained in Russia. there is an overlap between the prerevolutionary and the postrevolutionary periods.

Prose.—The period under review, which had begun with Krylov, included Pushkin and Tyutchev and ended with Blok. could not but be reckoned a great poetical age. But it was also the great age of the Russian novel. Partly because of the relative untranslatability of poetry and the far greater effectiveness and accessibility of translated novels, it is inevitable that to the world in general the period is primarily that of the great Russian novelists. Moreover the influence of novelists whose work has had world significance, such as Gogol. Turghenyev, Tolstoy, Dostoyevsky and Gorky, has been an intellectual and spiritual force in European literature in a way that that of even the greatest of poets could never be. At the same time a period which produced political. social and philosophical thinkers writing in prose. such as Vissarion Belinsky (*q.v.;* 1811–48), Aleksander (Alexander) Herzen (*q.v.;* 1812–70), Khomyakov, Dmitri hlerezhkovsky (*q.v.;* 1865–1941), Ivan Bunin (*q.v.;* 1870–1953), who in 1933 was awarded the Nobel prize for literature, Leonid Andreyev (1871–1919) and Mikhail Artsybashev (1878–1927) could not but be one in which Russian literature in a wider sense became an outstanding influence in the development of world thought.

Whereas, however, the work of intellectual journalists and political thinkers belongs rather to the history of thought than to that of literature proper, this period is rightly regarded as that in which the Russian realist novel flourished and became a world force. Many writers, such as Turghenyev and Merezhkovsky, wrote verse as well as prose; and indeed it was not uncommon for writers to try their hands at all types of literature and journalism before finding their true *métier*. But the fact remains that in this period Russia in several respects led the world in the novel, despite phases of relative decline such as the wave of pessimism and reaction which followed the assassination of Tsar Alexander II in 1881.

This was also the great age of the Russian short story. Both the poets Pushkin and Lermontov had written masterly tales which might well be regarded as short novels. respectively in *The* Captain's *Daughter* and A Hero of *Our* Time (this latter consisting of five tales or episodes all interconnected to produce an unforgettable picture of Pechorin who is one of the great Russian psychological masterpieces). This was in 1840. Within little more than two years Nikolai Gogol (*q.v.;* 1809–52) had published his Dead *Souls* (*Mertviya dushi*), the first and only complete part of his long satirical prose epic (*poema* as he called it). This set of caricatures of Russian provincial types, reminding the reader in some ways of both Dickens and Ben Jonson, together with Gogol's short stories. made him the first Russian prose writer to have a delighted and influenced public outside his own country. In 1857 Ivan Goncharov (*q.v.;* 1812–91) published his *Oblomov,* which is a study of a type of the "superfluous man" of a declining gentry class, whose devastating realism blended with imaginative sympathy has caused the Russian language to adopt the word *oblomovshchina* to connote this group of immediately recognizable qualities.

In the development of the novel and of its influence outside Russia. Ivan Turghenyev (1818–83) (see TURGENEV, IVAN SERGEYEVICH) stands apart for his unique sense of form and construction, somewhat French in quality. combining a genuine "Russianness" with a European appeal in his characterization and descriptions. His group of tales *A Sportsman's* Sketches (1852) was followed by A Nest of Gentlefolk (1858) and by Fathers and Sons (1862), in which the classical nihilist hero Bazarov makes his appearance. He continued to write outstanding novels and to produce short stories and plays. Absence of a sense of form and construction is characteristic of most Russian novels, so that Turghenyev is in a special sense classical.

Tolstoy and Dostoyevsky, however, are by far the most valued and influential novelists of their period. Each has been a dynamic force in the history of thought as well as in literature of world-

wide significance. Count Lyev Nikolayevich Tolstoy (*q.v.; 1828–1910*) completed his two great novels *War and Peace* and *Anna Karenina*, respectively, in 1869 and 1877. *War and Pence* combines the highest art with social realism and a philosophy of history in a way mhich has made it the world's masterpiece of its kind; *Anna Karenina*, less vast in size, is found by many to he even more readable if less profound. Tolstoy's *Diaries* and his *Confession* enable the reader to follow the development of his innermost mind. Fyodor Dostoyevsky *(1821–81) (see* DOSTOEVSKI, FEDOR MIKHAILOVICH) was the master of the compelling presentation of psychological — often psychopathic — types. who could "get inside" the human mind in its moments of crisis as no other novelist has done. He was a Slavophil. as contrasted with Turghenyev who was for long the literary leader of the westernizers. He was a religious thinker and prophet, while Turghenyev studied social types and problems without plumbing their philosophic implications. Dostoyevsky's greatest novels were *Crime and Punishment* (1866), *The Idiot* (completed *1869*). *The Possessed (Byesy) (1871)* and *The Brothers Karamazov (1880)*.

Anton Chekhov (*q.v.;* 1860–1904) is perhaps to be regarded as a master of short stories and a dramatist rather than a novelist. His pictures of Russian life combine a meticulous exactness with an art which conceals the labour of the task. Some have even thought that his work as an influence, both within and outside Russia, has been as important as that of Tolstoy and Dostoyevsky.

Maxim Gorky (*q.v.;* 1868–1936) is a short-story writer. novelist and dramatist who, like Boris Pasternak in poetry, bridges the October Revolution. though. unlike Pasternak, he became in his later years the recognized literary lender of the Soviet Union. His descriptions of the very lowest and most suffering human beings. and his immense vitality and confidence in the ultimate triumph of revolutionary Socialism made him the pioneer of that "Socialist Realism" which has been the aim of all officially acceptable Soviet literature. But his literary gifts in themselves were not enough to give him a high place and influence abroad. A natural bolshevik, he yet did much to maintain artistic standards and to encourage genuine literature after the Revolution. His *Creatures Who Have Been Human* (*Byvshiye Lyudi;* 1897), *Twenty-Six Men and a Girl* (1899) and *Mother* (1907) are among his most impressive nondramatic works. They bring the Russian peasant and industrial worker to life in a nay previously unparalleled. His autobiographical works, beginning with *Childhood* (1913), along with *Mother,* formed the material for most effective films after the Revolution. (*See* also NOVEL.)

Drama.—The literary drama proper begins with the one great play of Aleksander (.Alexander) Griboyedov (*q.v.; 1795–1829*), whose *The Mischief of Being Clever (Gore ot uma)* became public in *182j*. It is a Molièresque comedy in a rhymed irregular metre reminiscent of that of some of Krylov's *Fables*, and while brilliantly witty in dialogue, it is also lively in its characterization. It has become almost a'collection of sources for quotations. Several novelists were also playwrights. but the only great novelist (apart from Gogol) who also did outstanding work for the stage was Turghenyev. whose *A Month in the Country* (1850) has rightly achieved European popularity in translation as an example of psychological insight controlled by a sense of form and subtle comic play of personalities. But till the Moscow Art theatre which he did so much to inspire brought Chekhov to the fore. the theatre was dominated by Aleksander (Alexander) Ostrovsky (*q.v.;* 1823–86), who wrote many successful plays, mostly in prose, satirizing the middle classes and the still unwesternized merchants, in such vividly realistic if less well-formed plays as *The Bankrupt* (1850) and *The Poor Bride* (1852). Gogol's one brilliant dramatic masterpiece. *The Government Inspector* (*Revizor*), stands quite by itself in its appeal alike to Russia and Europe. It shows the best qualities of his *Dead Souls* dramatized, and. along with certain of Chekhov's plays, has retained universal popularity.

Chekhov's *The Seagull* (*Chayka*) was triumphantly acted under the great Stanislavsky at the then new Moscow Art theatre in *1898*, and there followed under the same production in quick succession *Uncle Vanya, The Three Sisters* and *The Cherry Orchard.* Though the meaning of Chekhov's plays is often in dispute, their profound and subtle reality and theatrical craftsmanship never are. With Chekhov's death in 1904 the great age of the Russian drama came to an end. though the theatre continued to grow in popularity and plays to be written successfully. (*See* also THEATRE: *20th Century: G.S.S.K.)*

POSTREVOLUTIONARY LITERATURE

A good deal of writing mhich carried on existing trends went on for some time in Russia after the Revolution, though some distinguished writers, such as Vyacheslav Ivanov, continued only as *emigrés.* Some outstanding authors, such as Maxim Gorky and Vladimir Mayakovsky, wrote to aid the Soviet regime, while others, such as Boris Pasternak and Anna Akhmatova, either sought to retain their artistic integrity by developing their personal qualities in comparative isolation from state "Socialist Realism" or ceased to produce almost entirely. But the dissolution of the Russian Association of Proletarian Writers (R.A.P.P.) in 1932, and the formation of the state-controlled Union of Soviet Writers in 1934, followed by the death of Gorky in *1936,* with the rigorous subordination of art to the needs of Marxism-Leninism under Stalin, made for uniformity and creative sterility. In general it may be said that all forms of literature after Gorky's death tended to be primarily subordinated to the needs of the Soviet state for reconstruction, patriotism and the "struggle for peace," and most of even the more impressive works deliberately served these ends.

Mayakovsky had a vigour and command of proletarian language combined with real poetic sensitiveness which Pasternak was among the first to recognize. But the tension between his unconscious artistic self and his need to support the Revolution as a kind of poet laureate of bolshevism finally led to his suicide. Somewhat similarly ended the young peasant lyric imaginist Yesenin and the *emigrée* poetess Marina Tsvetayeva (1892–1941). Anna Akhmatova, whose intense and profound lyrics of love and personal feeling were outstanding in the early days of the Revolution. afterward wrote only rarely for publication; and indeed subjective lyric poetry was strongly deprecated in Russia till the needs of the "Great Patriotic War" of 1941–45 brought back the lyric and song — at least in popular form, with such graceful and often moving poems as the war songs of Konstantin Simonov *(1915–*). Simonov illustrates. along with Ilya Ehrenburg (1891–), the really talented poet and man of letters who has turned his pen to whatever the needs of the state happened to be — novels, plays, films, poems or essays came with equal competence from their hands, though neither ever showed clear creative genius.

In the novel, the best work has continued with developments of the historical romance, which had first come to Russia through the influence of Scott and had found its earliest masterpiece in Pushkin's *The Captain's Daughter.* Mikhail Sholokhov (1905–) and Aleksey Nikolayevich Tolstoy (1882–1945) wrote historical novels of real merit in their respective masterpieces, *And Quiet Flows the Don* (*Tikhy Don*) and *Peter the First.* There were scarcely any plays of genius. yet often quite effective political dramas. such as Gorky's *Yegor Bulichev* against bourgeois capitalism and Simonov's *The Russian Question* (*Russky vopros*) against U.S. capitalist newspapers. Novelists and playwrights and poets sought to express the new Soviet hero of factory and collective farm. But one valuable feature of Soviet literary practice was its keen encouragement of poetry for the people, not merely in the writing of verses to stimulate the masses, but in the deliberate and highly successful popularization of the Russian classics. Pushkin and Chekhov found noble and scholarly editions but also cheap reprints which were bought by the million; and factory workers listened to university teachers on the literature of the Golden Age. Folklore was encouraged too, and it is to be remembered that the Russians had never lost that popular receptiveness of poetry which has almost disappeared from western Europe.

Boris Pasternak *(1890–1960)* remained the greatest and at once the most truly European and truly Russian of contemporary poets. He excelled in a subtly fantastic poetic prose in his *Tales (Rasskazy)* and in the autobiographic fragment of his *Safe Conduct* (*Okhrannaya Gramota)* with its moving account of the discovery

of the suicide of hlayakovsky, but perhaps even more in the analytical psychological insight into a young girl's mind seen in his *The Childhood of Lyuvers.* As a poet. despite some eccentricities of vocabulary caused by his early association with the Futurists and his intense seeking after the right tone of music (he was the son of a painter and a musician). he carried on the traditions of Pushkin and Lermontov in original imaginative n-ays and covered all the assimilated European movements. He has been compared in varying ways with T. S. Eliot, with John Donne and with R. M. Rilke. but he is in fact *sui generis.* As a translator. he did the best versions of some of Shakespeare's plays in Russian, as well as of *Faust.* Though he may miss some of the humour of Shakespeare. in tragic passages he makes the reader or audience feel that here (in *Hamlet* for instance) a great poet is rendering great poetry. Pasternak wrote a small amount of war poetry in which he simply shared the patriotism of the hour. and his little volume of 1945. *Earth's Spaciousness* (*Zemnoy* prostor), shows his simpler manner at its best.

The Soviet government greatly encouraged the study of the art of translation, and others. such as Samuil Marshak (1887-), translated foreign poetry with a poet's inner exactness, as may be seen in Marshak's versions of *English Songs and Ballads,* his Shakespeare's Sonnets and his Burns. Marshak. like Pasternak. also did well in some of his prose, notably in children'a fairy tales. Soviet Russian literature by the 1950s had become very consciously national, with deliberate searching after the literary expression of the mind of the people in *narodnost* and often markedly isolationist tendencies. Its greatest writers were not representative. nor had the quantity of literature of permanent artistic merit been great. Yet it had been regaining some of the old Russian virtues after a time'of sheer didacticism, and a renascence of creative work did not seem impossible. In 1943 Pasternak wrote:

To drramer and to midnight wanderer
Moscow is dearer than the whole wide world:
There he's at home, and at the primal source
Of all with which the century shall flower

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RUSSIAN SOVIET FEDERATED SOCIALIST REPUBLIC is the official name of Russia proper and of the largest member of the Union of Soviet Socialist Republics, extending from the Finnish frontier and the Baltic to the Bering sea and the Sea of Okhotsk. Originally this was the name of the whole state until it was officially changed on the basis of the agreement of Dec. 30, 1922, for the formation of the U.S.S.R. Thereafter its area changed many times. In 1923 it covered about 7,945,900 sq.mi. or 94.6% of the whole. Later it was successively reduced by the creation of the Uzbek and Turkmen republics in 1924, of the Tajik republic in 1929 and of the Kazakh and Kirghiz republics in 1936. On the eve of World War II the R.S.F.S.R. had an estimated area of 6,374,700 sq.mi. (*i.e.,* 77.3% of the U.S.S.R.); about 24% of the R.S.F.S.R. was then in Europe and the rest in Asia.

The total population of the R.S.F.S.R. was 93,457.996 in Dec. 1926 and 109,278,614 in Jan. 1939. The number of Russians in the R.S.F.S.R. revealed by these two censuses rose from 77,791,-124 (52.9% of the totalj to 99,019,929 (58.3% of the total). In 1926 the R.S.F.S.R. included 72,848,280 Russians who formed 78% of its total population; no similar data were published for 1939.

The annexations of 1939–45 and certain changes in the administrative divisions within the U.S.S.R. caused new variations in the area of the R.S.F.S.R. In 1940 it was further reduced when the Karelian X.S.S.R., with the area ceded by Finland. became the Karelo-Finnish S.S.R. In 1944 the Tannu Tuva People's Republic, formerly part of China, was included in the R.S.F.S.R. In 1945 the northern part of East Prussia, southern Sakhalin and the Kurile Islands were added to the R.S.F.S.R., while in 1946, when the Karachay Autonomous Region and the Chechen-Ingush A.S.S.R. were suppressed, parts of them were included in Georgia; finally, in 1954, the Crimea was "ceded" by Russia to the Ukraine. At that time the total area of the R.S.F.S.R. was 6,523,524 sq.mi., or 76% of the U.S.S.R. In Dec. 1953 a new region (*oblast*), Magadan, was formed from part of the Khabarovsk territory (*krai*); in Jan. 1954 five new *oblasts* (Arzamas, Balashov, Byelgorod, Lipetsk and Kamensk) were formed in European Russia by revising the boundaries of the existing ones. At that time the R.S.F.S.K. comprised 13 self-governing towns, 51 *oblasts,* 6 *krais,* 12 autonomous republics and 6 autonomous *oblasts.* On July 16. 1956, the Karelo-Finnish S.S.R. was re-established as the Karelian A.S.S.R. and incorporated into the R.S.F.S.R. This action. along with other annexations since 1940, increased the area to 6,592,812 sq.mi. by 1960.

According to the 1959 census, the total population was 117,534,315 of which 62,059,713 was urban.

Moscow was the capital of both the U.S.S.R. and the R.S.F.S.R. It was also the seat of two governments. the Soviet and the Russian. Many ministries existed in duplicate, one being Soviet and one Russian. There were, however, no Russian ministries of foreign affairs, of deiense. of internal affairs or of state security. Although the Russians constituted only slightly more than half the total population of the U.S.S.R., their strength within the Communist party of the Soviet Union was about three-quarters. (K. SM.)

RUSSIAN THISTLE, a common name applied especially to *Salsola* knli var. *tenuifolia,* a close relative of *Salsola* knli, the saltwort. which is also known as Russian thistle. Both plants are annuals of the goosefoot family, introduced from Eurasia, and are widespread along railway rights of way and in prairies and plains regions of the United States, forming bushy annuals that break off in the autumn to form tumbleweeds that may he carried long distances by wind, dropping seeds as they go. With good tillage and short rotations, however. they cause little damage in field crops. (J. M. BL.)

RUSSKY, NIKOLAI (1854–1918), Russian general, was educated at the infantry military school in St. Petersburg, graduated from the academy of the general staff in 1881, and by 1896 had reached general's rank. During the war with Japan (1904–oj) he was the head of the staff of the 2nd army. and planned the offensive carried out by General Grippenberg which led to the prematurely abandoned offensive of Sandepu. In 1914 he commanded the 3rd army. which attacked in Galicia and advanced to Lvov (Lemberg), through which it passed in the further advance to the San-Dniester line. The dramatic entry of the 3rd army into Lvov created for General Russky a prestige out of proportion to the real importance of his success. In Oct. 1914 he was appointed commander in chief of the northwestern and afterward of the northern armies. He continued to hold the command in spite of ill health, and it was at his headquarters that the final scenes of Nicholas II's reign and his abdication took place in March 1917. Soon after the Revolution General Russky retired, and in 1918 he was reported killed by the Bolsheviks.

RUSSO-JAPANESE WAR (1904–05). The seizure by Russia of the Chinese fortress of Port Arthur, which it had a few years previously, in concert with other powers, compelled Japan to relinquish, was from the Russian point of view the logical outcome of its eastward expansion and its need for an ice-free harbour on the Pacific. The extension of the Trans-Siberian railway through Manchuria to Port Arthur and a large measure of influence in Manchuria followed equally naturally. But the whole course of this expansion had been watched with suspicion by Japan, from the time of the Sakhalin incident of 1875—when the island power, then barely emerging from the feudal age, had to cede its half of the island to Russia—to the Shimonoseki treaty of 1895, when the powers compelled it to forego the profits of its victory over China. The subsequent occupation of Port Arthur and other Chinese harbours by European powers, and the evident intention of consolidating Russian influence in Manchuria, were again and again the subject of Japanese representations at St. Petersburg (Leningrad), and these representations became more vigorous when, in 1903, Russia seemed to be about to extend its Manchurian policy into Korea. No less than ten draft treaties were discussed in vain between Aug. 1903 and Feb. 1904, and finally negotiations were broken off on Feb. 5.[1] By the fourth negotiation Japan had decided to use force, and its military and naval preparations kept pace with its diplomacy.

This was in fact an eventuality which had been foreseen and on which the naval and military policy of Japan had been based for ten years. It, too, had its projects of expansion and hegemony, and by the Chino-Japanese War it had gained a start over its rival. The reply of the western powers was first to compel the victor to maintain the territorial integrity of China, and then within two years to establish itself in Chinese harbours. From that moment Japanese policy was directed toward establishing its own hegemony and meeting the advance of Russia with a *fait accompli*. But its armaments were not then adequate to give effect to a strong-handed policy, so that for some years thereafter the government had both to impose heavy burdens on the people and to pursue a foreign policy of marking time, and endured the fiercest criticism on both counts, for the idea of war with Russia was as popular as the taxes necessary to that object were detested. But as the army and the navy grew year by year, the tone of Japanese policy became firmer. In 1902 its position was strengthened by the alliance with England; in 1903 its army, though in the event it proved almost too small, was considered by the military authorities as sufficiently large and well prepared, and the arguments of the Japanese diplomatists stiffened with menaces. Russia, on the other hand, was divided in policy and consequently in military intentions and preparations. In some quarters the force of the new Japanese army was well understood, and the estimates of the balance of military power formed by the Russian minister of war, Alexei Kuropatkin, coincided so remarkably with the facts that at the end of the summer of 1903 he saw that the moment had come when the preponderance was on the side of the Japanese. He therefore proposed to abandon Russian projects in southern Manchuria and the Port Arthur region and to restore Port Arthur to China in return for considerable concessions on the side of Vladivostok.

His plan was accepted, but "a lateral influence suddenly made itself felt, and the completely unexpected result was war." Large commercial interests were in fact involved in the forward policy, "the period of heavy capital expenditure was over, that of profits about to commence," and the power and intentions of Japan were ignored or misunderstood. Thus Russia entered upon the war unprepared in a military sense. To the guards and patrols of the Manchurian railway and the garrisons of Port Arthur and Vladivostok, 80,000 in all, Japan could, in consequence of her recruiting law of 1896, oppose a first-line army of about 270,000 trained men. Behind these, however, there were scarcely 200,000 trained men of the older classes, and at the other end of the long Trans-Siberian railway Russia had almost limitless resources.[2] The strategical problem for Japan was how to strike a blow sufficiently decisive to secure its object before the then insignificant forces of the East Siberian army were augmented to the point of being unassailable. It turned, therefore, principally upon the efficiency of the Trans-Siberian railway and in calculating this the Japanese made a serious underestimate. In consequence, far from applying the "universal service" principle to its full extent. they trained only one-fifth of the annual contingent of men found fit for service. The quality of the army, thus composed of picked men (a point which is often forgotten), approximated to that of a professional force; but this policy had the result that. since there was no adequate second-line army, parts of the first-line had to be reserved, instead of being employed at the front. And when for want of these active troops the first great victory proved indecisive, half-trained elements had to be sent to the front in considerable numbers—indeed, the ration strength of the army was actually trebled.

Objects of Japanese Attack.—The aim of the war, "limited" in so far that the Japanese never deluded themselves with dreams of attacking Russia at home, was to win such victories as would establish the integrity of Japan itself and place its hegemony in the far east beyond challenge. Now the integrity of Japan was worth little if the Russians could hope ultimately to invade it in superior force, and since Port Arthur was the station of the fleet that might convoy an invasion, as well as the symbol of the longed-for hegemony, the fortress was necessarily the army's first objective, a convincing Sedan was the next. For the navy, which had materially only a narrow margin of superiority over the Russian Pacific squadron, the object was to keep the two halves of that squadron at Port Arthur and Vladivostok respectively separate and to destroy them in detail. But in February weather these objects could not be pursued simultaneously. Prior to the breakup of the ice, the army could disembark only at Chemulpo, far from the objective, or at Dalny under the very eyes of its defenders. The army could therefore, for the moment, occupy only Korea and try to draw upon itself hostile forces that would otherwise be available to assist Port Arthur when the land attack opened. For the navy, instant action was imperative.

On Feb. 8, the main battle fleet, commanded by Vice-Adm. Heihachiro Togo, was on the way to Port Arthur. During the night his torpedo boats surprised the Russian squadron in the harbour and inflicted serious losses, and later in the day the battleships engaged the coast batteries. Repulsed in this attempt, the Japanese established a stringent blockade, which tried the endurance of the ships and the men to the utmost. From time to time the torpedo craft tried to run in past the batteries, attempts were made to block the harbour entrance by sinking vessels in the fairway and free and deadly use was made by both sides of submarine mines. Though not destroyed, the Port Arthur squadron was paralyzed by the instantaneous assertion of naval superiority.

Alexeiev and **Makárov.**—Adm. Evgeni Alexeiev, the tsar's viceroy in the far east and the evil genius of the war, was at Port Arthur and forbade the navy to take the risks of proceeding to sea.[3] For a time, when, in place of Admiral Starck (who was held responsible for the surprise of February), Adm. Stepan Makárov, an officer of European reputation, commanded the fleet, this lethargy was shaken off. The new commander took his ships to sea every day. But his energetic leadership was soon ended by a tragedy. A field of electromechanical mines was laid by the Japanese in the night of April 12–13, and on the following day the Japanese cruisers stood inshore to tempt the enemy on to the mine field. Makárov. however, crossed it without accident, and pursued the cruisers until Togo's battle fleet appeared, whereupon he went about and steamed for port. In doing so he recrossed the mine field, and this time the mines were effectual. The flagship "Petropavlovsk" was struck and went down with the admiral and 600 men, and another battleship was seriously injured. Then the advocates of passivity regained the upper hand and kept the squadron in the harbour, and henceforward for many months the Japanese navy lay unchallenged off Port Arthur, engaging in minor oper-

[1] Belated declarations of war appeared on Feb. 10.

[2] The total Russian army on a peace footing was almost 1,000,000 strong.

[3] A vivid picture of the state of affairs in the navy at this period is given in Semenov's Rasplata (Eng. trans.).

ations, covering the transport of troops to the mainland, and watching for the moment when the advance of the army should force the Russian fleet to come out. Meantime seven Japanese cruisers under Vice-Admiral Kamimura went in search of the Russian Vladivostok squadron; this, however, evaded them for some months, and inflicted some damage on the Japanese mercantile marine and transports.

Landing of Japanese 1st Army.—The Japanese had not waited to gain command of the sea before beginning the sea transport of that part of their troops allotted to Korea. The roads of that country were so poor that the landing had to be made not on the straits of Tsushima, but as far north as possible. Chemulpho, nearer by 50m. to Port Arthur than to Japan, was selected. On the first day of hostilities Rear-Admiral Uriu disembarked troops at Chemulpho under the eyes of the Russian cruiser "Variag," and next day he attacked and destroyed the "Variag" and some smaller war-vessels in the harbour, and the rest of the 1st Army (Gen. Kuroki) was gradually brought over during February and March in spite of an unbeaten and, under Makbrov's régime, an enterprising hostile navy. But owing to the thaw and the subsequent break-up of the miserable Korean roads, six weeks passed before the columns of the army (Guard, 2nd and 12th Divisions), strung out along the "Mandarin road" to a total depth of six days' march, closed upon the head at Wiju, the frontier town on the Yalu. Opposite to them they found a large Russian force of all arms.

The Russian commanders, at this stage at least, had not and could not have any definite objective. Both by sea and by land their policy was to mass their resources, repulsing meantime the attacks of the Japanese with as much damage to the enemy and as little to themselves as possible. Their strategy was to gain time without immobilizing themselves so far that the Japanese could impose a decisive action at the moment that suited them best. Both by sea and by land such strategy was an exceedingly difficult game to play. But afloat, had Makárov survived, it would have been played to the end, and Togo's fleet would have been steadily used up. One day, indeed (May 15), two of Japan's largest battleships, the "Hatsuse" and the "Yashima," came in contact with free mines and were sunk. One of them went to the bottom with 500 souls. But the admiral was not on board. The Russian sailors said, when Makárov's fate was made known, "It is not the loss of a battleship. The Japanese are welcome to two of them. It is *he.*" Not only the skill, but the force of character required for playing with fire was wanting to Makárov's successors.

Plans of **Kuropatkin.**—It was much the same on land. Kuropatkin, who had taken command of the army, saw from the first that he would have to gain three months, and disposed his forces as they came on the scene, unit by unit, in perfect accord with the necessities of the case. His expressed intention was to fight no battle until superiority in numbers was on his side. He could have gained his respite by concentrating at Harbin or even at Moukden or at Liao-Yang. But he had to reckon with the fleet[1] at Port Arthur. He knew that the defences of that place were defective, and that if the fleet were destroyed whilst that of Togo kept the sea there would be no Russian offensive. He therefore chose Liao-Yang as the point of concentration, and having thus to gain time by force instead of by distance he pushed out a strong covering detachment towards the Yalu. But little by little he succumbed to his *milieu,* the atmosphere of false confidence and passivity created around him by Alexeiev. After he had minutely arranged the eastern detachment in a series of rearguard positions, so that each fraction of it could contribute a little to the game of delaying the enemy before retiring on the positions next in rear, the commander of the detachment, Zasulich, told him that "it was not the custom of a knight of the Order of St. George to retreat," and Kuropatkin did not use hisauthority to recall the general, who, whether competent or not, obviously misunderstood his mission. Thus, whilst the detachment was still disposed as a series of rearguards, the foremost fractions of it stood to fight on the Yalu, against odds of four to one.

[1]Not, as is often assumed, the fortress **itself.**

Battle of the **Yalu.**—The Japanese 1st Army was carefully concealed about Wiju until it was ready to strike. Determined that in this first battle against a white nation they would show their mettle, the Japanese lavished both time and forethought on the minutest preparations. Forethought was still busy when, in accordance with instructions from Tokio, Kuroki on April 30 ordered the attack to begin at daybreak on May 1. For several miles above Antung the rivers Yalu and Aiho are parallel and connected by numerous channels. The majority of the islands thus formed were held and had been bridged by the Japanese. The points of passage were commanded by high ground a little farther up where the valleys definitely diverge, and beyond the flank of the ill-concealed positions of the defence. The first task of the right division (12th) was to cross the upper Yalu and seize this. To the Guard and 2nd Divisions was assigned the frontal attack on the Chiuliencheng position, where the Russians had about one-half of their forces under Maj.-Gen. Kashtalinski. On April 30, Inouye's 12th Division accomplished its task of clearing the high ground up to the Aiho. The Russians, though well aware that the force in their front was an army, neither retired nor concentrated. Zasulich's mediaeval generalship had been modified so far that he intended to retreat when he had taught the Japanese a lesson, and therefore Kuropatkin's original arrangements were not sensibly modified. So it came about that the combined attack of the 2nd and Guard Divisions against the front, and Inouye on the left flank and rear, found Kashtalinski without support. After a rather ineffective artillery bombardment the Japanese advanced in full force, without hesitation or finesse, and plunging into the river stormed forward under a heavy fire. A few moments afterwards Zasulich ordered the retreat. But the pressure was far too close now. Broken up by superior numbers the Russian line parted into groups, each of which, after resisting bravely for a time, was driven back. Then the frontal attack stopped and both divisions abandoned themselves to the intoxication of victory. Meanwhile, the right attack (12th Division) encountering no very serious resistance, crossed the Aiho and began to move on the left rear of the Russians. On the side of the defence, each colonel had been left to retire as best he could, and thus certain fractions of the retreating Russians encountered Inouye's advancing troops and were destroyed after a most gallant resistance. The rearguard itself, at Hamatan, was almost entirely sacrificed, owing to the wrong direction taken in retreating by its left flankguard. Fresh attempts were made by subordinates to form rearguards, but Zasulich made no stand even at Fêng-hwang-chêng, and the Japanese occupied that town unopposed on May 5. The Japanese losses were 1,100 out of over 40,000 present, the Russian (chiefly in the retreat) at least 2,500 out of some 7,000 engaged.

The Yalu, like Valmy, was a moment in the world's history. It mattered little that the Russians had escaped or that they had been in inferior numbers. The serious fact was that they had been beaten.

Distribution of Russian Forces.—The general distribution of the Russian forces was now as follows: The main army under Kuropatkin was forming, by successive brigades, in two groups—1st Siberian Corps (Stakelberg), Niu-chwang and Kaiping; 2nd Siberian Corps, Liao-Yang. Zasulich (3rd Corps and various other units) had still 21,000. In the Port Arthur "fortified rayon," under Lieut.-Gen. Stössel (4th Corps), were 27,000 men, and Gen. Linievich around Vladivostok had 23,000. These are, however, paper strengths only, and the actual number for duty cannot have been higher than 110,000 in all. The Trans-Siberian railway was the only line of communication with Europe and western Siberia, and its calculated output of men was 40,000 a month in the summer. In October 1904, therefore, supposing the Japanese to have used part of their forces against Port Arthur, and setting this off against the absence of Linievich and Stossel, Kuropatkin could expect to have a sufficient superiority in numbers to take the offensive. His policy was still, "No battle before we are in superior force."

Landing of Japanese 2nd Army.—For the moment it was equally Japan's interest to mark time in Manchuria. Still intent upon the Russian Port Arthur squadron, she had embarked her

2nd Army (Gen. Oku, 1st, 3rd, 4th and 5th Divisions) during April, and sent it to Chinampo whence, as soon as the ice melted and Kuroki's victory cleared the air, it sailed to the selected landing-place near Pitszewo. Here, under the protection of a continuous chain of war-vessels between the Elliot islands and the mainland, Oku began to disembark on May 5. But the difficulties of the coast were such that it took three weeks to disembark the whole and to extend across the peninsula to Port Adams. Oku then, leaving the 5th Division behind, moved down with the rest towards Kinchow, and after storming that place found himself face to face with a position of enormous strength, Nanshan hill, at the narrowest part of the peninsula, where part of a Russian division (3,000 only out of 12,000 were actually engaged) had fortified itself with extreme care. On May 26 took place the battle of Nanshan. The Japanese attack was convergent, but there was no room for envelopment; the Russian position moreover was "all-round" and presented no flanks, and except for the enfilade fire of the Japanese and Russian gunboats in the shallow bays on either side the battle was locally at every point a frontal attack and defence. The first rush of the assailants carried them up to the wire and other obstacles, but they were for many hours unable to advance a step farther. But the resolute Oku attacked time after time, and at last the 4th Division, on his right, assisted by its gunboats, forced its way into the Russian position. The Russians had just begun to retreat, in accordance with orders from higher authorities. But it was a second undeniable victory. It was, moreover, a preface to those furious assaults on Port Arthur which, because they were the expression of a need that every soldier felt, and not merely of a tactical method, transcend all cool-blooded criticism. The Japanese losses were 4,500 out of 30,000 engaged, or 15%, that of the Russians fully half of the 3,000 engaged. The victors captured many guns, but were too exhausted to pursue the Russians, whose retirement was not made in the best order.

The transports were now conveying the 6th and 11th Divisions to Pitszewo; these were to form the 3rd Army (Nogi) for operations against Port Arthur. Oku exchanged his 1st Division for the 6th. The 2nd Army then turned northward (3rd, 4th, 5th and 6th Divisions). The 10th Division, forming the nucleus of the 4th Army, had begun to land at Takusham on May 19. The 2nd and 4th Armies were the left wing of a widespread converging movement on Liao-Yang. Oku had the greatest distance to march, Kuroki the smallest. The latter therefore had to stand fast in the face of the Russian eastern detachment, which was three days' march at most from Fêng-hwang-chêng and could be supported in three more days by Kuropatkin's main body, whereas the pressure of Oku's advance would not begin to be felt by the Russian southern detachment until the twelfth day at earliest. It was necessary therefore for the first objective to make a slight concession to the second. Oku had to start at the earliest possible moment, even though operations against Port Arthur were thereby delayed for a week or two. In fact, Oku's march began on June 13, Kuroki's on June 24; the moves of the intermediate forces at various dates within this time.

Meanwhile Kuropatkin, assembling the main army week by week, was in a difficult position. His policy of gaining time had received a severe blow in the failure of his executive officer to realize it, and that officer, though his unpursued troops quickly regained their moral, had himself completely lost confidence. On the news of the battle (coupled with that of a fresh army appearing on the Korean coast)[1], Kuropatkin instantly sent off part of his embryo central mass to bar the mountain passes of Fenshuiling and Motienling against the imagined relentless pursuit of the victors, and prepared to shift his centre of concentration back to Moukden. The subsidiary protective forces on either flank of Zasulich had promptly abandoned their look-out positions and fallen back to join him. But the commander-in-chief, soon realizing that the Japanese were not pursuing, reasserted himself, sent the protective troops back to their posts, and cancelled all orders for the evacuation of Liao-Yang. From this time forward Kuropatkin allowed his subordinates little or no initiative. A few days later, Zasulich's persistent requests to be allowed to retreat and the still uncertain movements of the 2nd Army induced him once more to prepare a concentration on Moukden. But on May 6 he learned that the Japanese 1st Army had again halted at Fêng-hwang-chêng and that the 2nd Army was disembarking at Pitszewo, and he resumed (though less confidently) his original idea. The eastern protective detachment, now strengthened and placed under the orders of Count Keller, was disposed with a view to countering any advance on Liao-Yang from the east by a combination of manoeuvre and fighting.

[1]This was the 2nd Army, waiting in the port of Chinampo for the moment to sail for Pitszewo.

Alexeiev and Kuropatkin.—It was at this moment of doubt that Alexeiev, leaving Port Arthur just in time and profoundly impressed with the precarious state of affairs in the fleet and the fortress, gave the order, as commander-in-chief by land and sea, for an "active" policy (May 19). Kuropatkin, thus required to abandon his own plan, had only to choose between attacking the 1st Army and turning upon Oku. He did not yield at once; a second letter from the viceroy, the news of Nanshan, and above all a signed order from the tsar himself, "Inform General Kuropatkin that I impose upon him all the responsibility for the fate of Port Arthur," were needed to induce him to execute a scheme which in his heart he knew to be perilous. The path of duty for a general saddled with a plan which he disapproves is not easily discoverable. Napoleon in like case refused, at the risk of enforced resignation, and so did Moreau; the generality of lesser men have obeyed.

Stakelberg's 1st Siberian Corps was therefore reinforced towards the end of May up to a strength of above 35,000. But it remained a detachment only. The Liao-Yang central mass was still held in hand, for the landing of the 4th Army—really only a division at present—at Takushan and the wrong placing of another Japanese division supposed to be with Kuroki (really intended for Nogi) had aroused Kuropatkin's fears for the holding capacity of Keller's detachment. Moreover, disliking the whole enterprise, he was most unwilling to use up his army in it. The Russians, then, at the beginning of June, were divided into three groups, the southern, or offensive group (35,000), in the triangle Neuchwang-Haicheng-Kaiping; the eastern or defensive group (30,000), the main body of it guarding the passes right and left of the Wiju-Liao-Yang road, the left (Cossacks) in the roadless hills of the upper Aiho and Yalu valleys; the right (Mishchenko's Cossacks and infantry supports) guarding Fenshuiling pass and the road from Takushan; the reserve (42,000) with Kuropatkin at Liao-Yang; the "Ussuri Army" about Vladivostok; and Stössel's two divisions in the Kwantung peninsula.

On the other side the 1st Army was at Fêng-hwang-chêng with one brigade detached on the roads on either hand, the left being therefore in front of the Takushan division and facing the Fenshuiling. Oku's 2nd Army (four divisions or 60,000 combatants) was about Port Adams. This last was the objective of the attack of Stakelberg's 35,000. Kuropatkin's orders to his subordinate were a compromise between his own plan and Alexeiev's. Stakelberg was to crush by a rapid and energetic advance the covering forces of the enemy met with, and his object was "the capture of the Nanshan position and thereafter an advance on Port Arthur." Yet another object was given him, to "relieve the pressure on Port Arthur by drawing upon himself the bulk of the enemy's forces," and he was not to allow himself to be drawn into a decisive action against superior numbers. Lastly, on June 7, while Stakelberg was proceeding southward on his ill-defined errand, Kuropatkin, imposed upon by the advance of the Takushan column to Siu-yen, forbade him to concentrate to the front, only removing the veto when he learned that the 4th Army had halted and entrenched at Siu-yen.

Battle of Telissu.—On the 14th, all his arrangements for supply and transport being at last complete, Oku moved north. Although he was still short of part of the 6th Division, he was in superior force. He had, moreover, the perfectly definite purpose of fighting his way north, and at Telissu or Wafangkou on June 14, as he expected, he came upon Stakelberg's detachment in an entrenched position. On the 14th and 15th, attacking sharply on

the Russian front and lapping round both its flanks, Oku won an important and handsome victory, at a cost of 1,200 men out of 35,000 engaged, while the Russians, with a loss of at least 3,600 out of about 25,000 engaged, retired in disorder. Thus swiftly and disastrously ended the southern expedition. Meantime, except for the movement on Siu-yen already mentioned[1], and various reconnaissances in force by Keller's main body and by Rennenkampf's Cossacks farther inland, all was quiet along the Motienling front. Kuroki entrenched himself carefully about Fêng-hwang-chêng, intending, if attacked by the Russian main army, to defend to the last extremity the ground and the prestige gained on May 1.

From this point to the culmination of the advance at Liao-Yang, the situation of the Japanese closely resembles that of the Prussians in 1866. Haicheng represents Miinchengratz, Liao-Yang Gitschin, and the passes east of Liao-Yang Nachod and Trautenau. The concentration of the various Japanese armies on one battlefield was to be made, not along the circumference of the long arc they occupied, but towards the centre. Similarly, Kuropatkin was in the position of Benedek. He possessed the interior lines and the central reserve which enables interior lines to be utilized, and a stroke of good fortune prolonged the period in which he could command the situation, for on June 23 an unexpected sortie of the Russian Port Arthur squadron paralysed the Japanese land offensive. In the squadron were seen the battleships damaged in the February attacks, and the balance of force was now against Togo, who had lost the "Yashima" and the "Hatsuse." The squadron nevertheless, tamely returned to harbour, Togo resumed the blockade and Nogi began his advance from Nanshan, but the 2nd and 4th Armies came to a standstill at once (naval escort for their seaborne supplies being no longer available), and the 1st Army, whose turn to advance had just arrived, only pushed ahead a few miles to cover a larger supply area. On July 1 the Vladivostok squadron appeared in the Tsushima straits, and then vanished to an unknown destination, and whether this intensified the anxiety of the Japanese or not, it is the fact that the 2nd Army halted for 11 days at Kaiping, bringing the next on its right, 4th Army, to *a* standstill likewise. Its next advance brought it to the fortified position of Tashichiao, where Kuropatkin had, by drawing heavily upon his central reserve and even on the eastern detachment, massed about two army corps.

Tashichiao.—On the 24th Oku attacked, but the Russian general, Zarubayev, handled his troops very skilfully, and the Japanese were repulsed with a loss of 1,200 men. Zarubayev, who had used only about half his forces in the battle, nevertheless retired in the night, fearing to be cut off by a descent of the approaching 4th Army on Haicheng. and well content to have broken the spell of defeat. Oku renewed the attack next day, but found only a rearguard in front of him, and without following up the retiring Russians he again halted for six days before proceeding to Haicheng to effect a junction with the 4th Army (Nozu), which meantime had won a number of minor actions and forced the passage of the mountains at Fenshuiling South[2].

The 1st Army, after its long halt at Fêng-hwang-chêng, which was employed in minutely organizing the supply service—a task of exceptional difficulty in these roadless mountains—reopened the campaign on June 24, but only tentatively on account of the discouraging news from Port Arthur. A tremendous rainstorm imposed further delays, for the coolies and the native transport that had been laboriously collected scattered in all directions. The Motieniing pass, however, had been seized without difficulty,and Keller's power of counter-attack had been reduced to nothing by the dispatch of most of his forces to the concentration at Tashichiao. But Oku's 2nd Army was now at a standstill at Kaiping, and until he was further advanced the 1st Army could not press forward. The captured passe: were therefore fortified (as Fêng-hwang-chêng had been) for passive resistance. This, and the movements of the 4th Army, which had set its face towards Haicheng and no longer seemed to be part of a threat on Liao-Yang, led to the idea being entertained at Kuropatkin's headquarters that the centre of gravity was shifting to the south. To clear up the situation Keller's force was augmented and ordered to attack Kuroki. It was repulsed with a loss of nearly 1,000 men in the action at the Motienling (July 17), but it was at least ascertained that considerable forces were still on the Japanese right, and upon the arrival of a fresh army corps from Europe, Kuropatkin announced his intention of attacking Kuroki. And in effect he succeeded in concentrating the equivalent of an army corps, in addition to Keller's force, opposite to Kuroki's right. But having secured this advantage he stood still for five days, and Kuroki had ample time to make his arrangements. The Japanese general occupied some 20m. of front in two halves, separated by 6m. of impassable mountain, and knowing well the danger of a "cordon" defensive, he met the crisis in another and a bolder fashion. Calling in the brigade detached to the assistance of Nozu as well as all other available fractions of his scattered army, he himself attacked on July 31 all along the line. It was little more than an assertion of his will to conquer, but it was effectual. On his left wing the attacks of the Guard and 2nd Divisions (action of Yang-tzu-ling) on the Russian front and flank failed—the frontal attack because of the resolute defence, the flank attack from sheer fatigue of the troops. Count Keller was killed in the defence. Meantime on the Japanese right the 12th Division attacked the large bodies of troops that Kuropatkin had massed (Yu-shu-ling) equally in vain. But one marked success was achieved by the Japanese. The Russian 3jth and 36th Regiments (10th European Corps) were caught between two advancing columns, and, thanks to the initiative of one of the column leaders, Okasaki, destroyed. At night, discouraged on each wing by the fall of Count Keller and the fate of the 35th and 36th, the whole Russian force retired on Anping, with a loss of 2,400 to the Japanese 1,000 men.

Russian Retirement **on Liao-Yang.**—This was the only manifestation of the offensive spirit on Kuropatkin's part during the six months of marking time. It was for defence, sometimes partial and elastic, sometimes rigid and "at-all-costs," that he had made his dispositions throughout. His policy now was to retire on Liao-Yang as slowly as possible and to defend himself in a series of concentric prepared positions. In his orders for the battle around his stronghold there is no word of counter-attack, and his central mass, the special weapon of the commander-in-chief, he gave over to Bilderling and to Zarubayev to strengthen the defence in their respective sections or posted for theprotectionofhislineof retreat. Nevertheless he had every intention of delivering a heavy and decisive counterstroke when the right moment should come, and meantime his defensive tactics would certainly have full play on this prearranged battlefield with its elaborate redoubts, bomb-proofs and obstacles, and its garrison of a strength obviously equal (and in reality superior) to that of the assailants. The Japanese, too, had effected their object, and as they converged on their objective the inner flanks of the three armies had connected and the supreme commander Marshal Oyama had taken command of the whole. But instead of boldly pushing out the 1st Army to such a distance that it could manoeuvre, as Moltke did in 1866 and 1870, he attached it to the general line of battle. It was not in two or three powerful groups but in one long chain of seven deployed divisions that the advance was made.

Battle of **Liao-Yang.**—On Aug. 25 the 2nd and 4th Armies from Haicheng and the 1st Army from the Yin-tsu-ling and Yu-shu-ling began the last stage of their convergent advance. The Russian first position extended in a semicircle from Anshantien (on the Liao-Yang-Hai-cheng railway) into the hills at Anping, and thence to the Taitse river above Liao-Yang; both sides had mixed detachments farther out on the flanks. The first step in the Japanese plan was the advance of Kuroki's army to Anping. Throughout the 25th, night of the 25th-26th, and the 26th of August, Kuroki advanced, fighting heavily all along the line, until on the night of the 26th the defenders gave up the contested ground at Anping. Hitherto there had only been skirmishing on a

[1] The occupation of Siu-yen was chiefly the work of the brigade pushed out to his left by Kuroki. Only a portion of the 10th Division from Takushan helped to drive away Mishchenko's Cossacks.

[2] The 5th Division of the 2nd Army had been sent to join the 10th *as* the latter approached Hsimucheng. The Guard brigade of Kuroki's army which had served with Nozu in the advance had now returned to Fêng-hwang chêng.

large scale on the side of Hai-cheng. Kuropatkin having already drawn in his line of defence on the south side towards Liao-Yang, the 2nd and 4th Japanese Armies delivered what was practically a blow in the air. But on the 27th there was a marked change in the Japanese plan. The right of the 1st Army, when about to continue the advance west on Liao-Yang, was diverted northward by Oyama's orders and ordered to prepare to cross the Taitszeho. The retirement of the Russian southern force into its entrenchments emboldened the Japanese commander-in-chief to imitate Moltke's method to the full. On the 28th, however, the 1st Army made scarcely any progress. The right (12th) division reached the upper Taitszeho, but the divisions that were to come up on its left were held fast by their opponents. The 29th was an uneventful day, on which both sides prepared for the next phase.

The Russians' semicircle, now contracted, rested on the Taitszeho above and below the town, and their forces were massed most closely on either side of the "Mandarin" road that the 1st Army had followed. Opposite this portion of the line was the Guard and the 4th Army. Oku was astride the railway, Kuroki extending towards his proposed crossing-points just beyond Kuropatkin's extreme left (the latter was behind the river). On the 30th the attack was renewed. The Guard, the 4th Army and the 2nd Army were completely repulsed.

On the night of the 30th the first Japanese troops crossed the Taitszeho near Lien-Tao-Wun, and during the 31st three brigades were deployed north of Kwan-tun, facing west. The Russian left wing observed the movement all day, and within its limited local resources made dispositions to meet it. Kuropatkin's opportunity was now come The remainder of the Japanese and Division was following the 12th, leaving a nine-mile gap between Kuroki and Nozu, as well as the river It was not into this gap, but upon the isolated divisions of the 1st Army that the Russian general proposed to launch his counterstroke Reorganizing his southern defences on a shorter front, so as to regain possession of the reserves he had so liberally given away to his subordinates; he began to ccllect large bodies of troops opposite Kuroki, while Stakelberg and Zarubayev, before withdrawing silently into the lines or rather the fortress of Liao-Yang, again repulsed Oku's determined attacks on the south side. But it was not in confidence of victory that Kuropatkin began the execution of the new plan — rather as a desperate expedient to avoid being cut off by the 1st Army, whose strength he greatly overestimated

On the morning of Sept. 1—the anniversary of Sedan, as the Japanese officers told their men—Oyama, whose intentions the active Kuroki had somewhat outrun, delivered a last attack with the 2nd and 4th Armies and the Guard on the south front, in the hope of keeping the main body of the Russians occupied and so assisting Kuroki, but the assailants encountered no resistance, Zarubayev having already retired into the fortress. North of the Taitszeho the crisis was approaching. Kuroki's left, near the river, vigorously attacked a hill called Manjuyama which formed part of the line of defence of the 17th Corps from Europe. But the right of the 1st Army (12th Division) was threatened by the gathering storm of the counterstroke from the side of Yentai mines, and had it not been that the resolute Okasaki continued the attack on Manjuyama alone the Japanese offensive would have come to a standstill. Manjuyama, th'anks to the courage of the army commander and of a single brigadier, was at last carried after nightfall, and the dislodged Russians made two counter-attacks in the dark before they would acknowledge themselves beaten Next morning, when Kuroki (who had conceived the mistaken idea of a general retreat of the Russians on Mukden) was preparing to pursue, the storm broke. Kuropatkin had drawn together seven divisions on the left rear of the 17th Corps, the strength of the whole being about 90,000. On the extreme left was Orlov's brigade of all arms at Yentai mines, then came the 1st Siberian Corps (Stakelberg), the 10th Corps, and finally the 17th. But Orlov, perplexed by conflicting instructions and caught in an unfavourable situation by a brigade of the 12th Division which was executing the proposed "pursuit," gave way — part of his force in actual rout — and the cavalry that was with him was driven back by the Kobi (reserve army) brigade of the Guard. The fugitives of Orlov's command disordered the on-coming corps of Stakelberg, and the outer flank of the great counterstroke that was to have rolled up Kuroki's thin line came to an entire standstill. Meantime the 10th Corps furiously attacked Okasaki on the Manjuyama, and though its first assault drove in a portion of Okasaki's line, a second and a third, made in the night, failed to shake the constancy of the 15th Brigade Misunderstandings and movements at cross-purposes multiplied on the Russian side, and at midnight Kuropatkin at last obtained information of events on the side of Yentai mines. This was to the effect that Orlov was routed, Stakelberg's command much shaken, and at the same time Zarubayev in Liao-Yang, upon whom Oku and Nozu had pressed a last furious attack, reported that he had only a handful of troops still in reserve. Then Kuropatkin's resolution collapsed, although about three divisions were still intact, and he gave the order to retreat on Mukden

Russian Retreat on **Mukden.**—Thus the Japanese had won their great victory with inferior forces, thanks "in the first instance to the defeat of Gen. Orlov. But at least as large a share in the ruin of the Russian operations must be attributed to the steadfast gallantry of the 15th Brigade on Manjuyama." The losses of the Japanese totalled 23,000, those of the Russians 19,000. Coming, as it did, at a moment when the first attacks on Port Arthur had been repulsed with heavy losses, this successful climax of the four months' campaign more than restored the balance. But it was not the expected Sedan. Had the two divisions still kept in Japan been present Kuroki would have had the balance of force on his side, the Russian retreat would have been confused, if not actually a rout, and the war might have been ended on Japan's own terms As it was, Kuropatkin drew off the wbole of his forces in safety, sharply repulsing an attempt at pursuit made by part of the 12th Division on Sept 4. The railway still delivered 30,000 men a month at Mukden, and Japan had for a time outrun her resources At St. Petersburg the talk was not of peace but of victory, and after a period of reorganization the Russians advanced afresh to a new trial of strength. But the remainder of the Manchurian campaign proved little more than a series of violent and resultless encounters of huge armies — armies far larger than those which had fought out the real struggle for supremacy at Liao-Yang.

Naval Actions.—At this time the siege of Port Arthur had progressed only so far that the besiegers were able to realize the difficulties before them. Their exertions and sacrifices were not crowned with success until the year had run its full course, and meantime the repeated frustration of their hopes had a moral reaction on the main struggle in Manchuria, apart from keeping one of their armies away from the decisive theatre. At sea, however, the Japanese navy scored two important successes. After months of blockade and minor fighting, the Russian Port Arthur squadron had been brought to action on Aug 10. Admiral Vitheft, Makárov's successor, had put to sea shortly after the appearance of the 3rd Army on the land front of Port Arthur. The battle opened about noon, 20m south of the harbour; the forces engaged on each side varied somewhat, but Togo finally had a superiority. As the Russians became gradually weaker, the Japanese closed in to within 3m. range, and Prince Ukhtomsky (who succeeded to the command on Vitheft being killed) gave up the struggle at nightfall. The Russians scattered, some vessels heading southward, the majority with the admiral making for Port Arthur, whence they did not again emerge. All the rest were either forced into neutral ports (where they were interned) or destroyed, among the latter being the third-class cruiser "Novik," which had already earned a brilliant reputation for daring, and now steamed half round Japan before she was brought to action and run ashore. The victors blockaded Port Arthur, until near the close of the siege when, after going ashore and examining the remnant of the Russian fleet from 203-Metre hill, Togo concluded that it would be safe to return to Japan and give his ships a complete refit. Kamimura's squadrons, after various adventures, at last succeeded on Aug. 14 in engaging and defeating the Russian Vladivostok squadron (Admiral Jessen). Thus the Russian flag disappeared from the Pacific, and thenceforward only the Baltic

fleet could hope seriously to challenge the supremacy of the Japanese navy.

The remainder of the war on land, although it included two battles on a large scale and numerous minor operations, was principally a test of endurance. After Liao-Yang there were no widely extended operations, the area of conflict being confined to the plain of the coast side of the Hun-ho and the fringe of the mountains. Japan had partially accomplished her task, but had employed all her trained men in this partial accomplishment. It was questionable, even in Oct. 1904, whether she could endure the drain of men and money if it were prolonged much further. On the other hand, in Russia opposition to the war, which had never been popular, gradually became the central feature of a widespread movement against irresponsible government. Thus, while the armies in Manchuria faced one another with every appearance of confidence, behind them the situation was exceedingly grave for both parties. **A** state of equilibrium was established, only momentarily disturbed by Kuropatkin's offensive on the Sha-ho in October, and by the Sandepu incident in the winter, until at last Oyama fought a battle on a grand scale and won it. Even then, however, the results fell far short of anticipation, and the armies settled down into equilibrium again.

Battle of the **Sha-ho.**—After the battle of Liao-Yang Kuropatkin reverted for a moment to the plan of a concentration to the rear at Tieling. Politically, however, it was important to hold Mukden, the Manchurian capital, and as the Japanese, as on previous occasions, reorganized instead of pursuing, he decided to stand his ground, a resolution which had an excellent effect on his army. Moreover, growing in strength day by day, and aware that the Japanese had outrun their powers, he resolved, in spite of the despondency of many of his senior officers, to take the offensive. He disposed of about 200,000 men, the Japanese had about 170,000. The latter lay entrenched north of Liao-Yang, from a point gm. west of the railway, through Yentai station and Yentai mines, to the hills farther east. There had been a good deal of rain, and the ground was heavy. Kuropatkin's intention was to work round the Japanese right on the hills with his eastern wing (Stakelberg), to move his western wing (Bilderling) slowly southwards, entrenching each strip of ground gained, and finally with the centre—*i.e.,* Bilderling's left— and Stakelberg, to envelop and crush the 1st Army, which formed the Japanese right, keeping the 4th Army (Nozu) and the 2nd Army (Oku) fixed by means of Bilderling's main body. The manoeuvre began on Oct. 5, and by the evening of the 10th, after four days of advanced-guard fighting, Stakelberg was in his assigned position in the mountainous country, facing west towards Liao-Yang, with his left on the Taitszeho. The advance of Bilderling, however, necessarily methodical and slow in any case, had taken more time than was anticipated. Still, Bilderling crossed the Sha-ho and made some progress towards Yentai, and the demonstration was so far effectual that Kuroki's warnings were almost disregarded by the Japanese headquarters. The commander of the 1st Army, however, took his measures well, and Stakelberg found the greatest trouble in deploying his forces for action in this difficult country. Oyama became convinced of the truth on the 9th and 10th, and prepared a great counterattack. Kuroki, with only a portion of the 1st Army, was left to defend at least 15m. of front, and the entire 2nd and 4th Armies and the general reserves were to be thrown upon Bilderling. On the 11th the real battle opened. Kuroki displayed the greatest skill, but he was of course pressed back by the four-to-one superiority of the Russians. Still the result of Stakelberg's attack, for which he was unable to deploy his whole force, was disappointing, but the main Japanese attack on Bilderling was not much more satisfactory, for the Russians had entrenched every step of their previous advance and fought splendidly. The Russian commander-in-chief states in his work on the war that Bilderling became engaged *à fond* instead of gradually withdrawing as Kuropatkin intended, and at any rate it is unquestioned that in consequence of the serious position of affairs on the western wing, not only did Stakelberg use his reserves to support Bilderling, when the 12th Division of Kuroki's army was almost at its last gasp and must have yielded to fresh pressure, but Kuropatkin himself suspended the general offensive on Oct. 13. In the fighting of Oct. 13–16 the Russians gradually gave back as far as the line of Sha-ho, the Japanese following until the armies faced roughly north and south on parallel fronts. The fighting, irregular but severe, continued. Kuropatkin was so far averse to retreat that he ordered a new offensive, which had fair success on the 16th–17th. Kuropatkin wished to continue the offensive, but his corps commanders offered so much opposition to a further offensive that he at last gave up the idea. The positions of the rival armies from Oct. 18, the close of the battle of the Sha-ho, to Jan. 26, 1905, the opening of the battle of Sandepu (Heikoutai)—a period almost entirely devoid of incident—may be described by the old-fashioned term "winter quarters."

In Jan. 1905 the Russians, 300,000 strong, were now organized in three armies, commanded by Generals Linievich, Grippenberg and Kaulbars; the total strength of the Japanese 1st, 2nd and 4th Armies and reserve was estimated by the Russians at 220,000. Towards the end of January Kuropatkin took the offensive. He wished to inflict a severe blow before the enemy could be reinforced by the late besiegers of Port Arthur, and sent Grippenberg with seven divisions against Oku's two on the Japanese left. The battle of Sandepu (Heikoutai), fought in a terrible snowstorm on Jan. 26 and 27, 1905, came near to being a great Russian victory. But after two days' severe fighting, although Grippenberg had not been checked, Kuropatkin, in face of a counterattack by Oyama, decided to abandon the attempt.

Battle of **Mukden.**—Both sides stood fast in the old positions up to the verge of the last and greatest battle. Kuropatkin was reinforced, and appointed Kaulbars to succeed Grippenberg and Bilderling to the command of the 3rd Army vacated by Kaulbars. On the other hand, Nogi's 3rd Army, released by the fall of Port Arthur, was brought up on the Japanese left, and a new army under Kawamura (5th), formed of one of the Port Arthur and two reserve divisions, was working from the upper Yalu through the mountains towards the Russian left rear. The Russian line covering Mukden was 47m. long, the armies from right to left being 2nd (Kaulbars), 3rd (Bilderling) and 1st (Linievich); a general reserve was at Mukden. On the other side from left to right, on a line 40m. long, were Oku (2nd Army), Nozu (4th), Kuroki (1st) and Kawamura (5th), the general reserve in rear of the centre at Yentai and the 3rd Army in rear of Oku. Each side had about 310,000 men present. The entire front of both armies was heavily entrenched. The Russians had another offensive in contemplation when the Japanese forestalled them by advancing on Feb. 21. The 5th Army gradually drove in Kuropatkin's small detachments in the mountains, and came up in line with Kuroki, threatening to envelop the Russian left. The events on this side and misleading information induced Kuropatkin to pay particular attention to his left. The Japanese 1st and 5th Armies were now engaged (Feb. 25), and elsewhere all was quiet. But on the 27th the fighting spread to the centre, and Nogi (originally behind Oku) was on the march to envelop the Russian right. He was held under observation throughout by Russian cavalry, but it seems that little attention was paid to their reports by Kuropatkin, who was still occupied with Kuroki and Kawamura, and even denuded his right of its reserves to reinforce his left. With a battle-front exceeding two days' marches the wrong distribution of reserves by both sides was a grave misfortune. Kuropatkin was at last convinced, on Feb. 28, of the danger from the west, and did all in his power to form a solid line of defence on the west side of Mukden. Nogi's first attack (March 1–2) had not much success, and a heavy counterstroke was delivered on the 2nd. Fighting for localities and alterations in the interior distribution of the opposing forces occupied much time, and by the 3rd, though the battle had become severe, Kuropatkin had merely drawn in his right and right centre (now facing west and south-west respectively) a little nearer Mukden. His centre on the Sha-ho held firm, Kuroki and Kawamura made but slight progress against his left in the mountains. Nogi and Oyama were equally impressed with the strength of the new (west) Russian front, and, like Grant at Petersburg in 1864,

extended farther and farther to the outer flank, the Russians following suit. The Japanese marshal now sent up his army reserve, which had been kept far to the rear at Yentai, to help Nogi. It was not before the evening of March 6 that it came up with the 3rd Army and was placed in position opposite the centre of the Russian west front. On the rest of the line severe local fighting had continued, but the Russian positions were quite unshaken and Kuropatkin's reserves—which would have been invaluable in backing up the counter-attack of March 2—had belatedly returned to face Nogi. He had organized another counterstroke for the 6th, to be led by Kaulbars, but this collapsed unexpectedly after a brief but severe fight.

Russian Retreat on **Tieling.**—Kuropatkin now decided to draw in his centre and left towards Mukden. On the 7th, the various columns executed their movement to the Hun-ho with complete success, thanks to good staff work. The Japanese followed up only slowly. Nogi and Kaulbars stood fast, facing each other on the west front; after the arrival of the general reserve, Nogi was able to prolong his line to the north and eventually to bend it inwards towards the Russian line of retreat. On the 8th the fighting between Nogi and Kaulbars was very severe, and Kuropatkin now made up his mind to retreat towards Tieling. On the 9th, by Oyama's orders, Nogi extended northward instead of further swinging in south-eastward, Oku now occupied all the original line of the 3rd Army. Nozu alone was left on the south front, and Kuroki and Kawamura began to engage Linievich seriously. But Nogi had not yet reached the Mukden-Tieling railway when, on the night of the 9th, every preparation having been made, Kuropatkin's retreat began. On the 10th, covered by Kaulbars, who held off Nogi, and by strong rearguards at and east of Mukden, the movement continued, and though confusion was prevalent and the rearguards suffered very heavily, the Russians managed to draw off in safety to the northward. On the evening of the 10th, after all their long and hardly contested enveloping marches, Nogi's left and Kawamura's right met north of Mukden. The circle was complete, but there were no Russians in the centre, and a map of the positions of the Japanese on the evening of the 10th shows the 17 divisions thoroughly mixed up and pointing in every direction but that of the enemy. Thus the further pursuit of the Russians could be undertaken only after an interval of reorganization by the northernmost troops of the 5th and 3rd Armies. But the material loss inflicted on the Russians was far heavier than it had ever been before. It is generally estimated that the Russian losses were no less than 97,000, and the Japanese between 40,000 and 50,000. Japan had had to put forth her supreme effort for the battle, while of Russia's whole strength not one-tenth had been used. But Russia's strength in Europe, with but one line whereby it could be brought to bear in the Far East, was immaterial, and on the theatre of war a quarter of the Russian field forces had been killed, wounded or taken.

Rozhestvenski's Voyage.—It remains to narrate briefly the tragic career of the Russian Baltic fleet. Leaving Libau on Oct. 13–14, 1904, the fleet steamed down the North sea, expecting every night to be attacked by torpedo-boats. On the 21st, in their excitement, they opened fire on a fleet of British trawlers on the Dogger Bank (*q.v.*), and several fishermen were killed. This incident provoked the wildest indignation, and threatened for some days to bring Russia into conflict with England. A British fleet "shadowed" Rozhestvenski for some time, but eventually the Russians were allowed to proceed. On reaching Madagascar, Rozhestvenski heard of the fall of Port Arthur, and the question of returning to Russia arose. But a reinforcement under Rear-Admiral Nebogatov was despatched from the Baltic via Suez early in March 1905, and the armada proceeded by the Straits of Malacca, Nebogatov joining at Kamranh bay in Cochin China. The united fleet was formidable rather in number than in quality; the battleships were of very unequal value, and the faster vessels were tied to the movements of many "lame ducks." Rozhestvenski had, moreover, numerous store-ships, colliers, etc. Nevertheless, the Japanese viewed his approach with considerable anxiety, and braced themselves for a final struggle. Of the various courses open to him, Togo prudently chose that of awaiting Rozhestvenski in home waters. The Russians left Kamranh on May 14, and for a time disappeared into the Pacific. It was assumed that they were making for Vladivostok either via Tsushima strait or by the Pacific. Rozhestvenski chose the former course, and on May 27 the fleets met near Tsushima. By superior speed and handling the Japanese gained an increasing advantage, and by the following day the whole Russian fleet, with few exceptions, had been captured or sunk. (See TSUSHIMA for battle.)

The Peace **of Portsmouth.**—After the disasters of Mukden and Tsushima, and being threatened with internal disorder in European Russia, the tsar, early in June, accepted the mediation of the president of the United States, and *pourparlers* were set on foot. The war, meanwhile, drifted on through May, June and July. Linievich, who succeeded Kuropatkin shortly after the battle of Mukden, retired slowly northward, reorganizing his forces and receiving fresh reinforcements from Europe. A Japanese expedition occupied Sakhalin (July 8–30), and another, under General Hasegawa, advanced through Korea towards Vladivostok. But the fighting was desultory. The peace negotiations were opened at Portsmouth (N.H.), on Aug. 9, and by the end of the month the belligerents had agreed as to the main points at issue—that Russia should cede the half of Sakhalin, annexed in 1875, surrender her lease of the Kwantung peninsula and Port Arthur, evacuate Manchuria, and recognize Japan's sphere of influence in Korea. The treaty of peace was signed on Sept. 5, 1905.

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RUSSO-POLISH CAMPAIGN. This campaign, of 1920, which resulted in the defeat and rout of the Soviet Army when it was within sight of the Polish capital, is full of dramatic incident. Organization of command, staff and administration was lacking on both sides, but above all it was the want of a proper system of supply which accounted for the sudden collapse of troops engaged in a victorious advance. The thinly populated territory lying between the Niemen in the north and the Dniester in the south was incapable of supporting large bodies of troops, and as both sides attempted to live on the country during their advances the failure of their operations followed quickly each success.

Cause **of** the **War.**—During the course of 1919 and early 1920, the Soviet Government had succeeded in clearing their territory of the White Russian armies under Kolchak, Denikin and Yudenich. They were thus at liberty to examine the situation on their frontiers. With such a mixture of races living side by side in the disputed regions no delimitation of frontier would have suited all parties, and in the absence of authority to enforce a decision, trouble quickly arose between the Soviet and the newly formed Polish State. Poland was determined to maintain her new liberty and had called up fresh levies to support the various legions which had been repatriated from the fronts upon which they had been fighting in the World War. The Soviet began to concentrate their troops towards the west. Inflammatory speeches in Moscow and a fierce propaganda amongst the Polish working people brought Polish public opinion to a fever heat. From seven divisions in January the Soviet had, by March, increased the number of their

troops facing the Poles to 20 divisions, with three cavalry divisions. Poland decided that she could not wait quietly for the inevitable Soviet attack by which she would certainly be destroyed, and that she must act at once.

Polish Offensive.— Strategically, the territory in dispute may be divided into two separate areas: White Russia in the north and Volhynia and Podolia in the south. The marshes of the Pripet divide one area from the other. Acting in collusion with Petlura, the Hetman of the Ukraine, who had promised to raise his country against the Soviet, the Poles advanced in April as far as Kiev. By the beginning of May the Polish-Soviet front ran from Dvinsk in the north along the course of the Dnieper to Kiev and thence to the Dniester near Kamenets. No sooner were the Poles established in Kiev than the Soviet northern army began to advance. The Poles were able to transfer troops from the south and counter-attacked the Soviet forces which had already penetrated as far west as Lida and Baranoicze. By the end of May the line held at the beginning of the month had been restored. Operations had been most ably carried out by the Polish minister of war, Gen. Sosnkowski, but there were indications that the Soviet were transferring more and more troops to the west and that a renewal of their attacks might be expected.

At the beginning of June, in the southern area there appeared a new Soviet cavalry leader, Budenny, who completely altered the situation. Budenny had been a non-commissioned officer in the old Russian Army and soon proved himself a man of action. Within a month he had driven back the Poles a distance of zoom. until their line in the south ran just east of Pinsk and Równe (Rovno) to the junction of the Dniester and Siret (Sereth).

Russian Success.—Fighting in the northern area continued intermittently during the month of June, preventing the Poles from transferring troops to the hard-pressed south. Despite the operations in the south it was clear that the main Soviet attack was coming in the north. On July 4 the blow fell. The whole Polish line gave way. Wilno (Vilna) and Minsk were lost in the first week. Grodno fell on July 20 and Bialystok on July 25. By the end of July the Soviet advance guards had reached the Bug. In 25 days the Poles had lost 300m. of territory. The main cause of the collapse was their failure to constitute reserves. In their desire to protect their new territory they had been led into a linear defence on a front of nearly 800m., where they were strong nowhere.

Disposition of Troops.— The Polish situation was now critical. With the help of the French military mission, under Gen. Weygand, a plan for a great counter-attack was evolved on Aug. 6. The situation of the opposing sides on that date was as follows:—

Soviet: (1) Northern group. Four armies—4th) 15th, 3rd and 16th, with a cavalry corps on the extreme north aiming to outflank the Polish left.

(2) Southern group. Two armies—12th and 14th with Budenny's cavalry, along a line from Kowel through Brody to Tarnupol. The men of the Soviet army were unfed and worn out with a month's marching.

Poles: (1) A Northern group formed of units which had been retreating for over a month, strengthened by reinforcements thrown in hastily as they came up. Much material had been lost and the men were tired and hungry, but the approach to the line of the Vistula was beginning to simplify the supply of food and munitions.

(2) Southern group. Three armies—6th, 3rd and 4th—facing the Soviet southern group. Here pressure from the enemy had been by no means so severe as in the north and many of the divisions still retained their original fighting value.

Polish Plan of Attack.— The Polish plan was to withdraw all but a minimum of force from the southern area and to attack the Soviet northern group with the greatest possible strength. The operation bears a close resemblance to Ludendorff's manoeuvre at Tannenberg. In many respects the situation was similar. The Russians were advancing in two main groups divided by the Pripet marshes instead of the Masurian lakes. Here the Soviet southern group was advancing slowly like Rennenkampf's army in 1914. The situation would become critical as soon as the two Soviet groups converged upon the Polish Army. No time was to be lost. Would the commander of the Soviet armies in the south allow himself to be deceived in the same manner as Rennenkampf?

On August 6 orders for the following fresh groupings were issued from Polish headquarters:—

(1) Three armies—2nd, ~ s and 5th—under Gen. Joseph Haller, were to withdraw slowly to the line of the Vistula from Dęblin to Modlin, with the 5th Army pushed well forward on the left to prevent any outflanking of the Polish left between Warsaw and the East Prussian frontier.

(2) Two armies, 3rd and 4th—were to concentrate behind the Wieprz between Chelm and Dęblin, ready to strike due north; the advance of these two armies to commence on Aug. 16.

(3) One army, 6th—would withdraw as necessity arose in the direction of Lemberg, tempting the Soviet southern group away from the critical point in the north.

By Aug. 12 all the armies, with the exception of the two on each flank, had reached their assigned positions without incident. In the south the 3rd had found the 12th Soviet army advancing and had been forced to throw out a detachment on its right flank to cover its concentration. It had been delayed in consequence. In the north, the 5th had been driven back by overwhelming strength and had been unable to prevent the enemy outflanking movement.

Enthusiasm in the Polish army had risen surprisingly in the days since the momentous decision to attack had been taken. The chief of the Polish State, Marshal Pilsudski, had himself taken command of the 3rd and 4th Armies. With the help of Weygand and his staff the service of supply had been restored. New bodies of reinforcements were moved forward from the depôts in Western Poland and the depleted units began to raise their heads again. National optimism returned. The enemy in the south made no determined move and appeared to have no inkling of what was afoot. Every hour that he delayed meant more chance of success for the Polish plan.

Polish **Advance.**—Gen. Sikorski's 5th Army in the north was the first to move. The Soviet movement round his left had assumed alarming proportions and had to be stopped. On Aug. 14 he pressed forward from his defensive position at Modlin and at once encountered the Soviet 15th Army advancing to the attack. Sikorski persisted in his attacks all through Aug. 15 and 16, his men fighting with determination. Not even the appearance of elements of the Soviet 4th Army in his left rear turned him from his purpose. Throwing out covering detachments to watch his rear, he attacked again on Aug. 17. His determination reaped its reward, for the enemy gave way in front of him, their retreat rapidly developing into a rout.

In the south Pilsudski's armies made good progress. The blow against the left of the Soviet 16th Army came as a complete surprise and they offered little resistance. During Aug. 16 and 17 the Poles covered over 50 miles. By Aug. 18 the 3rd Soviet Army, which lay between the 15th destroyed by Sikorski, and the 16th broken by Pilsudski, turned also in hopeless confusion.

On the extreme Soviet right their 4th Army, containing some of the picked Communist regiments, together with the cavalry corps, had reached the Vistula between Torun and Plock in their great turning movement when Sikorski suddenly advanced. Had they advanced resolutely even then, all might have been well, but they hesitated and were lost. Their half-hearted attacks against Sikorski's left had little effect. It was not till Aug. 20 that the order for a general retreat reached them. On Aug. 22, at Mlawa, and Aug. 23 at Chorzele they were successful in cutting themselves a passage, but on Aug. 24 at Kovno they ran up against Pilsudski's 4th Army blocking the way. Almost without making an effort to attack they passed ignominiously over the East Prussian border to internment.

The pace of the Polish pursuit was remarkable. From Aug. 16 to Aug. 25 the advanced units of the 2nd army had covered zoom. as the crow flies. The 4th Army averaged 25m. a day in their advance. The service of supply was left far behind. The troops existed as they could upon the exhausted country. Luckily

the Soviet resistance was so completely broken that there was no further fear of counter-attack and the Polish units had ample time in which to reorganize.

Conclusion.—The results of the battle of Warsaw, as it has been named, are only exceeded by those of Tannenberg. The Poles captured 70,000 prisoners, 200 guns and 1,000 machine-guns. From 50,000 to 100,000 Soviet troops passed over into East Prussia. The victory of the Poles was due to the adoption of a determined offensive based upon a sound plan. The raising of the ***morale*** of the beaten troops by the Polish authorities, roused to enthusiasm themselves by the inspiring presence of Gen. Weygand, is little short of miraculous. The crisis of the battle was undoubtedly Aug. 15–16, when Sikorski's 5th army cleared its front. If it was Pilsudski's force which completed the Soviet defeat, it was undoubtedly the magnificent fighting of Sikorski and his men which made victory possible.

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RUSSO-TURKISH WARS. The Greek insurrection in 1824 gave England, France and Russia occasion to press demands upon Turkey, which the Porte refused to accede to, rejecting besides the London Protocol of July 1827. Hostilities broke out in Oct. 1827, when the allied fleet under Admiral Codrington defeated the Turkish flotilla off Navarino. This victory greatly facilitated the eventual Russian operations against Turkey as the Russian army supported and provisioned by her own fleet could march along the coast by the shortest road to Adrianople and thence towards the Turkish capital.

Towards the end of April 1828 the Russian army consisting of three army corps stood between the Pruth-Dniester 69,000 strong, war having been formally declared on April 28. Turkey, whose army was being reorganized at the time, decided to resist the enemy in the quadrilateral, Ruschuk, Silistria, Varna and Shumla, for which purpose she assembled about 80,000 men. One corps of the invading army invested Braila, which was captured on June 17; another Russian corps crossed at the mouth of the Danube on June 11, while a third drove back the garrisons of Ruschuk and Widdin into these fortresses from which they had emerged. The first two Russian corps now advanced on Shumen but finding the Turks to be stronger than they supposed, they fell back on Yenibazar. A Russian force was thrown forward towards Varna but only on the arrival of the Russian guard corps could the idea be entertained of investing it. The siege began on Sept. 10 and a month later Varna surrendered. The Russians owing to numerical weakness retired into winter quarters in Moldavia and Wallachia. leaving two corps in the vicinity of Varna, Pravodi and Bazardjik. The fortress of Silistria was still in Turkish hands and it now became on the resumption of hostilities the principal Russian objective. Sizopol at the entrance to the harbour of Burgas was captured providing the Russians with a base for their operations south of the Danube. Silistria being invested fell on June 29. Meanwhile Reschid Pasha advanced from Shumla against Pravodi hoping to recapture Varna but was beaten off. General Diebitch, who had replaced Wittgenstein as Russian commander-in-chief, defeated Reschid Pasha at Tcherkovna on June 11. Diebitch now decided to advance south of the Balkans. Reschid attempted to hinder his march but was vanquished at Sliven on Aug. 12. Adrianople was entered Aug. 20, but as Diebitch had only 15,000 men and pestilence was ravaging his ranks he deemed it wiser to conclude a treaty in September before Turkey became aware of the state of his army. Success crowned the Russian arms in Asia, Paskevitch gaining two important victories on June 1 and 2 at Erivan, his advance coming to a close by terms of the treaty arranged in Europe. A conference held in London proclaimed the independence of Greece, Russia receiving the islands at the mouth of the Danube, while Moldavia and Wallachia were to be no longer provinces of Turkey, but only under her protectorate.

The War of 1877–78.—The oppression of the Christian subjects of the Sultan had made hostilities in 1877 between Turkey and Russia inevitable. After the Crimean War Turkey promised to grant reforms, thereby bettering the treatment of the Christian population, but the following years brought no material change. In 1875 an insurrection broke out in Hercegovina and Montenegro, to be followed by Serbia openly taking up arms against Turkey. Russia, whose sympathies by reason of race and religion, were wholly on the side of the Slavs, could not remain a silent onlooker of the events in the Balkans. Russian volunteers flocked in great numbers to join the Serbians and General Chernyaeff was entrusted with their command. Disparity of numbers however, went against the Serbians, the Turks gaining several successes, which culminated in their victory at Djunis on Oct. 29, 1876. Alexander II. then stepped forward and insisted on hostilities ceasing, to which Turkey hurriedly assented. A conference now assembled at Constantinople, but after months of deliberation, it failed to come to an agreement, Turkey taking advantage of the divergent views of the Great Powers. She became as time progressed less willing to make concessions. To prepare for all eventualities and to bring greater weight to her influence at the conference Russia mobilized six army corps in Nov. They consisted of the VII., VIII., IX., X., XI. and XII., corps and were concentrated on the southern frontier, on the Rumanian borders. Mobilization arrangements were not worked effectively nor the deployment of the forces. It must be borne in mind that conscription had been only enforced in Jan. 1874 and there was consequently a lack of well trained officers and reserves. Another great obstacle that hindered Russia from dealing a quick blow at Turkey was the lack of a fleet in the Black sea, though this restriction was removed in 1871. Knowing the unprepared state of the forces several experts, among them General Todleben, the world famous defender of Sevastopol in the Crimean War (*q.v.*), were opposed to Russia undertaking an active campaign, but the Pan-Slav movement which was general in Russia, forced the Tsar to declare war April 24. Having underrated her foe Russia began hostilities with insufficient forces, sending 257,000 men into Rumania and 70,000 each to the Caucasus and to the Austrian frontier. The Grand Duke Nicholas, the Tsar's brother, was in command of the forces and orders were instantly given to cross the Rumanian frontier; this state having proclaimed her independence of Turkey afforded every facility to the Russians to move their army to the Danube. Early in June the Russian army was assembled around Bucharest; it consisted of the VIII., IX. and XII. corps, with detachments thrown forward to the Danube. The XI. corps was guarding the region from the river Argis to the river Yalomniza, further east towards the Pruth stood the XIV. corps while the XIII. was expected by the middle of June and the IV. a month later. The Russian army was armed indifferently and tactically was ill trained, which was due to the men being unused to handling their new weapons. The Russian forces in the middle of June which intended crossing the Danube numbered 257,000 men, but one must deduct those guarding the railway line through Rumania.

The Turks numbered 135,000 men north of the Balkans who were distributed in the following manner: 80,000 in the quadrilateral, 23,000 around Vidin, 10,000 in Nicopol, 8,000 in Dobrudja, 3,000 in Tirnovo, 4,000 in Sistovo, 2,000 at Lom Palanka and 5,000 at Rahoff. Forty thousand men were grouped around Adrianople and Constantinople and some 80,000 in Bosnia, Montenegro and Epirus. The Turks besides disposed of another 120,000 men in Asia Minor.

Political and military reasons forced Turkey to remain on the defensive while Russia was bent on the swiftest possible offensive—bordering on rashness. Rumania having allowed the Russians to traverse her territory greatly aided their initial concentration towards the Danube. She was even prepared in the middle of June to join the Russians against the Turks with her force of 32,000 infantry and 5,000 cavalry, but the Russians, feeling certain of an easy victory, declined her proffered help. Two months later they were only too glad to avail themselves of this assistance which would have been of inestimable value in their first operations south of the Danube. To cross this river was their primary object, but this was impeded by the Turkish flotilla which patrolled the Danube and prevented them bridging

it. The Russians by means of steam launches, batteries, mines and torpedoes drove the Turkish ironclads into Sulina harbour, one being destroyed, while the smaller vessels were obliged to seek refuge in Silistria and Ruschuk Mines were laid across the Danube, bridging now being made possible. Hearing of the hostile approach, Abdul Kerim, the Turkish leader, decided not to make a resolute defence against the enemy crossing the Danube, but to attack him, when advancing to besiege Ruschuk and Shumla. The distribution of the Turkish troops remained little changed by the middle of June; the detachments guarding the Danube were generally too weak to offer any serious resistance to the invader.

The Russians began crossing the river in boats at Zimniza early on June 23 and the following day the VIII. corps was across, standing on the southern bank of the Danube. The same day a bridge 1,300 yards long was begun to be constructed at Nicopol, which was ready by July 1, a second one being ready by Aug. 1. The other Russian corps, the XII. and XIII., commanded by the Tsarevitch, having crossed the Danube moved to the Lom and Yantra facing Ruschuk with the object of laying siege to it while the IX. corps made for Nicopol. Gourko's advance guard entered Tirnova July 7, the VIII corps following it five days later. The Grand Duke Nicholas wished to cross the Balkans with two corps while guarding his right flank with the IX. corps, and watching Ruschuk fortress with the XII. and XIII. corps, but Alexander II. would not sanction this, rightly considering this plan too risky. Gourko left Tirnova July 12 hearing the Shipka Pass was defended by only 3,000 men. He made for the Hainkioi Pass intending to turn the Shipka Pass (*q.v.*), while a Russian detachment attacked the Pass from the north. Gourko having been delayed 24 hours, was repulsed by the Turks when attacking the Pass; the same fate befell the Russians advancing north of Shipka. Nevertheless next day Gourko again pressed forward, when the Turks offered to negotiate terms of capitulation. While they were being drawn up the Turks evacuated all their positions and retreated to Philipopolis. Gourko's capture of Shipka gave the advantage to the Russians for a short time only, though he hastened to put it in a state of defence and it remained in their hands up to the end of the war. Alarmed by the incursion of the Russians, the Turks recalled Suleiman Pasha from Montenegro with his army 30,000 strong and having transported it by sea to the mouth of Maritza pushed it forward without delay on July 23 between Hermanli and Karabunar. After several engagements against greatly superior forces Gourko received orders Aug. 5 from the Headquarters to return north of the Balkans. The passes being deemed of great importance the Russians decided to defend them with the 9th Division, 4th Rifle Brigade and a Bulgarian contingent.

Meanwhile Nicopol fell July 17, the IX corps capturing 8,000 men and it now received orders to advance to Plevna. General Krudener, its commander, detached one division under Schilder-Schuldner, which without any preliminary reconnaissance attacked the Turks July 20, only to be thrown back with heavy losses by Osman Pasha's much superior force, which had marched from Vidin unperceived by the Russians. Though the Rumanians had warned them of the hostile approach no serious attention was given by the Russian military authorities, for which they had to pay dearly. But even now the Russians thought this to be a momentary check and gave orders to make a fresh effort to capture Plevna, for which purpose they detailed 40,000 men. Osman Pasha had meanwhile entrenched himself round Plevna and had occupied Lovcha on the 26th, thereby securing the direct road to Sofia. The second attempt to capture the town, July 31, failed as the first and the Russians at last began to realize that their forces were inadequate to vanquish the enemy. The Tsar, by an Imperial Ukaze called up the Guard and Grenadier Corps, 24th and 26th Infantry Divisions, also the and and 3rd Infantry Divisions with the 3rd Rifle Brigade which had already left Moscow for Bulgaria. Valuable assistance was also forthcoming from the Rumanian forces, which now joined the Russians. The Russian plan of campaign, which was faulty to a degree, now became absolutely impossible, there being no longer any question of moving south of the Balkans, whilst Osman from Plevna might threaten not only their right flank. but the bridges across the Danube. Every effort was to be made to vanquish the Turkish force defending Plevna, now greatly strengthened by field works.

At the end of July, Abdul Kerim, the Turkish commander-in-chief was superseded by Mohammed Ali, who decided to attack the Russian forces under the Tsarevitch (XI., XII. and XIII. corps) on the river Lom. Mohammed Ali had two army corps for his offensive, not to mention five divisions at Shumla and two at Ruschuk, but he carried out his movement with little skill, sending his left wing against the Russians standing on the Yantra, which brought about two engagements at Ayazla on Aug. 22 and 23. The Russians retreated slightly, and a week later the XIII. corps was attacked at Karahassankioi, but no serious result was gained by this move. On Sept. 5, another engagement occurred, but though the Russians retired across the Lom the Turks were unable to march further west. The intended plan to unite the forces of Mohammed Ali with those of Suleiman at Trnova failed, his advance producing no effect on the Russian forces assembled around Plevna, which were by that time considerably reinforced (two Russian and three Rumanian infantry divisions, together with a Russian rifle brigade). On the Rumanians joining the Russians, it was agreed that Prince Charles of Rumania should be in nominal command of the forces grouped around Plevna, which were now known as the Western army. But the authority vested in Prince Charles was small, as the Commander-in-Chief, the Grand Duke Nicholas, was living in the vicinity, not to mention the Tsar himself and General Milutin, the War Minister. By this time the Russians had mobilized a huge army.

Meantime Suleiman Pasha was ordered to join Osman, but he was instructed firstly to capture the Shipka Pass which he attempted to do Aug. 21. Severe fighting took place for several days, but Radetsky, being reinforced, maintained his position, beating off every hostile attack. Suleiman in five days having lost 10,000 men, a quarter of his effective strength, decided to fall back on Kazanlik, leaving detachments by the pass. Hearing that Suleiman had been forced to give up momentarily the attempt to capture the Shipka Pass, the Russians began to fear that he might endeavour, by using the Rosalita and Trojan Passes, not only to turn the Shipka Pass, but by moving via Lovcha to get into communication with Osman Pasha, who might at any moment make for Tirnova. For this purpose Prince Imeretinsky was ordered to drive a Turkish detachment from Lovcha, which he forced to retire into Plevna. Leaving a brigade to guard the town, Imeretinsky fell back on Bogot. The Allies now decided to assault Plevna again, for which purpose they assembled about 100,000 men. Three Rumanian divisions were to advance from Grivitza, four Russian from Radishevo, and a division, having a brigade in reserve under Skobeleff, facing the Green Hills. A long artillery preparation took place Sept. 7–11, but the allies failed to make any proper reconnaissance, for which they had to pay a severe penalty, thousands of lives being sacrificed in vain. They advanced on the 11th, but failed to break the Turkish circle of defence. The Rumanians captured a redoubt at Grivitza, but were held up at Radishevo; Skobeleff on his part established himself on the Green Hills, but was thrown back the next day by Osman Pasha, who used his reserves for the counter attack. A serious crisis now arose among the Allies and a council of war was held. Many of the members, including Milutin, the War minister, urged that the army should recross the Danube and renew the advance the following spring with increased forces. This opinion was over-ruled, the Tsar showing great determination, and it was decided to invest Plevna, entrusting all operations to General Todleben, the heroic defender of Sevastopol during the Crimean War. With his arrival, the Russians gained confidence and renewed energy, one and all feeling they were at last being led by a masterly head, that chaos was replaced by order. The Guard Corps, on arriving from Russia, was sent to cut the Turkish communications and the enemy was driven out of Gorni Dubniak and Telish by General Gourko, Plevna being thus cut off from the outer world In the middle of Nov. the Russians stood as follows: 12 divisions around Plevna, 6 on the Lom; 3 by the Shipka Pass;

23 on the Plevna-Orhanie road.

Suleiman, now commanding the main Turkish army, took the offensive, crossed the Lom and attacked the Russians at Mechka and Tristenik Nov. 19 and 26, but both times sustained a repulse. Vessil Pasha, who now in place of Suleiman stood facing the Shipka Pass, had been considerably weakened through sending reinforcements to aid Mohammed Ali near Sofia, and he could only muster 20,000 men. Meanwhile Gourko, hearing of Mohammed's preparations to relieve Plevna, urged that the Russians should advance boldly on Sofia, thereby depriving the enemy of the initiative. This plan being agreed to, Gourko, at the head of 30,000 men, drove the Turks out of Entropol, forcing Mohammed to retreat to Araba Konak Nov. 23. Gourko disposed of too small a force to be able to pursue the enemy, and so took up a position near Orhanie. Meantime in Plevna Osman's provisions were getting shorter every day, and ultimately he attempted a sortie, hoping to cut his way through Berkovitza to Sofia. After several hours severe fighting, however, Osman was convinced of the impossibility of breaking through, and surrendered with his whole army, about 40,000 men, on Dec. 10.

The Russians now decided to move on Sofia, cross the Balkans, relieve Shipka from the south and attack Vessil Pasha, the Tsarevitch with his 70,000 men being left to guard the communications. Gourko on Dec. 23 advanced with 5½ divisions against the Turks but on reaching Toshkesen he found that the Turks had already retreated. The Russians, after occupying Sofia, followed the enemy, who was making for Tatar Bazardjik. There Suleiman assumed command, having collected a force 50,000 strong, including reinforcements from Shumen. Radetsky began his attack on Jan. 5 at Shipka, being aided by two columns coming on his left and right; the western, Skobeleff with 17,000; the eastern, Prince Imeretinsky with 19,000 men. The Prince's advance was held up, while Skobeleff, delayed, came on the scene only the following day, when they together captured the Turkish entrenched camp two miles south of the Pass, forcing Vessil Pasha to capitulate with 36,000 men. Suleiman, on hearing of Vessil Pasha's surrender, made for Philipopolis, Gourko following in direct pursuit, while Radetsky cut off his retreat from Adrianople, entering the town with his advanced guard on Jan. 19. After several minor actions near the town Suleiman retreated to the south over the Rhodope Mountains direct to the coast reaching Enos on Jan. 28. His forces were then shipped to Constantinople. The Russians advanced rapidly towards the Turkish capital, reaching the Chataldja lines on Jan. 30. Next day an armistice was concluded, the terms being greatly modified at the Berlin conference which took place the following July, when Russia was deprived of many important concessions, which greatly irritated both the nation and the army. Bulgaria now became an independent principality, while Eastern Roumelia was to be under the protectorate of Turkey.

While these events were taking place in Europe military operations were simultaneously being carried on in the Caucasus. The Grand Duke Michael, the Tsar's brother, commanded the Russian forces which were 65,000 strong. The Turks numbered 70,000 men under Mukhtar Pasha. The same mistake was committed in the Caucasus as had been done in Europe — the Russian army finding itself too weak was obliged to await reinforcements, which arrived by the end of August when they began their advance. The first serious battle occurred on Oct. 13, at Aladja Dagh, when the Turks were defeated, a part of their forces hurriedly making for Kars, which was an important fortress, while the other portion fled to Erzerum. Kars was now invested. A month later on Nov. 18, the Russians stormed and captured it. This was a brilliant feat of arms, perhaps the finest Russian exploit throughout this war. Their communications now being assured, the Russians moved rapidly towards Erzeroum, but the severe winter weather and the strength of the fortifications prevented them capturing it as quickly as they had hoped. When the armistice was concluded Erzeroum was still holding out, but the Turks were now forced to evacuate it under the terms of the armistice. The Russo-Turkish War amply proved the truth of the military maxim that to wage war with insufficient forces is highly risky. The Russians were many times on the brink of disaster, which would most certainly have occurred had they been faced by abler Turkish leaders and more efficiently trained troops. (A. SMI.)

RUST, a term usually applied to the reddish deposit formed on iron and having the approximate chemical composition $2Fe_2O_3.3H_2O$. See also CORROSION AND OXIDATION OF METALS. For a description of plant rusts see FUNGI: *Basidiomycetes* (Club Fungi).

RUSTICATION, in architecture, a form of masonry in which the stones have their edges cut back to a careful plane surface but with the central portion of the stone face either left rough or projecting markedly. (See DRAFTED MASONRY.) Rusticated masonry is found in the platform of the tomb of Cyrus at Pasargadae in Persia (560 B.C.) and is common in certain types of Greek and Hellenistic work, such as retaining walls and the like. It was similarly used for terrace and retaining walls by the Romans, who also realized its decorative value and employed it not only for such utilitarian works as the Pont du Gard at Nimes, France, and the aqueduct at Segovia, Spain (c. 109), but also decoratively as in the Porta Maggiore at Rome (time of Claudius), where the rustication is very rough, and the walls of the temple of Augustus at Vienne, France (c. 41), in which the rustication is carefully finished, the faces of the stone cut to a plane and the edges very delicately sunk.

The early Renaissance architects developed this tradition still further and in the 15th-century palaces in Florence used it with magnificent effect. Thus in the Pitti palace by Brunelleschi (1458), the Riccardi by Michelozzo (1444–52) and the Strozzi by Benedetto da Maiano (1489) the carefully studied rustication forms the chief element in the design; and in the Rucellai, from designs by Alberti (1446–51), the wall surfaces between the pilasters are delicately rusticated. During the baroque period rustication assumed great importance in garden and villa design, and all sorts of fantastic surfaces were employed on the projecting portions of the stones, such as vermiculated work, in which the surface is covered with wavy and serpentine sinkages like worm-eaten wood or treated with vertical dripping forms like lime deposits from dripping water. Sometimes the stones had sides beveled and brought to a point or ridge in the centre.

The use of rustication was introduced into England by Inigo Jones, as in the gate of the Botanic gardens at Oxford (1632), and became a dominant feature in much English Renaissance work. In American colonial work this influence is seen in the occasional shaping of outside sheathing boards to imitate rusticated masonry, as in portions of the Morris-Jumel house in New York (1765). Quoins, or corner blocks, are, in many styles, rusticated, where the face of the wall is left smooth.

RUTABAGA (*Brassica napobrassica*), also known as the swede turnip, is a root crop grown in cool climates, in Canada, Great Britain and northern Europe, but little cultivated in the United States. See TURNIP.

RUTACEAE, a family of dicotyledonous plants, mostly shrubs and trees, comprising about 144 genera and 1,600 species, found in temperate and tropical regions, and especially abundant in Australia and south Africa. Ruta graveolens is rue (*q.v.*). Citrus includes the grapefruit, orange, lemon (*qq.v.*), etc. Chloroxylon *swietenia* is satinwood (*q.v.*); Ptelea trifoliata is shrubby trefoil or wafer ash; Zanthoxylum *americanum* is prickly ash (*q.v.*).

RUTBA WELLS, a post and watering place in the Syrian desert, in 33° N. and 40° E. The post, which is the headquarters of part of the desert police, is the most westerly occupied place in Iraq. Westward from this point, L. H. D. Buxton found considerable traces of Paleolithic remains in the desert.

See L. H. D. Buxton, ***Antiquaries* Journal** (1926).

RUTEBEUF or RUSTEBUEF (fl. 1245–1285), French *trouvère*, was born in the first half of the 13th century. His name is nowhere mentioned by his contemporaries. He frequently plays in his verse on the word Rutebeuf, which was probably a pseudonym. Some of his poems have autobiographical value. In Le *Mariage* de Rutebeuj he says that on Jan. 2, 1261, he married a woman old and ugly, with neither dowry nor amiability. In the

Complainte de Rutebeuf he details a series of misfortunes which have reduced him to abject destitution. In these circumstances he addresses himself to Alphonse, comte de Poitiers, brother of Louis IX, for relief. His distress could not be due to lack of patrons, for his metrical life of Saint Elizabeth of Hungary was written by request of Erard de Valéry, who wished to present it to Isabel, queen of Navarre; and he wrote elegies on the deaths of Anceau de l'Isle Adam, the third of the name, who died about 1251, Eude, comte de Nevers (d. 1267), Thibaut V of Navarre (d. 1270) and Alphonse, comte de Poitiers (d. 1271), which were probably paid for by the families of the personages celebrated. In the *Pauvreté de Rutebeuf* he addresses Louis IX himself.

The piece which is most obviously intended for popular recitation is the *Dit de l'Herberie*, a dramatic monologue in prose and verse supposed to be delivered by a quack doctor. Rutebeuf was also a master in the verse *conte*, and the five of his *fabliaux* that have come down to us are gay and amusing. The adventures of *Frère Denyse le cordelier*, and of *"la dame qui alla trois fois autour du moûtier,"* find a place in the *Cent Nouvelles nouvelles*.

Rutebeuf's serious work as a satirist probably dates from about 1260. His chief topics are the iniquities of the friars, and the defense of the secular clergy of the university of Paris against their encroachments; and he delivered a series of eloquent and insistent poems (1262, 1263, 1268, 1274) exhorting princes and people to take part in the crusades. He was a redoubtable champion of the university of Paris in its quarrel with the religious orders, and he boldly defended Guillaume de Saint-Amour when he was driven into exile. The libels, indecent songs and rhymes condemned by the pope to be burned together with the *Périls des derniers temps* attributed to Saint-Amour, were probably the work of Rutebeuf. The satire of *Renart le Bestourné*, which borrows from the Reynard cycle little but the names under which the characters are disguised, was directed, according to Paulin Paris, against Philip the Bold. To his later years belong his religious poems, and also the *Voie de Paradis*, the description of a dream, in the manner of the *Roman de la Rose*.

The best work of Rutebeuf is to be found in his satires and verse *contes*. A miracle play of his, *Le Miracle de Thkophile*, is one of the earliest dramatic pieces extant in French.

BIBLIOGRAPHY.—The *Oeuvres* of Rutebeuf were edited by Achille Jubinal in 1839 (new edition, 1874); a more critical edition is by Dr. Adolf Kressner (*Rustebuef's Gedichte;* Wolfenbuttel, 1885). *See* also the article by Paulin Paris in *Hist. litt. de la France* (1842), vol. xx, pp. 719–783, and *Rutebeuf* (1891), by *M.* Léon Clédat, in the *Grands Écrivains français* Series

RUTGERS UNIVERSITY, the state university of New Jersey, has its main campuses in New Brunswick, N.J., with major centres in Newark and Camden. It offers undergraduate and graduate instruction for both men and women.

The university dates from Nov. 10, 1766, when Queen's college was chartered as the eighth college in the American Colonies. It owed its founding largely to the zeal for religion and education of Dutch settlers of the reformed Protestant faith who saw the need of an institution of higher learning that might provide training for candidates for the ministry. The New Brunswick Theological seminary was affiliated with the college until 1856. Classes began in 1771 in New Brunswick, but during the American Revolution the small student body was forced to evacuate the city and meet elsewhere. In 1809 Queen's building, a splendid example of Georgian Colonial architecture designed by John McComb, was erected and for several decades housed all the college work. It became the main administration building of the university.

In 1825 the name of the institution was changed to Rutgers college in honour of Col. Henry Rutgers. a leading churchman and philanthropist of New York city. In 1864 the state legislature designated the newly organized Rutgers Scientific school to be "The State College for the Benefit of Agriculture and the Mechanic Arts," and in 1917 the land-grant units were declared to be the state university of New Jersey. Rutgers is the only land-grant college with a colonial charter. In 1880 the New Jersey Agricultural Experiment station was located at the college farm.

The New Jersey College for Women was created in 1918 by the trustees of Rutgers as an integral part of the university but with a separate campus in New Brunswick. The name "Rutgers University" was adopted in 1924, although the corporate title remained "The Trustees of Rutgers College in New Jersey." Divisions, with the dates of their founding or their association with the university, are: the college of arts and sciences (1766), the college of engineering (1864), the college of agriculture (1864), the school of education (1923), the university extension division (1925), the college of pharmacy (Newark, 1927), the graduate faculty (1932), University college (1934), the Newark Colleges of Arts and Sciences (Newark, 1946), the school of business administration (1946), the school of law (Newark and Camden, 1946, 1949), the institute of microbiology (1949), and the College of South Jersey (Camden, 1950).

Rutgers university was designated by legislation effective July 1, 1945, as the state university of New Jersey "to be utilized as an instrumentality of the State for providing public higher education" on a contractual basis, and the state board of education was given "visitorial general powers of supervision and control" over the university. Management of the institution was vested in a board of trustees of 58 members, 16 of whom would represent the state, seven the alumni and one the State Federation of Women's Clubs. Thirty-four "charter trustees" are elected for life terms by the board.

About 50 courses of study leading to the degrees of bachelor of arts, bachelor of letters, bachelor of science and bachelor of laws were established. Graduate instruction leading to the degrees of master of arts, master of science, master of laws, master of education, doctor of education and doctor of philosophy is also offered. There were more than 6,600 full-time students in the latter 1950s. (R. P. McC.)

RUTH, BABE (GEORGE HERMAN RUTH) (1895–1948), U.S. baseball player, the game's most popular figure and holder of the all-time home-run record of 60 in a 154-game season (1927), was born on Feb. 6, 1895, in Baltimore. Md., into a poverty-stricken environment. At age seven he nent to live at St. Mary's Industrial school in Baltimore, where he spent much of his boyhood and where he first became interested in athletics.

The "Sultan of Swat" hit a total of 714 home runs in 22 big league seasons. He finished with a lifetime batting average of .342, but of all his records he was proudest of having pitched $29\frac{2}{3}$ scoreless innings for the Boston Red Sox in the world series—against the Brooklyn Dodgers in 1916 and the Chicago Cubs in 1918. He was the best left-handed pitcher in the American league when he was moved to the outfield because of his slugging.

Ruth batted and threw left-handed. He stood 6 ft. 2 in. and weighed 21 j lb. He began his professional career at Baltimore in 1914 and was sold later that season to the Boston Red Sox for an estimated $2,900. In Jan. 1920 Ruth was sold to the New York Yankees for $125,000. During his major-league career Ruth broke more than 50 records. He led the American league in home runs for 12 years; he hit at least 50 home runs in four separate seasons and at least 40 in each of 11 seasons. He played in ten world series—three with the Red Sox and seven with the Yankees.

In 1922 he was suspended for 30 days for an unauthorized barnstorming tour. In 1925 he was fined $5,000 by Yankee manager Miller Huggins for "misconduct off the ball field." In 1930 and 1931 Ruth received a salary of $85,000 per season, then the all-time high. He played his last season (1935) with the Boston Braves, was released June 2, 1935, and concluded his baseball career as coach of the Brooklyn Dodgers in 1938 He was one of the first five players elected to Baseball's Hall of Fame at Cooperstown, N.Y., in 1936. Ruth died on Aug. 16, 1948, in New York city. In 1961 Roger Maris of the New York Yankees hit 61 home runs, a record for the 162-game baseball season, but because Maris hit only 59 in the first 154 games of the season Ruth's record stood. (J. D. McC.; X.)

RUTH, BOOK OF, in the Old Testament. The story of Ruth. the Moabitess, great-grandmother of David. is one of the Old Testament Hagiographa *(see* BIBLE: *Hagiographa*). On the other hand, it follows Judges in the Septuagint, the Vulgate and the English version. Although a *late* rearrangement might transfer Ruth from the Hagiographa, to the historical books

and place it between Judges and Samuel, no motive can be suggested for the opposite change, unless it had been placed in the last part of the Jewish canon after the second (with the historical books) had been definitely closed. Moreover, the book is untouched by the "prophetic" or "Deuteronomic" editing, which gave the "Former Prophets" (Joshua–Rings) their present shape after the fall of the kingdom of Judah. Nor has the narrative any affinity with the view that the history of Israel was a series of examples of divine justice and mercy in the successive rebellions and repentances of the people of God. Finally, had the book been known when Joshua–Kings was edited it could hardly have been excluded, since David's ancestry (iv, 17, 18–22) was of greater interest than Saul's (given in 1 Sam. ix, 1), whereas the old history names no ancestor of David beyond his father Jesse.

Date.—The book of Ruth deals with a distant past (Ruth i, 1), and delights in depicting details of antique life and obsolete usages (iv, 7). It views the stormy period before the kingship through the softening atmosphere of time, in contrast to the harsher colours of the old narratives of the book of Judges. It has been argued that, as the author seems to take no offence at the marriage of Israelites with Moabite women, he must have lived before the time of Ezra and Nehemiah (Ezra ix; Neh. xiii); but the same argument would prove that the book of Esther was written before Ezra. The very designation of a period of Hebrew history as "the days of the judges" is based on the exilic "Deuteronomic" parts of the book of Judges (ii, 16 sqq.), and although the language sometimes recalls the narratives in Samuel and Kings, it can be assumed, either that the book is the work of a late author acquainted with the earlier literature, or that an old narrative was rewritten. The fact that the language is in contrast to that of Chronicles, Ezra, Nehemiah, etc., has no force since writings evidently more or less contemporary did not necessarily share the same characteristics (observe, for example, the prose parts of Job).

Purpose.—Like the stories appended to Judges, the book of Ruth connects itself with Bethlehem, the birthplace of David. Some connection between Bethlehem and Moab has been found in 1 Chron. iv, 22 (where the Targum and rabbinical exegesis discover references to the story of Ruth), and is explicitly suggested by the isolated 1 Sam. xxii, 3 seq., which knows of some relationship between Moab and David. Next, the writer claims the sympathy of his readers for Ruth, upon whose Moabite origin he insists, and this is noteworthy in view of the aversion with which intermarriage was regarded at a certain period (Deut. xxiii, 3; Neh. xiii; Ezra ix *seq.*). The independent evidence for the present late form of the book has led many scholars to the conclusion that it was directed against the drastic steps associated with the reforms of Ezra and Nehemiah, which, as is known, were not everywhere acceptable. Thus, not only have we a beautiful portrait of a woman of Moabite origin, but she becomes the ancestress of David himself; and in the days of these measures the simple story would raise the question whether the exclusiveness of Judaism was being carried too far.

BIBLIOGRAPHY.—*See* S. R. Driver, ***Lit.*** *of the Old,* Text.; C. F. Kent, Beginnings *of* Hrb. *Hist.* p. 310 seq.; Cannon, Theology vol. xvi, pp. 310–319, all of whom favour a pre-exilic origin. W. Robertson Smith's art. in the Ency. ***Brit.*** 9th and 11th ed. (portions of which are here retained) was revised and supplemented by T. K. Cheyne in Ency. ***Bib.*** (S. A. C.)

RUTHENIA (Ukr. CARPATHO-UKRAINE; Hung. RUTENFÖLD; Czech SUBCARPATHIAN RUTHENIA), a region lying southwest of the central Carpathian mountains; bounded W. by Slovakia, S.W. by Hungary. S. by Rumania and N.E. and N. by the western (formerly Polish) Ckraine. Much of the country is mountainous, deeply dissected by incised valleys which often open into broad, fertile basins in their upper courses. The southern edge of the highland is heavily forested with beech on its loner levels and conifers on the higher. But the plain, largely the drainage basin of the upper Tisza and its tributaries, is the important region. Sheltered from the cold winds of the north and northeast, it receives the full benefit of the moist southwesterly currents and the climate is ideal for cereal cultivation.

Before World War I Ruthenia had been a much neglected part of Upper Hungary. Agricultural methods were primitive and insufficient to assure an adequate standard of living to the population which in its large majority was Ruthenian. a Slavonic people closely related to the Ukrainians. Industrial activity was very small, illiteracy widespread. and the Ruthenian peasants without any initiative as a result of centuries of servitude.

The peace treaty of Trianon (June 4, 1920) brought the country under Czechoslovak administration. The Czechs founded a large number of schools with Ruthenian as the language of instruction, combatted illiteracy and the low state of public health and helped to modernize the economic life. The area of the province was 4,886 sq.mi.; the population in 1930 was 725,357, including 450,925 Ruthenians (62%), 115,805 Magyars (16%), 95,008 Jews, 34,511 Czechs and Slovaks and 13.804 Germans. With regard to religion 49.5% belonged to the Greek Catholic Church and 15.4% to the Greek Orthodox Church. Uzhgorod, the capital, had 32,250 inhabitants in 1941 and about 43,000 in 1956.

Following the Munich agreement of Sept. 29, 1938 (*i.e.,* the first partition of Czechoslovakia), the Prague government appointed on Oct. 9 an autonomous Ruthenian government headed by Father Augustin Voloshyn. By their Vienna award. on Nov. 2, 1938, Germany and Italy forced Ruthenia to cede to Hungary the southern districts including the capital city of Uzhgorod (Ungvar); 606 sq.mi. in all. Voloshyn moved the capital of the remaining part to Khust. On March 14, 1939, at the time of the second partition of Czechoslovakia. Voloshyn proclaimed the independence of his country. which was renamed Carpatho-Ukraine. Independence lasted one day before the Germans authorized occupation and annexation by Hungary.

When Czechoslovakia was restored in its pre-1938 frontiers after World War II, the Soviet government obtained from the Czechoslovak government the cession of Ruthenia. A formal treaty to this effect was signed in Moscow on June 29. 1945, Ruthenia becoming the Zakarpatskaya (Transcarpathian) *oblast* of the Ukrainian S S.R. On March 9, 1946. its Greek Catholic population was forced to abandon its faith and join the Greek Orthodox Church. The area of the Zakarpatskaya oblast is 4.916 sq.mi.; pop (1959) 920.173. Chief towns: Uzhgorod (cap), Mukachevo, Khust, Beregovo and Vinogradov (formerly Sevluysh).

Sre Michael Winch, Republic *for* a Day (London, 1939); Oscar Jaszi, "The Problem of Sub-Carpathian Ruthenia," in R. J. Kerner, ed, *Czechoslovakia;* Twenty Years of Independence (Berkeley, 1940; London, 1941). (H. Ko.; X.)

RUTHENIANS, a name also applied to those Ukrainians, or Little Russians. who were formerly Austrian subjects. The name is simply a Latinized form of "Russian," the terms "Red Russian," etc., being due to false derivations. When, honever the early Ruthene states lost their independence. the term "Russia" was monopolized by the Muscovite state which, anxious to deny to the Ruthenes a national individuality, gave them the name of "Little Russians." The Ruthenes themselves adopted the distinguishing title of "Ukrainians," *i.e.,* inhabitants of the Turko-Tatar frontier in S. Russia. The name Ruthene survived among the subjects of Poland and Lithuania, and later, Austria. The Ruthenians are thus neither more nor less than Ukrainians, and their linguistic and ethnographical features are described under that head. Yet they can be distinguished from the Ukrainians of Russia, both by their separate history (see POLAND, GALICIA) and bv their religion. After Galicia and Volhynia came under Polish and Lithuanian rule in the 14th century. their upper classes were soon assimilated into the conquering nations, whose language and Catholic faith they adopted. The peasants sank into a state of great degeneracy, which was largely due to the decadence of their own Orthodox priests; recognizing which, they themselves proposed union with Rome. This was proclaimed by the Pope and accepted by the Ruthenes at the Union of Brest-Litovsk, Oct. 6–10, 1596. Under this new "Uniate Church," the Ruthenes retained their Slavonic liturgy and most of the outward forms of the Greek Orthodox Church, while acknowledging the spiritual supremacy of the Pope. Although the two liturgies were nominally entitled to equal treatment in Poland, actually the Uniate was always treated as inferior, and its adherents sank into a lamentable state of ignorance and poverty, due partly to the ex-

actions of their feudal masters, partly to national oppression, partly to their portentous capacity for consuming fiery liquor, their habit of keeping the holidays of both Julian and Gregorian calendars (in 1860 16 districts in Galicia kept 160–200 days annually as holidays) and their superstitions (in 1807 a method of exorcising cattle plague was to place the carcasses of stricken animals in the wells, pastures and stables of uninfected districts).

On the partition of Poland, a number of Ruthenes passed back under Russian rule. Many of them were quickly reconverted to the Orthodox faith. and every effort was made to russify them. The Orthodox propaganda was extended to Galicia (see PAX-SLAVISM) but the results were more sensational than practical. The Russian government systematically discouraged Ruthenian nationalism until after the revolution of 1905, when some relaxation was made in the oppressive regulations. Similar efforts were made by the Poles of Galicia. and winked at by the Austrian government, but there something was done for the Ruthenes, A metropolitan bishopric was founded at Lemberg in 1806. and suffragates added at Przemysl and Stanislau. In 1877 a Ruthenian chair was established at Lemberg university, but Austria never granted a separate Ruthenian university, in spite of agitation.

After World War I the largest body of Ruthenes, those in east Galicia, claimed the right of self-determination, but their short-lived state was soon absorbed into Poland (see GALICIA). The Ruthenes in the northeast Carpathians were granted to Czechoslovakia, special guarantees being laid down for their national autonomy. They were formed into the province of Subcarpathian Russia (see CZECHOSLOVAKIA). The Ruthenes of Bessarabia and the Bukovina came under Rumanian rule (where the state religion was orthodox), with the protection of the Rumanian Minorities treaty.

The population of Transcarpathian oblast, formerly known as Ruthenia (*q.v.*) and bounded on northwest by Poland. west by Czechoslovakia, south by Rumania and southwest by Hungary, was (1956 est.) 929,000. The region, controlled briefly by Czechoslovakia during World War II, was ceded to the Soviet Union in Sept. 1945. It became an administrative unit of the Ukrainian Soviet Socialist Republic. See UKRAINE, POLAND, RUSSIA, etc.

See also the publications of the League for Ukrainian National Independence (1919–22). (C. A. M.)

RUTHENIUM is one of the platinum metals and resembles platinum in its silver-gray colour and lustre. It is found in small percentages in a number of platinum ores. It was identified as a chemical element in 1844 by Carl Claus, in Russia, and was the last of the platinum metals to be characterized. (See PLATINUM METALS.) The name was selected in honour of the district of Ruthenia by G. W. Osann in 1828, when he made a premature announcement of the discovery of the element in platinum ore from the Ural mountains. Although Osann's announcement was never confirmed, Claus retained the name.

Among the metals of the platinum group, only osmium is more infusible than ruthenium; the melting point of ruthenium is 2,450° C., and its boiling point. which can only be surmised, is estimated to be above 2,700° C. Because of the high melting point, ruthenium is not easily cast; its brittleness, even at a white heat. makes it very difficult to roll or draw into wires. Thus the industrial application of ruthenium is restricted to use as an alloy for platinum and other metals of the platinum group. It serves the same function as iridium for the hardening of platinum and, in conjunction with rhodium, is used to harden palladium. Ruthenium-hardened alloys of platinum and palladium have been found much superior to the pure metals in the manufacture of fine jewelry.

The chemical symbol of ruthenium is Ru, atomic number 44. atomic weight 101.1, specific gravity 12.38. Ruthenium is one of the group of more than 30 elements whose radioactive isotopes are formed when uranium and plutonium atoms disintegrate by the fission process. One of these ruthenium isotopes (Ru^{106}) emits beta rays with a half life of one year to yield a daughter, rhodium-106. Also radioactive, rhodium-106 emits high-energy beta rays and gamma rays with the half life of 30 seconds. This pair of isotopes contributes an important fraction of the residual radiation from uranium or plutonium fuels of fission-type atomic reactors which have "cooled" for a year following their use. The separation of ruthenium from the fissionable elements must be effected before these expensive fuels can be recovered and reprocessed to attain economically competitive atomic power. The chemical effects and hazards of intense radiation impose severe difficulties on the separation process. Similarities in the chemical behaviour of plutonium and ruthenium, in many cases,, make the separation even more difficult.

Ruthenium metal is not attacked by air in the cold. Heated in air or oxygen from about 700° to 1,200° C.. the powdered metal yields a dark blue dioxide, RuO_2, which decomposes at still higher temperatures. The element effectively resists attack by strong acids. even by aqua regia which readily dissolves platinum and gold. Ruthenium metal and the mineral alloys of ruthenium. osmium and iridium are most easily brought into soluble form by fusion with an alkaline oxidizing flux. Compounds, such as K_2RuO_4 (+6 state) and $KRuO_4$ (+7 state); are formed. When these compounds dissolve in aqueous systems, they usually decompose rapidly to lower oxidation states. Like all platinum elements, ruthenium can be readily reduced from its compounds to give free metal. Separation of ruthenium from other heavy metals is conveniently achieved by forming the tetraoxide. RuO_4, which is so volatile it readily distills from aqueous solutions. Osmium is the only other element which can form so high an oxidation state. However. OsO_4 is formed more readily and can be distilled from nitric acid alone. The formation of RuO_4 requires stronger oxidizing agents, such as bromate ion in acids or chlorine in alkaline solutions. RuO_4 is the only known compound of the element with the +8 oxidation state. It must be handled cautiously, for it is extremely poisonous, and above 100° C. it may decompose explosively. Although evidence for compounds of ruthenium in every oxidation state from 0 through +8 has been claimed, the +3, +4, +6 and +8 states are the most important.

The +3 and +4 oxidation states include numerous co-ordination complexes in which water or ammonia molecules. chloride ions or other groups are bonded covalently to a central ruthenium ion. Typically, six atoms bond to ruthenium. and the complexes are the inert type, in that groups are not replaced rapidly. Many of these co-ordination complexes possess striking colours. which facilitate chemical studies. The +3 or +4 oxidation states are readily interconvertible so that frequently in the past, errors have been made in the assignment of state to a particular compound'; *e.g.*, the compound which Claus originally thought was $K_2[RuCl_5]$, +3 state, proved to be $K_2[RuCl_5(OH)]$, +4 state. Exceptionally stable nitrosoruthenium compounds, containing NO groups bonded to the ruthenium ion, frequently form in the presence of nitric oxide. NO, or nitrate ion. Indeed, a salt which early workers believed mas $K_2[RuCl_6]$ was later shown to be $K_2[RuCl_5(NO)]$. More nitroso compounds are known for ruthenium than for any other element.

Solutions of ruthenium compounds with many reducing agents, such as zinc or hydrogen sulfide, give blue solutions containing the +2 state. A compound, $K_4[Ru(CN)_6]$, is an analogue of the familiar iron (II) compound. The carbonyl. $Ru(CO)_5$, represents the zero state. The only compound in the +5 state is the fluoride, RuF_5, prepared by the reaction between the elements.

(D. S. MN.)

RUTHERFORD, ERNEST RUTHERFORD, 1ST BARON. OF NELSOX AXD CAMBRIDGE (1871–1937), British physicist. winner of the Nobel prize in chemistry for 1908. whose researches in radiation and atomic structure were basic to the later 20th-century developments in nuclear physics. Born at Nelson, N.Z., on Aug. 30, 1871, he received his secondary training at Nelson college and, on graduation in 1889, gained a scholarship at the University of New Zealand, Wellington. By 1893 he had taken his M.A. degree with a double first in mathematics and physics.

In 189; Rutherford won an 1851 exhibition scholarship which took him to Cambridge university. At the Cavendish laboratory his ability was recognized at once by J. J. Thomson. His earliest research there was a detector for electromagnetic waves, its essential feature being a small magnetizing coil containing a tiny bundle of magnetized iron wire. Rutherford's second piece of

work, done jointly with Thomson, dealt with the temporary conduction in gases which results from ionization produced by X-rays.

In 1897 Rutherford worked with Thomson upon the mobility of ions and related topics, but especially upon the negative ions emitted when ultraviolet light falls upon a clean metal surface. The discovery of Becquerel rays and radium had aroused his curiosity as to just what kind of ions are emitted by radium. At this juncture Rutherford accepted a call to McGill university, Montreal, Que. On reaching the Macdonald laboratory there. in the autumn of 1898, he at once continued work begun at Cambridge on the radiation from radium, and reported in 1899 that it is quite complex, consisting first of all of easily absorbed rays—rays which are stopped by a few centimetres of air. These he called alpha rays. Besides these, he found uranium giving a far more penetrating radiation, able to pass through a sheet of aluminum several millimetres thick. These he named beta rays, and they proved to be high-speed electrons.

Rutherford's next work at Montreal was done jointly with R B. Owens. It was a study of thorium emanation, which led to the discovery of a new noble gas, an isotope of radon, later known as thoron. After Frederick Soddy came to McGill university in 1900, he and Rutherford created the modern theory of radioactivity, excellently set forth in Rutherford's *Radioactive Substances and Their Radzations.*

In 1907 Rutherford accepted an invitation to succeed Sir Arthur Schuster in the Langworthy professorship at Manchester university. It was about this time that he and J. T. Royds proved that alpha particles consist of helium atoms. The Nobel prize was presented to Rutherford on Dec. 11, 1908, two years before he began thinking about the scattering of alpha rays and the nature of a nucleus which could produce such scattering—his nuclear theory—the greatest of all his contributions to physics. In 1912 Niels Bohr came to work in the Manchester laboratory, and it was there that Bohr adapted the nuclear structure of Rutherford to the quantum theory of Max Planck and thus obtained an atomic structure which satisfied the experimental findings of J. R. Rydberg and other spectroscopists. About this time H. G. Moseley got in touch with Rutherford and worked with him during the year 1913. Moseley bombarded the atoms of various elements with cathode rays and proved that the inner structures of these atoms (with the positive charge on the Rutherford nucleus) respond in a group of lines which characterize the elements much as the natural numbers might do, so that each element can be assigned its atomic number. The importance of this discovery lies in the fact that the properties of an element are defined by its atomic number.

After World War I, in which he worked on methods of submarine detection, Rutherford succeeded, by the bombardment of nitrogen uith alpha particles, in transmuting the element nitrogen with an isotope of oxygen. *(See* NUCLEUS. *Description and History.)*

In 1919 Rutherford was invited to succeed J. J. Thomson in the Cavendish chair at Cambridge. Honours now came in rapid succession. Rutherford had been knighted in 1914. The Copley medal of the Royal society was bestowed on him in 1922; the presidency of the British Association for the Advancement of Science in 1923, to be followed, two years later, by the presidency of the Royal society. In 1925 he was appointed to the Order of Merit. In 1931 he was created 1st Baron Rutherford of Nelson. He died at Cambridge on Oct. 19. 1937.

Rutherford, together with J. Chadwick and C. Ellis, wrote *Radiations From Radioactive Substances* (1930), a book so thoroughly documented that it serves every need in the way of a chronological list of Rutherford's published papers.

See A. S. Eve, *Rutherjord* (1939). (H. Cw.; X)

RUTHERFORD, MARK, the pen name of William Hale White (1829–1913), English author, born at Bedford, Eng. His father, William White, a member of the nonconformist community of the Bunyan meeting. moved to London. where he was well known as a doorkeeper of the house of commons; he wrote sketches of parliamentary life for the *Illustrated Times*, papers afterward collected by his son as *The Inner Life of the House* of *Commons* (1897). The son was educated at Cheshunt and New College for the Congregational ministry, but the development of his views prevented his following that career, and he became a clerk in the admiralty.

He had already served an apprenticeship to journalism before he made his name as a novelist by the three books "edited by Reuben Shapcott," *The Autobiography oj Mark Rutherford* (1881), *Mark Rutherford's Delizerance* (1885), and *The Revolution in Tanner's Lane* (1887). Under his own name he translated Spinoza's *Ethics* (1883, new ed. 1894). Later books are *Miriam's Schoolzng, and other Papers* (1890), *Catherine Furze,* 2 vol. (1893), *Clara Hopgood* (1896), *Pages from a Journal, wzth other Papers* (1900), *John Bunyan* (1905), *More Pages from a Journal* (1910) and *Last Pages* (1915) which was edited by his wife Though for a long time little appreciated by the public, his novels—particularly the earlier ones—have a power and style which must always give his works a place of their own in the literary history of their time. He died at Groombridge, Sussex, on March 14, 1913.

See A. *E.* Taylor, "The Novels of Mark Rutherford" in *Essays and Studies* by members of the English association (1913–14).

RUTHERGLEN (locally pronounced *Rŭglen*), a royal and large burgh of Lanarkshire. Scot., 3 mi. S.E. of Glasgow, on the left bank of the Clyde. Pop. (1961) 25,067. Area 1.6 sq.mi. It is connected with the east of Glasgow by two bridges. The parish church stands near the spire of the ancient church where, according to tradition, the treaty was made in 1297 with Edward I, by which Sir John Menteith undertook to betray William Wallace to the English. Rutherglen was erected into a royal burgh by David I in 1126 and claims to he the oldest in Scotland. It then included a portion of Glasgow, but in 1226 the boundaries were rectified so as to exclude the city. and Rutherglen continued to resist incorporation with Glasgow. In early times it had a castle, which after the battle of Langside (1568) was burned by order of the regent Moray. In 1679 the Covenanters published their "Declaration and Testimony" at Rutherglen. The collieries in the area were worked out; the principal industries now include chemical works, paper mills. laundries and oatcake bakeries. and the making of' fireplaces, chairs and textiles, and light and structural engineering.

RUTHIN, a market town and municipal borough (1282) in the West Denbighshire parliamentary division of Denbighshire, Wales 5 mi. S.E. of Denbigh. Pop. (1961) 3.502. Area 3.1 sq mi. It stands on a hill above the Clwyd and is the administrative centre for Denbighshire. The castle, now a private nursing home, was founded in 1281. In 1646 it was demolished by order of parliament and rebuilt in 1826–52. St. Peter's church (1310) has a roof of black oak divided into about joo small panels; the incumbent is known as the warden. The old buildings of the grammar school. founded in 1574, are known as the Ellinor Roberts Memorial buildings. Nantclwyd house has been used as judges' lodgings from *c.* 1400. Ruthin has a mineral water industry.

RUTHVEN (riv'en), name of a noble Scottish family tracing descent from a certain Thor. who settled in Scotland during the reign of David I. In 1488 one of its members, Sir William Ruthven (d. 1528), was created a lord of parliament as Lord Ruthven. Patrick, 3rd Lord Ruthven (c. 1520–1566), played an important part in the political intrigues of the 16th century as a strong Protestant and a supporter of the lords of the congregation. He favoured the marriage of Mary with Darnley, and was the leader of the band which murdered Rizzio. This event was followed by his flight into England, where he died. Ruthven wrote for Queen Elizabeth a *Relation* of the murder, which is preserved in manuscripts in the British museum.

A descendant of the 1st Lord Ruthven in a collateral line, also named Patrick Ruthven (c. 1573–1651), distinguished himself in the service of Sweden, which he entered about 1606. After leaving the Swedish service he was employed by Charles I. in Scotland. He defended Edinburgh castle for the king in 1640, and when the Civil War broke out he joined Charles at Shrewsbury. He led the left wing at the battle of Edgehill, and after this engagement was appointed general-in-chief of the Royalist army. For his services he was created Lord Ruthven of Ettrick in 1639, earl of Forth in 1642 and earl of Brentford in 1644. The earl compelled Essex to surrender Lostwithiel, and was wounded at both battles of Newbury. In 1644 he was superseded in his com-

mand by Prince Rupert. After visiting Sweden on a mission for Charles II., Brentford died at Dundee on Feb. 2, 1651. He left no sons, and his titles became extinct.

Patrick, 3rd Lord Ruthven, was succeeded as 4th lord by his son William (c. 1541–1584), who like his father was prominent in the political intrigues of the period and was also concerned in the Rizzio murder. In 1582 he devised the plot to seize King James VI., known as the raid of Ruthven, and he was the last-known custodian of the famous silver casket containing the letters alleged to have been written by Mary, queen of Scots, to Bothwell. In 1581 he was created earl of Gowrie, but all his honours were forfeited when he was attainted and executed in May 1584. (See GOWRIE, 3RD EARL OF.)

In 1853 the barony descended to Mary Elizabeth Thornton (c. 1784–1864), the wife of Walter Hore (d. 1878). She and her husband took the name of Hore-Ruthven, borne by later barons.

See the Ruthven Correspondence, edited with introduction by the Rev. W. D. Macray (1868); J. H. Round, "The Barony of Ruthven of Freeland" in Joseph Foster's *Collectanea* Genealogica (1881–85); and Sir R. Douglas, The Peerage of Scotland (new ed. by Sir J. B. Paul).

RUTILE is the most abundant of the three native forms of titanium dioxide, the others being anatase and brookite (*q.v.*). Ordinary rutile is red or brown (hence the name from the Latin *rutilus*, "red").

Rutile, with the composition TiO_2, is a commercially important titanium mineral (See TITANIUM: Occurrence; Applications), although commercial TiO_2 is produced largely from ilmenite (*q.v.*), or titanic iron ore. Rutile has minor uses as a colouring agent in porcelain and glass, and in certain steels and copper alloys. Synthetic rutile, superior to natural crystals as a gem, is produced by the flame fusion (Verneuil) process. The boule as it comes from the furnace is black and is deficient in oxygen. Subsequent heating in an electric furnace in an atmosphere of oxygen produces a clear material. However, because of the high absorption of light in the violet end of the spectrum, the material has a yellow tinge. It has a very high index of refraction and high dispersion, hence shows "fire" and brilliance like the diamond, but is of inferior hardness. Synthetic gems can be produced in various colours by adding appropriate metal oxides to the original titanium dioxide. (See also GEM: Synthetic Gems.)

Like anatase, rutile crystallizes in the tetragonal system, but with different angles. It is isomorphous with cassiterite, SnO_2, the common ore of tin, which it resembles in crystal form, twinning, colour and streak, which is pale brown to yellow. The specific gravity is lower, being 4.2 in contrast to 7.0 for cassiterite. The hardness is 6 to 6.5. It is opaque. with a brilliant metallic to adamantine lustre. Some varieties contain significant amounts of iron, columbium or tantalum and are black, with a specific gravity as high as 5.5. Oriented microscopic crystals of rutile produce asterism in phlogopite, ruby and sapphire. The term sagenite is applied to needlelike crystals twinned to form reticulated, or netlike, skeletal plates. Rutilated quartz is rock crystal containing long delicate translucent needles of rutile. Venus's-hairstone (Pliny's *Veneris* crinis) refers to similar needles in smoky quartz.

Rutile is an accessory mineral in igneous rocks, but is more common in schists and gneisses. It is found in some pegmatites and in crystalline limestones. It occurs in apatite veins in Norway, where it is mined. Microscopic needles of rutile are of wide distribution in clays and shales and also in slates. It is common in detrital deposits, as in Florida sand deposits. Australia is the chief producing country. (L. S. RL.)

RUTILIUS CLAUDIUS NAMATIANUS, Roman poet, flourished at the beginning of the 5th century A.D. He was the author of a Latin poem, De Reditu Suo, in elegiac metre, describing a coast voyage from Rome to Gaul in A.D. 416. The literary excellence of the work, and the flashes of light which it throws across a momentous but dark epoch of history, combine to give it exceptional importance among the relics of late Roman literature. The poem was in two books; the exordium of the first and the greater part of the second have been lost. What remains consists of about seven hundred lines.

The author is a native of S. Gaul (Toulouse or perhaps Poitiers), and belonged, like Sidonius, to one of the great governing families of the Gaulish provinces. His father was an imperial officialwith a distinguished career, and Rutilius himself was secretary of State and *praefectus* urbi. After reaching manhood, he passed through the tempestuous period between the death of Theodosius (395) and the fall of the usurper Attalus, which occurred near the date when his poem was written. Undoubtedly the sympathies of Rutilius were with those who during this period dissented from and, when they could, opposed the general tendencies of the imperial policy. We know from himself that he was the intimate of those who belonged to the circle of the great orator Symmachus — men who scouted Stilicho's compact with the Goths, and led the Roman senate to support the pretenders Eugenius and Attalus in the vain hope of reinstating the gods whom Julian had failed to save.

Perhaps the most interesting lines in the whole poem are those in which Rutilius assails the memory of "dire Stilicho," as he names him. Stilicho, "fearing to suffer all that had caused himself to be feared," planted the cruel Goths, his "skin-clad" minions in the very sanctuary of the empire. May Nero rest from all the torments of the damned, that they may seize on Stilicho; for Nero smote his own mother, but Stilicho the mother of the world!

We shall not err in supposing that we have here (what we find nowhere else) an authentic expression of the feeling entertained by a majority of the Roman senate concerning Stilicho. He had but imitated the policy of Theodosius with regard to the barbarians; but even that great emperor had met with passive opposition from the old Roman families. It is noteworthy that Rutilius speaks of the crime of Stilicho in terms far different from those used by Orosius and the historians of the lower empire. They believed that Stilicho was plotting to make his son emperor, and that he called in the Goths in order to climb higher. Rutilius holds that he used the barbarians merely to save himself from impending ruin. The Christian historians assert that Stilicho designed to restore paganism. To Rutilius he is the most uncompromising foe of paganism.

With regard to the form of the poem, Rutilius handles the elegiac couplet with great metrical purity and freedom, and betrays many signs of long study in the elegiac poetry of the Augustan era. The Latin is unusually clean for the times, and is generally fairly classical both in vocabulary and construction. The taste of Rutilius, too, is comparatively pure. It is common to call Claudian the last of the Roman poets. That title might fairly be claimed for Rutilius, unless it be reserved for Merobaudes. At any rate, in passing from Rutilius to Sidonius no reader can fail to feel that he has left the region of Latin poetry for the region of Latin verse.

BIBLIOGRAPHY.—All existing mss. of Rutilius are later than 1494, and are copies from a lost copy of an ancient ms. once at the monastery of Bobio, which disappeared about 1700. The editio *princeps* is that by J. B. Pius (Bologna, 1520), and the principal editions since have been those by Barth (1623), P. Burman (1731, in his edition of the minor Latin poets), Wernsdorf (1778, part of a similar collection), Zumpt (1840), and the critical edition by Lucian Muller (Teubner, Leipzig, 1870), and another by Vessereau (1904); also an annotated edition by Keene, with a translation by G. F. Savage-Armstrong (1906). Muller writes the poet's name as Claudius Rutilius Namatianus, instead of the usual Rutilius Clauaius Namatianus; but if the identification of the poet's father with the Claudius mentioned in the Theodosian Code (2, 4, 5) be correct, Muller is probably wrong. Rutilius receives more or less attention from all writers on the history or literature of the times, but a lucid chapter in Beugnot, *Histoire* de la destruction du Paganisme en Occident (1835), may be especially mentioned, and one in Pichon's Derniers *écrivains* profanes (1906). See also O. Schissel von Fleschenberg, Rutilius *Namatianus* (Vienna and Leipzig, 1920). (J. S. R.)

RUTLAND, EARLS AND DUKES OF. The 1st earl of Rutland was Edward Plantagenet (1373–1415), son of Edmund, duke of York, and grandson of King Edward III. In 1390 he was created earl of Rutland, but was to hold the title only during the lifetime of his father, on whose death in 1402 the earldom accordingly became extinct, the earl then becoming duke of York. The title earl of Rutland seems to have been assumed subsequently by different members of the house of York, though it does not appear that any of them had a legal right to it. One of these

was the 1st earl's nephew, Richard Plantagenet, duke of York, father of King Edward IV. Richard's daughter Anne married for her second husband Sir Thomas St. Leger, and their daughter Anne married George Manners, 12th Baron Ros, or Roos (d. 1513). Their son, Thomas Manners (d. 1543), was therefore great-grandson of Richard Plantagenet, who had styled himself earl of Rutland among other titles. In 1525 Thomas Manners was created earl of Rutland, and his descendants have held this title to the present day.

Thomas was a favourite of Henry VIII., who conferred on him many offices and extensive grants of land, including Belvoir Castle, in Leicestershire, which became henceforth the chief residence of his family. He was succeeded in the earldom by his son Henry (c. 1516–1563); and his second son, Sir John Manners, acquired Haddon Hall, Derbyshire, by his marriage with Dorothy, daughter of Sir George Vernon, called "the king of the Peak." Henry, the 2nd earl, was an admiral of the fleet in the reign of Queen Mary, and later enjoyed the favour of Queen Elizabeth.

John, 9th earl (1638–1711), a partisan of the Revolution of 1688, received the Princess Anne at Belvoir Castle on her flight from London; after the accession of Anne to the throne she created him marquess of Granby and duke of Rutland in 1703. The 1st duke was three times married; the divorce in 1670, while he was still known as Lord Ros, of his first wife, Anne, daughter of the marquess of Dorchester, was a very celebrated legal case, being the first instance of divorce *a vinculo* by act of parliament, a divorce *a mensa et* thoro having previously been granted by the ecclesiastical courts. His grandson John, the 3rd duke (1696–1779), was the father of John Manners, marquess of Granby (*q.v.*), a distinguished soldier, whose son Charles, 4th duke of Rutland (1754–1787), succeeded his grandfather. When marquess of Granby he represented Cambridge university in the House of Commons, and hotly opposed the policy that led to war with the American colonies. He helped to procure the entrance of the younger Pitt to the House of Commons, and remained through life Pitt's intimate friend. After succeeding to the dukedom in 1779, he sat in the cabinets of Shelburne and of Pitt, and became lord lieutenant of Ireland in 1784.

He was one of the earliest to advocate a legislative union between Ireland and Great Britain, which he recommended in a letter to Pitt in June 1784. The poet Crabbe was for some time private chaplain to the duke at Belvoir. His wife, Mary Isabella (1756–1831), "the beautiful duchess," whose portrait was four times painted by Sir Joshua Reynolds, was a daughter of the 4th duke of Beaufort. His eldest son, John Henry, 5th duke (1778–1857), was "the duke" in Disraeli's *Coningsby;* the latter's two sons, who succeeded in turn to the dukedom, the marquess of Granby and Lord John Manners, figuring in the same novel as "the marquis of Beaumanoir" and "Lord Henry Sidney" respectively. The 7th duke is noticed separately.

RUTLAND, JOHN JAMES ROBERT MANNERS, 7TH DUKE OF (1818–1906), English statesman, was born at Belvoir Castle on Dec. 13, 1818, the younger son of the 5th duke of Rutland by Lady Elizabeth Howard, daughter of the 5th earl of Carlisle. Lord John Manners, as he then was, was educated at Eton and Trinity College, Cambridge. In 1841 he was returned for Newark in the Tory interest, along with W. E. Gladstone, and sat for that borough until 1847. Subsequently he sat for Colchester, 1850–57; for North Leicestershire, 1857–85; and for East Leicestershire from 1885 until in 1888 he took his seat in the House of Lords upon succeeding to the dukedom.

In 1841 Manners definitely associated himself with the "Young England" party, under the leadership of Disraeli. This party sought to extinguish the predominance of the middle-class *bourgeoisie*, and to re-create the political prestige of the aristocracy by resolutely proving its capacity to ameliorate the social, intellectual, and material condition of the peasantry and the labouring classes. Manners made an extensive tour of inspection in the industrial parts of N. England, in the course of which he and his friend Smythe expounded their views with a brilliancy which frequently extorted compliments from the leaders of the Manchester school. In 1843 he supported Lord Grey's motion for an inquiry into the condition of England, the serious disaffection of the working classes of the north being a subject to which he was constantly drawing the attention of parliament. Among other measures that he urged were the disestablishment of the Irish Church, the modification of the Mortmain Acts, and the resumption of regular diplomatic relations with the Vatican. In the same year he issued in pamphlet form a strong Plea for *National Holydays*. In 1844 Lord John vigorously supported the Ten-hours Bill, which, though strongly opposed by Bright, Cobden, and other members of the Manchester school, was passed in May 1847.

Manners figured as "Lord Henry Sidney" in Disraeli's *Coningsby*, and not a few of his ideas are represented as those of Egremont in Sybil and Waldershare in Endymion. But the disruption of the Young England party was already impending. Lord John's support to Peel's decision to increase the Maynooth grant in 1845 led to a difference with Disraeli. Divergences of opinion with regard to Newman's secession from the English Church produced further defections in the ranks, and the rupture was completed by Smythe acquiescing in Peel's conversion to Free Trade. Lord John produced another volume of verse, known as English Ballads, chiefly patriotic and historical, in 1850. During the three short administrations of Lord Derby (1851, 1858 and 1866) he sat in the cabinet as first commissioner of the office of works. On the return of the Conservatives to power in 1874 he became postmaster-general in Disraeli's administration, and was made G.C.B. on his retirement in 1880. He was again postmaster-general in Lord Salisbury's administration, 1885–86, and was head of the department when sixpenny telegrams were introduced. Finally, in the Conservative government of 1886–92 he was chancellor of the duchy of Lancaster. He had succeeded to the dukedom of Rutland in March 1888, upon the death of his elder brother. He died on Aug. 4, 1906 at Belvoir Castle.

RUTLAND, a midland county of England, bounded north and east by Lincolnshire, north and west by Leicestershire, and south-east by Northamptonshire. It is the smallest geographical county in England, having an area of 152 sq.mi. Rutland is a fertile county of rolling upland, rising to about 600 ft. on the Leicestershire border. On the western side the villages, built of local ironstone, are a golden colour. In the limestone areas, chiefly on the eastern side, gray stone walls and buildings are typical. The western portion is formed of the Jurassic beds, including Lias, inferior oolites and great oolites, which form the high ground. They dip gently to the east and are interrupted in places by faults, as in the Welland valley between Ketton and Duddington which is crossed by the Seaton viaduct ($\frac{3}{4}$-mi. long and 70-ft. high). The Lower Lias occupies but a small part in the extreme northwest. The Middle Lias includes ferruginous limestone (marlstone) yielding iron in workable quantities and forming the productive soil of the vale of Catmose. The Upper Lias forms the steep slopes below the oolitic scarps, and furnishes materials for bricks and tiles. Rutland's two chief rivers, the Gwash and the Chater, flow roughly parallel from west to east into the Welland, which forms the county's southern boundary.

History.— Ancient stone implements have been found in the Oakham district and along the Gwash river and small late Bronze Age hoards. At the time of the Roman invasion, this region was inhabited by a scanty population of the Coritani tribe. This is inferred by the absence of finds, although Ermine street passes through its eastern portion. Rutland was forested in pre-Norman days and only a few early settlements occurred, which were found on the belt of Northampton sands at its junction with the Lias clays, where dry sites could be found near springs, with pastures on the clay beds. These sites were occupied by a tribe of the Angli in the 6th and 7th centuries, and the whole region was absorbed subsequently in the kingdom of Mercia.

Although mentioned by name in the will of Edward the Confessor, who bequeathed it to his queen Edith for life with remainder to Westminster abbey, Rutland did not rank as a county at the time of the Domesday survey in which the term Rutland is applied only to that portion assessed under Nottinghamshire, while the southeast portion of the modern county is surveyed under Northamptonshire, where it appears as the wapentake of Wiceslea.

Rutland is first mentioned as a distinct county under the administration of a separate sheriff in the pipe roll of 1159, but as late as the 14th century it is designated "Rutland Soke," and the connection with Nottinghamshire. was maintained up to the reign of Henry III, when the sheriff of Nottingham mas by statute appointed also escheator in Rutland. Rutland was included in the diocese of Lincoln, and in 1291 it became a new rural deanery within the archdeaconry of Northampton; but on the elevation of Peterborough to an episcopal see by Henry VIII in 1541, the archdeaconry of Northampton with the deanery of Rutland was placed within the newly founded archdeaconry of Oakham.

The Norman Walkelin de Ferrers was connected with this county, and founded Oakham castle in the 12th century. One of the minor battles in the Wars of the Roses was fought (1470) north of Empingham on a site aftenvard known as hose coat field. Essendine was granted in 1545 to Richard Cecil of Burleigh, and the title of baron of Essenden bestowed on his grandson is retained by the earls of Salisbury. Burley-on-the-hill was the seat of George Villiers, duke of Buckingham, who there entertained James I. The present house was built by the earl of Winchelsea and Nottingham between.1694 and 1702 after the original had been burned down by the Parliament forces in 1645.

The county returned two members to parliament from 1295 until 1885, when the number was reduced to one. With part of the Kesteven division of Lincolnshire it forms the county constituency of Rutland and Stamford.

Agriculture and Trade.— Rutland has always been mainly an agricultural county. The Domesday survey mentions numerous mills in Rutland. and a fishery at Ayston rendered 325 eels. In the 14th century the county exported wool. Stilton cheese has long been made in Leyfield forest and the vale of Catmose, and limestone is quarried in many parts of the county. The development of the economic resources of Rutland was helped by the extension of the Melton Mowbray canal to Oakham, completed in 1803, now disused.

In the east and southeast districts of Rutland the soil is light and shallow, while in other districts it is a fertile loam, and in the vale of Catmose the soil is either clay or loam or a mixture of the two. The east part of the county is chiefly under tillage and the west in grass. The chief crops are barley. wheat. oats, turnips and other roots. Many sheep (Leicesters and Southdowns) and cattle (mainly Shorthorns) are reared. Large quantities of cheese are manufactured and sold as Stilton. Agriculture is practically the only industry of importance, hut there is some quarrying and bootmaking. The region producing iron is continued from Northampton into Rutland, and the working of the iron ore forms one of the industries of the county. The limestone quarries at Clipsham and Ketton have been worked since the 13th century. Clipsham stone has been used for many important buildings including cathedrals, Oxford colleges, and the house of commons after it was bombed in World War II; for the Cambridge colleges Ketton stone was largely used. Portland cement has been made at Ketton since 1928.

Population and Administration.— Thearea of the administrative county is 152 sq.mi., with a population (1951) of 20,537. The county contains five hundreds. Oakham (*q.v.*) is the county town and the only urban district., There are three rural districts: Ketton, Oakham and Uppingham (*q.v.*). The county is in the Midland circuit, and assizes are held at Oakham. It has one court of quarter sessions, and is not divided for petty sessional purposes.

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RUTLAND, a city of Vermont, U.S., is located 95 mi. N.E. of Albany, N.Y.; the seat of Rutland county. In 1759 the site was an outpost on Gen. Jeffrey Amherst's military road across Vermont, connecting forts on Lake Champlain with the Connecticut valley. Chartered in 1761 Rutland was settled by New England Yankees in 1770 and became one of the capitals of the republic of Vermont (see VERMONT: *History*).

After 1847 railroad construction and marble quarrying attracted many Irish, French Canadian and Italian settlers; around 1880 Rutland was Vermont's largest municipality. In 1886 three marble-producing areas (Proctor, Rutland Town and West Rutland) seceded; since then Rutland has been second in size to Burlington.

Rutland arrivals since 1900 include Scots, Swedes and Poles who found work in factories making scales, castings, dresses, gloves, plywood, machinery and airplane parts. Other economic opportunities came with Rutland's new highways, ski areas, golf courses, hospitals, hydroelectric plants and tourist accommodations; the city is also the business centre for west-central Vermont. Modern schools, public and parochial, are augmented by a public library. For comparative population figures see table in VERMONT: *Population.* (J. C. Hu.)

RUTLEDGE, JOHN (1739–1800), U.S. jurist and statesman: was born in Charleston, S.C. After studying law in England he returned to Charleston where he began to practise in 1761. He was a delegate to the Stamp Act congress in 1765 and to the Continental Congress in 1774–1777 and 1782–1783. He served as chairman of the committee which framed the state constitution of 1776 and as the first president or governor of South Carolina from 1776 to 1778 and again from 1779 to 1782. In 1787, having attained "distinguished rank among the American worthies," he was sent to the Constitutional Convention as one of South Carolina's representatives. There he championed the cause of slavery, urged the assumption of state debts by the national government and argued in favour of dividing society into classes as a basis for representation and requiring high property qualifications for office-holding. Having secured safeguards for slavery in the constitution, he took a strong nationalistic position, recommending as chairman of the committee of detail the granting to the national government of indefinite powers of legislation for the purpose, of promoting the general welfare. He was associate justice of the U.S. Supreme Court in 1789–1791, and chief justice of the supreme court of South Carolina in 1791–95. Nominated chief justice of the U.S. Supreme Court in 1795, he failed to win confirmation by the senate. He died in Charleston on July 18, 1800. (JN. C. M.)

His brother, EDWARD RUTLEDGE (1749–1800), a signatory of the Declaration of Independence, was born in Charleston on Nov. 23, 1749. He studied law in his brother's office, and in London in 1769–73, and practised in Charleston. He served in the Continental Congress in 1774–77, and was sent with John Adams and Benjamin Franklin to confer on terms of peace with Lord Howe on Staten Island in Sept. 1776. As captain of artillery and as lieutenant colonel he served against the British in South Carolina. He was a member of the State legislature from 1782 to 1798, and in 1791 drafted the act which abolished primogeniture in South Carolina. From 1798 until his death Jan. 23, 1800, he was governor of South Carolina.

RUTULI, a people of ancient Italy inhabiting Ardea and the district round it on the coast of Latium, at no very great distance from Aricia, and just west of the territory of the Volsci. They are ranked by the form of their name with the Siculi and Appuli (Apuli), probably also with the Itali, whose real Italic name would probably have been Vituli (see ITALY). This suggests that they belong to a fairly early stratum of the Indo-European population of Italy.

RUVO DI PUGLIA, a town and episcopal see of Bari, Puglia, Italy, 21 mi. W. of the city of Bari by tramway, 853 ft. above sea-level. Pop. (1951) 25,662. The cathedral, a splendid basilica with a very lofty nave and two aisles, has three apses, a square campanile and a rich façade with three portals. It belongs to the early 13th century. The interior has a fine triforium. Ruvo occupies the site of the ancient Rubi.

RUWENZORI, also known as Runsoro or Kokora, a mountain range of Central Africa, 65 mi. long and with a maximum breadth of 30 mi., trending a little east of north, lying just north of the equator between lakes Edward and Albert. The range falls steeply on the west to the central African rift-valley traversed by the Semliki, the western head-stream of the Nile, while on the east the fall is somewhat more gradual towards the western

Uganda uplands. The upper parts are separated by fairly low passes into six groups of snowy summits, lying a little west of the central line, rising in each case above 15,000 ft. and reaching, in the culminating point of the western group (Mount Stanley), 16,763 ft.

The origin of the range seems connected with that of the rift-valley on the west. Ruwenzori is a fault block of the Archaean floor of the continent, bounded east and west by lines of fracture, and having a general dip from west to east. A further upheaval produced an ellipsoidal anticline, causing the strata to dip outwards at a high angle. Traces of volcanic action are almost non-existent. Composed in its outer parts of Archaean gneisses and mica-schists offering no great resistance to denudation, in its centre the range consists of much more refractory rocks (amphibolites, diorites, diabases, etc.), to which fact, coupled with the existence of vertical fractures, the persistence and separation of the higher summits is probably due. The snow-clad area does not now extend more than ten miles in any direction; the snow-line is 13,450 ft. but there is evidence of a former extension to as low as 4,600 ft.

The upper region is almost entirely enveloped by day in thick cloud, which descends on the east to about 9,000 ft., and lower still on the west. As a result, the climate is excessively humid, the northern slopes having a rainfall of 200 inches a year giving extremely damp conditions on the mountain. The rivers are raging torrents and have cut deep valleys between the outer spurs. From the innermost recesses between Mounts Stanley, Speke and Baker, the main branches of the Mobuku descend to the east, while the four principal streams on the west unite to form the Butagu, the drainage on both sides ultimately finding its way to the Semliki, either directly or through lakes George and Edward.

The vegetation displays well-marked zones, varying with the altitude; but owing to the lower level to which the cloud descends on the west the limits of the several zones reach a lower level on the west than on the east. They have been defined as follows by Mr. R. B. Woosnam (1907), as follows, the figures in brackets being the upper limit on the east side:—grass (6,500 ft.), forest (8,500), bamboos (10,000), tree heaths (12,500) and lobelias and senecios (14,500), above which is the summit region of snow and bare rock. The boundaries between the zones merelv indicate the levels between which the respective forms are specially characteristic. The forest zone is the best marked, but on the west it merges in part with the low-lying forest of the Semliki valley. Mosses, hepaticae and lichens are prevalent in several of the zones, while bogs, vaccinium and other low-growing plants, are common above the forest zone. Helichrysums are abundant in the zone immediately below the snow. The larger mammals are found chiefly on the lower slopes, but bushbuck, pigs, leopards, monkeys, a hyrax and a serval cat occur at higher altitudes. The birds include kites, buzzards, ravens, sun-birds, touracos, a large swift, and various warblers and other small kinds. The upper limit of human settlement, with cultivation of colocasia and beans, has been placed at 6,700 ft.

In modern times the existence of a snowy range in this part of Africa was first made known by Sir Henry Stanley during the Emin Pasha relief expedition of 1887–89. Stanley named the main mass Ruwenzori, and outlying eastern peaks he called Mt. Gordon Bennett, Mt. Lawson, Mt. Edwin Arnold, etc.—the last named lying north-east of Lake George. Subsequently Stanley's own name was given to the chief summit. One of Stanley's officers, Lieut. Stairs, ascended the western slopes to over 10,000 ft. in 1889, and partial ascents were afterwards made by Dr. Stuhlmann, Mr. Scott-Elliot, Mr. J. E. S. Moore, Sir Harry Johnston, Mr. Douglas Freshfield, and others. Early in 1906 some of the secondary ridges above the snow-line were scaled by Messrs. Grauer, Tegart and Maddox, and by Dr. Wollaston and other members of the British Museum expedition, while later in the year the duke of Abruzzi led a well-equipped expedition to the upper parts of the range and ascended all the principal snow-clad peaks. The expedition produced for the first time a detailed map of the upper region, and threw much light on the geology and natural history of the range.

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RUYSBROEK or **RUYSBROECK, JAN VAN** (1293–1381), Dutch mystic, was born at Ruysbroek, near Brussels, in 1293. In 1317 he was ordained priest and became vicar of St. Gudule, Brussels. When 60 years of age he withdrew with a few companions to the monastery of Groenendael, near Waterloo, giving himself to meditation and mystical writing, and to a full share of the practical tasks of the society. He was known as the "Ecstatic Teacher," and formed a link between the Friends of God and the Brothers of the Common Life, sects which helped to bring about the Reformation. Ruysbroek insisted that "the soul finds God in its own depths," and noted three stages of progress in what he called "the spiritual ladder" of Christian attainment: (1) the active life, (2) the inward life, (3) the contemplative life. He did not teach the fusion of the self in God, but held that at the summit of the ascent the soul still preserves its identity. His works, of which the most important were *De vera contemplatione* and *De septem gradibus amoris*, were published in 1848 at Hanover; also *Reflections from the Mirror of a Mystic* (1906) and *Die Zierde der geistlichen Hochzeit* (1901).

BIBLIOGRAPHY.—A new edition of his works, *Alle de werken van J. van Ruysbroec de Wonderbare, etc.*, was published at Bussum in 1912 *seq.* A translation of his works into French was begun by the Benedictines of St. Paul de Wisques in 1920 *seq.* The following single works have been translated: *The Book of the Twelve Béguines* (1913); *The Adornment of the Spiritual Marriage*, etc, trans. by C. A. Wynschenk, ed. with introd and notes by E. Underhill (1916). *See* also R. *M.* Jones, *Studies in Mystical Religion*, pp 308–14 (1909); M. Maeterlinck, *Ruysbroek and the Mystics, with selections from The Adornment of the Spiritual Marriage* (trans. by J. T. Stoddart, 1894); V. Scully, *A Mediaeval Mystic* (1910); E. Underhill, *Ruysbroeck* (1915); Wautier d'Aygalliers, *Ruysbroeck l'admirable* (1923; Eng. trans., 1925).

RUYSDAEL (RUISDAEL, RUIJSDAEL), **SALOMON VAN** (c. 1602–1670), Dutch painter, best known for his landscapes, was born in Naarden. He originally had the name of De Gooyer, as did his brother Izack, the father of Jacob van Ruisdael (*q.v.*). Salomon entered the Haarlem Guild of St. Luke in 1628. His first dated pictures are from 1627. He spent his whole life in Haarlem, where he was head of the guild in 1648. He belonged to the Mennonites. He died as a well-to-do person in 1670.

Salomon's early works—winter scenes—continue the tradition of Esaias van de Velde, and his early landscapes are based on the colour scheme and composition of Pieter de Molyn. In the diagonal composition of the dunes and river scenes of the 1630s he is the equal of Jan van Goyen. The colours tend to a green. Around 1645 the composition becomes more powerful, with framing motifs of great trees on one side and a distant view on the other. The colours become warmer and more transparent. In later years the light effects are more outspoken, and the decorative elements become stronger. It is very probable that this change was partly caused by the influence of painters returning from Italy; *e.g.*, J. Both. In the 1660s a blue colour prevails, especially in the river scenes and broad river mouths, which the artist loved to paint. Another favourite subject was the village inn at the roadside with cattle and herdsmen.

Salomon van Ruysdael was a clever figure painter; all the small figures, which add much to the pleasant effects of his landscapes, are by his own hand. Unlike Jacob, he preferred to render actual scenery of Dutch towns, like Alkmaar, Arnhem, Dordrecht and Utrecht, but sometimes he combined motifs from different places in one picture. He also painted, especially in later years, large winter scenes, with skating on frozen rivers, of great decorative beauty.

See C. Hofstede de Groot, *Catalogue of Dutch Painters* (1912); W. Stechow, *Salomon van Ruysdael* (1938). (H. K. Gx)

RUYTER, MICHIEL ADRIAANSZOON DE (1607–1676), Dutch seaman reckoned as his country's greatest admiral, was born at Flushing on March 24, 1607. Going to sea as a boatswain's boy in 1618, he uorked his way up during the next 20 years to become an independent merchant captain. In 1641, he was appointed rear admiral of a fleet sent to assist Portugal against Spain and distinguished himself in a battle off Cape St. Vincent. He resumed his activities as a merchant captain in 1642, but on the outbreak of war with England in 1652 was persuaded to accept a command in the navy. Under Adm. M. H. Tromp, he showed outstanding skill in battles off Plymouth, in the Kentish Knock and off Dungeness (1652) and in the Three Days' battle in the Channel (1653). Appointed vice-admiral of Holland in the service of the Amsterdam admiralty board in Nov. 1653, he subsequently served against French privateers and Barbary pirates in the Mediterranean In 1659 he supported the Danes against the Swedes in the Baltic, but from 1661–64 he was again employed in the Mediterranean. In 1664–65, on secret orders from Holland, he took successful reprisals against the English on the Guinea coast where they had seized some Dutch trading settlements, but his campaign in the West Indies, where he went immediately afterward, was on the whole a failure. On his return to the Netherlands he became lieutenant admiral of Holland and collaborated closely with the grand pensionary. Johan de Witt, in strengthening the navy His greatest successes in the Second Anglo-Dutch War were the Four Days' battle (June 1666) and the raid on the Medway (June 1667), when he burned some of the finest English ships and carried off the flagship to Holland as a prize Perhaps his greatest services however, were in the Third Anglo-Dutch War. when his saving of the Dutch fleet in the battle of Solebay (Southwold bay) in 1672 and his victories over superior forces in the battles of Schooneveld and the Texel in 1673 prevented an Anglo-French invasion of Holland by sea. In 1675 and 1676 he was fighting against the French in the Mediterranean Wounded off Sicily on April 22, 1676, he died on April 29, at Syracuse.

See also DUTCH WARS.

See P. J. Blok, *Michiel Adriaanszoon de* ***Ruyter*** (1928), with Eng. trans., much abridged, by G. J. Renier (1933). (E. H. K.)

RUZICKA, LEOPOLD (1887–), Yugoslav-Swiss chemist, who was awarded the Nobel prize for chemistry jointly with Adolf Butenandt in 1939 for his work on polymethylenes and higher terpenes, and established the isoprene rule of molecular structure. He was born on Sept. 13, 1887, at Vukovar, Yugos., and educated at the Technische Hochschule, Karlsruhe. He was elected to the chair of organic chemistry at the University of Utrecht in 1926 but returned to the Technische Hochschule and became professor of chemistry in 1929. His original work was in organic chemistry, especially in the composition of the essential oils and the higher terpenes. His investigation of civetone, which occurs in the perfume civet, showed the existence of a 17-membered ring of carbon atoms in its structure. Similar studies on ambergris showed that it was related to the substance that gives violets their perfume. Much of his success in these structural researches depended on his application of the hypothesis that the more complicated molecules were composed of aggregations of isoprene molecules or at least built out of them. This so-called isoprene rule enabled him to determine the constitution of vitamin A. Further work led to the first laboratory production of a sex hormone, namely androsterone, and at the same time to the determination of its constitution. (D. McK.)

RYAZAN, an *oblast* of the Russian Soviet Federated Socialist Republic, U.S.S.R., surrounded by those of Moscow, Ivanovo, Gorkiy, Prenza, Tambov and Tula, and not coinciding with the pre-1917 province of the same name. Area 15.328 sq.mi. Pop. (1959) 1,444.000; mainly Great Russians, with some Tatars, Poles and Jews in the towns. The province is drained by the Oka and its tributaries, the Pronya and Pra, and small lakes are numerous in the wide depression of the Oka. Forests cover about one-fifth of the area, conifers. especially pines, prevailing in the more forested north, and deciduous forest with birch, ash and oak appearing in scattered patches in the south. North of the Oka is gray forest soil of little value for agriculture, but south of that river the fertile black earth of the steppe begins. The climate is extreme, average February temperature 3.2° F., July 67° F., rainfall 16 to 18 in. per annum.

Industries. — The region is essentially agricultural, except for a coal mining belt extending along the railway west from Ryazhsk. Dairying is not much developed, as the land is not suitable for pasture, but grain growing gives a good guarantee for the peasant, and the villages are large, averaging 534 inhabitants. There are some collective agricultural artels The chief crops are rye (50%), oats (19%), millet (11.2%) and potatoes (10%). Buckwheat. grass, hemp and sunflower seed are sown. Orchard fruits, especially apples. and cucumbers. cabbages, onions and other vegetables are cultivated in the valley of the Oka. Sheep, working and milch cattle, horses, pigs and a few goats are bred.

Koustar (peasant) textile industries are widespread, as is the making of leather and felt footwear, and the district was once famous for its lacemaking and leather embroidery. The northern region has small industries of this type. including the making of wooden vessels, sledges and boats. the preparation of pitch and tar and basketwork from the reeds in the marshy northern areas, which occupy 6% of the region. The electric plant of Ryazan works on peat fuel from these bog areas and also on the local coal. Marshy areas near the Oka river have been successfully drained and are now pasture lands.

There is a comparatively good railway net, and 57% of the rivers are available for steam navigation: a good deal of transit trade goes on throughout the region.

RYAZAN, chief town of the above *oblast,* situated on the elevated right bank of the Trubezh. a mile above its confluence with the Oka in 54° 40' N., 39° 43' E. Pop. (1959) 213,000. A wide prairie dotted with large villages, the bottom of a former lake, spreads out from the base of the crag on which Ryazan stands. and actually has the aspect of an immense lake when it is inundated in the spring. The town manufactures agricultural machinery, boots, shoes and leather goods, and bricks, and has a distilling industry. It is an important trading centre, on a navigable river, with four railways radiating from it and a good main road linking it with Moscow. The Krestovozdvizhensk church contains tombs of the princes of the 15th and 16th centuries.

The capital of Ryazan principality was Ryazan—now Old Ryazan, a village close to Spask, also on the Oka. It is mentioned in annals as early as 1097 but continued to be the chief town of the principality only until the 14th century. In the 11th century one of the Kiev princes founded, on the banks of a small lake, a fort which received the name of Pereyaslav-Ryazanskiy. In 1294 (or in 1335) the bishop of Murom, compelled to leave his own town, settled in Pereyaslav-Ryazanskiy. The princes of Ryazan followed his example and by and by completely abandoned the old republican town of Ryazan. In 1300 a congress of Russian princes was held there, and in the following year the town was taken by the Moscow prince. It continued, however, to be the residence of the Ryazan princes until 1517.

RYBINSK, a town in Yaroslavl *oblast,* Russian Soviet Federated Socialist Republic, U.S.S.R., in 58° 3' N., 38° 47' E., on the navigable Volga. opposite the mouth of the Sheksna. which connects the Volga system with Lake Ladoga. Pop. (1959) 181,000. There goods are transshipped from the large Volga boats to the smaller ones of the Marii system linking with Leningrad. There are shipyards, wiredrawing mills, nail, metal and match factories, flour mills, leather works and a brewery.

2. A small settlement of Asiatic Russia on a left bank tributary of the Irtysh, in 56° 5′ N., 72° 30' E.

3. A small town of Asiatic Russia south of the trans-Siberian railway, lying between Krasnoyarsk and Kansk, in 55° 55' N., 94° 55' E.

RYDBERG, (ABRAHAM) VIKTOR (1828–1895), Swedish author, whose wide range of activities enabled him to exercise great influence on Swedish cultural life, was born at Jönkoping on Dec. 18, 1828. His mother died in a cholera epidemic, his father became a dipsomaniac, and he grew up among strangers,

with no home of his own. He matriculated at Lund but had to break off his studies for lack of money. In 1855 he found employment with the liberal newspaper *Goteborgs handelstidning,* in which *Den siste dtenaren,* the novel which made his name. appeared serially in 1859. Its description of the clash between paganism and Christianity in ancient Athens. showing a bias against clerical intolerance and orthodoxy, had a direct bearing on conditions in Sweden. He had previously published *Singoalla* (1857; revised 1865), a romantic lyrical tale of the middle ages in Sweden. His *Bibelns lära om Kristus* (1862), in which he maintained that, according to the Bible, Christ was not God, did much to further a liberal outlook in theology and the church.

In the 1870s Rydberg engaged in many new activities. He entered the *riksdag* for a short time. He advocated linguistic reform, being particularly anxious to reduce the number of words borrowed from the German. In 1874 he visited Rome and on his return wrote *Romerska dagar* (1877), in which his interest in classical antiquity finds its most mature expression. In 1876 he completed his translation of part i of Goethe's *Faust,* which had occupied him for many years. During these years also he revealed outstanding talent as a poet: his collection *Dikter* (1882) established him as the foremost lyrical poet since Esaias Tegnér and Erik Stagnelius. He gradually gained official recognition and was given an honorary doctorate by Uppsala university in 1877, elected to the Swedish Academy in 1878 and in 1884 called to the chair of cultural history at the Stockholm *högskola,* this professorship being subsequently changed to one in the theory and history of art. In the 1880s he was chiefly concerned with research into mythology, the results of which were published in the learned and imaginative *Undersökningar i germanisk mytologi,* 2 vol. (1886–89). In 1891 he published two late flowerings of his literary genius: *Vapensmeden,* a novel describing life at the time of the Reformation in Sweden, and a new collection of poems, one of which, "Den nya Grottesången," is a remarkable indictment of existing social conditions.

Rydberg was an idealist, faithful to the romantic tradition in poetry and thought but with a mind receptive to the ideas of a new age. He achieved an unequaled position of authority in Swedish culture. He died at Djursholm on Sept. 21, 1895.

His *Samlade Skrifter* were edited by K. Warburg, 14 vol. (1896–99).

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RYDE, a municipal borough and watering place in the Isle of Wight, Eng.. 4½ mi. S.W. of Portsmouth across the Solent. Pop. (1961) 19,796. Area 12.3 sq.mi. On rising ground on the northeast coast, overlooking Spithead, Ryde has woods reaching to the water's edge. and miles of golden sands. It is built on the site of a village called La Rye or La Riche, which mas destroyed by the French in the reign of Edward II. At the close of the 18th century it was a small fishing hamlet, but it rapidly grew as a watering place, and catering for tourists became its chief industry, with agriculture second in importance. The ancient Ryde carnival is held annually in September. The town was incorporated in 1868. Ryde is connected by boat with Portsmouth. The principal buildings are All Saints church, the market house and town hall. the Royal Victoria Yacht club, the pavilion, the Royal Isle of Wight infirmary and the Commodore theatre.

RYDER, ALBERT PINKHAM (1847–1917), U.S painter, noted for his lunar landscapes and allegorical scenes, was born at New Bedford, Mass.. March 19. 1847. About 1868 the family settled in New York city. where Ryder briefly studied painting. He first exhibited at the National Academy of Design in 1873, but most of his exhibited work was shown at the Society of American Artists, of which he was a founding member. In 1882 he traveled in Europe, but paintings in the art galleries interested him little. He was an imaginative, solitary painter; his lifework of about 150 pictures was produced slowly.

By 1900 his powers were impaired, and he injured some earlier paintings with misjudged reworkings; thus he unconsciously prepared the way for the many forged examples that appeared. After a critical illness, friends took him to their home in Elmhurst, Long Island. N.Y., where he died March 28, 1917. Major works include "Siegfried," "The Race Track" and "Toilers of the Sea." Extraordinary colourfulness triumphs over technical imperfections, and his themes range from an idyllic pastoralism through intensifying romanticism to an epic splendour. Many of Ryder's paintings have suffered rapid deterioration.

See Frederic Fairchild Sherman, *Albert Pinkham Ryder* (1920); *L.* Goodrich, *Albert Pinkham Ryder* (1947). (VL. B.; X.)

RYE, a municipal borough and market town in the Rye parliamentary division of East Sussex, Eng., 11 mi. N.E. from Hasting~by road. Pop. (1961) 4,429. Area 1.2 sq.mi. Rye is a picturesque market town, built up a hill by the Rother river, with cobbled streets and timber-framed and Georgian houses. Ypres tower (12th century), which stands on the cliff, was its only defense until Edward III walled the town, but Landgate (1329), one of the three original entrance gates, is all that remains of the 14th century fortifications. The Norman to Perpendicular church of St. Mary has a notable quarter-boy 16th-century clock, and in the churchyard is a Georgian reservoir. Other interesting buildings are the old grammar school (1636), the town hall (1742), the old hospital, the Mermaid inn (*c.* 1420) and the Flushing inn, which contains a mural dated 1547.

As part of the manor of Rameslie, Rye was granted by Edward the Confessor to the monks of Fécamp, by whom it was retained until resumed by Henry III in 1247. The town became a full member of the Cinque Ports *c.* 1350 when, with Winchelsea, the other ancient town, it was added to the confederation. It was then a flourishing port but declined in the late 14th century, partly recovered its prosperity with the decay of Winchelsea in the 1 jth and 16th centuries and then sank again when the sedimentation and consequent receding of the sea, which had been going on slowly since the 14th century, made the use of the harbour impracticable. By the mid-20th century the Rother's mouth was 2 mi. from the town. Rye was twice burned down by the French, in 1377 and 1448 The town was incorporated in 1289 and was granted a three days' fair. Twice-weekly markets had been held before 1405 when the Friday market was changed to Saturday. The market now serves a wide agricultural area. Industries include light engineering, dry cleaning and the tourist trade.

RYE. The cultivated types of rye, known botanically as *Secale cereale,* are grown extensively in Europe, Asia and North America for human and animal consumption. As the least important of the cereal crops, rye generally is grown for grain only where the environmental conditions are relatively unfavourable. Rye probably originated in southwestern Asia. like several other important genera. such as *Triticum* (wheat), *Avena* (oats) and *Hordeum* (barley).

The progenitor of *Secale cereale* is not known with certainty, but there is evidence to indicate that it came from *Secale ancestrale.* There are annual and perennial species that have a brittle rachis. Many varieties of weedy plants are closely related to the cultivated species. Early cultivation was likely in western Asia. followed by westward migration across the Balkan peninsula and over Europe (*see* AGRICULTURE).

No trace of cultivated rye has been found in early Egyptian monuments; likewise no reference to this crop is found in ancient a-ritings. However. the name occurs in northern European languages, suggesting early cultivation in this area.

Only one species of cultivated rye is recognized. *Secale cereale,* although several other species have been found growing wild. Rye has 14 somatic chromosomes, and there is no evidence of a polyploid series except for artificially produced tetraploids with 28 chromosomes. Most rye is grown as a fall-sown annual, though a little is spring sown with spring instead of winter varieties.

The greatest production of rye occurs in the temperate and cool regions of the world; it grows also where altitudes are high. It has the greatest winter hardiness of all small grains, and its culture

extends to the more northerly parts of North America and as far north as the Arctic circle of Europe and Asia. The type of soil has an important influence on geographic distribution. Rye is frequently gromn where other crops fail because of low fertility Most production is from the poorer soils of Europe and the U.S S R and the sandier and poorer soils of North America where it is too cool for winter wheat Soil requirements are modest—even more so than for oats. Rye will produce well on fertile soil, such as the chernozem (black earth) of eastern Europe, but this type of soil is reserved for growing other crops.

Cultivation and Uses.—Rye is gromn much the same as other cereal crops Usually it is planted nith a grain drill at a rate of five to six pecks per acre. depending upon the size of seed. It is not used generally as a companion crop in establishing forages as is common with wheat and oats. Usually it is rotated with other crops. taking the place of winter wheat. Where it is used for pasture, it serves largely as an emergency crop. Seedings are made in the fall, and the crop matures somewhat earlier than the other small grain crops such as wheat, oats and barley. Harvesting in the northern areas comes in late June and early July.

The principal uses of rye are as flour for bread. as feed for livestock and as a pasture plant. Of the cereals, only wheat and rye have the qualities necessary for making a loaf of bread from the flour. The rye flour, however, is very inferior to wheat for baking, lacking the elasticity so essential to a good loaf and being heavy and dark in colour. In Eurasia a loaf made from pure rye flour commonly is referred to as black bread because of its colour. Relatively little rye flour is used for breadmaking in the United States; when so used, it is commonly blended in varying proportions with wheat flour.

Livestock feed is one of the main uses of the rye crop For most classes of livestock it is usually fed in a mixture. It has less fats than has wheat, about the same protein content and compares favourably with wheat and corn for carbohydrates. Vitamin B_1 content is slightly lower than in barley and wheat and much lower than in oats. Rye is used also in the making of alcoholic beverages *(see* WHISKY).

Rye straw is fibrous and tough and used less for feed than for litter or bedding. It is used for mattresses and thatching in certain areas of the world, and in the manufacture of hats and paper.

Rye has considerable use for fall and spring cattle grazing. As a spring pasture it is available before permanent pastures have made sufficient growth for livestock use. The leaves are high in vitamin A content. In warmer areas the grain is used for fall grazing and cover cropping. It is also used as a green manure crop, being plowed under in the spring and followed by a crop of greater economic value.

Diseases.—Ergot is a disease condition that follows when the young kernel is penetrated by the fungus *Claviceps purpurea.* This results in purplish-black ergot bodies called sclerotia. They contain pharmaceutical compounds, such as ergosterol, ergotoxine, ergotamine, ergonovine, ergoclavine, etc.

Although other diseases, including snow mold. attack rye, most of them cause only minor yield reduction. There are several leaf and stem diseases, such as leaf and stem rust, stalk and head smut, scald and blotch, and some root rots. On the whole, if ergot is omitted. disease losses in rye are less than in other small grains.

Botanical Characteristics.— The spike of the rye plant resembles wheat in having alternately ranked spikelets attached to a zigzag axis or rachis, forming a fairly dense head or ear. Spikelets are composed of two thin, narrow, chaffy scales or glumes that subtend two or more florets, which, in turn, are enclosed by a lemma and palea. The lemmas taper into slender bristles or awns that are about two to four centimetres long. Each floret contains three stamens and a pistil, which, after pollination, develop into a one-seeded fruit that is partly exposed. The threshed seed or fruit is known as a caryopsis, a term applied generally to the fruits of cereal crops. Grain colour varies, but grayish-green and light brown predominate, while some are almost white. The thin shell or pericarp sometimes ruptures over the germ. Sterile florets occur to the extent of 25% to 30%, thereby reducing production. Cross-pollination occurs almost completely because the floaers are largely self-sterile. The first foliage leaf is reddish or purplish tinged. Other leaves are long, narrow and thin with a short ligule and a moderate-sized auricle at the juncture of the blade and sheath. The leaf sheaths have a bluish-green bloom. The height and number of the jointed stems or culms depend upon growth conditions.

Rye has the tallest and strongest straw of all of the small grain crops. The straw may attain a height of seven to eight feet on fertile soils but is usually five feet or less. Improved varieties generally have straw of a length more suitable for the use of harvesting equipment. There are numerous fibrous roots, and they penetrate more deeply than do those of other small grains.

Breeding and Hybridization.— Improvement of the rye plant by breeding is difficult because of the high degree of self-sterility. Most improvement has been accomplished by mass selection rather than by the pure line method of breeding. Varieties are genetically impure because of cross-pollination. Moderately self-fertile inbred lines can be perpetuated without difficulty. Hybrid vigour uith greater productivity than open-pollinated varieties results when selected inbred lines are properly mated. No method has been found to utilize this biologic principle commercially.

Since rye is thrifty and winter hardy it has been hybridized with wheat, resulting in winter-hardy selections with the appearance and quality of wheat. However, commercial production of varieties from wheat-rye hybrid origin is rather small. Hybrids with other genera have been made.

During the 1940s tetraploids (28 somatic chromosomes) in rye were produced by several scientists. One tetraploid called Tetra Petkus gained some prominence in the early 1950s; it is stiff strawed, leafy and late in maturity. Kernels are large, weighing $1\frac{1}{2}$ to 2 times as much as common rye. Tests indicate Tetra Petkus flour will bake satisfactorily. Reduced yield may result if the tetraploids are sown close to the common varieties, because cross-pollinated flowers do not produce seed.

In North America the following varieties of common rye are used commercially: Dakold, Emerald, Pierre, Imperial, Caribou, Rosen, Balbo and Abruzzi. The Balbo variety is especially valuable as a pasture crop. Tetra Petkus has proved excellent for pasture in some sections. Most of these varieties have come from stocks of European and Russian origin.

In other countries some important varieties are: Petkus, Kings II, Steel, Star, Ensi, Toivo, Borris Pearl and Vjatka.

Production and Trade.—The estimated world production of rye in the late 1950s was 1,430,000,000 bu. a year. Of this total, approximately 40% was produced in the U.S.S.R. The United States and Canada produced approximately 2.5% of the world total. The leading rye-producing countries in order of importance were the U.S.S.R.. western Germany, Argentina, Turkey, the United States, Spain, Hungary, France, the Netherlands, Austria and Denmark. The average acre yield in the United States is about 12 bu. The low yields are in part due to the practice of growing rye on poor soils unsuited to other crops. Yields in Europe are somewhat higher due to more intensive cultivation *(see* FOOD SUPPLY OF THE WORLD: *Cereals).* The leading rye-producing states in the U.S. are North Dakota, South Dakota, Nebraska, Minnesota and Wisconsin.

Trade in rye has been more limited than that in other grains. Seasonal production influences trade between countries. The U.S.S.R., Canada, Turkey and Argentina usually export rye, while Germany, Finland, Austria and Norway import much more than they export. The United States has been a large exporter but was importing modest quantities in the 1950s.

See also CEREALS; GRAIN PRODUCTION AND TRADE.

(H. L. Ss.; H. K. W.)

RYE GRASS, the common name given to species of the genus *Lolium,* comprising a few annual or perennial Eurasian grasses. Two species are of agricultural importance in the United States: English, or perennial rye grass (L. *perenne*) and Italian rye grass (*L. multiflorum*). Both are used to some extent for meadow, pasture and lawn, especially the latter, where a vigorous early growth is desired Another species (L. *temulentum*), commonly known as

darnel and occasionally found in waste places, is supposed to be the tares of the Bible. It is a weed possessing poisonous properties, probably oming to a fungus in the grains. (J. M. Bl.)

RYKOV, ALEKSEY IVANOVICH (1881–1938), Russian politician, was born at Saratov, on Feb. 13, 1881, the son of a peasant. At 18 he was a member of the Russian Social Democratic Workers' party (R.S.D.R.P.), visited Nicolai Lenin at Geneva in 1902, and returned to Russia as a revolutionary propagandist in various industrial districts. He was many times arrested and deported. but each time escaped. He attended the 3rd congress of the R.S.D.R.P. (London, 1905) and was elected a member of its central committee. He took part in the 1905 revolution and again was in London as a delegate to the 5th congress (1907). He lived for some time in Paris (1910–11), later returning to Russia. In 1913 he was exiled to Narym. western Siberia; in 1915 he escaped, was recaptured and sent back to Narym where he remained until the March 1917 revolution.

Rykov took an active part in the Nov. 1917 revolution and became people's commissar of the interior in the first Communist government headed by Lenin. In 1918 he became chairman of the Supreme Economic council, in 1923 was elected to the Politburo, and in Jan. 1924, after Lenin's death, was appointed chairman of the council of people's commissars. When Joseph Stalin started his fight against L. D. Trotsky, Rykov sided against the latter believing that by so doing he was working for peace, although he had no illusions about Stalin's thirst for dictatorial power. Later Rykov's influence waned and in 1930 he was succeeded by V. M. Molotov as chairman of the council of people's commissars. In 1931 Rykov became people's commissar for communications but on Sept. 29, 1936, was dismissed from this post and on March 17, 1937, expelled from the All-Union Communist party for his allegedly "treacherous anti-party activity." On March 13, 1938, with N. I. Bukharin, G. G. Yagoda and other "right-wing deviationists." he was sentenced to death and shot the next day.

See A. I. Rykov, *Statii i ryechi* (Articles and Speeches), 4 vol. (Moscow, 1926–28); A. Lomov, *A. I. Rykov* (Moscow, 1926).

RYLANDS, JOHN (1801–1888), English manufacturer and merchant, was born at St. Helens, Lancashire, on Feb. 7, 1801, and was educated at the grammar school in that town. In 1819 he, his elder brothers and his father, a manufacturer of cotton goods, founded the firm of Rylands and Sons, cotton goods and linen manufacturers, at Wigan. The business rapidly increased, dye-works and bleach-works were added, and the discovery of coal under some of the firm's property added materially to its wealth. In 1825 the partners became merchants as well as manufacturers, and subsequently acquired spinning mills at Bolton and elsewhere. In 1847, his father being dead and his brothers having retired, John Rylands assumed entire control of the business, which in 1873 was turned into a limited liability company. John Rylands was a benefactor to various charities, and was one of the original financiers of the Manchester Ship canal. He died at Stretford on Dec. 11, 1888. A permanent memorial, the John Rylands Library, was erected by his widow in Manchester in 1899.

RYMER, THOMAS (1641–1713), English historiographer royal, was the younger son of Ralph Rymer, lord of the manor of Brafferton in Yorkshire, executed for his share in the "Presbyterian rising" of 1663. Thomas was probably born at Yafforth Hall early in 1641, and was educated at a private school kept at Danby-Wiske by Thomas Smelt, a noted Royalist, and at Sidney Sussex college, Cambridge. He left the university without taking a degree. On May 2, 1666, he became a member of Gray's Inn, and was called to the bar on June 16, 1673. Rymer executed translations, wrote plays, prefaces and complimentary pieces. In 1692 Rymer became historiographer royal.

Within eight months of his official appointment Rymer was directed (Aug. 26, 1693) to carry out that great national undertaking with which his name will always be honourably connected, and of which there is reason to believe that Lords Somers and Halifax were the original promoters. The *Codex Juris Gentium Diplomaticus* (1693) of Leibniz was taken by the editor as the model of the *Foedera*. The plan was to publish all records of alliances and other transactions in which England was concerned with foreign powers from 1101 to the time of publication, limiting the collection to original documents in the royal archives and the great national libraries. Unfortunately, this was not uniformly carried out, and the work contains some extracts from printed chronicles. From 1694 Rymer corresponded with Leibniz, by whom he was greatly influenced with respect to the plan and formation of the *Foedera*. While collecting materials, Rymer unwisely engraved a spurious charter of King Malcolm, acknowledging that Scotland was held in homage from Edward the Confessor. When this came to be known the Scottish antiquaries were extremely indignant, and a controversy arose, the documents in which are now rare and valuable.

At last, on Nov. 20, 1704, was issued the first folio volume of the *Foedera, Conventiones, Litterae et cujuscumque generis Acta Publica inter reges Angliae et alios quosvis imperatores, reges, etc., ab* A.D. *1101 ad nostra usque tempora habita aut tractata*. The publication proceeded with rapidity, and 15 volumes were brought out in nine years. Rymer died after the appearance of the last volume, but he had prepared materials for carrying the work down to the end of the reign of James I. These were placed in the hands of Robert Sanderson, his assistant, who produced the remaining five volumes (1715–17 and 1726–35).

Rymer died at Arundel Street, Strand, on Dec. 14, 1713, and was buried in the church of St. Clement Danes. His will was dated July 10, 1713.

In 1810 the Record Commissioners authorized Dr. Adam Clarke to prepare a new and improved edition of the *Foedera*. Six parts, large folio, edited by Clarke, Caley and Holbrooke, were published between 1816 and 1830. Considerable additions were made, but the editing was performed in so unsatisfactory a manner that the publication was suspended in the middle of printing a seventh part. The latter portion, bringing the work down to 1383, was ultimately issued in 1869. A general introduction to the *Foedera* was issued by the Record Commission in 1817, 4to.

The best account of Rymer is to be found in the prefaces to Sir T. D. Hardy's *Syllabus* (1869–85, 3 vols. 8vo).

RYNCHOPIDAE: *see* SKIMMER.

RYOT or **RAYAT,** properly a subject, then a tenant of the soil (from the Arabic *ra'a,* "to pasture"). The word is used throughout India for the general body of cultivator.-; but it has a special meaning in different provinces. The *ryotwari* tenure is one of the two main revenue systems in India. Where the land revenue is imposed on an individual or community owning an estate, and occupying a position analogous to that of a landlord, the assessment is known as *zamindari;* and where the land revenue is imposed on individuals who are the actual occupants, the assessment is known as *ryotwari*.

RYSBRACK, JOHN MICHAEL (1694–1770), one of the principal sculptors and designers in England in the 18th century, was born at Antwerp in 1694 and studied there, probably in the workshop of Michael van de Voort. He was also influenced by the sculpture of F. Duquesnoy. He worked in Copenhagen, Paris and Rome and in 1720 established himself in London, where, except for another journey to France and Italy, he lived until his death on Jan. 8, 1770.

Rysbrack worked in a classical, sometimes eclectic manner, avoiding emphatic gestures, exaggerated asymmetry and extremes of illusionism. His work includes 16 monuments in Westminster abbey, the splendid equestrian statue of William III at Bristol, tombs in parish churches all over England and innumerable portrait busts. In some respects Rysbrack outshone L. F. Roubillac, his only rival for pre-eminence in England at that time. Pyramidal composition and judicious choice of material are characteristic features of Rysbrack's funeral sculpture.

See M. Batten, *Michael Rysbrack, Sculptor* (1954). **(J. A. Dr.)**

RYSWICK, TREATY OF, the treaty of peace which in 1697 ended the war which had begun in 1689 between France on the one side and the Empire, England, Spain and Holland on the other *(see* GRAND ALLIANCE, WAR OF THE). The treaty was signed by all the Powers concerned except the Empire on Sept. 20, 1697, a treaty being concluded between France and the Emperor on Oct. 30.

The basis of the peace was that all towns and districts seized

since the treaty of Nijmwegen in 1679 should be restored. Thus France surrendered Freiburg, Breisach and Philippsburg to Germany, although she kept Strasbourg. On the other hand, she regained Pondicherry and Nova Scotia, while Spain recovered Catalonia, and the barrier fortresses of Mons. Luxemburg and Courtrai. The duchy of Lorraine, which for many years had been in the possession of France, was restored to Leopold Joseph, a son of duke Charles V., and the Dutch were to be allowed to garrison some of the chief fortresses in the Netherlands, including Namur and Ypres. Louis undertook to recognize William as king of England, and promised to give no further assistance to James II.; he abandoned his interference in the electorate of Cologne and also the claim which he had put forward to some of the lands of the Rhenish palatinate.

See C. *W.* von Koch and F. Scholl, *Histoire abregée des traitds de paix* (1817–18); *A.* Moetjens, *Actes et mémoires de la paix de Ryswick* (The Hague, 1725); A. Legrelle, *Notes et documents sur la paix de Ryswick* (Lille, 1894); H. Vast, *Les Grands Traitds du règne de Louis XIV.* (1893–99).

RYŪKYŪ ARCHIPELAGO (called also LUCHU), a long chain of islands at one time forming Okinawa prefecture of Japan. stretching from a point 80 mi. S. of Kyushu to a point 73 mi. from the N.E. coast of Formosa, and lying between 24° and 30° N. and 123° and 130° E. Cartographers reckon the Luchu islands as 55, having a total coastline of 768 mi., an area of 848 sq.mi., and a population (1960) 881.967. They divide them into three main groups, of which the northern is called Oshima-shoto; the central, Okinawa-gunto; and the southern, Sakishima-retto. The terms *shoto, gunto* and retto signify "archipelago," "cluster of islands" and "string of islands" respectively. The last-named group is subdivided into Miyako-gunto and Yayeyama-gunto.

Almost at the extreme north of the chain are two islands with active volcanoes, Nakano-shima (3.386 ft.) and Suwanose-Jima (2.708 ft.), but the remaining members of the group give no volcanic indications, and the only other mountain of any size is Yuwan-dake (2,278 ft.) in Amami-Oshima. The capital is Naha in Okinawa, which possesses the principal harbour and has considerable trade. Shuri, on the same island, site of a picturesque castle, was the ancient capital.

Though so close to the tropics, the islands cannot be said to present tropical features: the bamboo is rare; there is no high grass or tangled undergrowth; open plains are numerous; the trees are not crowded together; lakes are wanting; the rivers are insignificant; and an unusual aspect is imparted to the scenery by numerous coral crags. The temperature in Naha ranges from a mean of 82° F. in July to 60" in January.

The fauna includes wild boars and deer, rats and bats. Excellent small ponies are kept, together with cattle, pigs and goats. The majority of the islands are infested with venomous snakes called *habu* (Trimeresurus), which attain a length of 6 to 7 ft. and a diameter of from $2\frac{1}{2}$ to 3 in. Their bite generally causes speedy death, and in the island of Amami-Oshima they claim many victims every year. The most important cultivated plant is the sugar-cane, which provides the principal staple of trade.

Luchu is noted for the production of particularly durable vermilion-coloured lacquer, which is much esteemed for table utensils in Japan. The islands also manufacture fabrics.

People.—Although the upper classes in Luchu and Japan closely resemble each other, there are palpable differences between the lower classes, the Luchuans being shorter and better proportioned than the Japanese; having higher foreheads, eyes not so deeply set, faces less flattened, arched and thick eyebrows, better noses, less marked cheek-bones and much greater hairiness. The last characteristic has been attributed to the presence of Ainu blood, and has suggested a theory that when the Japanese race entered south-western Japan from Korea, they drove the Ainu northwards and southwards, one portion of the latter finding their way to Luchu, the other to Yezo. Women of the upper class never appear in public in Luchu, and are not even alluded to in conversation, but women of the lower orders go about freely with uncovered faces. The Luchu costume resembles that of Japan. The chief staple of the people's diet is the sweet potato, and pork is the principal luxury. An ancient law, still in force, requires each family to keep four pigs. In times of scarcity a species of sago (obtained from the Cycas revoluta) is eaten.

History.—Tinsunshi, "Grandson of Heaven," is the mythical founder of the Luchu monarchy. Towards the close of the 12th century his descendants were driven from the throne, but the old national party soon found a victorious leader in Shunten, son of Tametomo, a member of the famous Minamoto family, who, having been expelled from Japan, had come to Luchu and married there. The introduction of the arts of reading and writing are assigned to Shunten's reign. Chinese invasions of Luchu may be traced back to A.D. 605, but they did not result in annexation; and it was in 1372 that China first obtained from the Luchuans recognition of supremacy. Luchuan relations with Japan had long been friendly, but at the end of the 16th century the king refused Japan assistance against Korea, and in 1609 the prince of Satsuma invaded the islands with 3,000 men, took the capital by storm, captured the king and carried him off to Kagoshima. A few years later he was restored to his throne on condition of acknowledging Japanese suzerainty and paying tribute. The Luchuans nevertheless continued to pay tribute to China also.

The Chinese government, however, though taking a benevolent interest in the welfare of the islanders, never attempted to bring them under military sway. The incongruity of this state of affairs did not force itself upon Japan's attention so long as her own empire was divided into a number of semi-independent principalities. But in 1879 the Japanese government, treating Luchu as an integral part of the mikado's dominions, dethroned its prince, pensioned him as the other feudal chiefs had been pensioned, and converted Luchu into a prefecture under the name of Okinawa. China remonstrating, a conference was held in Peking, when plenipotentiaries of the two empires signed an agreement to the effect that the archipelago should be divided equally between the claimants. The Chinese government, however, refused to ratify this compromise, and the Japanese continued their measures for the effective administration of all the islands. Ultimately (1895) Formosa also came into Japan's possession, and her title to the whole chain of islands ceased to be disputed.

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RZESZOW, a town of Poland, in the wojewodzfwo (province) of Rzeszow, situated on the river Wislok, half-way between Lwow and Cracom. Pop. (1960) 62,000. It was founded by Casimir the Great and became the seat of a great family. taking their name from the town and dying out in 1583. The old church shows traces of the original structure built by King Casimir in the 14th century. Ordinarily it is a prosperous town in an agricultural and pastoral district. It was captured by Germany in Sept. 1939.

RZHEV (RZHOV), a town in the Kalinin *oblast* of the Russian Soviet Federated Socialist Republic, U.S.S.R., in 56° 20' N., 34° 19' E.. lying on both sides of the Volga river. there 350 ft. wide and navigable for steamers. It is a centre for four branch railway lines and a telegraph line, and has a radio station. Pop. (1956 est.) 42,200, mainly employed in sawmilling, leather work, oil pressing, silk spinning. distilling, brewing and the making of machinery. In the 12th century it was part of the principality of Smolensk, from 1225 a dependency of Novgorod. In the 15th century the parts of the town on the left and right banks were governed separately under independent princes.

S THIS letter corresponds to the Semitic W (sin "tooth"). The Greek treatment of the sibilants that occur in the Semitic alphabet is somewhat complicated. Semitic ǂ (*samech*) appears in Greek as Ξ (ksi) with the value in early times of *ss,* later and more generally of *x* or ks. The name *samech,* however, which through its Aramaean form became in Greek sigma, was applied to the letter ϟ which corresponded to Semitic W (sin) and stood for *s*. In certain Greek alphabets the letter was called by the name *san.* Semitic ssade appears in the early alphabets of Thera and Corinth in the form M representing s. These alphabets have no *sigma,* while those that have *sigma* do not have M .

Greek forms of the letter were Ϟ, Ɛ, Ϛ, ʃ, Ɛ. A rounded form appeared in the Chalcidian alphabet and from this it was taken into Latin. Etruscan had no rounded form, but it appears in Umbrian and Faliscan. In Latin cursive writing of the 6th century the form was ſ, and from this descended the Irish and Saxon forms ſ. The Carolingian form on the other hand nas extended above the line instead of belon, *e.g.,* ſ. In England in the 17th century the form was ſ and this is occasionally still seen in handwriting when followed by another s. The form ſs also occurs, the left-hand oblique stroke being really part of a ligature with a preceding letter. There was a Greek minuscule form ϲ or C of the 9th century AD., which may be the source both of the Cyrillic с and of the lunate *sigma* ϲ used in some fonts of Greek type at the present time. (See also ALPHABET.)

NAME OF FORM	APPROXIMATE DATE	FORM OF LETTER
PHOENICIAN	B.C. 1,200	W
CRETAN	1,100-900	? 3
THERAEAN	700-600	? ϟ
ARCHAIC LATIN	700-500	ϟ
ATTIC	600	ϟ ϟ
CORINTHIAN	600	? ϟ
CHALCIDIAN	600	ϟ
IONIC	403	ϟ ϟ
ROMAN COLONIAL	PRE-CLASSICAL AND CLASSICAL TIMES	ϟ Ϛ ϟ S
URBAN ROMAN		S
FALISCAN		ϟ S
OSCAN		ϟ ϟ
UMBRIAN		ϟ
CLASSICAL LATIN AND ONWARDS		S

THE DEVELOPMENT OF THE LETTER 'S' FROM THE PHOENICIAN, THROUGH THE CLASSICAL. DOWN TO MODERN TIMES

The letter represents an unvoiced sibilant. This has become voiced in English when intervocalic (e g., *houses,* nose). In most other positions it remains unvoiced (e g., sing, save, stamp, speak, aspect). When doubled the letter represents the unvoiced sound in all positions (e.g., grasses, miss, assess). In vision and other words ending in sion the *s,* provided it is not doubled, has the voiced sound *ž,* and similarly in pleasure, leisure.

(B.F.C.A.; J. W. P.)

SAADIA BEN **JOSEPH** (SAID AL-FAYYUMI) (882–942) the greatest figure in the literary and political history of medieval Judaism, was born at Dilaz in the Faiyum, Egypt. Nothing certain is known of his father or of his early life. Saadia's literary work appears at a time when learning seemed to be dead in both east and west. Since the completion of the Talmud very little of any literary importance, except for a few midrashim, had been produced among the orthodox (rabbanite) Jews, although the Babylonian schools at Sura and Pumbeditha continued to enjoy a somewhat intermittent prosperity. On the other hand, learning was cultivated among the Karaites. In Saadia, however, the rabbanites found a powerful champion. Almost his first work was an attack on the teaching of 'Anan ben David (*q.v.*), the founder of Karaism (*q.v.*). This, like most of Saadia's polemical writings, is no longer extant, but something of its contents may be inferred from references in the author's other works and from the statements of his opponents. The controversy turned largely on the calendar, which of course involved the dates of festivals, and, since the rabbanite calendar had come down from ancient times, opened up the whole question of oral tradition and the authority of the Talmud. The conflict raged for many years, the chief representative of the other side being Solomon ben Yeruham, a virulent if not successful opponent. In 922 Ben Meir, a person of importance in Palestine. attempted to make alterations in the calendar, against the authority of the Babylonian schools. Saadia, who was then at Baghdad, warned him of his errors, refuted him in a work called "The Book of the Festivals," and finally procured his excommunication by David ben Zakkai, the exilarch or head of the Jewish community in Babylonia. The exilarch appointed Saadia as Gaon (q v.) of Sura, but within two years the exilarch, influenced by rival scholars, dismissed Saadia, uhile Saadia retorted by declaring the exilarch deposed (930). After three years of contention David ben Zakkai succeeded in sufficiently bribing the new and needy caliph, who definitely forbade Saadia to act as Gaon.

The next four years, spent in retirement at Baghdad. were devoted to literary labours. Eventually a reconciliation was effected nith David ben Zakkai, favoured probably by the new caliph Radi, and Saadia was reinstated as Gaon of Sura in 938.

Under his brief rule the school attained the highest reputation among the Jewish communities of east and west. His health was broken. however, and he died in 942.

Works.—Saadia's works were for the most part written in Arabic, the vernacular of the Jews in the east, so that after the breakup of the Babylonian schools in the middle of the 11th century they would be studied only in Spain, the new centre of Jewish learning, and in Egypt. After the expulsion of the Jens from Spain, Arabic practically ceased to be used by them for literary purposes, and in the rest of Europe (except perhaps in southern Italy) it was never understood. Even some Hebrew works, of great modern interest, must have been regarded at the time as of purely temporary value. The anti-Karaite works against 'Anan, Ibn Sakawaihi and Ben Zuta, the *Kitab at-tamyiz, Kitab al-Shara'i, Kitab al-'Ibbur* (calendar) and a book on anthropomorphisms, all in Arabic, are lost and only known from quotations. So also are the refutation of the skeptic Hivi of Balkh, and the *Sefer 'Ovayoth* (on prohibited marriage, against Karaites). Of the *Sefer ha-Mo'adim* and *Sefer ha-Galui* (against David ben Zakkai), both in Hebrew, some fragments have been recovered.

Closely allied to Saadia's polemical writings are his exegetical works. He translated most of the Bible into Arabic and commented on at least some of the books; the memorial edition of his complete works, edited by J. Derenbourg (1893), contains part of this work. The translation of the five Megilloth and of Daniel (with commentary), usually ascribed to Saadia, are not really by him, but a genuine translation of Daniel. with commentary, exists in manuscript. There is also ascribed to him a midrashic work on the Decalogue. These all, no doubt, exhibit the defects necessary to the time in which their author lived. But it must be remembered that Saadia was a pioneer. Hayyuj, the father of Hebrew grammar, was not yet born, nor had the scientific and comparative study of the language begun. In this respect Saadia contributed little to the subject. But both translations and commentaries are remarkable for their great learning, sound sense and an honest endeavour to arrive at the true meaning of the original. They were thus admirably suited for their purpose, which was, like the earlier Targums and the later work of Moses Mendelssohn (*q.v.*), to render the sacred text more intelligible to the faithful generally and to check the growth of error.

The grammatical work called *Agron,* a sort of dictionary, is lost, as are also the *Kutub al-Lughah* and perhaps other treatises on Hebrew grammar. The explanation of the 70 (really 90) *hapax legomena* in the Bible and a poem on the number of letters in the Bible are extant.

On Talmudic subjects again little is preserved beyond the *Kitab al-Mawarith* and a short treatise in Hebrew on the 13 *Middoth* or canons of exegesis of R. Ishmael and some *responsa* mostly in Hebrew. The translation of the Mishnah. the introduction to the Talmud and other works of the kind are known only by repute.

Of the *Siddur* or arrangement of the liturgy by Saadia, a large part exists in a single manuscript at Oxford, and several additional fragments were recovered from the Genizah (archive) of the old synagogue at Cairo. Numerous other liturgical poems, or parts of them, were obtained from the same source, and several were subsequently published in periodicals. His *Azharoth,* a poetical enumeration of the 613 precepts, in Hebrew, is included in the complete works.

Saadia's philosophical works are (1) a commentary on the *Sefer Yezira,* a mystical treatise ascribed to the patriarch Abraham. which, as the foundation of the cabala, had great influence on Jenish thought, and was the subject of numerous commentaries; (2) the *Kitab al-Amanat w'al-Z'tiqadat* ("Book of Beliefs and Convictions"), written in 933. Its system is based on reason in conjunction with revelation, the two being not opposed but rnutually complementary. It is thus concerned, as the title implies, with the rational foundation of the faith and deals with creation, the nature of God, revelation, free will, the soul. the future life and the doctrine of the Messiah. It shows a thorough knowledge of Aristotle, on whom much of the argument is based, and incidentally refutes the views of Christians, Moslems, Brahmans and skeptics such as Hivi. From its nature, however, the work, although of great interest and value, never had the same wider influence as that of Ibn Gabirol (*q.v.*). The Arabic text was published by S. Landauer (1880), the Hebrew version at Constantinople in 1562 and frequently thereafter. *See* also HEBREW LITERATURE; JEWISH PHILOSOPHY.

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SAALE, a river of Germany, a tributary of the Elbe, 265 mi. long, rises between Bayreuth and Hof in the Fichtelgebirge. It joins the Elbe just above Barby. It is navigable from Naumburg, 120 mi., with the help of sluices, and is connected with the Elster near Leipzig by a canal. Its chief affluents are the Elster, Regnitz and Orla (right), and the Ilm. Unstrut, Salza, Wipper and Bode (left). Its upper course is rapid. It is sometimes called the Thuringian or Saxon Saale, to distinguish it from another Saale (86 mi. long), a right-bank tributary of the Main.

SAALFELD, a town in the district of Gera, Germany, in the former *Land* of Thuringia. situated on the left bank of the Saale, 24 mi. S. of Weimar and 77 mi. S.W. of Leipzig by rail. Pop. (1950) 27,673. Saalfeld grew up around the abbey founded in 1075 by Anno, archbishop of Cologne, and the palace built up by the emperor Frederick I. In 1389 it was purchased by the landgrave of Thuringia, and with this district it formed part of Saxony. In 1680 it became the capital of a separate duchy, but in 1699 it was united with Saxe-Coburg, passing to Saxe-Meiningen in 1826. One of the most ancient towns in Thuringia, Saalfeld is still partly surrounded by old walls and bastions and contains some interesting medieval buildings, among them a palace, built in 1679 on the site of the Benedictine abbey of St. Peter. which was destroyed during the Peasants' War; the Gothic church of St. John, dating from the beginning of the 13th century; the Gothic town hall, completed in 1537; the Kitzerstein, a palace standing on an eminence above the river, probably first erected by the German king Henry I, although the present building is not older than the 16th century; and the ruin of the Hoher Schwarm, called later the Sorbenburg, said to have been erected in the 7th century. Saalfeld has a number of prosperous industries, and there are ochre and iron mines in the neighbourhood.

SAAR (SAARLAND), an industrial and mining region on the Franco-German frontier, north of Lorraine, near the iron ore of Briey. Area 991 sq.mi.; pop. (1947 est.) 848,052; (1951) 955,413. Chief town, Saarbriicken, pop. (1939 est.) 135.080; (1951) 111.450. The basic industry is coal, good for industrial purposes and gas production and indifferent for coke.

History.—From 1381 to 1793 the city of Saarbrucken on the Saar river was ruled by the counts of Nassau-Saarbrucken, the territory around it, although inhabited by a German-speaking population, being latterly much influenced, and partially ruled, by France in the 150 years which followed the treaties of Westphalia (1648). After the defeat of Napoleon the Saar valley was included in the new Prussian province on the Rhine except for a small portion which was given to Bavaria. After World War I the Saar mines were ceded to the French state "as compensation for the damage to the north of France and as part payment toward the total reparation," and in Jan. 1920 the Saar was placed under a governing commission of the League of Nations for 15 years, at the end of which time a plebiscite was to be held enabling the inhabitants to choose between Germany, France or a continuation of the authority of the league.

The first president of the governing commission was a French chauvinist, Victor Rault. His attitude, and above all the French occupation of the Ruhr in 1923, aroused much anti-French feeling in the Saar, causing the first large-scale miners' strike there which lasted for 100 days. After this the Saar prospered under League of Nations rule, but when the full force of the Nazi propaganda machine was brought to bear upon the Saarlanders in 1933 it was easy enough to arouse anti-foreign feelings together with chau-

vinistic exaltation and personal fear. When it came to the plebiscite on Jan. 13, 1935, the attempts made by the league to ensure a free and secret vote failed to carry much conviction, and more than 90% of the votes went to Germany with 8.8% for the status quo and only 0.4% for France. The Saar territory was therefore handed over to Nazi Germany, which bought back the coal mines as the treaty of Versailles had stipulated.

In 1945 the Saar was occupied by the French. Two years later, having slightly extended its frontiers, the French military governor, Gilbert Grandval, arranged for the election of a representative assembly. The new Diet consisted mainly of representatives of the Christian People's party led by a Catholic, Johannes Hoffmann, who had opposed the Nazis in 1935, and of Social Democrats; it agreed to the political autonomy of the Saar within a diplomatic, tariff and financial union with France. By a Franco-Saar convention (1950), the Saar mines were leased to France for 50 years.

Hoffmann was elected prime minister of the autonomous Saar in 1947. He was attacked by German patriots as the tool of France, but his second success in the elections of Nov. 1952 showed that he was not unpopular. On this occasion his party alone, apart from his Socialist allies, polled 54.8% of the valid votes, while only 24.4% of the voters spoiled their papers to indicate their support of the suppressed pro-German parties. Indeed, because of its autonomy, the Saar recovered economically faster than the rest of Germany, and enjoyed more generous social services. It was only in 1954 that Hoffmann and autonomy lost ground, partly because of the failure of the European Deiense community project with which he linked his policy, and partly because West German prosperity by then magnetically attracted the sympathies of the Saarlanders.

In Oct. 1954 the French and German governments agreed to a statute for the Saar according to which French control should be replaced by that of Western European union; the Saarlanders were to give consent to this plan by referendum, the prohibited parties which favoured reunion with Germany being permitted three months before the vote. The referendum was fixed for Oct. 1955, and the pro-German parties therefore began their activities in July, and immediately announced that to reject the statute would be to vote for Germany. Their campaign, dominated by the lawyer, Heinrich Schneider, was passionate, and culminated in the casting of 67.7% of the votes against the statute. Hoffmann immediately resigned and the pro-German parties formed a government led by Hubert Ney. A new Diet was elected in Dec. 1955, leaving the party position unchanged with the Hoffmann party still holding 13 of the 40 seats. The French agreed in principle to the return of the Saar to Germany and negotiations began early in 1956. In June agreement was reached. The Saar became the tenth *Land* of the German Federal Republic on Jan. 1, 1957. France was allowed to continue to exploit the Warndt coal field on the Franco-Saar border and to canalize the Moselle between Coblenz and Thionville; concessions were made by France about the projected Alsace canal and the damming of the Rhine.

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(E. WI.)

SAAR, a right-bank tributary of the Moselle river. It rises in the Donon, an eminence of the Vosges, and flows generally northward through the Saar coal field to its junction with the Moselle at Konz. The principal towns on the Saar are Saarguemines, Saarbrucken, Saarlouis and Saarburg. The river is navigable up to Saarguemines, a distance of 75 mi., where there is connection with the Rhine-Marne canal.

SAARBRÜCKEN, the capital of the *Land* Saarland, German Federal Republic, lies on both banks of the Saar river, 100 mi. S.W. of Frankfurt. Saarbriicken, which was formed in 1909 from the union of the former Saarbriicken with Malstatt-Burbach and St. Johann, is the centre of the Saar's industrial, commercial and cultural life. Pop. (1951) 111,450, (1956 est.) 122,600. It is finely situated among wooded hills and has been called the city of parks and baroque architecture. Among buildings of historic interest are the old town hall and the baroque Ludwigskirche (both of the 18th century) and the 13th-century Stiftskirche, a Gothic church in the St. Arnual district of the town. The 18th-century castle, formerly belonging to the princes of Nassau-Saarbriicken, stands on the site of the earlier royal castle of Sarabrucca; the castle church is of the 15th century. There is a university, an advanced college for electrical engineering and machine construction, and colleges for adult education, arts and crafts, music, local government and other specialized studies. The town is the seat of the Saar parliament and government and of the government's administrative offices. The district and higher courts meet there.

Situated in one of the world's great coal-mining regions, Saarbriicken is principally an industrial city. Its chief importance lies in its iron and steel industries, but manufactures, which are many and various, include optical instruments, lime and cement, soap, sugar and foodstuffs. There are breweries, potteries and printing works. The international Saar fair is held there annually.

Saarbriicken is a frontier town lying at the intersection point of Germany's chief arteries of road and rail communication with France, the Netherlands, Belgium, Luxembourg, Switzerland and Italy, as well as with the rest of Germany. There is an airport to the east of the city in the district of St. Arnual.

History.—The town's history has been traced back to Celtic times from the discoveries of coins, jewels and other artifacts. During the 1st and 3rd centuries there were Roman settlements where Saarbriicken now stands, but an entirely German settlement was later established by the Franks. The present town grew up around the royal castle of Sarabrucca, built by the Frankish kings and first mentioned in A.D. 999. Its early rulers were the bishops of Metz and the counts of Saarbriicken. The city received its charter in 1321. It belonged to the counts of Nassau-Saarbriicken from 1381 to 1793, when it was occupied by the French. In 1815 it passed to Prussia. Saarbriicken became the capital of the Saarland in 1919. As a vital centre of coal production, industry and communications, it was subjected to heavy bombing during World War II. By the late 1950s, however, extensive rebuilding had restored it to its former status.

(F.-J. J.)

SAAREMAA (formerly ÖSEL), an island of the Estonian S.S.R., U.S.S.R., lying in the Baltic sea across the mouth of the Gulf of Riga. Pop. 55,851. It has a length of 45 mi., and an area of 1,010 sq.mi. The chief town is Arensburg, on the south coast, noted for mud baths. In 1227 Ösel was conquered by the Knights of the Sword, and was governed by its own bishops until 1561 when it passed into the hands of the Danes. By them it was surrendered to the Swedes in 1645. Along with Livonia, it was united to Russia in 1721, passing to Estonia in 1918.

SAARLOUIS, a town in the Saar, German Federal Republic, on the left bank of the Saar river, 40 mi. S. of Trier. Pop. (1951) 31,102. Saarlouis was founded in 1681 by Louis XIV of France, and was fortified by Vauban in 1680–85. By the peace of Paris, in 1815, it was ceded to the Allies and by them was turned over to Prussia. There are coal mines in the vicinity, and the town has foundries and large manufactures. The city was named Saarlautern, 1936–45.

SAAVEDRA FAJARDO, DIEGO DE (1584–1648), Spanish diplomat and man of letters, showed himself master of an excellent prose style in his *Idea de un principe politico cristianc* (1640), of which there is an English translation by Astry (1700). His most interesting work is the *República literaria,* published in 1655 as the *Juicio de Artes y Sciencias* under the name of Claudio Antonio de Cabrera.

SAAVEDRA LAMAS, CARLOS (1878–1959), Argentine lawyer, professor, diplomat and Nobel peace prize winner, was born on Nov. 1, 1878, in Buenos Aires. He received the degree of doctor of law *summa cum laude* from the University of Buenos Aires (1903). He held numerous political posts, appointive and elective, in the municipal and national governments of Argentina, including those of minister of justice and public education (1915) and minister of foreign affairs (1932–38). He was Argentine delegate to conferences on world peace and international law, and became a member of several learned societies and academies the world over. For his untiring work for world peace he received the Nobel prize (1936) and numerous decorations and honours from Latin-American and European governments. He held various professorial chairs in the social sciences at the University of Buenos Aires and was rector of that university from 1941 to 1943. He wrote treatises on economics, education, and Argentine and international law. some of which have been translated into French and English. His most noteworthy work is *Por la Paz de las Américas*

(1937). He died in Buenos Aires on May 5, 1959. (C. S. SN.)

SABADELL, a town of northeastern Spain, in the province of Barcelona; on the Ripoll river and on the Barcelona-Zaragoza railway. Pop. (1950) $7,594. Cloth, linen, paper, flour and brandy are manufactured, and there are iron foundries and sawmills. About half the inhabitants are employed in the textile factories. Sabadell is said to be the Roman *Sebendunum,* but in Spanish annals it is not noticed until the 13th century.

SABAEANS. This name is used loosely for the ancient dwellers in southwest Arabia, in the parts now called Yemen, Hadhramaut and Asir. Strictly it belongs to one tribe and one state only. The chief source of information about these peoples is their inscriptions, found in their own land and elsewhere; other sources are the Greek geographers, Babylonian and Ethiopic inscriptions, the Bible and the record of Aelius Gallus' expedition.

History.— The land produced spices and incense and mas a stage on the trade road from India, the Malay archipelago and Africa. At an early date men from Arabia migrated to Abyssinia. The oldest state in Yemen of which anything is known was Ma'in or Ma'an, the Minaeans of the Greeks. Its chief towns, Karnawu, Kaminahu and Yathil (the modern Barakish), lay in the southern Jof, about 120 km. N.N.E. of Sanaa. Though the names of 20 kings are known, the history of Ma'in cannot be written. Relations with Hadramaut were friendly, indeed they "almost suggest a personal union," and there was a colony or outpost at Ma'in Musran (now El 'Ola) to guard the trade road to Egypt and Palestine. Later the state of Kataban began to encroach on Minaean territory, and after fighting with and becoming a vassal or ally of Saba, it joined with that state in destroying Ma'in about 700 B.C. Taking all things into account, the extent of the state, the number of kings, the highly developed script and language, the beginning of the Minaean kingdom cannot be put later than about 1500 B.C. The Sabaeans are mentioned in a Minaean inscription as nomads who raided the caravan road to El 'Ola. This suggests that they may have migrated south to Yemen and founded the kingdom of Saba which bears their name. Perhaps the queen of Sheba lived in the north of Arabia though she has been decorated with the wealth of the kingdom in Yemen. Marib, 100 km. east of Sanaa, was its capital. An inscription of Sargon (c. 715 B.C.) refers to It'i-amara the Sabaean, and one of Sennacherib (c. 685 B.C.) to Ka-ri-bi-lu, king of Saba'i. More than once the second successor of a Yt' 'Mr was a Krb'l. Most probably the pair referred to by the Assyrian kings was Yt' 'mr'Byn, who completed the Marib dam, so famous in Arab story, and defeated Ma'in, killing 45,000 of its inhabitants, and his grandson Krb'l Wtr, who finished the overthrow of Ma'in and pacified the country. Sennacherib speaks of receiving a present from Saba; even court flattery did not dare to call it tribute. About the same time Ausan, which had been a vassal of Kataban, was crushed along with its ally and neighbour Datinat.

Krb'l Wtr was one of the last of a line of rulers who bore the title Mkrb. It was used also by the earlier lords of Kataban. Not long after, the title of king was adopted by the ruler of Saba and used until 115 B.C. This period is marked by the rise of noble clans and ended with the incorporation of Kataban after war both civil and foreign. At home the Hamdan clan tried for the throne and Himyar appears for the first time among the external enemies with Gedarot which had taken the place of the older Ausan. This year 115 is the first of an era by which some of the later monuments are dated. Now began a serious attack on the trade supremacy of the Sabaeans. The Nabataeans fixed themselves across the trade road to Syria, and from Egypt as a base Rome tried to control the sea traffic, besides sending Gallus to attack by land. The royal title now became king of Saba and Du Raidan. About A.D. 300 Hadramaut was conquered and the style became king of Saba, Du Raidan, Hadramaut and Yamnat. This change coincided with a slackening of the Roman effort to control the eastern trade. In the middle of the century Abyssinia conquered the land, but by 375 there was a native king again. His immediate successor adopted the Jewish religion, a mark of an anti-Roman policy, and in 525 Du Nuwas, the last Jewish king, was killed and an Abyssinian governor ruled the land. The failure of the dam at Marib was at once an effect and a cause of the national decay. In 5i9 Persia conquered the country and in 628 the governor turned Moslem and submitted to the prophet. Kataban was ruled at first by Mkrb and then by kings who may have been foreigners. The capital Tmna lay about 110 km. S.E of Marib. The capital of Hadramaut was Sabwat, the Sabota of the ancients.

Government and Social Conditions.— The states were built up of tribes mostly held together by local ties, not by blood bonds. A tribe contained an aristocracy, tenant vassals, resident aliens and serfs. The name Kataban stood for the kingdom and for the tribes composing it; all were children of the god 'Amm. In Saba the tribe of that name stood apart from the others and held a commanding position in the kingdom. The common phrase is "Saba and the tribes." Saba alone is the child of 'Imkh. Later it was put on a level with the other tribes. and was merged in the militia. The king, tribal aristocrats and the temples were the great landholders. Under the form of government in Kataban (probably much the same in the other states) the king was helped and to some extent controlled by a council of elders, though general policy was decided by the assembly of the tribes. In this the serfs had. of course, no place. At a later time in Saba the government became feudal; no longer did the tribal assembly decide the allocation of the land, the king granted fiefs. The change may have been helped by the example of the temples, where the retainers had to obey the orders of the god whose land they tilled. The offices of Mkrb and king mere hereditary and the latter seems often to have associated his son with himself. The land paid three taxes which are never mentioned separately. The amount paid is not knonn but it was assessed while the crops mere standing. Taxes were paid to the temples also; the tithe is named. Public works were done by forced labour. No list of customs, duties or tolls has been found. In early times the title Kbr was given to the chief of a tribe or clan, the governor of a town or district, the chief of the king's serfs and the head of a college of officials; thus there were many offices with one name. Down to the latest times a Kbr was the eponym after whom the year was named. Kyl is first heard of as the name of a leading section of a tribe in the territory of the god Ta'lab Riyam. The ancestors of a petty king were also called Kyl. So it is probable that he was part of the tribal organization and took the place of the Kbr. The Kyn was an administrative officer to serve princes, temples or cities. One mas a priest. The name suggests that he was not a part of the tribal organization.

Trade and the Arts.— Monuments of the south Arabians have been found in Kuweit and Mesopotamia; a coffin of a dealer in spices nas found in Egypt and an altar with a bilingual dedication to Wadd in Delos. Spices and incense were the chief exports and re-exports. The road from Hadramaut ran through the capitals of the other three states, so it is not surprising that one tried to make itself supreme. The returning caravans certainly brought back female slaves for the temple service; women from Gaza and Yathrib (Medina) are mentioned. The production of incense was in the hands of the nobles, 3,000 families Pliny says, and was surrounded aith various tabus, besides a tithe paid to the temple at Sabwat. Great care was given to irrigation and the terracing of the hills into fields. The people were fine masons and stonecutters. The dam at Marib is now in much the same condition as when Hamdani (A.D. 848) saw it. The buildings were made of stone so carefully dressed that often the joints are scarcely visible; the stones are held together by leaden dowels and pillars are strengthened by mortise and tenon joints. Big buildings were often elaborately decorated and several forms of pillars and capitals were in use. The Arab tales of lofty houses with windows of translucent stone are not much exaggerated. The pointed arch was known. Many of the old cisterns are still in use. Many of the inscriptions are beautiful and testify to the skill of the stonecutters, nho were successful with the figures of animals and conventional foliage in low relief. Figures in the round were less good and in statues of men the body is usually a mere block while the face is nooden and expressionless and often out of proportion. Stone pots and jars for household use are simple but neat and well shaped. Most of the metalnork that survives is figures of animals and tablets with inscriptions. The figures are generally

crude. It is not certain that the jewelry, pottery and similar small articles really belong to the land and the period. The best things' suggest foreign influence or even origin. At first the coins followed Athenian models and the workmanship is very good in some. Later they degenerated until the owl looks like a jar with two round handles. Curiously, the standard is Babylonian. The latest coins are weak imitations of Koman coins.

Inscriptions and Language.— The inscriptions are all on stone or metal. Words are separated by a divider and the letters are never joined. In early times the characters were angular but later the corners were rounded and curves appear. The alphabet is connected with the Phoenician; some of the letters are exactly alike, some look as if they had been purposely altered by those who understood the art of carving in stone, and some not found in Phoenician are formed by differentiation from those that are. Short inscriptions have been found in Mesopotamia in nhich Sabaean letters are combined with others resembling the Phoenician and Greek forms. It is not certain nhether this is an early form of the alphabet or merely a freak. There are 29 letters. the 28 of Arabic and the second form of *s* which is found in Hebrew. The language is classified with Abyssinian as south Semitic and is split into several dialects which differ in grammatical forms and vocabulary. In Ma'in and Kataban *s* is used in the pronoun of the third person and in the causative form of the verb where Sabaean has *h*. Hadramaut has forms nhich are from a later period phonetically than the other dialects. The vowels are not indicated so the pronunciation of all words is a matter of guesswork. The writing is usually from right to left but some of the oldest inscriptions read alternately from right to left and from left to right. This is occasionally found in later ones but then for special reasons. Presumably there was a literature, but it has disappeared. Sabaean inscriptions have been found in Abyssinia and the Ethiopic alphabet is derived from the south Arabian. Inscriptions in various alphabets derived from the Sabaean are found in different parts of Arabia as far north as Damascus and testify to the widespread influence of the south Arabian kingdoms. Many of the south Arabian inscriptions are hard to interpret and the sense highly problematical.

Religion.— Over 100 gods and many temples are named but next to nothing is knonn about them. Certain deities are common to the nhole land. Sams, the sun, is feminine and perhaps all goddesses are forms of it. 'Attar, the star Venus, is masculine but corresponds philologically with the Babylonian Ishtar and the Canaanite Ashtoreth. The moon. Warah, Sahr or Sin, occurs occasionally and I1 or Ilan is the name of a god as well as a common noun. Each country had its own god; Ma'in had Wadd, Kataban had 'Amm, Saba had Ilmukah and the clan of Hamdan had Ta'lab Riyam. Perhaps these tribal gods are all forms of the moon. There are indications that the moon. sun and Venus formed a divine family. Others are Anbai, Du Samawi, the enigmatic Nakrah and Atirat (the Hebrew Ashera). Other divine names are clearly descriptive; Hawbas "the drier" is the moon according to Hamdani, Kahil "the old," Sa'd "luck" the giver of good fortune and Hukm "judgment" the judge. At times kings seem to have been worshiped (after death?). Springs and water courses were inhabited by spirits. The bull. the bull's horns and the crescent were symbols of the moon and a disk stood for both the sun and Venus. Often one cannot decide which of the two is meant. The people were the offspring and the king the first-born of the god, so the formula runs "god. king and people." There were no images of the gods. To obtain success in one's undertakings it was the custom to dedicate to the god a statue of oneself in stone, or figures of men or animals in gold (gilt?). Sacrifices and incense were offered to them. The names for altar and sacrifice are the common Semitic terms, and the altar of incense has among other names that of *miḳtār* as in Hebrew. A variety of spices (the wealth of the land) are named on these altars: as rand. ladanum. costus. tarum. frankincense and others not yet interpreted. Pilgrimages mere made at certain seasons and the pilgrim month was named Du Hijjatan or Du Mahajjat. There are many names for the months, some of which refer to agriculture. The name for priest is r-š-w (which may mean giver) and in the El 'Ola texts comes the word I-IT-': both masculine and feminine, which looks like Levite. In later times the name Rahman for God suggests Jewish influence. Christianity was introduced into south Arabia but it was not favoured because of its association with Abyssinia; the famous church in Sanaa mas looked on as a sign of foreign domination. The massacre of Christians in Nejran had poiitical causes as well as religious.

The ruins of the temple at Marib are an open space surrounded by an elliptical wall with the main door at one end of the shorter axis and a smaller at one end of the longer axis. Columns flanked the main door. Outside are several groups of pillars and a set of four may have held a canopy over a throne. The temple at Sirwah is an oblong building with two sets of pillars inside it. One set held up the roof of the sanctuary and the other surrounded a light well. Another at Yeha in Abyssinia is an oblong building with the door at one end. It seems to have been of three stories.

(A. S. T.)

SABANG, a port situated on the island of Pulu Weh, about 20 mi. N. of Kota Raja, the capital of Atjeh, in north Sumatra, Indonesia, 308 mi. from Penang (from which it lies due west), 608 mi. from Singapore and 1,100 mi. from Djakarta. Pop. about 9,000.

Sabang is the first port of call in the Malay archipelago for vessels proceeding from Europe eastward, being the westernmost point at the entrance to the Straits of Malacca. The harbour, built in 1887, principally as a coaling station, is sheltered from the heavy swell of the Indian ocean and strong winds by mountains and high stretches of coast line.

SABARKANTHA, a district of Bombay state, India, which includes some areas of the old Sabarkantha agency. Area of the district, 2,831 sq.mi.; pop. (1951), 684.017.

The SABARKANTHA AGENCY, a subagency of the Western India States agency?was set up in 1934 by the combination of the former Banas Kantha and Mahi Kantha agencies, with headquarters at Sadra. The agency comprised 46 petty states, 13 *talukas* and a number of other estates grouped into 9 thanas (police divisions); the agency occupied a large tract in northwestern Gujarat and five detached areas to the southeast. All the Sabarkantha states?etc., mere merged into Bombay in 1918.

SABATIEW, (LOUIS) AUGUSTE (1839–1901), French Protestant theologian, who applied to New Testament studies the methods of historical criticism and, particularly through his symbolic interpretation of Christian dogma. exerted influence on the Modernist movement (see MODERNISM). was born at Vallon (Ardèche), in the Cévennes, on Oct. 22, 1839. He was educated at the Protestant theological faculty of Montauban and the universities of Tiibingen and Heidelberg. After four years' work as a pastor he became professor of reformed dogmatics at Strasbourg (1867–73) and then (1877) at the newly established Protestant Theological faculty at Paris. He died April 12. 1901.

Among Sabatier's chief works were *The* Apostle *Paul* (1870; Eng. trans. 1891); *Outlines* of *a Philosophy* of *Religion* (1897; Eng. trans. 1897); and his posthumous *Religions* of *Authority and the Religion* of *the* Spirit (1903; Eng. trans. 1904).

See E. Ménégoz, "The Theology of Auguste Sabatier of Paris," *Expository Times, 15*:30–34 (1903–04).

SABATIER, PAUL (1858–1928), French historian who is chiefly remembered as a biographer of St. Francis of Assisi, was born at Saint-Ilichel-de-Chabrillanoux (Ardèche) on Aug. 3, 1858. A Calvinist from birth. he began his studies at the Protestant faculty of theology in Paris in 1880 and became pastor of St. Nicholas, Strasbourg. in 1885. He was expelled from Xlsace in 1889. because he refused to become a German subject, and although he was given a parish in the Cévennes, ill health forced him to retire and he devoted himself to historical research. He was professor of Protestant theology at Strasbourg from 1919 until his death there on March 4, 1928.

Sabatier's *Vie* de *St. François d'Assise* (1893; Eng. trans. 1894) enjoyed an immediate and spectacular success, running through more than 40 editions during its author's lifetime. The work, however, has many defects. not the least of which is Sabatier's disregard for the ideal of historical objectivity. He viewed St.

Francis as an earlier counterpart of the 19th-century Protestant liberal, whose obedience to the church was mere conformity and who u-as in reality the leader of the laity in the 12th century in rebellion against ecclesiastical authority.

SABATIER, PAUL (1854–1941), French organic chemist, shared the Nobel prize for chemistry in 1912 with Victor Grignard for researches in catalytic organic synthesis, and particularly for the discovery of the catalytic activity of finely divided nickel in hydrogenation-dehydrogenation reactions. Born at Carcassonne, Nov. 5, 1854. Sabatier studied at the École Normale Supérieure and under Marcellin P. E. Berthelot at the Collège de France, taking his doctor's degree in 1880. After a year at Bordeaux, he moved to the University of Toulouse in 1882, where he became professor (1884) and dean (1905).

Sabatier's discoveries formed the bases of the margarine, oil hydrogenation and synthetic methanol industries, as well as of numerous laboratory syntheses. He explored nearly the whole field of catalytic syntheses in organic chemistry, personally investigating several hundred hydrogenation and dehydrogenation reactions, showing that several other metals besides nickel possess catalytic activity, though in smaller degree. He also studied catalytic hydration and dehydration, examining carefully both the feasibility of specific reactions and the general activity of the various catalysts.

Sabatier's great discovery was made in 1897 when he and his pupil J. B. Senderens passed efhylene over hot nickel, in an effort to prepare a nickel compound of ethylene. They believed that since carbon monoxide, which has unsaturated valences, combines with nickel to form a carbonyl, then ethylene, too, which is also an unsaturated compound. might form an analogous compound with nickel. Actually, they obtained much carbon, indicating decomposition of the ethylene, and some ethane. Concluding that the ethane could have come only from undecomposed ethylene which had been reduced by hydrogen formed from the ethylene which had decomposed, they tried passing a mixture of hydrogen and ethylene over the nickel, and immediately obtained a smooth reduction.

Sabatier was invited to succeed Henri Moissan (*q.v.*) at the University of Paris, but he remained at the University of Toulouse until his retirement in 1930. He died Aug. 14, 1941.

See H. S. Taylor, *J. Amer. Chem. Soc.,* 66:1615 (1944); H. Vincent, *C. R. Acad. Clerm.-Ferrand,* 213:281 (1941). (P. O.)

SABAZIUS, a Phrygian or Thracian deity, frequently identified with Dionysus, sometimes (but less frequently) with Zeus. His worship was closely connected with that of Cybele and Attis and was chthonian and mystic in character. It reached Greece in the 5th century B.C. A few passages state that the Jews worshiped him (confusion with Heb. *sabaōth?*) see Val. Max. I, 3, 2. The true etymology of the name is unknown. Whether he was the same as Sozon, a marine deity of southern Asia Minor, is doubtful. His image and name are often found on "votive hands," a kind of talisman adorned with emblems, the nature of which is obscure. His ritual and mysteries (Sacra Svadia) gained a firm footing in Rome during the 2nd century A.D.

See Eisele in Roscher's *Lexikon, s.v.* (bibl.).

SABBATAI ZEBI (ZEVI or SEBI) (1626–1676), Jewish Cabalist and pseudo-Nessiah, was born in Smyrna (modern Izmir, Turk.) of Spanish descent. As a boy he was attracted by the mysticism of Isaac Luria (*q.v.*), which led him to adopt the ascetic life. He passed his days and nights in a condition of ecstasy, and attracted a steadily increasing number of followers. Sabbatai began to dream of the fulfillment of messianiac hopes, being supported in his vision by the outbreak of English millenarianism (see MILLENNIUM). Christian visionaries had fixed the year 1666 for the millennium, and since Sabbatai's father, Mordecai, was the Smyrna agent for an English firm, Sabbatai often heard of the expectations of the English Fifth Monarchy men (*q.v.*). In 1638 (the year the cabalists had calculated as the year of salvation), Sabbatai proclaimed himself Messiah. He left Smyrna in 1651 and went first to Salonika, an old cabalist centre, and then to Constantinople, where he encountered a man who pretended that he had been warned by a prophetic voice that Sabbatai was indeed the long-awaited redeemer. He journeyed to Palestine and then to Cairo, where he secured the support of Raphael Halebi, a philanthropist and treasurer of the Turkish governor. With a retinue of believers and considerable funds: Sabbatai returned in triumph to the Holy Land, transferring the centre of his growing movement to Jerusalem. Nathan of Gaza assumed the role of Elijah, the Messiah's forerunner, proclaimed the coming restoration of Israel and the salvation of the world through the bloodless victory of Sabbatai, "riding on a lion with a seven-headed dragon in his jaws." Again 1666 was given as the apocalyptic year.

Threatened with excommunication by the rabbis of Jerusalem, Sabbatai returned in the autumn of 1665 to Smyrna, where he was received with wild enthusiasm. From the Levant the Sabbatian movement spread to Venice, Amsterdam (hailed particularly by the numerous marranos who had fled there from Portugal), Hamburg, London and other centres of Europe and north Africa. Day by day Sabbatai was hailed by all the world as king of the Jews.

At the beginning of the fateful year 1666 he went (or was summoned) to Constantinople. He was placed under arrest, but the reports of miracles continued, and many of the Turks were inclined to become converts. Soon he was transferred to Abydos, where, in prison, he lived like a king, holding court and even receiving foreign delegates. In September Sabbatai was brought before the sultan, and he had not the courage to refuse to accept Islam. He became a Moslem and was appointed doorkeeper to the sultan. The messianic imposture thus ended in the apostacy of Sabbatai. He died in obscurity in Albania in 1676.

A sect of Moslem Sabbatians—the Donmeh of Salonika—survived him, and within the Jewish faith the controversy for and against his Messiahship continued up to the modern period, erupting into the Frankist movement in southern Poland and Czechoslovakia in the 18th century (see FRANK, JAKOB).

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SABBATH, the seventh day of the week as a day of rest and sanctification according to the Jewish religion.

In the Pentateuch the institution of Sabbath is connected with various ideas. (1) It is associated with the doctrine of creation: the creation of the world was completed in six days; and God rested on the seventh day (Gen. ii, 1–2; Ex. xx, 11). (2) Sabbath has a social aspect: it is a day of rest for all men, servants and strangers (Ex. xx, 10; Deut. v, 12–15; Ex. xxiii, 12), and thus stands for the idea of equality of man. On that day there is neither master nor slave; in rest all men are alike. (3) Sabbath also is associated with the idea of holiness: "You shall be holy . . . and you shall keep my sabbaths" (Lev. xix, 1–3). (4) Sabbath is a covenant between God and Israel: "Wherefore the people of Israel shall keep the sabbath, observing the sabbath throughout their generations, as a perpetual covenant. It is a sign for ever between me and the people of Israel" (Ex. xxxi, 16–17). All these ideas must have arisen in different times; their historical sequence however, is difficult to establish.

Observances.—In the prophetic writings the people are continuously admonished to keep the Sabbath holy. Few commandments received the same emphasis. Deutero-Isaiah connects it with doing justice and righteousness: "Keep justice and do righteousness . . . Blessed is the man who does this . . . who keeps the sabbath, not profaning it, and keeps his hand from doing any evil" (Isaiah lvi, 1–2). The attainment of the highest blessings is made dependent on the keeping of the Sabbath (Isaiah lviii, 13–14). Jeremiah warns the people of the impending destruction of the Temple as a punishment for their desecration of the Sabbath: "But if you do not listen to me, to keep the sabbath day holy . . . then I will kindle a fire in its gates" (Jer. xvii. 27). Ezekiel singles out the sin of desecration of the Sabbath along with that of idolatry, as the only reasons for the wrath of God (Ex. xx, 13–24).

The strict observance of the laws of Sabbath since ancient times may be seen from the book of I Maccabees (ch. ii). When the

soldiers of Antiochus Epiphanes were arrayed against the Jews on the Sabbath, the Jews "answered them not, neither cast they a stone at them . . . And they rose up against them in battle on the Sabbath and they died, they and their wives and their children." Realizing that this policy could lead to the annihilation of the people, the Maccabees took counsel and decided, "Whosoever shall come against us to battle on the Sabbath day we shall fight against him and me shall in no wise all die." It was later established as a rule by the authorities that in war the laws of Sabbath are suspended (Bab. Talmud Sabbath 19*a*). The Essenes went to the extreme of not leaving their houses on that day (Josephus, Wars of the *Jews*), and the Jewish sect of Karaites followed this practice, assigning literal meaning to Ex. xvi, 29: "let no man go out of his place on the seventh day." Since the Sabbath begins Friday at sunset, they also insisted on remaining in darkness on Friday night, basing their action on their interpretation of Ex. xxxv, 3. On the other hand, rabbinic law ordained the kindling of lights before the beginning of Sabbath, and upon the lady of the house imposed the duty of inaugurating the Sabbath with a benediction on the kindling of lights.

In the Pentateuch there is no general definition of the kinds of work prohibited. There are, however, specific references to interdicted labours, such as plowing and harvesting (Ex. xxxiv, 21), the kindling of fire (Ex. xxxv, 3), gathering of wood (Num. xv, 32–36) and baking and cooking (Ex. xvi, 23). The types of work prohibited on Sabbath were established by the rabbinic authorities as consisting of 39 main categories of work and are enumerated in the Tractate Sabbath of the Talmud. The basis for the derivation of these prohibited categories was the consideration of the kinds of nork the Jews must have performed while in the wilderness in connection mith the building of the Tabernacle. From each of the main categories of mork cognate types were derived.

The positive duties of Sabbath observance are to wear one's best clothes, to rejoice (derived from Isaiah lviii, 13) and to eat at least three meals during the day. Before the evening meal a special blessing of sanctification, Kiddush, is read. An abbreviated Kiddush is recited before the meal following the morning service (see KIDDUSH AND HABDALAH). The service in the synagogue includes psalms extolling the majesty of God's work and of the Sabbath day. The entire Pentateuch is divided into sections (*Sidroth*), designed to be read on the 52 Sabbaths of the year. A prophetic selection (Haftarah; *q.v.*) is chanted after the reading of the Torah.

At the conclusion of the Sabbath a special blessing (Habdalah) is recited, emphasizing the idea of separation or distinction—separation between Sabbath and weekdays, between the holy and the profane, between light and darkness, etc. In the evening service at the end of the day a reference to the idea of separation is included in the prayer for wisdom and understanding. The concept of separation and discrimination is as indispensable to understanding as is the act of identification.

The precepts prohibiting all kinds of work on the Sabbath are suspended in case of danger to life. A very ancient rabbinic text reads: "It is written: 'You shall keep the Sabbath. because it is holy for you' (Ex. xxxi, 14), the Sabbath is given to you, you are not given to the Sabbath" (Yoma, 85*b*). The laws of Sabbath are thus not ends in themselves but are subordinated to a higher principle, the enhancement of human life. The statutes of the law were given that man might live by them (Lev. xviii, 5; Talmud Yoma 85*b*). The Sabbath laws are suspended even when the danger to health is doubtful. Where human life or health is jeopardized, "It is better to profane one Sabbath for the sake of making possible the observance of many Sabbaths" (ibid.). All affairs of business, even when they do not involve physical exertion, are prohibited on the Sabbath. But the law allows the exercise of offices of humanity, such as caring for the poor, and attending to communal matters, as well as the hiring of a teacher, even for the purpose of teaching one's child a trade (Talmud Sabbath 150*a*).

Some of the pagan Greek and Latin authors attacked the institution of Sabbath on the ground of its wastefulness; to be idle every seventh day is to lose a seventh part of one's life. Because of the Sabbath, the Roman emperors exempted Jews from military service. In modern times the austerity of the Sabbath laws has been criticized, but in fact, in the great age of faith, the Sabbath was pre-eminently a day of spiritual delight, not of either idleness or austerity. Complete abstention from the profane tasks of everyday life made possible the cultivation of intellectual and spiritual interests; worship in the synagogue, study of religious literature, and discourses on religious subjects occupied the better part of the day. It was a day of happiness and spiritual joy that guarded the Jew against the strains and stresses of a hostile world in the long history of his wanderings. "More than the Jew kept the Sabbath, the Sabbath kept the Jew." The close relationship between the observance of the Sabbath and the preservation of Israel was expressed in a poem by Abraham ibn Ezra (12th century): "I keep the Sabbath, God keeps me; it is a sign between Him and me."

Origin. — The question concerning the origin of the Sabbath and the part it played in the life of the Israelites before the Exile is still shrouded in mystery, despite the attempts that have been made to shed light upon it. Friedrich Delitzsch (Babel und *Bibel*) mas the first to propound the theory of the Babylonian origin of the Jewish Sabbath. From Babylonian sources it is known that certain days of the month, the 7th, 14th, 21st and 28th, were days in which the king might not perform certain acts, such as eating roast flesh, changing his dress, offering sacrifice, mounting his chariot or pronouncing judgment; neither might the *magus* prophesy, nor the physician minister to the sick. Thus Delitzsch found the original home of the biblical Sabbath in Babylonia. This theory remains unconvincing for the following reasons: The Babylonian days were "evil days," not propitious for certain actions. Furthermore, those actions were prohibited only to particular persons. such as the king, the *magus* and the physician. In addition to the days mentioned, the 19th day of the month also mas an "evil day," on which those actions were prohibited. Those days in the Babylonian calendar must have had their origin in some magical concept. This has nothing in common with the biblical Sabbath as a day of rest for all men, slave and stranger included—an institution that is bound up with the ethical and monotheistic concept of God as Creator. To be sure, the name Sabbath seems to have its origin in Babylonia. It may be a loan word from the Babylonian *Šappattu,* or Sabbattu, the 15th day of the month; it is, however, equally possible that both, *Šappattu* and Sabbath are derived from a common ground in a prehistoric Semitic tradition. In any case there is a long step from days of taboo to a day of spiritual delight.

There is no evidence of Sabbath observance in the patriarchal period. The reference in the historical and prophetic books of the Bible seem to indicate that a close connection existed betneen the Sabbath and the new-moon festival, and much has been made of the passages implying such a connection. When the Shunammite proposed to visit the prophet, her husband asks: "Why will you go to him today? It is neither new moon nor sabbath" (II Kings. iv, 23). Hosea warned the people in the name of the Lord: "And I will put an end to all her mirth, her feasts, her new moons, her sabbaths, and all her appointed feasts" (Hosea ii, 11). Amos denounced the dishonest traders who say: "When will the new moon be over, that we may sell grain? And the sabbath that we may offer wheat for sale?" (Amos viii, 5). In excoriating the offensive manner of the religious observances, Isaiah says: "Incense is an abomination to me. New moon and sabbath and the calling of assemblies" (Isaiah i, 13). New moon and Sabbath thus are commonly linked together. Hosea implies that Sabbath and new moon were days of festal joy, and from Amos it follows that on those days ordinary business activity was suspended. That carrying any burden on the Sabbath was not allowed can be seen from Jer. xvii, 21–27. That it was customary to visit the Temple on Sabbath days is clear from Isaiah lxvi. 23: "From new moon to new moon, and from sabbath to sabbath, all flesh shall come to worship before me." The linking together of Sabbath and the new moon led I. Meinhold to suggest that the Sabbath must have been originally the day of the full moon, since the counterpart of "new moon" is "full moon" and not the seventh

day of the week. It is further noted that among the Phoenicians the new moon and the full moon were the chief days of sacrifice.

Various theories have been suggested as to when the day of the full moon became the Sabbath. Meinhold attributes the change to Ezekiel. S. Mowinckel suggests a time shortly before the Exile. Max Weber rejects the exilic origin of the Sabbath, citing Neh. xiii, 15 as clear demonstration that those who remained in Palestine knew of the Sabbath as a weekly day. These theories, ho ever, are little more than stabs in the dark, since the transition from a moon-oriented day to the unvarying observance of a seventh day is left unexplained. The law of *Shmita* (*i.e.*, the sabbatical year) is associated with the Sabbath day. Both require cessation of work, the former prohibiting work in general on the seventh day and the latter forbidding agricultural labour in the seventh year. The law demanding the release of slaves in the seventh year (Ex. xxi, 2) again suggests the Sabbath as occurring on the seventh day. *(See* JUBILEE.)

Max Weber accepted the theory that the Sabbath is related to the Babylonian *Šappattu*, but only as a matter of common heritage and not as a borrowing from Babylonia. Weber argued on the basis of Neh. xiii, 15 that the seventh day was originally a day of rest and joy, on which the farmers came to the town markets to sell their produce and perhaps also to amuse themselves. He compared this day with the Roman *nundinae*, the first day of the eight-day week, which had the same social function in Roman life. Likewise, Eduard Meyer compared the Sabbath with the Roman *nundinae*, stressing the economic-social origin of the holiday. He repudiated the connection of the week-day Sabbath with the moon and considers its association with the Babylonian *Šappattu* improbable. He left the name Sabbath unexplained, however. The analogy of the Roman *nundinae* with the Sabbath, as it appears to Meyer and Weber from Nehemiah, is a sociological hypothesis, thus repudiating the speculations of an astrological origin of the Sabbath.

The nature of the Sabbath, however, can hardly be deduced from references to the practice of the people at a certain historical period. This practice was more likely a deviation from a previously existing law or tradition. In denouncing the people for their conduct on the Sabbath and characterizing it as a profanation. Nehemiah clearly implied the prior existence of a different tradition. "'What is this evil thing which you are doing. profaning the sabbath day? Did not your fathers act in this way, and did not our God bring all this evil on us and on this city? Yet you bring more wrath upon Israel by profaning the sabbath'" (Neh. xiii, 17–18). Not the practice of the people, but rather Nehemiah's reaction to their practice should serve as a basis for the understanding of the original nature of the Sabbath as a Jewish institution. Nehemiah is here not instituting something new but referring to a hallowed tradition concerning a day of rest. the profanation of which has in the past brought down upon Israel the wrath of God.

The various attempts to explain the origin of the Sabbath do not take into account the probability of a core of Mosaic or prophetic legislation with which the Sabbath law was closely connected. Admitting that biblical legislation in the form in which it came down to us is of a later date, its essential elements, such as the contents of the Decalogue, were known as a Mosaic tradition, as can be seen from the prophetic references to the "law of hloses." The laws relating to Sabbath as a rest day for all men, to the sabbatical year and to the release of slaves in the seventh year of servitude. imposing restrictions on ownership and on the power of the individual, were revolutionary and idealistic in character; apparently they were grounded in a concept of property and labour closely connected with the prophetic philosophy of God and man. Just as the prophetic concept of ethical monotheism was a new, indeed a unique idea, neither to be derived from, nor to be reduced to the various conceptions of God prevalent in the ancient world, so was the biblical institution of the Sabbath. The new concept of God transformed the sociological and astrological raw material into a new institution; with the result that the analogies to the Sabbath that can be found in the ancient world serve only to accentuate its uniqueness.

Modern Period. — Conservative and Reform Judaism have been confronted by the problem of Sabbath observance in the modern age. Conservative Judaism has not developed a unified point of view with regard to the laws of Sabbath observance. The traditionalists of that movement deny that there is any difference between conservative and orthodox Judaism as to observance of the law. The spokesmen of the liberal wing of the movement plead for certain changes, taking into consideration the conditions of modern life. such as allowing travel to the synagogue. Such modifications, however, have not received the unanimous approval of the official authoritative bodies.

The reform movement also has wrestled with the problem of preserving the Sabbath under modern conditions. It realizes the serious obstacles standing in the way of full observance of the Sabbath laws. The consensus, however, is that Sunday could never become the Jewish Sabbath. The institution of public services on Sunday aims merely at reaching those who are prevented from observing the Sabbath. The distinctive character of the Sabbath as a day of sanctification is necessarily bound up with the Sabbath as hallowed by tradition. A day of rest could be shifted to another day. But Sabbath is the symbol of the covenant of Israel with God and of creation; it is therefore indispensable for the Jew as a sign of his religion. If it is difficult to observe the day in accordance with traditional prescription, it is necessary to strive to observe it to the best of our ability. The humanitarian idea of the Sabbath has a universal message, which constitutes an essential element of the Jewish religion. Recognizing the distinctive and the positive idea of the day. Reform Judaism has striven to preserve it. Such an authoritative body as the Central Conference of American Rabbis recommended conscientious abstention from all those activities that would obscure the difference between Sabbath and the weekdays. By emphasizing in practice the line of cleavage between Sabbath and the weekdays, the idea of the Sabbath will be preserved and intensified. Reform Judaism instituted late Friday evening services and the reading of the Torah portion at that hour. This, of course, is in addition to the regular Sabbath morning Torah service. Reform liturgy provides also for a service in the home (Kiddush). These provisions aim at preserving the Sabbath in its essential elements.

Christianity. — The position Jesus took — that "the sabbath was made for man. not man for the sabbath" (Mark ii, 27) — was essentially in keeping with the rabbinic saying* cited above. It appears, however, that Jesus or his followers went far beyond the rabbis in the application of this. The early Christians taught that the principle of the love of God superseded the law of Moses. Jesus thus justified the conduct of the disciples in plucking ears of corn on the Sabbath, though this act violated the rule prohibiting harvesting. He himself. in healing the sick, broke the rule that one should not administer aid to a sick man when it involves a transgression of the precepts of Sabbath, except when life is threatened. For Jesus and for his followers, the love of God was a surer guide of conduct than mere obedience to the law of Moses.

The Jewish Christians of the early church continued to observe the Sabbath. According to Eusebius, the Ebionites kept both the Sabbath, as a memorial of the creation, and the Lord's day (Sunday), the weekly celebration of the Resurrection; and this was the general practice of the early Christians, as recommended by the Apostolic Constitutions *(see* CONSTITUTIONS, APOSTOLIC). The Eastern Church in recognizing the festive character of the Sabbath and prohibiting fasting on that day is in accordance with Jewish law. The spread of Christianity to the gentile world brought about a change in the Christian attitude. Paul began by insisting that the Jewish Sabbath was not binding on Christians. He ended by asserting that the principle of love was in contradiction of the law of Moses, and bitterly condemned the Christians who abided by the laws of Sabbath (Col. ii, 16 and Gal. iv, 9–11).

Chiefly because of the fact that the Resurrection took place on Sunday (*q.v.*), that day eventually replaced the Sabbath in Christian religion. A few post-Reformation bodies (as the Seventh-Day Adventists) observe the Sabbath rather than Sunday.

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SABBATION or SAMBATYON, a river (1) natural and (2) supernatural. (1) The Targum pseudo-Jonathan to Exod. xxxiv., 10 states that the Ten Tribes were exiled beyond the Sambatyon: this is repeated in Gen. Rabba lxxiii.: Num. Rab. xvi. and Yalqūṭ Genesis 984. This is therefore a river in Media, identified by Ramban (Deut. xxxii., 26) with the Gozan (II Kings xvii., 6) and a natural stream. Fuenn (*Pirḥe Çafōn* ii., 133) identifies this with the Zab in Adiabene which Xenophon calls Sabatos and which became corrupted to Sabbation. This river must be sharply distinguished from that mentioned by Josephus (*War,* vii., v., 1) who makes Titus on his return from the destruction of Jerusalem pass, near Beirut, a river which, flowing only on one day in seven, is called after the Sabbath. It will be noted that this river is in Palestine, not in Media and that it is periodic.

(2) With Pliny (*Hist. Nat.* xxxi., 2) two supernatural elements enter the story. First the river rests one day in seven instead of flowing on that day and secondly that day is the Sabbath. A variant of the miracle occurs in Gen. Rabba xi. In the 9th century the mysterious Eldad the Danite carried the wonder still further. In his chronicle the river is waterless but full of sand and stones which roll with a great noise during the week-days but rest on the Sabbath. Th. Noeldeke (*Beiträge zur* Gesch. d. Alexanderromans, 48) traces the Sambatyon in the Alexander legend. The river of sand (*Wadi* ar-Raml) is mentioned by Kazwini (Cosmography ed. Wiistenfeld, ii., 17) and by Mas'udi. Benjamin of Tudela mentions the ten tribes and the Gozan river but he ascribes no miraculous properties to it, save that David Alroy crossed it on his mantle. In the 17th century the miracles hsve increased. Travellers from India relate that the sand or water is curative of leprosy. Menasseh ben Israel states that the sand, if kept in a bottle moves about during the week but rests on Sabbath. It has been suggested that the sand element in the story is to be explained by a confusion of a Hebrew name נהר חל (*Nehar Ḥōl*) which could mean either "weekday river" or "river of sand."

See Jew. *Enc. s.v.* and *A.* Neubauer, *Jew. Quart. Rev. I.,* "Where are the Ten Tribes?"

SABELLIC (from Latin *Sabellus,* "Samnite") has often been used of a minor group of the Italic dialects, namely the pre-Latin dialects of the Paeligni, Marrucini and Vestini (better called North Oscan), of the Volsci, and of the Marsi, Aequi, Sabini and other central Italian tribes (conveniently called Latinian); these dialects are all closely related to Oscan (*q.v.*). The same name, or sometimes Old Sabellic, is also used, but inaccurately, to describe two small but distinct groups of inscriptions from various sites near the east coast of central Italy: (1) from Novilara and Fano (near Pesaro); (2) from Belmonte Piceno, Cupra Marittima, Castignano, Bellante, Grecchio and Superequo. These may be better designated, by "East Italic."

The second group, not more recent in date than the 6th century B.C., are doubtless the oldest written documents known from Italian soil. The lines of writing run alternately left to right and right to left, the positions of the letters being both reversed and inverted in the lines written right to left. Their alphabet is clearly of the same Chalcid-Etruscan origin as that of all the other alphabets of ancient Italy (except the Greek and Phoenician), but shows some peculiarities which suggest direct Greek influence; the language, still untranslated, will probably prove to be an Indo-European (two I.-E. stems, *pater* "father," *mater* "mother" have been identified) and ancient Illyrian dialect (*meitime* is an Illyrian name). For it is known from the elder Pliny, from the Iguvine tables (*iapuzkum* "Iapydian," *i.e.,* "belonging to the Illyrian Iapydes"), and from archaeological evidence, that there were Illyrian settlers in or near that district, the ancient Picenum, where these inscriptions were discovered.

But the documents of the Novilara group are later in date, distinct in alphabet — this is perhaps of Etruscan origin, but shows certain resemblances both to the Umbrian and to the Oscan alphabets — and probably also in dialect. The suggestion that the dialect, however, is allied to Etruscan itself, is quite unsupported by the evidence; the decorative motifs, for example the spiral, which appear on all three of the inscriptions of this group, point rather to the opposite coast of the Adriatic, where similar motifs occur, especially round Nesazio, on contemporary monuments; and there is nothing in the word forms of these documents which may not be Indo-European, while the characteristic Etruscan Syncope and elision (at least in the writing) are entirely lacking.

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SABELLIUS (*fl.* 230), early Christian presbyter and theologian, was of Libyan origin, and came from the Pentapolis to Rome early in the 3rd century. He became the leader of the strict Modalists (who regarded the Father and the Son as two aspects of the same subject) whom Calixtus had excommunicated along with their most zealous opponent Hippolytus. His party continued to subsist in Rome for a considerable time, and withstood Calixtus as an unscrupulous apostate. In the West, however, the influence of Sabellius seems never to have been important; in the East, on the other hand, after the middle of the 3rd century his doctrine found much acceptance, first in the Pentapolis and afterwards in other provinces. It was violently controverted by the bishops, notably by Dionysius of Alexandria, and the development in the East of the philosophical doctrine of the Trinity after Origen (from 260 to 320) was very powerfully influenced by the opposition to Sabellianism.

Sabellian Doctrine. — The Sabellian doctrine itself, however, during the decades above mentioned underwent many changes in the East and received a philosophical dress. In the 4th century this and the allied doctrine of Marcellus of Ancyra were frequently confounded, so that it is exceedingly difficult to arrive at a clear account of it in its genuine form. Sabellianism, in fact, became a collective name for all those Unitarian doctrines in which the divine nature of Christ was acknowledged: The teaching of Sabellius himself was very closely allied to the older Modalism ("Patripassianism") of Noetus and Praxeas, but was distinguished from it by its more careful theological elaboration and by the account it took of the Holy Spirit. His central proposition was to the effect that Father, Son and Holy Spirit are the same person, three names thus being attached to one and the same being. What weighed most with Sabellius was the monotheistic interest.

Sabelhus further maintained that God is not at one and the same time Father, Son and Spirit, but, on the contrary, has been active in three apparently consecutive manifestations or energies — first in the πρόσωπον of the Father as Creator and Lawgiver, then in the πρόσωπον of the Son as Redeemer, and lastly in the πρόσωπον of the Spirit as the Giver of Life. It is by this doctrine of the succession of the πρόσωπα that Sabellius is disiinguished from the older Modalists. In particular it is significant, in conjunction with the reference to the Holy Spirit, that Sabellius regards the Father also as merely a form of manifestation of the one God — in other words, has formally put Him in a position of complete equality with the other Persons. This view prepares the way for Augustine's doctrine of the Trinity. Sabellius himself appears to have made use of Stoical formulas (πλατύνεσθαι συστέλλεσθαι), but he chiefly relied upon Scripture, especially such passages as Deut. vi. 4; Exod. xx. 3; Isa. xliv. 6; John x. 38. Of his later history nothing is known; his followers died out in the course of the 4th century.

The sources of our knowledge of Sabellianism are Hippolytus (*Philos,* bk. ix.), Epiphanius (*Haer.* lxii.) and Dionys. Alex. (*Epp.*); also various passages in Athanasius and the other fathers of the 4th century. For modern discussions of the subject *see* Schleiermacher (*Theol. Ztschr.* 1822, Hft. 3); Lange (*Ztschr.* f. *hist. Theol.* 1832, ii. 2); Döllinger (*Hippolyt u. Kallist.* 1853); Zahn (*Marcell v. Ancyra,* 1867); R. L. Ottley, *The Doctrine of the Incarnation* (1896); various histories

of Dogma, and Harnack (*s.v.* "Monarchianismus," in Herzog-Hauck, Realencyk. fur prot. *Theol. und* Kirche, xiii. 303). (A. HA.)

ṢABIANS. The Ṣābians (*aṣ-Sābi'ūn*) who are first mentioned in the Koran (ii. 59, v. 73, xxii. 17) were a semi-Christian sect of Babylonia, the Elkesaites, closely resembling the Mandaeans or so-called "Christians of St. John the Baptist," but not identical with them. How Mohammed understood the term "Ṣābians" is uncertain, but he mentions them together with the Jews and Christians. The older Mohammedan theologians were agreed that they possessed a written revelation and were entitled accordingly to enjoy a toleration not granted to mere heathen. Curiously enough, the name "Ṣābian" was used by the Meccan idolaters to denote Mohammed himself and his Muslim converts, apparently on account of the frequent ceremonial ablutions which formed a striking feature of the new religion.

From these true Ṣābians the pseudo-Ṣābians of Ḥarrān (*Carrhae*) in Mesopotamia must be carefully distinguished. In A.D. 830 the Caliph Ma'mūn, while marching against the Byzantines, received a deputation of the inhabitants of Ḥarrān. Astonished by the sight of their long hair and extraordinary costume, he inquired what religion they professed, and getting no satisfactory answer threatened to exterminate them, unless by the time of his return from the war they should have embraced either Islam or one of the creeds tolerated in the Koran. Consequently, acting on the advice of a Mohammedan jurist, the Ḥarrānians declared themselves to be "Ṣābians," a name which shielded them from persecution in virtue of its Koranic authority and was so vague that it enabled them to maintain their ancient beliefs undisturbed. There is no doubt as to the general nature of the religious beliefs and practices which they sought to mask. Since the epoch of Alexander the Great Ḥarrān had been a famous centre of pagan and Hellenistic culture; its people were Syrian heathens, star-worshippers versed in astrology and magic. In their temples the planetary powers were propitiated by blood-offerings, and it is probable that human victims were occasionally sacrificed even as late as the 9th century of our era. The more enlightened Ḥarrānians, however, adopted a religious philosophy strongly tinged with Neoplatonic and Christian elements. They produced a brilliant succession of eminent scholars and scientists who transmitted to the Muslims the results of Babylonian civilization and Greek learning, and their influence at the court of Baghdad secured more or less toleration for Ṣābianism, although in the reign of Harūn al-Rashīd the Ḥarrānians had already found it necessary to establish a fund by means of which the conscientious scruples of Muslim officials might be overcome. Accounts of these false Ṣābians reached the West through Maimonides, and then through Arabic sources, long before it was understood that the name in this application was only a disguise.

See also "Nouveaux documents pour l'étude de la religion des Harraniens," by Dozy and De Goeje, in the *Actes* of the sixth Oriental congress, ii. 281 f. (1885); and Chwolsohn, *Sabier und der Sabismus* (1856).

SABICU WOOD is the produce of a large leguminous tree, *Lysiloma latisiliqua,* a native of Cuba, Haiti and the Bahamas. The wood has a rich mahogany colour; it is exceedingly heavy, hard and durable.

SABINE, SIR EDWARD (1788–1883), English astronomer and geodesist known for his work on terrestial magnetism, was born in Dublin, Ire. on Oct. 14, 1788. He served in the Royal Artillery and was appointed astronomer to the arctic expeditions of Sir John Ross (1818) and Sir William Parry (1819; *qq v.*) in search of the northwest passage. From 1821 to 1823 Sabine conducted pendulum experiments, to determine the figure of the earth, on the coasts of Africa, America and the arctic, publishing the results in 1825. These experiments he continued on the length of the seconds pendulum in London and Paris, the results appearing in 1828, in which year he was appointed one of the three scientific advisers to the admiralty. Most of his life was devoted to researches on terrestial magnetism, and he superintended the establishment of magnetic observatories on British territory throughout the world. The results appeared in Observations on Days of Unusual Magnetic Disturbance (1843). In 1852 he discovered a connection between the periodic variation of sun spots and magnetic disturbances on the earth. Sabine was president of the Royal society (1861–71) and was made a knight commander of the Order of the Bath (1869). He died at East Sheen, Surrey, on June 26, 1883.

SABINE RIVER in the southwestern United States, flows southeast and south for 380 mi. from Hunt county in eastern Texas to Sabine lake and on through Sabine pass into the Gulf of Mexico. The drainage basin of 10,400 sq.mi. lies entirely in Texas and in the Louisiana coastal plain. Discharge of the river varies from 372 to 61,200 cu.ft. per second. From southeast Panola county, Tex., to the gulf the Texas-Louisiana boundary follows the river, Sabine lake and Sabine pass. The Sabine has successively served as a boundary between France and Spain, Spain and the United States, Mexico and the United States and Texas and Louisiana; it has been in dispute many times.

The Sabine-Neches waterway, a portion of the Gulf Intracoastal waterway, provides 52 mi. of deep waterway through Sabine pass, along western Sabine lake and the lower Neches river to Beaumont, Tex., and 44 mi. of deep waterway to Orange, Tex. located 10 mi. N. of the Sabine river mouth. The Neches river, originating near Tyler, Tex., flows 280 mi. S.E. to Sabine lake. Commodities transported on the waterway are mostly crude petroleum and petroleum products. Navigation of the river above Orange, Tex., is not important. Port Arthur, Tex., is another important city on the Sabine-Neches waterway. (M. W. M.)

SABINI. This was an ancient tribe of Italy which was more closely in touch with the Romans from the earliest recorded period than any other Italic people. They dwelt in the mountainous country east of the Tiber, and north of the districts inhabited by the Latins and the Aequians in the heart of the Central Apennines. Their boundary, between the southern portion of the Umbrians on the north-west, and of the Picentines on the north-east, was probably not very closely determined. The traditions connect them closely with the beginning of Rome, and with a large number of its early institutions, such as the worship of Jupiter, Mars, and Quirinus, and the patrician form of marriage (*confarreatio*).

Of their language as distinct from that of the Latins no articulate memorial has survived, but we have a large number of single words attributed to them by Latin writers, among which such forms as (1) *fircus,* Lat. *hircus;* (2) *ausum,* Lat. aurum; (3) *novensiles,* Lat. *novensides* ("gods of the nine seats"); (4) the river name *Farfarus,* beside Pure Lat. *Fabaris* (Servius, ad *Aen.* vii. 715); and (5) the traditional name of the Sabine king, *Numa Pompilius* (contrasted with Lat. Quinctilius), indicate clearly certain peculiarities in Sabine phonology: namely, (1) the representation of the Indo-European palatal aspirate *gh* by f instead of Lat. *h;* (2) the retention of *s* between vowels; (3) the change of medial and initial d to l; (4) the retention of medial f which became in Latin *b* or *d;* and (5) the change of Ind.-Eur. *q* to *p*. The tradition (*e.g.,* Paul *ex Fest.* 327 M.) that the Sabines were the parent stock of the Samnites is directly confirmed by the name which the Samnites apparently used for themselves, which, with a Latinized ending, would be *Safini* (see SAMNITES and the other articles there cited, dealing with the minor Samnite tribes).

To determine the ethnological relation of these tribes, whom we may call "Safine," to the people of Rome on the one hand, and the earlier stratum or strata of population in Italy on the other, linguistic and archaeological material must be examined. Archaeological evidence connects the Sabines with the patricians of Rome, (see ROME, Ancient History). What language did the Sabines speak? Was it most nearly akin to Latin or to Oscan or again to Umbrian and Volscian? Festus, though he continually cites the Lingua Osca, never spoke of Lingua Sabina, but simply of Sabini, and the same is practically true of Varro, who never refers to the language of the Sabines as a living speech, though he does imply (v. 66 and 74) that the dialect used in the district differed somewhat from urban Latin. The speech therefore of the Sabines by Varro's time had become too Latinized to give us more than scanty indications of what it had once been. The language of the Samnites was that which is now known by the name of Oscan.

It appears that in, say, the 7th century, B.C., the Safines spoke a

language not differing in any important particulars from that of the Samnites, generally known as Oscan; and that when this warlike tribe combined with the people of the Latian plain to found or fortify or enlarge the city of Rome, and at the end of the 6th century to drive out from it the Etruscans, who had in that century become its masters, they imposed upon the new community many of their own usages, especially within the sphere of politics, but in the end adopted the language of Latium henceforth known as lingua Latina.

See R. S. Conway, *Italic Dialects* p. 351 (1897). For the history of the Sabine district *see* Mommsen, *C.I.L.* ix. p. 396; and Beloch, "Der italische Bund unter romischer Hegemonie" (1880) and "La Conquista Romana della regione Sabina," in the *Rivista di storia antica* ix. p. 269 (1905)

SABINIAN (d. 606), pope from 604 to 606, was of Tuscan origin. Little is known of his life and pontificate. Under Pope Gregory the Great he served in the important post of papal apocrisiary (legate) at Constantinople. As Gregory's successor, elected in 604, he seems to have been markedly more conservative than his predecessor. This, together with his cautious administration of the papal granaries during a winter famine, probably explains the later untrustworthy legend of his stinginess. which is moreover refuted by the praise of his generosity in his epitaph. It is uncertain modern conjecture that because of his unpopularity disorders threatened to erupt at his funeral in 606. (JN. SR.)

SABLE, the name of a small quadruped, closely akin to the martens, and known by the zoological name of Martes *zibellina*. It is a native of Siberia and famous for its fur. The name appears to be Slavonic in origin, whence it has been adapted into various languages. The Eng. and Med. Lat. sabellum are from the O.Fr. sable or saible (see MARTEN and FUR). "Sable" in English is a rhetorical or poetical synonym for "black." This comes from its usage in heraldry (first in French) for the colour equivalent to black.

SABLE ANTELOPE, a large and handsome South African antelope (*Hippotragus niger*), exhibiting the rare feature of blackness or dark colour in both sexes. The sable and the roan antelope (H. *equinus*) belong to a genus nearly related to the oryxes (*q.v.*), but distinguished by the stout, thickly ringed horns (present in both sexes) rising vertically from a ridge over the eyes at an obtuse angle to the plane of the lower part of the face, and then sweeping backward in a bold curve. The muzzle is hairy; there is no gland below the eye; the tail is long and tufted. Sable antelopes are among the handsomest of South African antelopes, and are endowed with great speed and staying power. They are commonly met with in herds including from 10 to 20 individuals. Forest-clad highlands are their favourite resorts. The roan antelope is a larger animal, with shorter horns, strawberry-roan in colour in both sexes. See also ANTELOPE.

SABLE ISLAND, an island of Nova Scotia, Canada, 110 mi. S.E. of Cape Canso. Composed of shifting sand, it is the exposed portion of a 50 mi. long, gently curved bar. The island itself is about 20 mi. long and 1 mi, wide, and the sand hills shaped by the wind rise to elevations up to 100 ft. It is reported to be moving slowly eastward, owing to the encroachment of the sea on the western end and the continual sand accumulation at the eastern end. The smooth coast line is without a harbour. Vegetation consists of grasses and other plants but no trees. It has long been known as "the graveyard of the Atlantic"; over 200 known wrecks have been catalogued. During the frequent fogs and storms this slender ribbon of land is virtually indistinguishable until close at hand. The danger of shipwreck has been minimized, however, by the Canadian government's maintenance of several lighthouses and lifesaving stations. (C. N. F.)

SABOTAGE, originally a designation of labour protest by impairing the profitable operation of the employer's business, had its inception in the French railway strike of 1910, which involved workers who cut wooden "shoes" (sabots) that held rails to sleepers. By legend, an aggrieved French worker clogged machinery with his wooden shoe. From 1912 to 1918 the American branch of the Industrial Workers of the World (I.W.W.) officially approved sabotage, described by Elizabeth Gurley Flynn, in her Sabotage (1915), as slowing up work, hence interfering with quantity of output, and also interfering with the quality of the product; sabotage, she said, "is simply another form of coercion."

The I.W.W.'s sanction of sabotage as a means of protest reflected the casual migratory worker's lack of reserve funds, the ease of replacing him, his generally footloose condition and his sometimes foreign birth, factors that made the use of formally organized strikes and conventional pressure bargaining relatively difficult. I.W.W. organizers cautioned against violent sabotage, and violence generally, even under provocative circumstances, and in 1918 the organization officially repudiated sabotage in any form because of wartime conditions. This did not forestall wartime and postwar legislation prohibiting advocacy as well as practice of sabotage. Membership in the I.W.W., or alleged membership, frequently was found sufficient cause for imprisonment. The peril to civil liberties of such procedure later came to be appreciated. World War II antisabotage legislation professedly aimed to punish action, not words. Some writers have applied the term to wasteful, restrictive and speculative business practices. At mid-20th century, "sabotage" came to be used interchangeably with "espionage," an ambiguity fraught with familiar dangers to civil liberties.

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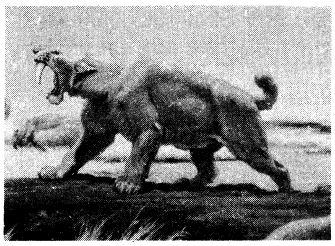
SABRATHA, an ancient city of Africa Proconsularis (Tripolis), founded in the 7th–6th century B.C. by Tyrian settlers as a factory on the shore of a flat and inhospitable coast, mod. Sabratha Vulpia, 48 mi. W. of Tripoli by rail. Toward the end of the 2nd century A.D. its prosperity began to increase: Antoninus Pius built two temples; the tribunal before which Apuleius (*q.v.*) was tried met there; under Commodus the Sabratenses had a statio (or office) at Ostia (*q.v.*). Toward the end of the 4th century there occurred fiscal exactions, religious disputes and attempts at invasion by the tribes of the interior (the most destructive being that of the Austuriani in A.D. 363), after which, as inscriptions show, the buildings of Sabratha, and notably the baths, were rebuilt. The Vandals themselves, who only occupied Tripolitania in A.D. 455, were defeated by a native rebellion, and after the destruction of their power by the Byzantines the very natives who had invited the aid of the latter rose against them also. During the years of peace following 548 new fortifications were made. Justinian's death, in 565, brought a renewal of the native risings. The Arabs took Tripoli in 643, and Sabratha was surprised in the night and sacked. Excavations have revealed the east gate of the Roman walls, while Byzantine fortifications surround the western portion of the city, where are situated the forum, the *curia* or council hall, a temple of Jupiter (of whom a fine bust was found), and another temple (perhaps the Capitolium), both of the time of Antonius Pius, two Christian basilicas (one, erected by Justinian, with fine mosaics) and a baptistery. The theatre and the amphitheatre, fairly well preserved and recently carefully restored, lie farther away, near the quarries. The streets are wide and well laid, and the houses are numerous and closely built, without courtyards. There were no less than 12 fountains, supplied by an aqueduct. The Roman harbour was constructed by joining the rocks with masses of concrete, so as to form two moles with a narrow entrance between them; while along the shore were cisterns and storehouses.

SABRE FENCING: see FENCING.

SABRE-TOOTHED TIGER, an extinct subfamily, Machairodontinae, of the cat family, Felidae. The most characteristic feature, the basis of the name, is the pair of elongated, bladelike canine teeth in the upper jaw. The subfamily ranges in age from the Oligocene epcch, 30,000,000 to 35,000,000 years ago, to the Pleistocene, with final extinction not more than a few thousand years in the past. Well known as this subfamily is, there remain unresolved differences of opinion about its relationships to other felids and indeed differences as to the placement of some Oligocene and Miocene genera as sabretooths, false sabretooths (nimravines) or true cats (felines). In this article only the animals that can be placed nithout serious question among true sabre-toothed tigers (Machairodontinae) are considered.

The best-known genus of the subfamily is Snzilodon of the Pleistocene of North and South America. This was a large, massive, short-limbed carnivore with immense canine teeth. These



BY COURTESY OF CHICAGO NATURAL HISTORY MUSEUM, FROM A MURAL BY CPARLES R KNIGHT

RESTORATION DRAWING OF EXTINCT SABRE-TOOTHED TIGER

teeth appear to have been used for stabbing and slashing attacks upon the large, thick-skinned herbivores that formed the chief prey of the sabretooths. The skull was notably modified in adaptation to this type of feeding. The occipital region was high and the ventral mastoid processes long, in accommodation of strong neck muscles. The lower jaw was formed in such a way that it could be widely opened, thus freeing the dagger-like canines for action. Molar teeth were shearing blades, with no vestiges of grinding surfaces. Among living cats, only the lion approaches *Smilodon* in massiveness, and even the largest lions do not reach the proportions of the largest sabretooths.

The basic sabretooth characters were present, but less fully developed, in *Hoplophoneus,* a moderate sized Oligocene ancestor of *Smilodon.* Other early members of the family Felidae. such as *Dinictis* of the Oligocene, also had fairly well-developed sabre-like teeth but for the most part lacked the other specializations seen in the true sabretooths. Such forms have been variously classified as true cats or as false sabretooths.

Throughout the Miocene and Pliocene epochs of the Tertiary, machairodonts were present in North America and Europe, although, as for most carnivores, their remains are relatively rare. By Pliocene times they had spread to Asia and Africa, and in the Pleistocene were present in South America. The pattern of extinction of the sabre-toothed cats follows closely the pattern of extinction of the mastodons which appear to have been one of their principal sources of food. As these large, elephantlike animals become reduced and extinct in the late Pliocene of the old world, the sabre-toothed cats died out and are not found in the Pleistocene. In North and South America, where mastodons persisted through the Pleistocene. sabre-toothed tigers continued successfully to the end of that epoch. The best-known occurrence of *Smilodon* is in the tar pits of Rancho La Brea. in Los Angeles, Calif., where many individuals were trapped in the tar, apparently as they preyed upon large herbivores that also had become bogged. The tar deposits have preserved a wealth of bones virtually unaltered since the deaths of the animals. (E. C. O.)

SACAGAWEA or SACAJAWEA (1790?–1884?), the "Bird Woman," a Shoshone Indian girl who, in 1805–06, accompanied the Lewis and Clark expedition. She has been widely but erroneously credited with having guided the expedition across the Rocky and Cascade mountains to the Pacific coast. Actually her geographical knowledge and usefulness as a guide were limited to her native region of western Montana. Nevertheless, with her French-Sioux mate Toussaint Charbonneau, Sacagawea did accompany the expedition all the way from Fort Mandan, N.D., to the Pacific coast and back. First-hand accounts of the expedition, by Meriwether Lewis, William Clark, Patrick Gass and others, praise her courage, resourcefulness and good humour, while indicting that Charbonneau mistreated her and was not worthy of his hire.

Charbonneau was engaged as a guide in the autumn of 1804 and insisted upon bringing along Sacagawea, one of the two wives he had purchased from Indian slave traders. A son, Jean-Baptiste Charbonneau, was born to Sacagawea Feb. 11, 1805, at Fort Mandan, and the baby, too, made the entire journey. Toussaint Charbonneau was paid $500.33 for his services to the expedition, but Sacagawea received no remuneration. Their son was later taken to St. Louis, Mo., where Clark sponsored his education. The later history of the "Bird Woman" is obscure. An old Indian woman, who called herself Sacagawea and displayed a remarkably intimate and accurate knowledge of the Lewis and Clark expedition, died in Dakota territory in 1884.

See John Bakeless, *Lewis and Clark, Partners in Discovery* (1947); Charles Morrow Wilson, *Meriwether Lewis of Lewis and Clark* (1934).

SÁ-CARNEIRO, MÁRIO DE (1890–1916), Portuguese poet and novelist of the so-called "modernist" generation and one of the most original and complex figures in Portuguese literature in the first half of the 20th century was born in Lisbon on May 19, 1890. After leaving the secondary school there, he went to Paris where he studied for a year (1912–13) in the law faculty at the Sorbonne. Before leaving Lisbon he had made the acquaintance of Fernando Pessoa, the greatest literary figure of the generation, and maintained a regular correspondence with him while he was in France. Sá-Carneiro's first literary production was the play *Amizade* written in collaboration with a fellow-pupil while he was still at school. In 1912 he published *Princípio,* a collection of prose tales. His first poems were written in Paris in 1914 and were published in the same year under the title. *Dispersão.* In 1914 also he published the novel *A Confissão de Lúcio* and, back in Portugal, he launched the review *Orpheu* in 1915 in collaboration with Fernando Pessoa and other young men of the modernist group. The same year saw also the appearance of his collection of short stories, *Céu em Fogo.* Having returned to Paris, he suffered a moral and financial crisis, abandoned his studies, quarreled with his father and gave himself up to the life of a literary Bohemian. The crisis came to a head in 1916 when the poet, the victim of a sensibility which left him facing life disarmed—"without support" as he himself put it—committed suicide in the Hotel de Nice in Paris on April 26. Before his death he had sent his unpublished poems to Pessoa, and these appeared in 1937 under the title *Indicios de Oiro.* His *Poesias* were edited, with a preface, by J. Gaspar Simões in 1946.

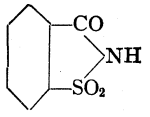
See A. Casais Monteiro, "Mário de Sá-Carneiro," in *Considerações Pessoais* (1933); J. Gaspar Simões, *Historia da Poesia Portuguesa do Seculo xx* (1959). (J. G. Ss.)

SACATEPEQUEZ, a department in the highlands of central Guatemala, just west of Guatemala City. Area 179 sq.mi. Pop. (1950) 60,124. Its capital is Antigua, pop. (1950) 10,996, former capital of Guatemala. The department is a part of the chief coffee-producing area of the country. Other crops include maize, beans and hay. Much land is used for the grazing of beef cattle. The department is served by the Inter-American highway and by several all-weather feeder roads. Antigua was abandoned as the national capital because of frequent earthquakes. (P. E. J.)

SACCARDO, PIER ANDREA (1845–1920), Italian mycologist, is chiefly noted as author of the *Sylloge fungorum* (25 vol., 1882–1931), a compilation, in Latin, of nearly all species of fungi described through the year 1920. Born at Treviso on April 23, 1845, he was professor (1878–1915) and director of the botanical garden at the University of Padua. Many of the descriptions in *Sylloge fungorum,* especially of microscopic Ascomycetes and Fungi Imperfecti, are from Saccardo's own studies, but most are merely copied or translated. Saccardo's carpologic classification of species is a formal one, making much of colour, shape and septation of spores, and violates the rule that a genus should first be recognized and then defined; Saccardo decided in advance what characters should define a genus. Nevertheless, as a work bringing together descriptions of over 78,000 species of fungi, the *Sylloge* is invaluable to mycologists and pathologists. Saccardo died at Padua on Feb. 11, 1920.

BIBLIOGRAPHY.—*Proceedings Linnean Society of London,* 133:53–54 (1921); *Nuovo g. bot. ital.,* n.s., 27:39–74 (1920); *Sylloge fungorum,* 23:ix–xxxii (1925). (D. P. R.)

SACCHARIN is a name applied to several organic substances. The commonly known saccharin of commerce is derived from toluene. Commercial saccharin is marketed as insoluble saccharin, I—the imide of ortho-sulphobenzoic acid—and as soluble saccharin, II—the sodium salt of the former substance. Pharmaceutical manufacturers who compound saccharin for con-



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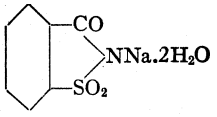

II

sumer use commonly tablet saccharin into tiny pellets containing ¼, ½ or 1 gr. of pure saccharin. The pellets may contain the saccharin in the form of the soluble sodium salt or in the acid form combined with sodium bicarbonate which converts the acid to the sodium salt upon dissolving.

Commercial saccharin is a sweetening agent; it possesses no food value at all. The sweetening power of the commercial powder is estimated at 425 times the sweetening power of ordinary sugar; the commercial crystals, which contain some water of crystallization, are estimated to have a sweetening power 375 times that of sugar. A one-quarter grain pellet has roughly the same sweetening power as a level teaspoon of sugar. Saccharin is used all over the world as a sweetener. It cannot be considered as a substitute for sugar, since it offers no nourishment. However, saccharin is used as part of the diets of people who must avoid excessive sugar intake, such as diabetics. It is also used in the preparation of dietetic foods, dentifrices, mouthwashes and cosmetics, and for sweetening tobacco and medicinal preparations, particularly where the presence of sugar might lead to spoilage by fermentation or mold growth. Saccharin is not metabolized; it is excreted unchanged from the body in the urine.

Saccharin was discovered by Ira Remsen and C. Fahlberg in 1879 in the course of investigations at the Johns Hopkins university on the oxidation o-toluene-sulphonamide. Fahlberg noticed an unaccountable sweet taste to his food and found that this sweetness was present on his hands and arms, despite his having washed thoroughly after leaving the laboratory. Checking over his laboratory apparatus by taste tests, Fahlberg was led to the discovery of the source of this sweetness—saccharin.

Saccharin is made by treating toluene with chlorosulphonic acid. The reaction produces ortho- and para-toluene sulphonylchlorides. The two products are separated and the ortho-toluene sulphonylchloride is treated with ammonia to form the amide. The amide is then oxidized to saccharin.

See Thorpe's *Dictionary of Applied Chemistry,* vol. x (1950).

(F. D. SH.; X.)

SACCHETTI, FRANCO (c. 1330–1400), Italian poet and novelist whose work is typical of late 14th-century Florentine literature, was born in Ragusa of a noble Florentine family. Both as merchant and as *podesth* he traveled widely, thus acquiring an experience of life which compensated for his lack of a regular education. In his letters, in some of his verses and in the *Sposizioni di Vangeli* he expressed his political and moral views. Although poetry was not his main interest, some of his poems, written to be set to music, are among the best of 14th-century minor poetry. As a novelist he wrote 300 stories of which only 223 are known: they consist mainly of anecdotes and jokes derived from oral tradition and the author's direct observation of life. Their artistic value is to be found in the colourful and vivid description of people and places, and their best passages depict scenes from everyday life. Sacchetti does not convey the substance of human life, but only its external appearance.

BIBLIOGRAPHY.—The best modern editions of Sacchetti's works are *Il libro delle Rime* (1936) and *Battaglia, Lettere, Sposizioni* (1938), both ed. by A. Chiari; *Il Trecentonovelle,* ed. by V. Pernicone (1946). *See* also E. Li Gotti, F. *Sacchetti* (1940); L. Caretti, *Saggio sul Sacchetti* (1951). (G. A.)

SACCHI, ANDREA (1599–1661), Italian painter, was the chief representative of the classical current in Roman mid-17th-century painting (Nicolas Poussin, being a Frenchman. belonging in a sense apart) and as such he stood in opposition to the full baroque. He was born at Nettuno, 30 mi. S. of Rome, but trained under Francesco Albani at Bologna. After returning to Rome in 1621 he worked there till his death (June 21, 1661), except for short visits to north Italy after 1635 and to Paris in 1640.

His Bolognese training gave him an initial bias toward classicism and a taste for colour. But the direct influence of Raphael is already added to these qualities in the "Miracle of St. Gregory" of 1625–27 (chapter house, St. Peter's). This work brought Sacchi to the notice of the Sacchetti family, who employed him, with Pietro da Cortona, in the decoration of their villa at Castel Fusano in 1627–29. Both artists were next taken on by Antonio Cardinal Barberini to decorate the Barberini palace in Rome, and it was then that the classical and baroque currents became separated. Sacchi's ceiling fresco, "The Allegory of Divine Wisdom" (1629–33), is a grave, static work, markedly Raphaelesque in conception and containing relatively few figures, in contrast with Pietro da Cortona's full baroque "Triumph of Divine Providence" in an adjoining room. Sacchi's two altarpieces in Sta. Maria della Concezione, Rome (1631–38), are likewise distinguished by their classicism from the other pictures in the church.

His most important work after the "Divine Wisdom" is the series of eight canvases illustrating the life of St. John the Baptist in the cupola of S. Giovanni in Fonte, Rome (1639–45). He painted a few portraits but concentrated mainly on religious works. (M. W. L. K.)

SACCO-VANZETTI CASE, a murder trial in Massachusetts, extending over seven years, 1920–27, and resulting in the execution of the defendants, Nicola Sacco and Bartolomeo Vanzetti. The trial resulted from the murders in South Braintree, Mass., on April 15, 1920, of F. A. Parmenter, paymaster of a shoe factory, and Alessandro Berardelli, the guard accompanying him, in order to secure the payroll they were carrying. On May 5 Sacco and Vanzetti, two Italians who immigrated to the United. States in 1908, one a shoe worker and the other a fish pedlar, were arrested for the crime. On May 31, 1921, they were brought to trial before Judge Webster Thayer of the Massachusetts superior court, and on July 14, were both found guilty by verdict of the jury. Socialists and radicals protested the men's innocence. Many people felt that there was less than a fair trial and that the defendants were convicted for their radical, anarchist beliefs rather than the crime for which they were tried. All attempts for retrial on the ground of false identification failed. On Nov. 18, 1925, one Celestino Madeiros, then under a sentence for murder, confessed that he had participated in the crime with the Joe Morelli gang.

The state supreme court refused to upset the verdict since at that time the trial judge had the final power to reopen on the ground of additional evidence. The two men were sentenced to death on April 9, 1927.

A storm of protest arose with mass meetings throughout the world. Gov. A. T. Fuller appointed an independent investigatory committee of Pres. A. Lawrence Lowell of Harvard university, Pres. Samuel W. Stratton of the Massachusetts Institute of Technology and Robert Grant, a former judge. On Aug. 3, 1927, the governor refused to exercise his power of clemency; his advisory committee agreed with this stand. Demonstrations proceeded in many cities throughout the world and bombs were set off in New York and Philadelphia. The men, maintaining their innocence, were executed Aug. 23, 1927. Sacco-Vanzetti agitation continued and as late as April 1959, a legislative committee sat in Boston giving a full day for hearing on a proposal by Rep. Alexander J. Cella to the legislature to recommend to the present governor a retroactive pardon. The committee and the legislature declined to take such a step. Evidence was offered at the hearings, however, by correspondence and otherwise pointing to the guilt of Morelli and his gang. The entire record of the case has been preserved in printed form with a foreword written by a group of the leading attorneys of the nation.

BIBLIOGRAPHY.—N. D. Baker *et al.* (eds.), *The Sacco-Vanzetti Case: a Transcript of the Record of the Trial* (1928); F. Frankfurter, *The Case of Sacco and Vanzetti* (1927), 2nd ed. (1954); Herbert B. Ehrmann, one of the attorneys ior the defendants, *The Untried Case; The Sacco-Vanzetti Case and the Morelli Gang* (1933); R. P. Weeks (ed.), *Commonwealth v. Sacco and Vanzetti* (1958). (M. L. E.)

SACHEVERELL, HENRY (1674–1724), English ecclesiastic, was the son of Joshua Sacheverell, rector of St. Peter's, Marlborough. He was adopted by his godfather, Edward Hearst, and his wife; was sent to Magdalen college, Oxford, in 1689; was demy of his college from 1689 to 1701 and fellow from 1701 to 1713. Sacheverell took his B.A. in 1693, and became M.A. in 1695 and D.D. in 1708. His first preferment was the small vicarage of Cannock in Staffordshire; and in 1705 he was elected to the chaplaincy of St. Saviour's, Southwark. He had already shown himself a strong, indeed a violent, high churchman by his sermons and pamphlets. In 1709 he gained notoriety by his fa-

mous sermons attacking the Whig ministers on the charge of neglecting to watch over the interests of the church. These sermons were delivered, one in Derby on Aug. 15, the other in St. Paul's cathedral on Nov. 5; and both, in excessively violent language, especially aimed at the treasurer, the earl of Godolphin. They were immediately printed and made the preacher the idol of the Tory party.

The attention of the house of commons was drawn to the two sermons by John Dolben in Dec. 1709, and they were denounced as "malicious, scandalous and seditious libels." The ministry, then slowly but surely losing the support of the country, were divided as to the wisdom of impeaching Sacheverell. Sir John Somers was against it; but the earl of Sunderland and Godolphin urged the necessity of a prosecution, and gained the day. The trial lasted from Feb. 27 to March 23, 1710, and the verdict was that Sacheverell should be suspended for three years from preaching and that the two sermons should be burned at the Royal Exchange. The trial hastened the downfall of the ministry, Godolphin being dismissed in August and the other ministers in September. Immediately on the expiration of his sentence (April 13, 1713), Sacheverell was presented by the queen to the valuable rectory of St. Andrew's, Holborn, by the new Tory ministry. He died at the Grove, Highgate, on June 5, 1724. (*See* also ENGLISH HISTORY.)

SACHEVERELL, WILLIAM (1638–1691), English statesman, son of Henry Sacheverell, a country gentleman, entered parliament in 1670 for Derbyshire. He was an opponent of the court policy, especially of the secret treaty with France. In 1678 he was one of the most active investigators of the "Popish Plot," and one of the managers of the impeachment of the five Catholic peers. He also served as a manager in the impeachment of Danby. He made the first suggestion of the Exclusion Bill on Nov. 4, 1678, in a debate raised by Lord Russell with the object of removing the duke from the King's Council. He vigorously promoted the bill in the House of Commons and opposed granting supplies till it should pass.

At the general election following the death of Charles II. in 1685 Sacheverell lost his seat, but he was an active member of the convention parliament. He died on Oct. 9, 1691. In the judgment of Speaker Onslow, Sacheverell was the "ablest parliament man" of the reign of Charles II. He was one of the earliest of English parliamentary orators; his speeches greatly impressed his contemporaries, and in a later generation, as Macaulay observes, they were "a favourite theme of old men who lived to see the conflicts of Walpole and Pulteney."

SACHS, HANS (1494–1576), the most prolific German poet and dramatist in the 16th century, born in Nürnberg, Nov. 5, 1494, son of a tailor, was educated at the Latin school and apprenticed in 1509 to a shoemaker. Lienhard Nunnenbeck, a weaver, taught him the art of the Meistersinger (*q.v.*). As a journeyman (1511–16) he visited most of south and central Germany, making contact everywhere with Meistersinger guilds. In 1517 he became a master in the Nürnberg *Singschule* and in 1519, when he married, a master shoemaker. *Die Wittembergisch Nachtigall* (1523), a verse allegory supporting Luther, made him famous. Other Protestant writings followed, until in 1527 the Nürnberg council forbade further publications. Thereafter his life was devoted to his trade and especially his poetry. He died in Niirnberg, Jan. 19, 1576.

Besides 13 *Meisterlied* tunes and seven prose dialogues, Sachs wrote more than 6,000 poems, including some 200 dramas. His subject matter comes from the Bible, Greek, Latin and Italian literature (in translation), Germanic legend, courtly romances and collections of anecdotes, historical events and daily life. But everything is reduced to a common level of thought and language; his characters are essentially contemporary Niirnberg citizens. Subjects are used with little concern for their appropriateness to a particular genre; indeed Sachs's guiding principles are moral and didactic rather than aesthetic.

Sachs is regarded—especially since Wagner's Meistersinger *von Nürnberg*—as the greatest of the Meistersingers. His compositions (over 4,000 *Meisterlieder*) certainly contributed to Nürnberg's pre-eminence in Meistergesang; but his popularity rests on other foundations, for Meistergesang was not a popular art. Again, his tragedies and comedies, long-winded and formless, are simple stories in dialogue form, divided arbitrarily into acts in imitation of the humanists; they have only historical interest. His best and most popular works are his short, humorous narrative poems—Sankt Peter mit der Geiss (1555), Das *Kälberbrüten* (1557), *Der Müller mit* dem Studenten (1559)—and his *Fastnachtspiele,* some of which are still performed—*Der farend Schüler im Paradeis* (1550), Der bos Rauch (1557), Das *heiss Eisen* (1551) and *Der Rossdieb zu Fünsing* (1553). His work, though it has been overpraised, reflects a common sense, realistic attitude to life, a strong moral sense, a deep—but tolerant—attachment to Protestant Christianity, and a sometimes uproarious but always kindly humour.

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SACHS, JULIUS VON (1832–1897), German botanist and outstanding plant physiologist, was born at Breslau (Wroclaw) on Oct. 2, 1832. On leaving school in 1851 he became assistant to the physiologist J. E. Purkinje at Prague. In 1856 he graduated as doctor of philosophy, and established himself as *Privatdozent* (official but unpaid lecturer) for plant physiology in the University of Prague. In 1859 he was appointed physiological assistant to the Agricultural academy of Tharandt in Saxony, and in 1861 he went to the Agricultural academy at Poppelsdorf, near Bonn. He remained there until 1867, when he was nominated professor of botany in the University of Freiburg im Breisgau. In 1868 he accepted the chair of botany in the University of Würzburg, which he continued to occupy until his death on May 29, 1897.

Sachs was especially associated with the development of plant physiology which marked the latter half of the 19th century, though he contributed to every branch of botany. His earlier papers, in botanical journals and publications of learned societies, are of interest. Prominent among them is the series of "Keimungsgeschichten," which laid the foundation of knowledge of microchemical methods and the morphological and physiological details of germination. There is also his resuscitation of the method of water culture first used by J. Woodward in 1699, and its application to problems of nutrition; and, further, his discovery that the starch grains to be found in chloroplastids are the first visible product of their assimilatory activity. Sachs's later papers were published in the three volumes of the Arbeiten des *botanischen Instituts in Würzburg* (1871–88). Among these are his investigation of the periodicity of growth in length; his researches on heliotropism and geotropism, in which he introduced the "clinostat"; his work on the structure and arrangement of cells in growing points; the evidence upon which he based his imbibition theory of the transpiration current; and his studies of the assimilatory activity of the green leaf. Sachs was a great teacher, and botanists from all over the world worked in his laboratory. He had a great influence on British and American botany at the time when there was a swing over from purely systematic studies, an influence to which the English translations of his textbooks contributed.

Sachs's works are: Handbuch der *Experimentalphysiologie der Pflanzen* (1865; French ed., 1868); *Lehrbuch der Botanik* (1868; Eng. ed., 1875 and 1882), a comprehensive work, giving a summary of the botanical science of the period, including the results of original investigations; *Vorlesungen über Pflanzenphysiologie* (1882; 2nd ed., 1887; Eng. ed., 1887); Geschichte *der* Botanik (1875; Eng. ed., 1890).

See E. G. Pringsheim, *Julius* Sachs (1932).

SACHS, MICHAEL (1808–1864), German Rabbi, one of the first of Jewish graduates of the modern universities, was appointed Rabbi in Prague in 1836, and in Berlin in 1844. He took

the conservative side against the Reform agitation, and retired from the Rabbinate rather than acquiesce in the use of the organ in the synagogue. Sachs co-operated with Zunz in a new translation of the Bible. He is best remembered for his work on Hebrew poetry, *Religiose Poesie der Juden in Spanien* (1845).

SACKBUT, SHAKBUSSHE, SAGBUT, DRAW or DRAWING TRUMPET, the earliest form of slide trumpet, derived from the Roman buccina, which afterwards developed into the trombone. As soon as the effect of the slide in lengthening the main tube and therefore proportionally deepening the pitch of the instrument was understood, and its capabilities had been realized, the development of a family of powerful tenor and bass instruments followed as a matter of course. The transformation of the busine *(buccina)* into the sackbut involved two or three processes, the addition of the slide being accomplished in at least two stages, the extending portion of the tube being at first straight and later bent or folded to make the instrument less unwieldy. (*See* also TROMBONE; TRUMPET.)

SACKING AND SACK MANUFACTURE. Sacking is a heavy closely woven fabric, originally made of flax, but now almost exclusively made of jute or of hemp. The more expensive kinds, such as are used for coal sacks for government and other vessels, are made of hemp, but the jute fibre is extensively used for the same purpose, and almost entirely for coal sacks for local house supplies. The same type of fabric is used for wool sacks, cement bags. ore bags, pea sacks and for any heavy substance; it is also made up into a special form of bag for packing cops and rolls of jute and flax yarns for delivery from spinners to manufacturers. Proper sacking is essentially a twilled fabric, in which the number of warp threads per inch greatly exceeds the number per inch of weft.

Large quantities of cotton sacks are made for flour, sugar and similar produce; these sacks are usually plain cloth, some woven circular in the loom, otners made from the piece.

Large quantities of seamless bags or sacks for light substances are woven in the loom, but these are almost invariably made with what is termed the double plain weave; *i.e.,* the cloth, although circular except at the end, is perfectly plain on both sides, and similar in structure to, but wider than hose-pipe (*q.v.*). Circular bags have been made both with three-leaf and four-leaf twills, but it is found much more convenient and economical to make the cloth for these kinds, and in most cases, for all other types, in the piece, and then to make it up into sacks by one or other of the many types of sewing machines. The pieces are first cut up into definite lengths by special machinery, which may be perfectly automatic or semi-automatic — usually the latter, as many thicknesses may be cut at the same time, each of the exact length. The lengths of cloth are then separately doubled up, the sides sewn by special sewing machines.

For paper sacks *see* PAPER: *Manufacture.*

See T. Woodhouse, *The Finishing* of *Jute and Linen Fabrics (1928).*

SACKVILLE, GEORGE, 1ST VISCOUNT (1716–1785), generally remembered as Lord George Sackville or Lord George Germain, third son of Lionel Cranfield Sackville, 1st duke of Dorset, was born on Jan. 26, 1716. Educated at Westminster School and Trinity College, Dublin, he was gazetted captain in 1737, and saw active service in the German campaign. Wounded in the charge of Cumberland's infantry column at Fontenoy, he was taken to the tent of King Louis XV. to have his wound dressed, and was soon released. He received rapid military promotion, and was gazetted major-general in 1 75 j and lieutenant-general in 1757. Meanwhile he filled the offices of first secretary to his father, the lord-lieutenant of Ireland, and Irish secretary of war, and sat in each of the two Houses of Commons at Westminster and Dublin. In 1758, under the duke of Marlborough, he shared in the ineffective raid on Cancale Bay, and the troops, after a short sojourn in the Isle of Wight, were sent to join the allied army of Duke Ferdinand of Brunswick in Germany. Marlborough died shortly after they landed, and Sackville succeeded him as commander-in-chief of the British contingent. His haughty and domineering temper estranged him both from his second-in-command, Lord Granby, and the commander-in-chief, Prince Ferdinand. This culminated on the day of Minden (August 1, 1758). The British infantry, aided by some of the Hanoverians, had won a brilliant success, and every man in the army looked to the British cavalry to charge and to make it a decisive victory. But Sackville, in spite of repeated orders from Prince Ferdinand, sullenly refused to allow Granby's squadrons to advance. The crisis passed, and the victory remained an indecisive success. A court-martial in 1760 pronounced him guilty of disobedience, and adjudged him "unfit to serve his Majesty in any military capacity whatsoever." In 1763 his name was restored to the list of the Privy Council. In 1769 he allied himself with Lord North. To this period belong the famous Junius Letters, with the authorship of which Sackville was erroneously credited. In 1770, under the terms of a will, he assumed the name of Germain. In 1775, having meantime taken an active part in politics, he became secretary of state for the colonies in the North cabinet, and he was practically the director of the war for the suppression of the revolt in the American colonies. Germain and the North cabinet misunderstood the situation and there was constant friction with the generals and the army in the theatre of war. Nevertheless he received a peerage. He died at Stoneland Lodge (Buckhurst Park) Sussex, on Aug. 26, 1785.

SACKVILLE, THOMAS, 1ST EARL OF DORSET (d. 1608), English statesman and poet, son of Sir Richard Sackville, was born at Buckhurst, Sussex, between 1527 and 1536. He was called to the bar at the Inner Temple. He married Cecily, daughter of Sir John Baker of Sissinghurst, Kent. In 1558 he entered parliament as member for Westmorland, in 1559 he sat for East Grinstead, Sussex, and in 1563–67 for Aylesbury, Buckinghamshire.

During a visit to the continent in 1565 he was imprisoned at Rome for a rash declaration of Protestant opinions. The news of his father's death on April 21, 1566, recalled him to England. On his return he was knighted in the presence of Queen Elizabeth I, receiving at the same time the title of baron of Buckhurst.

He was sent on missions to France in 1568 and again in 1571, when he congratulated Charles IX on his marriage with Elizabeth of Austria. He also took part in the negotiations for the projected marriage of Elizabeth to the duke of Anjou. In 1571 he was created M.A. at Cambridge. In 1572 he was one of the peers who tried Thomas Howard, duke of Norfolk, and in 1586, after he had become a privy councillor, he was selected to convey the sentence of death to Mary queen of Scots.

He was sent in 1587 as ambassador to The Hague but failed to carry out his difficult mission to the queen's satisfaction and was recalled in disgrace. He was, however, liked and trusted by the Dutch and there was talk of sending him there again in 1589–90. This project fell through, but in 1598 he negotiated a new treaty with the states general.

He was elected chancellor of the University of Oxford in 1591, and in 1599 succeeded Lord Burghley as lord high treasurer. In 1601 as high steward he pronounced sentence on Essex. James I confirmed him in the office of lord treasurer. He was created earl of Dorset in 1604, and died suddenly at the council table on April 19, 1608.

Sackville's eldest son, Robert, the 2nd earl (1561–1609), was a member of parliament and a man of great learning. Two other sons were William (*c.* 1568–91), a soldier killed in the service of Henry IV of France, and Thomas (1571–1646), also a soldier.

Sackville is remembered, not only by his distinguished political career, but by his share in two works, each of which was, in its way, a new departure in English literature. To the second edition (1563) of William Baldwin's *Myrroure for Magistrates,* Sackville contributed the *Complaint* of Henry Stafford. duke of Buckingham, to which he prefixed an *Induction.* This induction was arbitrarily transposed (1610) to the beginning of the collection by a later editor, Richard Niccols, a proceeding which led to the attribution of the general design to Sackville. The originators were certainly Baldwin and his "printer" who designed the *Myrroure* as a continuation of John Lydgate's *Fall of Princes* in the form of laments of the ghosts of great men written by various hands. Fragments of the earliest edition entitled *A Memorial1 of such princes as . . . have been unfortunate . . .* are sometimes found bound up with Lydgate's book.

Sackville's *Induction* opens with a description of the oncoming of winter. The poet meets Sorrow, who offers to lead him to the infernal regions that he may see the sad estate of those ruined by their ambition, and thus learn the transient character of earthly joy. At the approaches of Hell he sees a group of terrible abstractions, Remorse of Conscience, Dread, Misery, Revenge, Care, etc., each vividly described. The last of these is War. on whose shield he sees depicted the great battles of antiquity. Finally, penetrating to the realm of Pluto, he is surrounded by the shades, of whom the duke of Buckingham is the first to advance, thus introducing the *Complaint.*

Sackville's models were Gavin Douglas and Virgil. The dignity and artistic quality of the narrative of the fall of Buckingham make the work one of the most important between the *Canterbury Tales* and the *Faerie Queene.*

Sackville has also the credit of being part author with Thomas Norton of the first legitimate tragedy in English. This was *Gorboduc* or *Ferrex and Porrex,* which was "furniture of part of the grand Christmasse in the Inner Temple" in 1560 and was later shown before the queen at Whitehall by "the Gentlemen of Thynner Temple" on Jan. 18, 1562 (*cf.* Sir E. *K.* Chambers, *The Elizabethan Stage,* iii, 457, Oxford, 1923).

The story is taken from book ii, chap. xvi, of Geoffrey of Monmouth's history. It was first printed (1565) in an unauthorized edition as *The Tragedie of Gorboduc* "where of three Actes were wrytten by Thomas Nortone, and the two laste by Thomas Sackuyle." Another, undated, edition, *The Tragidie of Ferrex and Porrex,* appeared about 1570–71. The tragedies of Seneca were now being translated, and the play is conceived on Senecan lines. The paucity of action is eked out by a dumb show to precede each act, and the place of the chorus is supplied by four "ancient and sage men of Britain." In the variety of incident, however, the authors departed from the classical model. The play is in blank verse, and is the first example of the application of Henry Howard, earl of Surrey's innovation to drama.

Jasper Heywood in the poetical address prefixed to his translation of Seneca's *Thyestes* alludes to "Sackvylde's Sonnets, sweetly sauste," but only one, prefixed to Sir T. Hoby's translation of Baldassare Castiglione's *Courtier,* survived. According to Archbishop George Abbot *(A Sermon preached at Westminster,* 1608), Queen Elizabeth I shared the general high opinion of Sackville's merits as a writer.

The best edition of *Mirror for Magistrates* is that of Lily B. Campbell, edited from original texts in the Huntington library (Cambridge, New York, 1938). *See* also her *Parts added to the Mirror for Magistrates* (Cambridge, New York, 1946); *Gorboduc* in *J. W.* Cunliffe (ed.), *Early English Classical Tragedies* (Oxford, 1912); *Cambridge History of English Literature,* iii; C. S. Lewis, *English Literature in the 16th Century Excluding Drama* (Oxford, 1954).

SACRAMENT, the title given by Christians to an external rite or ceremony regarded as the instrument, or at least a symbol, of the reception by those who participate in it of a spiritual benefit whereof Christ is the author. As the conception of a spiritual benefit received through participation in an external rite is by no means peculiar to Christianity, the expression is often applied also to rites in other religions more or less analogous to those designated sacraments by Christians, and sometimes to any instance of the use of material objects as instruments whereby spiritual benefits may be conveyed or appropriated, even although no religious doctrine or ritual be associated with such conveyance or appropriation.

The present article, however, will be mainly concerned with the Christian conception of a sacrament, and rather with the content and significance of that conception than with its history.

In the *Sentences* of Peter Lombard, bishop of Paris 1159–60, which served for centuries as the theological textbook of western Christendom, *sacramentum* in the most general use of the word is defined (5 *Sent.* dist. 1 B. following Augustine *Ep.* 138 § *8, signa quae, cum ad res divinas pertinent, sacramenta appellantur*) as *sacrae rei signum;* and, more precisely, as *invisibilis gratiae visibilis forma;* but in its strictest acceptation, wherein it is applicable only to certain Christian rites, as *quod ita signum est gratine Dei et invisibilis gratiae forma ut ipsius imaginem gerat et causa existat* — *an* outward and visible sign of an inward divine grace, which it both aptly represents (as immersion in baptismal water represents cleansing from sin, or eating and drinking eucharistic bread and wine the maintenance and strengthening of spiritual life) and also actually imparts to the recipient.

The word *sacramentum* is used in classical Latin literature of the pledge deposited in a temple by the parties to a lawsuit, and also of the soldier's oath of allegiance to his commander; and neither of the senses has been without influence on its employment by Christian theologians. But the far less restricted sense given to it by the Latin-speaking Fathers and their choice of it to render the Greek μυστήοιον point to its having had a more general signification, corresponding to its etymology, such as is suggested by St. Thomas Aquinas when he says that that may be called *sacramentum* whereby anything is made sacred (*sacratur)* as that whereby anything is adorned *(ornatur)* is called *ornamentum* (in 4 *Sent.* i. 1; *cf. Summ. Theol.* q.u. lx. art. 1: *Sacramentum dicitur a sacrando, sicut medicamentum a medicando*). Thus, behind the conception of a sacrament lies the notion, common to all peoples, of a "sacred" sphere or world, distinct from, but in close contact with, that of everyday life, so that particular persons, things, places and times can, by recognized methods of "consecration" or "desecration," be removed from one to the other.

The word μυστήριον, employed by the Greek-speaking Church, was associated with the same notion, being the regular designation of religious ceremonies of initiation. These ceremonies distinguished the initiated from those not counted worthy of such translation from the sphere of ordinary life to communion with denizens of a higher world, and suggested the *secrecy* with which "sacred" rites were invested, in order to secure their performance from the intrusion of profane or unconsecrated persons or things. In the New Testament μυστήριον is almost exclusively used of the divine secrets (*e.g.,* of God's purpose to include all nations in the covenant made by him at first with Israel alone) which are described as now at length divulged to the world by the preaching of Christ's apostles. It is not applied to the solemn rites of initiation and communion which were nevertheless already regarded as "means of grace," and came, with the spread of Christianity in the Graeco-Roman world, to be treated as corresponding in the new faith to the ceremonies there denoted by the name, in which Christians from Justin onwards, were accustomed to see a diabolical travesty of the Christian "sacraments." Nor for a long time was the word *sacramentum,* by which the earliest Latin translators of the Scriptures rendered μυστήριον limited to those outward "means of grace" to which it came eventually to be appropriated; and, even after it had been thus appropriated, it was only gradually that among a host of ceremonies and things used in ceremonies, all supposed to convey divine grace in some manner or degree, a certain number were definitely acknowledged as properly entitled to the name of sacraments.

THE SEVEN SACRAMENTS

Seven rites were recognized in the west, from Peter Lombard onwards, as sacraments in the strict sense: Baptism, Confirmation, the Eucharist, Penance, Extreme Unction, Orders and Marriage; the Councils of Trent and of the Vatican endorsed this list which has also been adopted by the orthodox Church of the east. The Churches of the Reformation, on the other hand, acknowledged only baptism and the eucharist, to which indeed a certain pre-eminence was universally allowed, as entitled to be called sacraments in the proper sense; mainly on the ground that these alone could be proved from Scripture to have been instituted by Christ himself as external ceremonies effecting, or at least attesting and sealing, the conveyance of an inward spiritual grace to worshippers qualified to receive it by faith in the promise expressly associated with its performance by its divine Founder. In demanding that a sacrament in the proper sense must be able to claim institution by Christ the Reformers did not differ from the Roman Church. But they refused to accept inferences from the words of Scripture, though supported by ecclesiastical tradition, as evidence of such institution equivalent to the direct

commands to be found for baptism in Matt. xxviii. and for the eucharist especially in 1 Cor. xi.

The Scriptural texts alleged to suggest a like institution for the other rites recognized by the Roman Church as sacraments seemed to them either to be inapplicable to them or else to make no such provision for a particular outward symbol of the promised grace as was necessary to constitute a "sacrament," while the traditional rendering of μυστήριον by *sacramenturn* in the application of the word to marriage in Eph. v. 32 could hardly be said to warrant the interpretation of the word there, as intended in a very specialized sense otherwise unknown to the New Testament. Where, however, there was, as with baptism and the eucharist, express scriptural authority for the institution by Christ of an outward and visible sign of an inward spiritual grace, of the bestowal whereof it was to be, to a believer in his promise, at least the assurance, if not the instrument, there the Protestant as well as the Catholic, recognized a genuine sacrament.

There was, however, an important point of difference between them, in respect of such ceremonies as they agreed in regarding as "sacraments." The former denied, and the latter affirmed that they confer grace *ex opere operato*. This phrase seems to have been originally intended to express the belief that sacraments do not depend for their efficacy on the moral character or even on the private beliefs of the individual minister; that where an otherwise qualified person, though wicked or unbelieving, yet intending "to do what the Church does," observes the appointed forms, the recipient need not be afraid that the promised grace is not received; the human minister being no more than an instrument in the hand of the true Giver, Christ Himself. This the Churches of the Reformation for the most part did not deny; the view of Wyclif that only one himself in a state of grace could administer a valid sacrament obtained little acceptance. But the Reformers objected to the phrase *ex opere operato*, which was solemnly reaffirmed against their objections by the Council of Trent. It seemed to them inconsistent with the supreme place assigned in their theology to faith as the sole means of justification. Catholics did not indeed deny that the absence of personal faith in a recipient in whom it could be present (as it could not be, for example, in infants brought to baptism) would present an impediment to this profiting by the grace offered in a sacrament, and on their side, Protestants, in allowing infant baptism, were constrained to admit that the requisite faith was not necessarily that of the individual recipient, but might be that of his parents or of the Church.

Nevertheless, the difference between Catholic and Protestant in that the one laid stress upon the necessity to salvation of sacraments where they could be had, and the other on the indispensableness of faith, which could justify without sacraments, while without it sacraments could not justify, profoundly affected their respective attitudes towards an institution which the Protestant as little intended to disparage as the Catholic. In respect of the eucharist, whereas Luther, Calvin, and the Reformers generally had hoped, by abolishing celebrations at which the priest alone communicated, to restore the primitive frequency of communions, the actual result of the changes introduced by them was to deprive that service in any form of the central place in the public worship of the Church which it had held from the very beginnings of Christianity. Catholics on the other hand were driven by the necessity of maintaining the efficacy of sacraments *ex opere operato* into placing and encouraging a reliance on sacraments which exposed them to the charge of allowing their religion to degenerate in practice into magic.

SYMBOLISM

It cannot be denied that the use of sacraments presents a certain resemblance to some kinds of magic. There is in both the employment of material objects and of bodily gestures in conjunction with a particular form of words to produce effects which, apart from such conjunction, they could not have accomplished, But sacraments resemble far more closely facts of human life which no one would think of describing as magical in any disparaging sense; such as the operation of words, spoken or written, in creating states of feeling, inspiring action, or revealing personality. Here the necessity of intelligent acceptance by those affected of the conventional meaning of the sounds or words employed, the limitation of the effect produced to a certain social context, and the quality (not merely physical, but intellectual or spiritual) of the result obtained distinguish verbal communication (though, as certainly not fully explicable on the principles recognized in the natural sciences, it may fairly be called *mysterious)* from what is usually meant by *magic*. And in these respects, sacraments must be classed with verbal communication. No Christian theologian would allow that these are effective altogether outside of the context of that agreement as to the meaning of the signs and formulas used which exists among Christians, or for the production of merely physical effects according to any law which, like those called "natural," operates irrespectively of the consciousness of tho'se in whose bodies they are produced.

Attempts to treat sacraments as thus effective for "magical" purposes have not been unknown; but they have always been denounced by ecclesiastical authority and regarded as wrong and profane. Without entering into details as to charges of the magical use of sacraments made by theological opponents against particular groups of Christians, it may be observed, in reference to one of special historical importance that, while it is quite arguable that to use the eucharist as a focus of adoring devotion apart from communion is an unwarrantable departure from its original intention, both parties to the controversy here indicated would agree in disapproving as illegitimate any use of it for purposes really other than that or those (whatever it or they may be) for the sake of which it was originally instituted.

Wherever sacraments are used at all (and few Christian denominations have, like the Society of Friends, abandoned the use even of the two which undoubtedly date back to New Testament times), although there may be no crude abuse of them for confessedly magical purposes, quite other than those which the Church holds them to be intended to secure, it is possible to assimilate them to magical performances, by losing sight of their function as vehicles for communicating to individuals a life essentially social and, like all social life, requiring a conventional or ceremonial mode of expression, and of the essentially ethical character of the life which they are thus designed to communicate. The use of material objects or of bodily gestures in the communication of spiritual grace is not alien to the religion of the New Testament, but it is never there taken out of the context of a moral and social life in the imparting and maintaining of which the whole purpose of such use of objects and gestures consists. It is in a firm grasp of the *social* character of sacraments and of the *moral* quality of the life which they are designed to serve as instruments in communicating that the true safeguard against the very real danger of a degeneration of sacramentalism into magic-mongering should be sought rather than in the elimination of sacramentalism from religion, with the whole history of which it is intimately bound up, and by which, as has been well said, "the higher gifts are made accessible to persons of all stages of culture."

"The principle that spiritual values and forces are mediated through material processes," the same writer observes, "runs through nature as a whole." The very production of a new personality is only possible through "a material process the most liable . . . to carnal misuse." "Truth, beauty, goodness . . . become effective only through material forms." There are "natural sacraments"—the kiss, the handshake, the flag—outside of religion. The admittedly important part which these and their like play in our common social life the sacraments play in religion; and in Christianity in particular, "we are bidden to act as sons of God and sharers in Christ, knowing by an outward sign that we are so. Our reliance is to be on the word and act of God, while the joy of responsive emotion comes and goes." (Gore, The Holy Spirit and the *Church,* p p 24, 146, 148.)

To the value of sacramentalism to human life Goethe (Wahrheit *u. Dichtung*, Th. ii., B. 7) and Comte, who devised an elaborate system of symbolic rites for his new Religion of Humanity, may be cited as witnesses. That in the early stages of civilization the

magical and the sacramental are not easily discriminated is no more than may be said of the magical and the religious in general, or indeed of the magical and the scientific. Primitive magic owes its disappearance at a higher level of culture to its confusion (arising at first from lack of experience, afterwards from the persistence of uncriticized tradition) of different kinds of causation; the supposition, for instance, that the utterance of a name may affect an animal, thing, or unconscious person as it may a person who hears himself called; or that the moral healing of a soul may be effected by external actions without a change in the direction of the will. We still know too little about the interaction of mind and body to despise our ancestors or undeveloped contemporaries for making mistakes in this department, which it has taken centuries of progress, religious and scientific, to render us inexcusable in making. But neither need these ancient errors, even though they may, here as elsewhere, have left traces of themselves, interesting to the archaeologist in conventions and customs which have survived the false beliefs in which they originated, be supposed to render trivial or illusory the higher activities and experiences in connection with which these traces are retained.

THE ARGUMENT OF CONTINUITY

But while we may speak of "natural sacraments" the word is strictly appropriate only where a distinction is drawn between the everyday world and a "sacred" world transcending this, although not necessarily separated from it in space or time. Where the use of the term is extended to the communication of spiritual illumination or power through material symbols apart from religion, we have to do either with a metaphor or, more usually, with a conviction that what is experienced in religion may be employed as a key to the true or ultimate nature of the world as a whole, including those features of it which are revealed to us in that part of our experience which is not in itself specifically religious. For Christians the "sacred" sphere is that which is directly related to Christ, and accordingly nothing can be properly called a "sacrament" which cannot claim authorization by Christ as a vehicle of Divine grace. While a statement in the Bible was taken as, by its presence there, guaranteed to be, when rightly understood, free from error, the undoubted occurrence in Scripture of direct statements that Christ instituted baptism and the eucharist was sufficient to establish their claim. Critical study of the Bible has here, however, altered the situation. Few scholars would now be prepared to regard Matt. xxviii. 19, and 1 Cor. xi. 23 sqq. as putting it beyond doubt that the historical Jesus actually prescribed the permanent observance of these rites by his followers. Thus the old question as to the number of sacraments cannot be argued on the old grounds, but rather on that of the continuity between any rite now in use and a rite observed in the primitive Christian community from which the New Testament proceeded; and of the degree in which that community regarded it as intimately bound up with that fellowship with the crucified and risen Saviour which this community existed to offer to all who would join themselves with it.

That baptism and the eucharist were regarded as very intimately bound up with it is certain. Converts were always initiated by a ceremonial washing in Christ's name; such a washing, symbolical of cleansing from sin, being (whether or no actually practised or enjoined by Jesus) familiar to Jews as used in the admission of proselytes and specially associated with Christ's own baptism by John the Baptist, whose mission Christians believed to have been preparatory to their Master's. From the first the followers of Jesus continued the custom, which had plainly been characteristic of his daily intercourse with his disciples, of the solemn blessing and breaking of bread at their social meals; a custom invested with specially solemn associations by the circumstances of His last supper whereat he was believed to have used words identifying the bread and cup shared among his companions with his own body and blood, which were so soon after to be broken and shed upon the cross.

The credentials of the other rites acknowledged by many Christians as sacraments were more doubtful. A laying on of hands symbolical of the gift of the Spirit seems usually from the beginning to have formed part of the initiatory rite, though sometimes detached from the baptism proper; but no tradition connected it with any injunction of Jesus; the gift imparted was associated in the New Testament with extraordinary manifestations not destined to be permanent; of the anointing which later became the chief feature of "confirmation" Scripture says nothing. Jesus had been wont to forgive sins, and sins were believed to be washed away in baptism; hut no ceremony or fixed formula is recorded to have been used by Jesus in this connection; only gradually was it realized that sin after baptism would be a normal feature of the Christian's life; nor can scriptural authority be claimed for the system of penitential discipline which was gradually developed in the Church. The unction of the sick mentioned in James was not, like the later rite which appealed to its precedent, intended to be "extreme"; its primary purpose was not the imparting of a spiritual gift, but bodily healing, which alone is mentioned as the object of unction in the only scriptural passage (Mark vi, 13) which appears to represent it as performed by Christ's direction. The setting apart of office-bearers in the Christian community by laying on of hands is certainly apostolical; but this symbolic mode of appointment is nowhere stated in Scripture to have been used or enjoined by Jesus himself. Lastly, the only claim of the immemorial and universal institution of marriage to be a "sacrament of the new law" appears, as said above, to be the incidental observation of St. Paul (doubtless suggested by the prophetic use of it as a symbol of the bond between Yahweh and Israel) that it is a "great mystery" or "sacrament" as representing the union of Christ with his Church. But though only certain rites may be reckoned as sacraments in a prerogative sense, the whole system through which individual members of a religious group are placed, through symbols, conventionally recognized therein as instruments of its communication, in contact with the spiritual life which gives unity to the group may be regarded as sacramental. In Christianity—and the associations of the word "sacrament" are Christian—this is the divine life historically manifested in the person and work of Jesus Christ and believed to be continued in the community which, as inspired by His Spirit, may be called His "mystical body." Here those rites, the continuous experience of grace received through which throughout the history of the community attest the unbroken presence therein of the same source of spiritual life are entitled to the name of sacraments. It is clear that only where there exists faith in the reality of this divine life and in the organic relation of the community thereto, can any significance or efficacy be attributed to these; but also that such faith can only be other than an illusion if this life and this relation are in fact real. (See also BAPTISM, EUCHARIST.)

BIBLIOGRAPHY.—Peter Lombard, *Sententiae*, book iv; St. Thomas Aquinas, *Summa Theologica*, part 3; *Concilii Tridentini Canones et Decreta; Sylloge Confessionum sub tempus reformandae Ecclesiae editarum* (Oxford, 1827); Calvin, *Institutes*, book iv; Harnack, *Dogmengeschichte; cf.* the articles on *Sacraments* in Hastings' *Encyclopaedia of Religion and Ethics* and the bibliographies. (C. C. J. W.)

SACRAMENTALS, in the Roman Catholic Church, originally denoted the ceremonies, outside the essentials, used in the administration of the sacraments to elevate the mind to the contemplation of the divine mysteries; *e.g.*, genuflections during mass, the anointing of the priest's hands during ordination, the triple pouring at baptism. In a larger sense, they are all the other external signs employed by the church to obtain spiritual effects. These signs can be actions (exorcisms, making the sign of the cross, saying of grace at meals, blessings, etc.) or things (holy water, blessed candles, vestments, palms and ashes, crucifixes, rosaries, etc.).

The sacramentals are like sacraments in that they are sensible signs and symbols. They differ from the sacraments in that they do not give grace of themselves; rather, their special spiritual effects, e.g., an increase of charity, derive from the power of the church's prayer and are conditioned in the concrete by the dispositions of the user.

See J. Sullivan, *The Externals of the Catholic Church* (1959).

(E. J. A.)

SACRAMENTARIANS, the name given to those who during the Reformation controversies not only denied the Roman

Catholic doctrine of "transubstantiation," but also the Lutheran "consubstantiation." They admitted a spiritual presence of Christ which the devout soul can receive and enjoy, but denied any physical or corporeal presence. Finally accepting the Confession of Augsburg, they were merged in the general body of Lutherans; with the exception of the Swiss followers of Huldreich Zwingli, whose position was incorporated in the Helvetic Confession. It is a curious inversion of terms that in recent years has led to the name Sacramentarians being applied to those who hold a high or extreme view of the efficacy of the sacraments.

SACRAMENTO, the capital city of California, U.S., and seat of Sacramento county, is located about 75 mi. N.E. of San Fiancisco at the confluence of the American and Sacramento rivers, midway between the Sierra Nevada range and the Pacific ocean. Because of climatic factors favourable to growing camellias, the city became known as "the camellia capital."

History. — In Aug. 1839, John Augustus Sutter (*q.v*). a Mexican citizen. established a colony, known as New Helvetia, on the site of the future city. He had received a land grant of 11 square leagues (about 73 sq.mi.) from the Mexican governor Juan Alvarado and between 1839 and 1844, he used Indian labour to build an adobe fortress known as Fort Sutter. Situated as it was on the main line of travel, Fort Sutter soon became one of the greatest trading posts in California. Sutter extended unbounded hospitality to American immigrants between 1843 and 1848 James W Marshall, an employee of Sutter, was supervising the construction of a sawmill on the American river near Coloma. 35 mi. N.E. of the fort. when, on Jan 24, 1848. he found a gold nugget in the millrace. The discovery of gold on his land was, ironically the cause of Sutter's ruin. for his men deserted him. gold seekers pillaged his property and he died a poor man.

Sutter's son, who had been deeded the family property near the Embarcadero along the river, laid out a town there named after the Sacramento river. The federal census reported a population of 6.820 as early as 1850, the year that Sacramento was incorporated. Strategically located at the entrance to the gold areas, the city became a typical mining boom-town of about 10,000 within a few months.

When state government was established in 1849 Sacramento campaigned to be named the capital and offered $1,000.000 for the honour; in 1854 it was chosen the permanent seat of government. Three times between 1849 and 1853, and again in 1861, the city suffered from devastating floods, and in 1852 two-thirds of it was destroyed by fire.

Sacramento was a major depot on the overland mail routes between the Missouri frontier and the Pacific during the 1850s. When the pony express was established, the city became the western terminal As early as 1856 the Sacramento Valley railroad was completed to Folsom, 24 mi. N.E., and uas the first railway in the state to tap the freighting business between the gold camps by providing faster service than the freight wagons on the roads and trails. Theodore Dehone Judah, the chief engineer of the railroad. planned to extend the line across the Sierra Nevada. He found four merchants in Sacramento, Leland Stanford, Mark Hopkins, Charles Crocker and Collis P. Huntington, willing to help finance and promote his transcontinental project These men became the founders of the Republican party in California and thereby gained generous government support for their railroad that was constructed between 1863 and 1869. With the advent of rail transportation into the area, the future of Sacramento was assured.

Population. — The population of Sacramento city in 1960 was 191.667, an increase of 54.095 since the 1950 census representing a 39.3% growth. The standard metropolitan statistical area of Sacramento comprising Sacramento county had a population of 502.778 in 1960 and includes North Sacramento, Arden. Folsom, Natomas, Del Paso Heights, Town and Country area. Carmichael, Fair Oaks, North Highlands, Citrus Heights and Orangeville, all on the east side of the Sacramento river, with populations ranging from 5,000 to 45,000. The rapid growth of suburban communities in the Sacramento vicinity has caused the population growth of the county, 122.1% between 1950 and 1960, to exceed that of the state percentage-wise. (For comparative population figures see table in CALIFORNIA: *Population.)*

Administration. — Sacramento adopted a council-manager form of government in 1921. The nine members of the city council are elected for a two-year term. Sacramento county government is based upon a state charter providing for the election of five supervisors for four-year terms from defined geographic districts. A city-planning board was established in 1926 and zoning ordinances are in effect.

Transportation, Commerce and Industry. — Sacramento is on the main line of two transcontinental railroads and there is a connection with a third. Two major east-west transcontinental highways and the principal north-south Central valley route come together at Sacramento, making it a hub of highway transportation. Sacramento county has 14 airports: one is municipally controlled, one is administered by the county, two are United States air force installations and the remainder are privately owned. Barge service along the Sacramento river connects the city with the port of San Francisco and is used extensively in transporting agricultural and petroleum products.

Sacramento is the centre of an extensive wholesale and retail trade. Because of the surrounding region's high agricultural productivity. canning and food processing is the principal manufacturing activity with more than 100 plants. Associated with this agricultural processing are flour millers, bean and rice cleaners and polishers, olive-packing plants and one of the world's largest almond shelling plants. Among other large industrial establishments are manufacturers of jet-propellants, soaps and detergents. furniture, machine engine parts, boxes, brick and clay pipe and mining equipment. There are also large railroad shops and three military installations that maintain and repair aircraft. Natural gas fields in the vicinity and water power from the Sacramento river system provide the area with ample power facilities.

Education and Cultural Activities. — Public education is available from kindergarten through college. Sacramento City college was established in 1916. American River Junior college, opened in 1955, was relocated on a new campus in 1958. Sacramento State college (1947) emphasizes teacher education. The University of California, Davis, 15 mi. W. of Sacramento, offers advanced instruction in its colleges of agriculture, letters and science and school of veterinary medicine.

The state library there has an outstanding collection on the history of California, a fine law library and is an extensive depository of government documents. The E. B. Crocker Art gallery houses one of the largest and most valuable collections west of the Mississippi river. The municipal auditorium, completed in 1927, seats 5.000 and is a centre of cultural entertainment.

Parks and Recreation. — The state capitol, located in the heart of downtown Sacramento, is surrounded by a 40-ac. park, with numerous varieties of native American and foreign trees and shrubs, comprising one of the most diversified horticultural collections to be found within an area of similar size. The capitol, constructed 1869–74, is four stories high, surmounted by a large dome, and is Roman Corinthian in design. In 1951 a large annex, the east wing, was added to the building. One mile east of the capitol is old Fort Sutter, maintained by the state as a historic museum, surrounded by a public garden.

A vast network of waterways in the Sacramento area provide about 1,500 mi. of picturesque routes for boating enthusiasts. Folsom lake. 14 mi. long and covering 11,500 ac., provides for water skiing and other aquatic sports. (W. T. J.)

SACRAMENTO RIVER, the largest and most important stream in northern California, U.S., slightly less than 400 mi. long, but close to 600 if measured from the source of its longest tributary, the Pit, rises in the Klamath mountains near Mt. Shasta and empties into San Francisco bay. Flowing southward for most of its length, it turns westward just below the city of Sacramento, unites with the northward-flowing San Joaquin near Pittsburg and passes through Suisun and San Pablo bays and San Pablo strait into San Francisco bay. Its navigability varies with water level and dredging operations, with Red Bluff, about 250 mi. upstream, being accessible to small craft at high water. The Sacra-

mento and its tributaries, especially the American and Feather rivers, were the scene of the famous California Gold Rush of 1849. Together with the San Joaquin, the Sacramento forms the great Central valley of California, one of the richest agricultural areas in the world.

The Sacramento (northern) portion of the valley has only one third of the arable land but two thirds of the water resources (an average annual runoff of about 22,000,000 ac.-ft.). To control floods and shift surplus water to the more arid San Joaquin region, the Central Valley project was launched by the Federal Bureau of Reclamation in the 1930s. The project includes various dams, such as Shasta near Redding, one of the largest in the world. reservoirs, power plants and canals. (D. E. F.)

SACRED HEART. Devotion to the Sacred Heart of Jesus is a cult peculiar to the modern Roman Catholic Church. The principal object of this devotion is the Saviour Himself. Saint Marguerite Marie Alacoque (*q.v.*), assisted by her director, the Blessed Claude de la Colombière, S.J. (*q.v.*), spread the devotion This devotion was strongly opposed by the Jansenists, who claimed that the Heart of Christ was being adored as separate from the rest of His Being. Despite similar misunderstandings, the devotion has flourished strongly in the Catholic Church. The Jansenist synod of Pistoia, assembled by Scipio de Ricci, bishop of Pistoia (1780–91), which formulated this objection against the devotion, was condemned by Pope Pius VII in the Bull Auctorem *Fidei*, Aug. 28, 1794. In May 1805 De Ricci submitted to the papal condemnation of the synod. In 1856 Pius IX introduced the feast into the general calendar of the Roman Catholic Church, fixing the Friday after the Octave of Corpus Christi for its celebration, The beatification of Blessed M. M. Alacoque in 1864 gave a new impetus to the devotion.

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SACRED HEART, BROTHERS OF THE (SOCIETAS FRATRUM SACRIS CORDIS; S.C.), a religious order founded in 1821 in Lyons, France, by André Coindre, a missionary priest, is primarily a teaching order, specializing in high school and elementary school education in both parochial and private schools. The Brothers arrived in the United States in 1847, from where they spread rapidly into Canada; there are seven Canadian provinces and three U.S. provinces. The Brothers are also a missionary society with missions all over the world. The motherhouse is in Rome. (A. Ro.)

SACRED HEART, MISSIONARIES OF THE (in full, SOCIETY OF THE MISSIONARIES OF THE SACRED HEART OF JESUS; SOCIETAS MISSIONARIORUM SACRATISSIMI CORDIS JESU; M.S.C.), is a Roman catholic congregation of men founded at Issoudun, France, Dec. 8, 1854, by Jules Chevalier, a secular priest, for restoring the faith in the rural sections of France. Pius IX directed the congregation to foreign-mission work.

The M.S.C. have provinces in Europe, the Americas (two in the U.S.) and Australia, and do foreign-mission work on all the continents and in the Pacific islands. The general motherhouse is in Rome. (L. F. P.)

SACRED HEART, PRIESTS OF THE (in full, CONGREGATION OF THE PRIESTS OF THE SACRED HEART OF JESUS; CONGREGATIO SACERDOTUM A SACRO CORDE JESU; S.C.J.), a congregation of priests and brothers founded in Saint-Quentin, France, in 1878, by Leo John Dehon.

Its aim is to spread the apostolate of the Sacred Heart and to undertake all forms of the priestly ministry: teaching, missions, retreats, home and foreign missions. The congregation has spread to five continents and to nine states in the U.S. Generalate headquarters are located in Rome. (J. T. O'C.)

SACRIFICE, the ritual destruction of an object, or, more commonly, the slaughter of a victim by effusion of blood, suffocation, fire or other means (from Lat. *sacrificium;* sacer, holy, and *facere,* to make). While the Hebrew for sacrifice, זֶבַח, makes the killing of the victim the central feature, the Latin word brings out sacralization (see TABU) as an essential element in many cases. The sacrifice of desacralization is also found; hence MM. Hubert and Mauss describe a sacrifice as "a religious act, which, by the consecration of a victim, modifies the moral state of the sacrificer or of certain material objects which he has in view"; *i.e.,* it either confers sanctity or removes it and its analogue, impurity. It is, in fact, "a procedure whereby communication is established between the sacred and profane spheres by a victim, that is to say by an object destroyed in the course of the ceremony."

Principles of Classification. — It is possible to classify sacrifices according to (1) the occasion of the rite, (2) the end to be achieved, (3) the material object to be effected or (4) the form of the rite. (1) The division into periodical and occasional is important in Hindu and other higher religions; the former class is obligatory, the latter facultative. In less developed creeds the difference tends to remain in the background; but where sacrifices are found, solemn annual rites, communal, purificatory or expiatory, are celebrated, and are obligatory. (2) The end to be achieved is sometimes sacralization, sometimes desacralization. In the former case the sacrificer is raised to a higher level; he enters into closer communion with the gods. In the latter either some material object, not necessarily animate, is deprived of a portion of its sanctity and made fit for human use, or the sacrificer himself loses a portion of his sanctity or impurity. In the sacrifice of sacralization the sanctity passes from the victim to the object; in that of desacralization, from the object to the victim. (3) Sacrifices may be classified into (a) subjective or personal, where the sacrificer himself gains or loses sanctity or impurity; (*b*) objective, where the current of mana (see TABU) is directed upon some other person or object, and only a secondary effect is produced on the sacrificer himself.

Ritual. — The necessary elements of a Hindu sacrifice are: (1) the *sacrificer,* who provides the victim, and is affected, directly or indirectly, by the sacrifice; he may or may not be identical with (2) the *officiant,* who performs the rite; we have further (3) the place, (4) the instruments of sacrifice and (5) the *victim;* where the sacrificer enjoys only the secondary results, the direct influence of the sacrifice is directed toward (6) the *object;* finally, we may distinguish (7) three *moments of the rite* —(*a*) the *entry,* (*b*) the *slaughter,* (*c*) the *exit.*

Sacralization and desacralization, sometimes performed by means of subsidiary sacrifices, were the essential elements of the preparation for sacrifice and the subsequent lustration. In developed forms, such as the offering of *soma,* they assumed a great importance; (1) the sacrificer had to pass from the world of man into a world of the gods; consequently he was separated from the common herd of mankind and purified; he underwent ceremonies emblematic of rebirth and was then subject to numberless taboos imposed for the purpose of maintaining his ceremonial purity. In like manner (2) the officiant prepared himself for his task; but in his case the natural sanctity of the priest relieved him of the necessity of undergoing all that the common man had to pass through; in fact, this was one of the causes which brought him into existence, the other being the need of a functionary familiar with the ritual, who would avoid disastrous errors of procedure, destructive of the efficacy of the sacrifice. (3) Where there was an appointed place of sacrifice there was no need of preparation of a place of sacrifice. (4) The necessary rites included (*a*) the establishment of the fires, friction being the only permitted method of kindling, (*b*) the tracing on the ground of the vedi, or magical circle, to destroy impurities, (*c*) the digging of the hole which constituted the real altar, (d) the preparation of the post which represented the sacrificer and to which the victim was tied, and other minor details. (5) The victim might be naturally sacred or might have to undergo sanctification. In the former case (a) individual animals might be distinguished by certain marks, or, (b) the whole species might be allied to the god. In the latter case the victim had to be with-

out blemish; (c) the age, colour or sex of the victim might differ according to the purpose of the sacrifice. It reached a degree of sanctity when only the priest might touch it. Finally, the priest made three turns round it with a lighted torch in his hand, which finally separated it from the world and fitted it for its high purpose. The sacrificer had to remain in contact with the victim, either personally, or, to avoid ritual perils, by the intermediary of the priest. After excuses made to the animal or to the species in general, the victim was placed in position, and silence observed by all who were present. The cord was drawn tight and the victim ceased to breathe; its spirit passed into the world of the gods. It remained to dispose of the corpse. After a rite intended to secure its perfect ceremonial purity, a part of the victim was removed, held over the fire and finally cast into it. The remainder, divided into portions, was cooked; a certain number of these portions fell to the sacrificer, after an invocation, which made them sacred by calling the deity to descend into the offering and thus sanctify the sacrificer. (6) Then followed the rites of desacralization. Finally the priest, the sacrificer, and his wife performed a lustration and the ceremonies were at an end.

With present knowledge the problem of the original form of sacrifice, if there be a single primary form, is insoluble. It is impossible to give a general survey of the purposes of sacrifice; they are too numerous, and it is rare to find any but mixed forms.

Cathartic Sacrifice.—In primitive cults the distinction between sacred and unclean is not well defined (see TABU); consequently we find two types of cathartic sacrifice—(i.) one to cleanse of impurity and make fit for common use, (ii.) the other to rid of sanctity and in like manner render suitable for human use or intercourse.

(i.) The best example of the first class is the, scapegoat, where a more concrete idea of expulsion of evil (see DEMON; EXORCISM) is present among primitive peoples, as, for example. the Australians.

(ii.) A5 an example of the second class may be taken the sacrifice of the bull to Rudra, which exemplifies the concentration of holiness in a single animal as representative of its species (see ANIMAL WORSHIP).

Communal Sacrifice.—The common meal is not a primitive rite of adoption. The custom of eating the body of the victim does not necessarily spring from any idea of communion with the god; it may also arise from a desire to incorporate the sanctity which has been imparted to it—an idea on a level with many other food customs. and based on the idea that eating anything causes its qualities to pass into the eater.

Where the victim is an animal specially associated with a god (the most conspicuous case is perhaps that of the corn spirit), it may be granted that the god is eaten; but precisely in these cases there is no custom of giving a portion of the victim to the god.

Deificatory Sacrifice.—The object of certain sacrifices is to provide a tutelary deity of a house, town or frontier. (a) In many countries, those who die a violent death are held to haunt the place where they met their fate; consequently, when a town is built living men are interred beneath the ramparts and the pillars of the gates. (b) In parts of North America the *nagual* or manitu animal, of which the Indian dreams during the initiation fast and which is to be his tutelary spirit, is killed with certain rites. (c) Human representatives of the corn or vegetation spirits are killed; in these, as in other cases of the sacrifice of the man-god, the killing of the old god is at the same time the making of a new god. (d) Suicide is treated as a means of raising a human being to the rank of a god. (e) Gods may be sacrificed (in theriomorphic form) to themselves as a means of renewing the life of the god. (f) The method of creating a fetish (see FETISHISM) on the Congo resembles deificatory sacrifice: but here there is no actual slaughter of a human being; magical means are alone relied upon.

Honorific Sacrifices.—Sacrifices tend to be interpreted as gifts to the god. Man seeks to influence his fellow men in various ways, and it is quite natural to find the same ideas in the sphere of religion. Food is often given to a god because he is believed to take pleasure in eating; the germ of this idea may have been to nourish the divine life. With the spiritualization of the god, comes a refinement of the tastes attributed to him, and the finer parts of the sacrifice, finally it may be only its savour, are alone regarded as acceptable offerings. Just as attendants are provided for the dead, so the god receives sacrifices intended to put slaves at his disposal. The gift theory of sacrifice is closely associated with that of the god as the ruler or king to whom man brings a tribute, just as he had to appear before his earthly king bearing gifts in his hands. The honorific sacrifice is essentially a propitiation but must be distinguished from the *piaculum* (see (below).

Mortuary Sacrifice.—Sacrifices, especially of human beings, are offered immediately after a death or at a longer interval. Their object may be (a) to provide a guide to the other world; (b) to provide the dead with servants or a retinue suitable to his rank; (*c*) to send messengers to keep the dead informed of the things of this world; (d) to strengthen the dead by the blood or life of a living being, in the same way that food is offered to them or blood rituals enjoined on mourners.

Piacular Sacrifice.—Whereas the god receives a gift in the honorific sacrifice, he demands a life in the piacular. The essential feature of the *piaculum* is that it is an expiation for wrong-doing, and the victim is often human.

Human Sacrifice.—If tradition is any guide, human sacrifice seems in many important areas to be of secondary character; in spite of the great development of the rite among the Aztecs, tradition says that it was unknown till 200 years before the conquest; in Polynesia human sacrifices seem to be comparatively modern; and in India they appear to have been rare among the Vedic peoples On the whole. human sacrifice is far commoner among the semi-civilized and barbarous races than in still lower stages of culture.

In Australia however, where sacrifice of the ordinary type is unknown. the ritual killing of a child is practised in connection with the initiation of a magician.

Among the forms of human sacrifice must be reckoned religious suicide. mainly found in India but riot unknown in Africa and other parts of the world.

Sacrifice in Greece and Rome.—Both on the mainland of Greece and in the Greek colonies human sacrifice was practised, usually as a means towards expulsion of evil. (See GREEK RELIGION)

At Rome the scapegoat did not suffer death; but in the Saturnalia a human victim seems to have been slain till the 4th century A.D. Many forms of animal sacrifice were found.

Sacrifice in Egypt.—Of Egyptian ritual little is known. (See EGYPT: *Ancient Religion.*)

Sacrifice in India.—Among human sacrifices may be mentioned the suttee, or custom of immolating a widow on the funeral pyre of the husband, and the Khond sat rifice of the Meriah, who was either purchased or the son of a victim father. Some days before the sacrifice, the victim, who was often kept in captivity for long periods, was devoted and his sanctity was increased; finally he was put to death by strangulation or pressure. The remains were dismembered and distributed among the fields, excepting the portion offered to the earth goddess, which was buried.

Sacrifice in Africa.—Especially in West Africa, many forms of sacrifice are found. Three main forms of human sacrifice existed: (1) the scapegoat; (2) the messenger: and (3) the expiation; but combinations were not infrequent. On the Congo, if a man committed a murder, the community voted whether he should die or be expelled; if the latter, a victim was killed, of which all partook; this is not a *piaculum* for re-establishment of the tribal bond, for the criminal is driven out of the community.

Sacrifice in America.—The Pawnees had an elaborate ritual, in which a human victim was sacrificed to the Morning Star; the blood of the victims was sprinkled on the fields, and the details of the rite are not unlike those of the Khond custom. The Iroquois sacrifice of the white dog bore in later times the character of a scapegoat festival. In Mexico human sacrifices were very

common, the number being estimated at 20,000 a year.

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THE IDEA OF SACRIFICE IN THE CHRISTIAN CHURCH

There can be no doubt that the idea of sacrifice occupied an important place in early Christianity. It had been a fundamental element of both Jewish and Gentile religions, and Christianity tended rather to absorb and modify such elements than to abolish them. To a great extent the idea had been modified already. Among the Jews the preaching of the prophets had been a constant protest against the grosser forms of sacrifice, and there are indications that when Christianity arose bloody sacrifices were already beginning to fall into disuse; a saying which was attributed by the Ebionites to Christ repeats this protest in a strong form, "I have come to abolish the sacrifices; and if ye do not cease from sacrificing the wrath of God will not cease from you" (Epiph. xxx. 16). Among the Greeks the philosophers had come to use both argument and ridicule against the idea that the offering of material things could be needed by or acceptable to the Maker of them all. Among both Jews and Greeks the earlier forms of the idea had been rationalized into the belief that the most appropriate offering to God is that of a pure and penitent heart, and that the vocal expression of contrition in prayer or of gratitude in praise is also acceptable.

The best instances of these ideas in the Old Testament are in Psalms l. and li., and in Greek literature the striking words which Porphyry quotes from an earlier writer, "We ought, then, having been united and made like to God, to offer our own conduct as a holy sacrifice to Him, the same being also a hymn and our salvation in passionless excellence of soul" (Euseb. *Dem. Ev.*, 3). The ideas are also found both in the New Testament and in early Christian literature: "Let us offer up a sacrifice of praise to God continually, that is, the fruit of lips which make confession to His name" (Heb. xiii. 15); "That prayers and thanksgivings, made by worthy persons, are the only perfect and acceptable sacrifices I also admit" (Just. Mart. *Trypho*, c. 117); "We honour God in prayer, and offer this as the best and holiest sacrifice with righteousness to the righteous Word" (Clem. Alex. *Strom.*, vii. 6).

But among the Jews two other forms of the idea expressed themselves in usages which have been perpetuated in Christianity, and one of which has had a singular importance for the Christian world. The one form, which probably arose from the conception of Yahweh as in an especial sense the protector of the poor, was that gifts to God may properly be bestowed on the needy, and that consequently alms have the virtue of a sacrifice. Biblical instances of this idea are—"He who doeth alms is offering a sacrifice of praise" (Ecclus. xxxii. 2); "To do good and to communicate forget not, for with such sacrifices God is well pleased" (Heb, xiii. 16); so the offerings sent by the Philippians to Paul when a prisoner at Rome are "an odour of a sweet smell, a sacrifice acceptable, well pleasing to God" (Phil. iv. 18). The other form, which was probably a relic of the conception of Yahweh as the author of natural fertility, was that part of the fruits of the earth should be offered to God in acknowledgment of His bounty, and that what was so offered was especially blessed and brought a blessing upon both those who offered it and those who afterwards partook of it. The persistence of this form of the idea of sacrifice constitutes so marked a feature of the history of Christianity as to require a detailed account of it.

Meals as Thank-offerings.— In the first instance it is probable that among Christians, as among Jews, every meal, and especially every social meal, was regarded as being in some sense a thank-offering. Thanksgiving, blessing and offering were co-ordinate terms. Hence the Talmudic rule, "A man shall not taste anything before blessing it" (Tosephta Berachoth, *c.* 4), and hence St. Paul's words, "He that eateth, eateth unto the Lord, for he giveth God thanks" (Rom. xiv. 6; cf. 1 Tim. iv. 4). But the most important offering was the solemn oblation in the assembly on the Lord's day.

The points in relation to this offering which are clearly demonstrable from the Christian writers of the first two centuries, but which subsequent theories have tended to confuse, are these. (1) It was regarded as a true offering or sacrifice; for in the Teaching of the Twelve Apostles, in Justin Martyr and in Irenaeus it is designated by each of the terms which are used to designate sacrifices in the Old Testament. (2) It was primarily an offering of the fruits of the earth to the Creator; this is clear from both Justin Martyr and Irenaeus, the latter of whom not only explicitly states that such oblations are continued among Christians, but also meets the current objection to them by arguing that they are offered to God not as though He needed anything but to show the gratitude of the offerer (Iren. iv. 17, 18). (3) It was offered as a thanksgiving partly for creation and preservation and partly for redemption: the latter is the special purpose mentioned (*e.g.*) in the Teaching of *the* Twelve Apostles; the former is that upon which Irenaeus chiefly dwells; both are mentioned together in Justin Martyr (*Trypho*, c. 41). (4) Those who offered it were required to be not only baptized Christians but also "in love and charity one with another"; there is an indication of this latter requirement in the Sermon on the Mount (Matt. v. 23, 24, where the word translated "gift" is the usual lxx. word for a sacrificial offering, and is so used elsewhere in the same Gospel, viz. Matt. viii. 4, xxiii. 19), and still more explicitly in the *Teaching*, c. 14, "Let not any one who has a dispute with his fellow come together with you (*i.e.* on the Lord's day) until they have been reconciled, that your sacrifice be not defiled." This brotherly unity was symbolized by the kiss of peace. (5) It was offered in the assembly by the hands of the president; this is stated by Justin Martyr (*Apol.* i. 65, 67), and implied by Clement of Rome (*Ep.* i. 44, 4).

Sacred Meals.—Combined with this sacrifice of the fruits of the earth to the Creator in memory of creation and redemption, and probably always immediately following it, was the sacred meal at which part of the offerings was eaten. Such a sacred meal had always, or almost always, formed part of the rites of sacrifice. There was the idea that what had been solemnly offered to God was especially hallowed by Him, and that the partaking of it united the partakers in a special bond both to Him, and to one another. In the case of the bread and wine of the Christian sacrifice, it was believed that, after having been offered and blessed, they became to those who partook of them the body and blood of Christ. This "communion of the body and blood of Christ," which in early writings is clearly distinguished from the thank-offering which preceded it, and which furnished the materials for it, gradually came to supersede the thank-offering in importance, and to exercise a reflex influence upon it. In the time of Cyprian, though not before, we begin to find the idea that the body and blood of Christ were not merely partaken of by the worshippers but also offered in sacrifice, and that the Eucharist was not so much a thank-offering for creation and redemption as a repetition or a showing forth anew of the self-sacrifice of Christ.

This idea is repeated in Ambrose and Augustine, and has since been a dominant idea of both Eastern and Western Christendom. But, though dominant, it has not been universal, nor did it become dominant until several centuries after its first promulgation. The history of it has yet to be written. For, in spite of the important controversies to which it has given birth, no one has taken the pains to distinguish between (i.) the theories which have been from time to time put forth by eminent writers, and which, though they have in some cases ultimately won a general acceptance, have for a long period remained as merely individual opinions, and (ii.) the current beliefs of the great body of Christians which are expressed in recognized formularies. A catena of opinions may be produced in favour of almost any theory; but formularies express the collective or average belief of any given period, and changes in them are a sure indication that there has

been a general change in ideas.

It is clear from the evidence of the early Western liturgies that, for at least six centuries, the primitive conception of the nature of the Christian sacrifice remained. There is a clear distinction between the sacrifice and. the communion which followed it, and that which is offered consists of the fruits of the earth and not of the body and blood of Christ. Other ideas no doubt attached themselves to the primitive conception, of which there is no certain evidence in primitive times, *e.g.* the idea of the propitiatory character of the offering, but these ideas rather confirm than disprove the persistence of those primitive conceptions themselves. All Eastern liturgies, in their present form, are of later date than the surviving fragments of the earlier Western liturgies, and cannot form the basis of so sure an induction; but they entirely confirm the conclusions to which the Western liturgies lead.

In the course of the 8th and 9th centuries, by the operation of causes which have not yet been fully investigated, the theory which is first found in Cyprian became the dominant belief of Western Christendom. The central point of the sacrificial idea was shifted from the offering of the fruits of the earth to the offering of the body and blood of Christ. The change is marked in the rituals by the duplication of the liturgical forms. The prayers of intercession and oblation, which in earlier times are found only in connection with the former offering, are repeated in the course of the same service in connection with the latter. The designations and epithets which are in earlier times applied to the fruits of the earth are applied to the body and blood. From that time until the Reformation the Christian sacrifice was all but universally regarded as the offering of the body and blood of Christ. The innumerable theories which were framed as to the precise nature of the offering and as to the precise change in the elements all implied that conception of it. It still remains as the accepted doctrine of the Church of Rome. For, although the council of Trent recognized fully the distinction which has been mentioned above between the Eucharist and the sacrifice of the mass, and treated of them in separate sessions (the former in Session xiii., the latter in Session xxii.), it continued the mediaeval theory of the nature of the latter.

The reaction against the mediaeval theory at the time of the Reformation took the form of a return to what had no doubt been an early belief,—the idea that the Christian sacrifice consists in the offering of a pure heart and of vocal thanksgiving. Luther at one period (in his treatise *De captivitate Babylonica*) maintained, though not on historical grounds, that the offering of the oblations of the people was the real origin of the conception of the sacrifice of the Mass; but he directed all the force of his vehement polemic against the idea that any other sacrifice could be efficacious besides the sacrifice of Christ. In the majority of Protestant communities the idea of a sacrifice has almost lapsed. That which among Catholics is most commonly regarded in its aspect as an offering and spoken of as the "mass" is usually regarded in its aspect as a participation in the symbols of Christ's death and spoken of as the "communion." But it may be inferred from the considerable progress of the Anglo-Catholic revival in most English-speaking countries that the idea of sacrifice has not yet ceased to be an important element in the general conception of religion.

See J. H. Srawley and H. Watt, art. "Eucharist" in Hastings, *Encyclopaedia of Religion and Ethics*, vol. v.; *R.* A. S. Macalister, art. "Sacrifice (Semitic)," *ibid.* vol. ix., p. 31; M. Gaster, art. "Sacrifice, Jewish," *ibid.* p. 24; *G.* F. Moore, art. "Sacrifice" in the *Encyclopaedia Biblica; W. R.* Smith, *Religion of the Semites (1889;* reprint of 2nd ed., 1907); J. G. Frazer, *The Golden Bough*, pt. vi., "The Scapegoat," and *Folklore* in *the Old Testament.*

SACRILEGE, the violation or profanation of sacred things. The word comes from the Lat. *sacrilegiurn*, which originally meant merely the theft of sacred things, although already in Cicero's time it had grown to include in popular speech any insult or injury to them.

In primitive religions inclusive of almost every serious offence even in fields now regarded as merely social or political, its scope is gradually lessened to a single part of one section of ecclesiastical criminology, following inversely the development of the idea of holiness from the concrete to the abstract, from fetishism to mysticism. The primitive defence against sacrilege lay directly in the nature of sacred things, those that held a curse for any violation or profanation (*see* TABU). Early criminal law brought a measure of physical sanction into consideration. The Levitical code exacted of the offender reparation for the damage with the addition of one-fifth of the amount, and an expiatory sacrifice (Lev. v. 15, 16). The tragic story of the stoning of Achan, who stole some of the spoils of Jericho which Joshua had consecrated to the treasury of Yahweh, is one of the most graphic details of Old Testament history (cf. Joshua vii. 20–25).

No religion was more prodigal in rules to safeguard that which was holy or consecrated than the Jewish, especially in its temple laws; violation of them often led to mob violence as well as divine chastisement. The temple rules do not apply to synagogues, however, and unseemly conduct in them is liable only to civil action.

While the Roman cults were amply protected by tabus, there was no comprehensive term in Roman law for religious violations and profanations in general. *Sacrilegium* was narrowly construed as the theft of sacred things from a sacred place. According to Ulpian the punishment for *sacrilegium* varied according to the position and standing of the culprit and the circumstances under which the crime was committed. For the lower classes it was crucifixion, burning or the wild beasts. The latter penalty was also attached to theft of sacred things by night, but stealing by day from a temple objects of little value brought only sentence to the mines. People of higher rank were deported. During classical times the law kept to the narrow meaning of *sacrilegium*, but in popular usage it had grown to mean about the same as the English word. Traces of this usage are frequent in Augustan writers. The early church Fathers use the word most frequently in the restricted sense, although an effort has been made to read the wider meaning in Tertullian. But by the middle of the 4th century the narrower meaning had disappeared. In Ambrose, Augustine and Leo I., *sacrilegium* means sacrilege. The wider meaning had invaded the law as well. Mommsen was of the opinion that *sacrilegium* had no settled meaning in the laws of the 4th century. But it was rather that an enlarged application of the idea of sacredness made the crime of sacrilege in the sense of *violatio sacri* a more general one. This was partly due to the influence of Christianity, which sought to include as objects of sacrilege all forms of church property, rather than merely those things consecrated in pagan cults, partly to the efforts of the later emperors to surround themselves and everything emanating from them with highest sanctions. In the Theodosian Code the various crimes which are accounted sacrilege include—apostasy, heresy, schism, Judaism, paganism, attempts against the immunity of churches and clergy or privileges of church courts, the desecration of sacraments, etc., and even Sunday. Along with these crimes against religion went treason to the emperor, offences against the laws, especially counterfeiting, defraudation in taxes, seizure of confiscated property, evil conduct of imperial officers, etc. There is no formal definition of sacrilege in the code of Justinian but the conception remains as wide.

The penitentials (*q.v.*), or early collections of disciplinary canons, gave much attention to sacrilege. The Frankish synods emphasize the crime of seizing church property of every kind, including the vast estates so envied by the lay nobility. The worst sacrilege of all, defiling the Host, is mentioned frequently, and generally brought the death penalty accompanied by the cruellest and most ignominious tortures. The period of the Reformation naturally increased the commonness of the crime. Under the emperor Charles V. the penalty for stealing the Host was the stake; that for other crimes was graded accordingly. In France, in 1561, under Charles IX., it was forbidden under penalty of death to demolish crosses and images and to commit other acts of scandal and impious sedition. In the declaration of 1682, Louis XIV. decreed the same penalty for sacrilege joined to superstition and impiety, and in the somewhat belated religious persecution of the duke of Bourbon in 1724 those convicted of larceny in churches, together with their accomplices, were condemned, the men to the galleys for life or for a term of years, the

women to be branded with the letter V and imprisoned for life, or for a term. The trial of La Barre in 1766 at Abbevilie is the most famous sacrilege case in modem times. Convicted of wearing his hat while a religious procession was passing—as well as of blasphemy—he was accused as well of having mutilated a crucifix standing on the town bridge. Declared guilty, after torture, he was sentenced to have his tongue cut out, to be beheaded and the body to be burned, a sentence which was confirmed by the parlement of Paris and the bigoted king Louis XV. In the midst of the French Revolution respect for *civic* festivals was sternly enacted, but sacrilege was an almost daily matter of state policy. In 1825 the reactionary parlement once more brought back the middle ages, by decreeing the death penalty for public profanation, the execution to be preceded by the *amende honorable* before the church doors. "Theft sacrilege" was treated in a separate series of equally savage clauses. This ferocious legislation was expressly and summarily abrogated in 1830.

English Law.—In English law, sacrilege is the 'breaking into a place of worship and stealing therefrom. At common law benefit of clergy was denied to robbers of churches. A statute of 1553 made the breaking or defacing of an altar, crucifix or cross in any church, chapel or churchyard punishable with three months' imprisonment on conviction before two justices, the imprisonment to be continued unless the offender entered into surety for good behaviour at quarter sessions. The tendency of the later law has been to put the offence of sacrilege in the same position as if the offence had not been committed in a sacred building. Thus breaking into a place of worship at night, says Coke, is burglary, for the church is the mansion house of Almighty God. The Larceny Act of 1861 punishes the breaking into, or out of, a place of divine worship in the same way as burglary, and the theft of things sacred in the same way as larceny. Now by the Malicious Damage Act 1861 the unlawful and malicious destroying or damaging any picture, statue, monument or other memorial of the dead, painted glass or other monument or work of art, in any church, chapel, meeting-place or other place of divine worship, is a misdemeanour punishable by imprisonment.

SACY, ANTOINE ISAAC SILVESTRE DE, BARON (1758–1838), French scholar, the leading orientalist of his age, who specialized in Arabic and Islamic studies. His interest in these was aroused early by a monk in an abbey opposite his home in Paris, where he was born on Sept. 21, 1758. He learned, privately, Arabic, Hebrew, Persian and Turkish, and his studies ranged over oriental history, geography, religion and numismatics, as well as grammar and philology. In. 1781 he entered the civil service, but resigned in 1792. As a fervent Catholic and monarchist, he was out of sympathy with the revolutionary regime. Nevertheless. in 1795, despite his refusal to take a required oath against monarchism, he was given the chair of Arabic in the newly founded École des Langues Orientales Vivantes, and in 1806 was appointed professor of Persian in the Collège de France. In 1815, he became rector of the University of Paris. and from 1815 was active in the commission of public instruction. He was also official orientalist in the ministry of foreign affairs (1805–29), making Arabic translations of various state documents. He was made a baron by Napoleon in 1813, and created a peer of France in 1832.

Despite his distinction as an orientalist, he only once traveled outside France; and then no further than Genoa. He died in Paris, Feb. 21, 1838.

His skill as a teacher is attested by the long list of his pupils—especially French and German—who achieved fame. His works include editions of *Hariri* and *Kalila and Dimna,* and the incomplete *Expose' de la religion des Druzes,* 2 vol. (1838), the result of over 30 years' study. Of immense influence were his textbooks.

Sacy's *Grammaire arabe,* 2 vol. (1810) set a new standard for such works. and his *Chrestomathie arabe,* 3 vol. (1806) and *Anthologie grammaticale* (1829) were also important.

See Henri Dehérain, *Silvestre de Sacy—ses contemporains et ses disciple~* (1938); Émile Chassinat (ed.), *Bibliothèque des Arabisants Français,* 1st series, *Silvestre de Sacy,* vol. 1, pp. i–lix (1905)

(J. A HD.)

SADDLE, a seat, usually of leather, fixed by girths to the back of a horse for riding; also a padded cushion for the back of a draft horse, fastened by girths and crupper; to it are attached the supports for the shafts, and rings for the reins. *(See* HARNESS AND SADDLERY.)

The word is also applied to many objects resembling a saddle in shape or function, such as a block to support a spar in a ship or in machinery to support a rod.

In architecture, a saddle is a piece of wood, metal, marble, etc., at the bottom of a door opening. The term is also applied to a saddle-shaped stone used as a coping.

Saddle bars are small, horizontal bars of iron or bronze running across a stained glass window; fastened to the stone or frame on each side. they brace the window structure, and form a rigid base to which the leading of the glass can be attached.

SADDLERY AND HARNESS: *see* HARNESS AND SADDLERY.

SADDUCEES, the name of a party in Judaism which was opposed to the Pharisees down to the destruction of Jerusalem in A.D. 70. 'The basic difference between the two parties lay in their respective attitudes toward the Torah, the Sadducees representing the extreme conservative view.

See JEWISH SECTS DURING THE SECOND COMMONWEALTH: *Pharisees* and *Sadducees*; JUDAISM.

SADE, DONATIEN ALPHONSE FRANÇOIS, COUNT (usually called the MARQUIS DE SADE) (1740–1814), French writer. was born in Paris on June 2, 1740. He entered the light horse at 14 and saw considerable military service before returning to Paris in 1766. There his vicious practices became notorious. and in 1772 he was condemned to death at Aix for an unnatural offense and for poisoning. He fled to Italy, but in 1777 he was arrested in Paris, taken to Aix for trial and there found guilty. In 1778 he escaped from prison, but was soon re-arrested and finally committed to the Bastille. There he began to write plays and obscene novels. In 1789 he was sent to the Charenton lunatic asylum, but was discharged in 1790, only to be recommitted as incurable in 1803. He died there on Dec. 2, 1814. Among his works, all of the type indicated. were *Justine* (1791). *Juliette* (1792). *Philosophie dans le boudoir* (1793) and *Les Crimes de l'amour* (1800). The word sadism is derived from his name.

See C. R. Dawes, *The Marquis de Sade: His Life and Works* (1927).

SADEDDIN, HOCA (1536–1599), Turkish historian. was the author of the renowned *Tac üt-tevarih* ("Crown of Histories"). The son of Hasan Can, court chamberlain to Selim I, he was tutor to Prince Murad. governor of Manisa, and followed him to Istanbul when he became sultan as Murad III. He was influential in the palace and later accompanied Murad's son, Sultan Mohammed III, on his campaign in Hungary, playing an important part in the victory at Erlau (1596) by the moral support he gave at a critical hour. He was made shaikh ul-Islam in 1598.

The *Tac üt-tevarih,* which covers the period from the origins of the Ottoman empire to the end of the reign of Selim I (1520), is based on earlier works. Its reputation can be attributed partly to its rhetorical and ornate style, popular in the 16th century, and to the fact that the author's family were influential in the palace for nearly a century. (F. I.)

SÁ DE MIRANDA, FRANCISCO DE (1481–1558), the first of the Portuguese Renaissance poets. was probably born on Aug. 28, 1481, the illegitimate son of a canon of Coimbra, Gonçalo Mendes de Sá. and Dona Inês de Melo. He was made legitimate in 1490. He studied at the university, which was then in Lisbon, and seems to have lived mainly in the capital until 1521, frequenting the royal court and taking part in the poetical improvisations there and, possibly, teaching at the university. The years from 1521 to 1526 he spent in Italy, visiting Milan, Venice, Florence, Rome, Naples and Sicily. He made the acquaintance of Giovanni Ruccellai, Lattanzio Tolomei and Jacopo Sannazaro; he met the illustrious Vittoria Colonna, a distant connection of his family, and in her house he probably talked with Cardinal Pietro Bembo and Ariosto, and perhaps met Machiavelli and Francesco Guicciardini. By the time he returned home in 1526 he had become familiar with Italian verse forms and metres: the sonnet and *canzone* of Petrarch, the tercet of Dante, the ottava

rima of Ariosto. the eclogue in the manner of Sannazaro, and Italian hendecasyllabic verse. He did not, however, abandon the short national metre, which he carried to perfection in his *Cartas* or epistles in verse.

His play *Os Estrangeiros,* written *c.* 1527, was the first Portuguese prose comedy in the classical manner, and he wrote another, *Os Vilhalpandos, c.* 1538 (published 1560). His *Cledpatra* (written *c.* 1550), of which only a dozen lines are extant, was probably the first Portuguese classical tragedy. About 1528 Sá de Miranda made his first attempt to introduce the new Renaissance forms of verse by writing in Spanish a *canzone* entitled *Fdbula do Mondego,* and this was followed a year or two later by the eclogue *Alexo.*

About 1530, in which year he married, he left Lisbon finally and settled on his country estate in the Minho. It is in this later period that he produced his best work: the eclogue *Basto,* the *Cartas* and the satires, in which he shows himself a stern critic of contemporary society. Some of the sonnets of this period are admirable, combining a grave tenderness of feeling and refinement of thought with simplicity of expression. He died on his estate at Tapada probably in May 1558.

Sa de Miranda was the leader of a revolution in Portuguese literature, and especially in poetry, which under his influence became higher in aim, purer in tone and broader in sympathy. As well as introducing the poetic and dramatic forms and spirit of the Renaissance into Portugal, he made an austere stand against the growing materialism of his time.

Poesias de F. de Sá de Miranda was edited, with life. notes and glossary. by C. Michaelis de Vasconcelos (1885); *Obras completas de F. de Sá de Miranda* was edited by M. Rodrigues Lapa, 2 vol. (1937).

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SA'DI (MUSHARIFF-UD-DIN) (*c.* 1184–C.1291), Persian poet and prose writer. the author of two works, the *Bustan* ("Orchard") and *Gulistan* ("Rose Garden"), which came to be regarded as classics of Persian literature. He lost his father Muslih ud-din in early childhood; later he was sent to study in Baghdad at the renowned Nizamiya college where he acquired the traditional learning of Islam.

The unsettled conditions following the Mongol invasion of Persia, when, in the words of Sa'di, the world resembled "the curly hair of a Negro," led the poet to wander in many countries. He refers to his adventures in north Africa, central Asia and India; in Syria he was captured by the Franks and put to work in the trenches of the fortress of Tripoli. When he reappeared in his native Shiraz he was an elderly man. He dedicated the *Bustan* (1257) and the *Gulistan* (1258) to the local ruler (atabeg) Abu-Bakr ibn Sa'd. (His pen-name Sa'di was derived from the name Sa'd borne both by the father and the son of Abu-Bakr.) He seems to have spent the rest of his life in Shiraz. for his poems were dedicated to the later atabegs and governors, both heathen and Moslem, whom the Mongol *ilkhans,* established in Tabriz, sent to the province of Fars. References to contemporary events in Sa'di's works stop at about 1270.

That Sa'di produced his two greatest works so late in life and in such quick succession is not surprising. The material for them must have been collected and many of the poems written long before an opportunity for their publication occurred. The *Bustan* is entirely in verse (in the metre used in epic) and consists of stories aptly illustrating the standard virtues recommended to Moslems (justice, liberality, modesty. contentment), as well as of reflections on the behaviour of dervishes and their ecstatic practices.

The *Gulistan* is mainly in prose, and contains stories and personal recollections. The text is interspersed with a variety of charming little poems containing aphorisms, advice and humorous reflections. The morals preached in the *Gulistan* border on expediency; *e.g.,* a salutary lie is admitted to be preferable to a blunt truth. The fate of those who depend on the changeable moods of kings is contrasted with the freedom of the dervishes:

> I am neither riding a camel, nor carrying a load like a camel; I am neither a lord of subjects, nor the slave of a potentate; grief for what there is or distress for what there is not do not trouble me; I draw my breath freely and thus spend my life.

For western students the *Bustan* and *Gulistan* have a special attraction. but Sa'di is also remembered as a great poet, the author of a number of masterly general odes portraying human experience and also of particular odes (such as the lament on the destruction of the caliphate by the Mongols in 1258), which have a great appeal for Persian readers. A special section of his complete works is in Arabic, but Arabs find some of his methods of expression strange.

The peculiar blend of human kindness, resignation and humour displayed in Sa'di's works, together with a tendency to avoid the hard dilemma, make him, to many, the most typical and lovable writer in the world of Iranian culture.

BIBLIOGRAPHY.—Best editions of the *Bustan* and *Gulistan* are by M. A. Furughi (1938). The first competent trans. of the *Gulistan* was by *F.* Gladwin (1806, reprinted 1928), followed by that of E. B. Eastwick (1852, reprinted 1880); partial trans. are by Sir Edwin Arnold (1899), Sir R. Burton (1928) and A. J. Arberry (1945). A good French trans. of the *Bustan* is hy Barbier de Meynard (1880). Sir L. W. King trans. two series of the odes, the *Tayyibāt* (1919–21) and the *Badāyi'* (1925). A comprehensive bibliography is in H. Massé, *Biographie de Saadi* (1919). For a general appreciation *see* E. G. Browne, *A Literary History of Persia,* vol. ii (1928); A. J. Arberry, *Classical Persian Literature* (1958). Critical ed. of the *Gulistan* with Russian trans. by R. Aliyev (1960). (V. F. M.)

SADLER, MICHAEL THOMAS (1780–1835), English social reformer and politician, was born at Snelston. Derbyshire, on Jan. 3, 1780. While still young he became a Wesleyan Methodist, and his religion turned him into a philanthropist. In 1800 he became a businessman at Leeds, importing Irish linens, and soon he became a politician as well. He was Tory M P. for Newark, 1829 and 1830, and for Aldborough, 1831–32, but he failed to win the new Leeds seat in Dec. 1832, when he was opposed by T. B. (later Lord) Macaulay.

Macaulay had already criticized his *Law of Population* (1830), a massive anti-Malthusian treatise, and Sadler in turn was an outspoken critic of all forms of Whiggery. Along with Richard Oastler. Sadler became an advocate of factory reform. and of government intervention in the hours of child labour and factory conditions in general. As parliamentary representative of the newly founded short-time committees in the north of England, he introduced a factory reform bill in the house of commons in 1831 and subsequently acted as chairman of the select committee to which it was referred.

Sadler died in Belfast, July 29, 1835, after the parliamentary cause of factory reform passed into the hands of Lord Ashley. (4. BRI.)

SADLER (or SADLEIR), **SIR RALPH** (1507–1587), English statesman, was born at Hackney, Middlesex. in 1507. While a child he was placed in the family of Thomas Cromwell, afterward earl of Essex, whose secretary he eventually became. Sadler held many positions under Henry VIII, but he is best known for his employment under Elizabeth I in connection with the affair of Mary. Queen of Scots. Elizabeth sent him (1559) to Scotland, ostensibly to settle the border disputes, but in reality to secure a union with the Protestant party there, and he helped to arrange the treaty of Leith, July 6, 1560.

In 1568 Sadler was appointed chancellor of the duchy of Lancaster, and in the same year was one of the English commissioners employed in treating on the matters arising from the flight of the Queen of Scots. From this time he seems to have been continually engaged as a discreet and trusty servant in connection with Mary's captivity, and was frequently sent with messages to her. On Aug. 25, 1581, when, because of the imputations made by his countess. George 6th earl of Shrewsbury resigned his guardianship of the queen, Sadler succeeded him.

In September, Mary was removed from Sheffield to Wingfield and early in 1585 to Tutbury. In April, Sadler, after numerous petitions on his part, was permitted to resign his distasteful charge.

On March 30, 1587, Sadler died at Standon, and was buried there. His letters on Scottish affairs are interesting.

See *Letters and Negotiations of Sir Ralph Sadler* (1720); *The State Papers and Letters of Sir R. Sadler,* ed. *by* Arthur Clifford, 3 vol. (1809).

SADO, Japanese island of Niigata prefecture, 32 mi. W. of Niigata, the prefectural capital. Area 248 sq.mi., pop. (1955) 90,705. Sado, long known as an island of romance, is the home of *okesa* (folk-dancing songs, ballads). Camellia trees grow in abundance. The climate is mild all the year.

Sado was famous as a place of exile and among many statesmen and scholars banished two of the most exalted were the emperor Juntoku (1197–1242) and the Buddhist priest Nichiren (1222–1282). Sado is known for its gold and silver mines, continuously operated from 1601. Rice is the first product, followed by fishing. Tourism provides an important source of income. Ryōtsu, on the east shore! is the only city. It is the centre of the island's administration, and of its fishing industry. Serving as an outer port of Niigata, it is the principal port on the island. Aikawa is the largest town on the west coast. (R. B. H.)

SÁENZ, MANUELA (1797–1856), known throughout Latin America as "La Sáenz," mistress of the liberator Simón Bolivar, was born in Quito, Ecuador, on Dec. 27, 1797. At the time of her birth her mother was unwed, and the stain of illegitimacy left its mark. For years she shrouded her origins in mystery. In 1817 she married a British merchant. James Thorne, who took her to Lima, Peru; there Manuela first came into contact with the movement for independence which was then challenging Spanish rule throughout Latin America. On her return to Quito in 1822 she met Simón Bolivar, who had just completed the liberation of Ecuador. Manuela became the great passion of his life; she threw caution to the winds and united her life with his—and with the cause for which he was fighting.

The exigencies of war separated the couple for long periods, and there were occasions of neglect which Manuela bitterly resented. In return for her unflinching devotion she demanded an exclusiveness to which Bolivar was unaccustomed. When the war took Bolivar to Peru Manuela did not hesitate to follow him.

As she had shared the zenith of Bolivar's life, she also became engulfed in his decline. Her efforts to keep the Peruvians on his side were in vain. She was exiled from Lima and joined Bolivar in Bogotk, Colom., where on Sept. 25, 1828, she saved him from conspirators.

In the spring of 1830, when Bolivar resigned his office to go into exile. Manuela was left behind. His papers remained in her care and she refused to hand them over to his enemies. When she learned of his death (Dec. 17, 1830) she unsuccessfully attempted to take her own life.

In 1534, Manuela was exiled from Bogotá and went to the small Peruvian port of Paita, where she made a living as a vendor of sweets and tobacco. She died at Paita on Nov. 23, 1856.

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SÁENZ PEÑA, ROQUE (1851–1914), Argentine president and diplomat. Although a wealthy leader of the landed aristocracy, he was responsible during his presidency for a broad suffrage law, which placed Argentina in the vanguard of Latin-American democracy.

Sáenz Peña was born in Buenos Aires on March 19, 1851, the descendant of a famous family. He was educated in Argentina, traveled in Europe and entered politics in the 1870s. when Argentina's population and economy were rapidly expanding. Among the many posts he held were those of minister of foreign affairs, delegate to the first International Conference of American States (Washington, D.C.. 1889–90) and ambassador to Spain and to Italy (1901–10). He was elected president in 1910 in a conservative-controlled election, but he had the vision to respond to the mounting demands of the popular majority, represented by Hipólito Irigoyen's Radical party, and forced a series of electoral reforms through the oligarchy-dominated congress. These laws, which have since borne his name and have been the basis of Argentine democracy, gave every Argentine male at the age of 18 the right to vote on a secret ballot.

Sáenz Peña died in office on Aug. 9, 1914, as Argentina was entering an era of change marked bv World War I and the election to the presidency in 1916 of his former opponent. Irigoyen. (T. F. McG.)

SAFARIK, PAVEL JOSEF (1795–1861), one of the leading figures of the Czech national revival and a pioneer of Slavonic philology and archaeology. Born at Kobeliarov, Slovakia, May 13, 1795, of a Protestant family, he studied at Jena and was director of the Serbian Orthodox grammar school at Novi Sad before settling in Prague in 1833. In 1841 he refused an invitation to occupy the chair of Slavonic philology at Berlin. preferring to remain as a private scholar in his own country. He died at Prague. June 26. 1861.

Erudition and scholarly integrity characterize a series of influential works on the history and languages of the Slavs: *Geschichte der slavischen Sprache und Literatur nach allen Mundarten* (1826); *Slovanské starožitnosti* (183;). better-known in the German translation *Slawische Altertümer* (1843); *Über den Ursprung und die Heimat des Glagolitismus* (1858); *Geschichte der südslawischen Literatur* (1864).

Although his work on the origins and migrations of the Slavs has been superseded. it was of great value in its time. His philological works can still be read with profit: in his belief in the priority of the Glagolitic alphabet over the Cyrillic he was far ahead of his time. (R. AY.)

SAFED KOH, in many respects the most remarkable range of mountains on the northwest frontier of West Pakistan. extending like a 14,000 ft. wall, straight and rigid, towering above all surrounding hills. It separates the Kabul basin from the Kurram and Afridi Tirah and thus forms a natural boundary between Afghanistan and Pakistan. The highest peak, Sikaram, is 15,600 ft. above sea level. Geographically the Safed Koh is not an isolated range, for there is no break in the continuity of water divide which connects it with the great Shandur offshoot of the Hindu Kush except the narrow trough of the Kabul river. which cuts a deep waterway across where it makes its way from Dakka into the Pesharvar plain. The northern spurs are extremely barren but the intervening valleys support agriculture and gardens abounding in mulberries, pomegranates, etc. The main range and the upper portions of the spurs are wooded with pine and deodar.

The same name is often used for the mountain range north of the Hari Rud river in its upper course.

SAFES, STRONG ROOMS AND VAULTS. Although boxes provided with locks or coffers must have followed closely on the development of locks (q *v.)* and been in use in ancient Egypt, no examples remain of earlier date than the middle ages. The earliest examples extant were constructed of hard uood banded with hammered iron, and subsequent development took place rather on artistic than on practical lines up to the time of the introduction of boxes entirely of iron On the continent of Europe the iron box was developed to a high standard of artistic beauty and craftsmanship, but with no real increase of security.

Milner's **Work.**—Up to the 17th century no attempt was made to make coffers fireproof. for though a patent for fireproofing was taken out in 1801 by Richard Scott, it does not appear to have been used In 1834, however, a patent was obtained by William Marr for the application of nonconducting linings, followed about four years later by a similar patent in the name of Charles Chubb. The foundation, however, of the modern safe industry was laid by Thomas Milner, originally a tinsmith of Sheffield, who after a few years' business in Manchester established, in 1830, works at Liverpool for the manufacture of tinplate and sheet iron boxes and who later made plate iron chests or coffers and, probably the earliest, safes about the year 1846.

Chatwood's Patent, 1860.—Concurrently with the increase of strength in safes and probably with the increased value of articles preserved in safes, the skill of the professional thief had also increased, and this went on for some years until the Cornhill burglary of 1865 called general attention to the question. In 1860

a patent was taken out by Samuel Chatwood for a safe constructed of an outer and inner body with the intervening space filled with ferromanganese or spiegeleisen in a molten state, the total thickness being 2 in.

To prevent safes from being opened by the drilling of one or two small holes in such positions as to destroy the security of the lock itself, advantage was taken of the improvements in the manufacture of high carbon steel and, even in the modern "fireproof" safe, a plate of steel which offers considerable resistance to drilling is placed between the outer doorplate and the lock. About 1888 the solid safe was introduced. In this the top, bottom and two sides of the safe, together with the flanges at the back only or at both back and front, are bent from a single steel plate.

The Modern Safe.—The requirements of a modern safe may be briefly summarized as follows:

For fire-resisting safes, the safe body must be constructed of steel plate of sufficient thickness to withstand the effect of a fall from an upper floor in the event of a fire and to resist the crushing effect of falling masonry, displaced girders, etc. The "proofing" of the safe must be of sufficient quantity, packed around the whole area of the body and door to preserve the heat resistance over a long period, otherwise when this reserve is exhausted the safe would become a slow oven and its contents charred and completely destroyed.

Safes which are intended to resist burglars, as well as fire, must be made with greater constructional strength successfully to resist brute force and destructive violence. In addition, they need to be formed from such a combination of metals and alloys as will withstand all forms of cutting and piercing tools and appliances, in addition to the oxyacetylene cutting blowpipe. The more successful of these alloys, although they can be heated by the gas flame to their melting point, cannot be cut, like steel, by the application of a stream of pure oxygen when their melting temperature has been reached.

It is essential that the walls and doors of such safes should be of considerable thickness, as mass is of great importance in providing resistance to the blowpipe method of attack. The doors of such safes must be closely and accurately fitted to the opening and secured in the closed position by a number of suitable moving bolts operated by an external handle. The actual shape of the bolts is not of vital importance provided they are of sufficient strength and rigidity to resist all forces that can be brought to bear against them in an effort to force the door away from the safe body. The majority of safe manufacturers use bolts formed from either round or flat section steel bars, but others are of special shape and design.

In the United States, fire-resisting safes usually are not made burglar proof, the highest standard of requirement being 20 minutes' protection against amateur attack through the door. Burglar-proof alloy steel chests are however frequently fitted into fire-resisting safes. Most important are the locks used to control its operation. To provide the maximum amount of security and lengthen the period of resistance that a safe will offer to forcible entry. more than one lock should be employed and the locks need to be made as large as possible to increase the amount of material which has to be removed to expose the lock. It is also advisable to provide the lock aith more than one moving bolt to engage with the bolting mechanism, as it is this moving lock bolt which prevents the bolt action being operated and the bolts retracted into the door.

When gunpowder was the only explosive available, it was possible to construct safe locks to resist its use, but with modern high-power explosives other methods must be employed. In good quality safes these take the form of independent bolting actions which are brought into active operation only by the actual force of an explosive, when used to destroy the working lock. The effect of such an explosion is to substitute the dogging action of the special device for that of the lock which it was sought to destroy.

Time locks with two, three or four chronometer movements are frequently employed to control the hours for opening safes and vault doors. These locks are fitted in addition to either the key or dial operated locks and are intended to prevent the door being opened at any other than the official times.

Strong Rooms and Vaults.—For the purpose of providing security for deeds, papers and books against the risk of fire, rooms are built either of brick or concrete, according to the conditions existing on the site and the amount to be expended on the construction, the thickness of the walls varying from 14 to 18 in. if built in brick, and from 8 to 14 in. in concrete. Bank vaults and strong rooms for the custody of securities, cash, etc., are mainly constructed of reinforced concrete or with a combination of brick and concrete, the thickness of the walls varying with their importance and the ground space available. Generally speaking, reinforced concrete walls can be built of less thickness than brickwork to provide equivalent security against penetration, but in all important vaults and strong rooms it is advisable to reinforce the walls, roof and floor with linings of steel and flame resisting alloy, forming a self-contained safe inside the concrete shell.

The most effective method of employing steel to reinforce the concrete construction is to use it in the form of plates attached to the inner face of the walls. The steel then prevents the breaking away of the inner face of the concrete in large sections into the strong room, whereas if the steel reinforcement is distributed throughout the concrete walling in the form of bars or mesh work, it can be quickly and easily cut through with the blowpipe.

In the design of strong rooms and vaults, the formation of the roof and floor is frequently of more importance than that of the walls. The latter are usually subject to inspection (unless the room is built against an exterior or party wall, which should be avoided if possible), whereas the floor is liable to attack by means of tunneling which can be carried out without any indication being given until the actual breaking through of the floor. The highest degree of security is obtained when the vault is built as an island with an inspection or patrol passage entirely surrounding it.

Electrical devices are frequently installed to give an alarm in the event of a burglariou: attempt upon strong rooms, either upon the main structure or the door. It is said that a burglar would require about six hours of uninterrupted effort with the oxyacetylene torch to penetrate a modern vault door 20 in. thick, containing a 12 in. plate of pure copper. The high resistance of copper to torch attack is explained by the fact that this metal is a rapid conductor of heat, in contrast with other metals of low heat conductivity heretofore used in vault construction. **A** torch capable of developing a heat between 5,000° F. and 6,000° F. will penetrate the first few inches of a copper plate in a comparatively short time. However, the flame loses its efficiency as the copper conducts the heat rapidly away before the entire body of the metal can be raised to a fusing point. The ductility of the metal makes it unsuited for successful attack with explosives.

SAFETY GLASS: see GLASS.

SAFETY LAMP. Toward the end of the 18th century coal mine explosions became increasingly common as the seams were dug to deeper levels where firedamp (methane gas) was more prevalent, and efforts were made to devise means of lighting which would be safe in the presence of the gas. The explosive nature of a cloud of fine coal dust was not then recognized, and explosions were attributed wholly to gas. The explosions usually originated at the flame of a tallow candle.

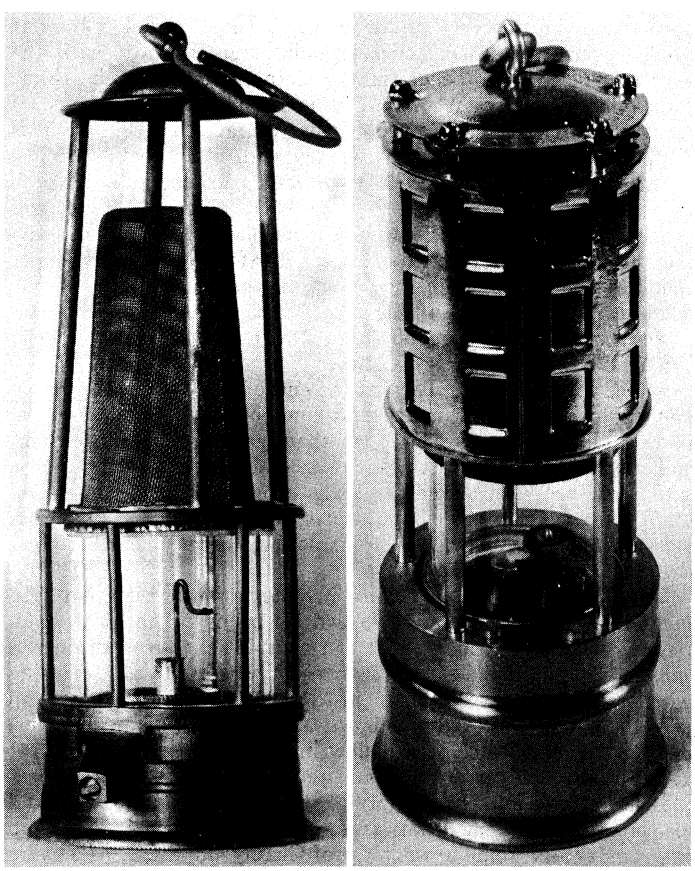
Davy Lamp.—W. Reid Clanny invented a form of lamp in 1813 in which the external air was blown by bellows through a small cistern of water and the products of combustion forced through a similar water seal. George Stephenson, who was experimenting with lamps for underground use in 1815, concluded that "if a lamp could be made to contain the burnt air above the flame, and permit the firedamp to come in below in small quantity to be burnt as it came in, the burnt air would prevent the passing of the explosion upwards and the velocity of the current from below would also prevent its passing downwards." Though neither type of lamp was satisfactory, some of the ideas of Clanny and Stephenson were incorporated in the Davy lamp as the latter was developed and improved. In Aug. 1815 the Sunderland Society of the Prevention of Accidents in Mines interested Sir Humphry Davy in the problem

of mine explosion, and by the end of that year the first Davy lamp was ready for testing.

Although many others worked along the same lines, his name is more generally known as the inventor of a relatively safe oil-burning lamp. He demonstrated the fact that a metal gauze having 28 openings to the linear inch would cool the products of combustion so that the heat of the flame would not ignite inflammable gas on the other side of the gauze. In order to avoid danger resulting from failure of a single gauze cylinder surrounding the flame, he found it necessary to use two concentric cylinders. one slightly smaller than the other. The lower edges fit snugly to the bowl containing the fuel; the upper ends of the cylinders were, of course, covered by disks of similar gauze. In the hands of a careful person, the Davy lamp could be used safely, but it could not be used in a strong air current because of the danger of passage of the flame through the gauze.

Eiectric Lamps. — Portable electric hand lamps and cap lamps were introduced in coal mines in the early 1900s, but their weight and cost retarded their widespread adoption until after World War I. By mid-20th century, however, portable electric cap lamps were used almost exclusively by miners in both coal and metal mines. The headpiece on the cap, attached by flexible rubber-insulated cable to the battery on the belt of the wearer, furnishes the miner with a powerful beam of light directed at the work in hand. Batteries use either an alkaline or acid solution and are recharged between working shifts to maintain almost constant illumination for eight hours or more. In the headpiece, there is a safety device that shuts off the electric current if the bulb or bulbs are broken. A single bulb may be fitted with two filaments. If one burns out, a switch may be turned to bring the other into use with no loss of time.

While the electric cap lamp gives excellent illumination, it is completely independent of the surrounding air. Therefore, it gives no warning of noxious gases or lack of oxygen. Consequently, a flame safety lamp must be kept burning within easy reach of the workers or frequent inspections must be made by an official, using a flame safety lamp or other form of detector. When the flame safety lamp is placed in an atmosphere containing firedamp the flame elongates, and if the gas is present in considerable quantity the lamp is filled with blue flame. For testing the presence of gas the flame of the lamp is lowered until the yellow part is at a minimum, when the gas will be discernible as a smal! blue cap to the flame. U.S. usage, based on federal and state laws, recommend that a minimum of two flame safety lamps in good operating condition be available at all mines for testing the presence of methane or oxygen deficiency. Specifications require that each lamp be equipped with double steel or brass gauzes constructed of wire between 29 and 27 American wire gauge (0.0113 to 0.014 in. in diameter), with mesh openings from 28 to 30 per lineal inch. There should be a shield or bonnet so constructed as to prevent injury to the gauzes and shield the gauzes from strong air currents. Lamp locks should be of the magnetic type and the relighting device simple and safe to use in the presence of flammable gas.



BY COURTESY OF BUREAU OF MINES, U.S DEPT. OF INTERIOR

FLAME SAFETY LAMPS

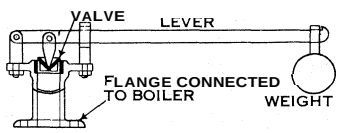
(Left) A Clanny lamp, 1815; (right) mid-20th-century lamp, used for gas detection only

The statutory regulations governing the manufacture and use of safety lamps vary slightly from country to country but are alike in substance. In addition to portable safety lamps, electric lighting from power mains may be allowed underground provided adequate safety features are incorporated in the design of the lighting fixtures, and care is exercised in the siting. Electropneumatic lamps are extensively used in European coal mines.

See also COAL AND COAL MINING: *Hazards of Mining and Measures of Safety.* (M. D. CR.)

SAFETY RAZOR: *see* RAZOR.

SAFETY VALVE is a valve which lifts at a predetermined pressure and "lets off steam," thus preventing the accumulation of a dangerous pressure in a steam boiler or hydraulic system. The resistance to pressure is provided by a weight or by springs, the use of the latter being obligatory if the boiler is not a stationary one. The lever valve *(see* diagram) is loaded with a weight at the end, to keep the valve shut. A casing with lock may be fitted over the device to prevent tampering by an unauthorized person. Many boilers carry two safety valves as a precaution, one being locked up. Marine boiler valves are of the direct spring-loaded type, the spring encircling the valve spindle. The pop valve blows off sharply with a pop, and is used for yacht and launch boilers. The valve closes again quickly when the pressure has been slightly reduced.



SCHEMATIC DIAGRAM OF SAFETY VALVE ON STEAM BOILER

SAFFARIDS, a Persian dynasty of the 9th century, founded about 866 by Yakub ibn Laith al-Saffar ("the coppersmith"), who gained the command of a body of local troops and took control of his native province of Seistan. He soon added Herat, Fars, Balkh and Tabaristan to his possessions, overthrew the Tahirid governors of Khurasan and, though still nominally dependent on the caliphs of Baghdad, established a dynasty in Seistan *(see* CALIPHATE: *The Abbasid Caliphs;* and PERSIA: *History).* In 900 Yakub's successor was defeated by the Samanids (*q.v.*), and few of the later Saffarids had any wide authority.

See T. Noldeke, Sketches from Eastern History, tr. by J. S. Black (1892).

SAF LOWER, the common name for *Carthamus tinctorius,* a flowering annual plant of the Compositae (*q.v.*) family, native to mountainous areas of southwest Asia and Ethiopia. It grows from one to three feet in height and is characterized by orange-red blossoms.

It was important at one time as a source of a red textile dye called carthamin ($C_{14}H_{16}O_7$), obtained from the dried flowers. Carthamin was replaced by synthetic aniline dyes, except in local areas of southwest Asia. Occasionally it has been an adulterant of saffron (*q.v.*). Safflower is grown now primarily for the oil obtained from the seed, the oil being used in paints and varnishes, and in salad and cooking oils.

Most of the production is in the Indian states of Bombay and Hyderabad. It has been introduced as an oil crop to the United

States, Australia, Israel, Turkey and Canada. It requires a growing season of 120 days or more and dry atmospheres after the appearance of the buds.

See P. F Knowles, "Safflower: Production, Processing and Utilization" in *Economic Botany,* vol. 9 (1955). (P. F. K.)

SAFFRON, a product manufactured from the dried stigmas and part of the style of the saffron crocus, a cultivated form of Crocus *sativus;* some of the wild forms are also employed. The purple flower, which blooms late in autumn, is very similar to that of the common spring crocus, and the stigmas, which protrude from the perianth, are of a characteristic orange-red colour; the fruit is rarely formed. The Egyptians, though acquainted with the bastard safflower (Carthamus *tinctorius*), often used to adulterate saffron, do not seem to have possessed the true saffron, but it is named in S. of Sol. iv, 14 among other sweet-smelling herbs. It is also mentioned by Homer and Hippocrates.

Saffron has long been cultivated in Iran and Kashmir, and is supposed to have been introduced into China by the Mongol invasion. It is mentioned in the Chinese materia medica (Pun tsaou, 1552–78). The chief seat of cultivation in early times, however, was in Cilicia. It was cultivated by the Arabs in Spain about 961, and is mentioned in an English leech-book of the 10th century, but seems to have disappeared from western Europe until reintroduced by the crusaders. According to Hakluyt, it was taken to England from Tripoli by a pilgrim, who hid a stolen corm in the hollow of his staff. It was especially cultivated near Histon in Cambridgeshire and in Essex at Saffron Walden (*q.v.*), its cultivators being called "crokers."

Saffron was used as an ingredient in many of the complicated medicines of early times; that it was much used in cookery is evidenced by many writers; the Chinese used to employ it largely, and the Iranians and Spaniards still mix it with their rice.

As a perfume saffron was strewn in Greek halls, courts and theatres, and in the Roman baths. The streets of Rome were sprinkled with saffron when Nero made his entry into the city. It was, however, mainly used as a dye. It was a royal colour in early Greek times, though afterward, perhaps from its abundant use in the baths and as a scented salve, it was especially appropriated by the hetaeriae.

Saffron is chiefly cultivated in Spain, France, Sicily, on the lower spurs of the Apennines and in Iran and Kashmir. It occurs in the form of cake saffron, which consists of the stigmas and part of the style which have been "sweated" and pressed together into a cake, and also as hay saffron, which consists of the dried stigmas alone.

SAFFRON WALDEN, a market town and municipal borough in the Saffron Walden parliamentary division of Essex, Eng., 27 mi. N.N.W. of Chelmsford by road. Pop. (1951) 6,828. Area 11.7 sq.mi. Of the old castle, dating probably from the 12th century. the keep and a few other portions still remain. Near it is a series of curious circular excavations in the chalk, called the Maze, of unknown date or purpose. The earthworks west and south of the town are of great extent; a large Saxon burial ground was there. The large church of St. Mary the Virgin contains the tomb of Lord Audley, chancellor to Henry VIII. The town has a museum with good archaeological and natural history collections. In the neighbourhood is the fine mansion of Audley End, built by Thomas, 1st earl of Suffolk, in 1603 on the ruins of the abbey, converted in 1190 from a Benedictine priory founded by Geoffrey de Mandeville in 1136.

The town corporation grew out of the Guild of the Holy Trinity. which was incorporated under Henry VIII, the lord of the town, in 1513. It was dissolved under Edward VI, and a charter was obtained appointing a treasurer and chamberlain and 24 assistants, uho, with the commonalty, formed the corporation. In 1694 William and Mary made Walden a free borough. The culture of saffron was the most characteristic industry at Walden from the reign of Edward III until its gradual extinction about 1768; market gardening is now the main industry.

SAFFRON WOOD or SAFFRONHOUT (Elaeodendron croceum), a South African tree belonging to the staff-tree family (Celastraceae) and yielding valuable timber. The genus *Elaeodendron* contains about 30 species, confined to the tropics and subtropics.

SAFI or ASFI, a seaport on the west coast of Morocco, in 32° 20′ N., 9° 12′ W., 106 mi. W.N.W. of Marrakesh. The old town, built on the rapid slope of a plateau toward the sea, is surrounded by crenellated ramparts dominated by an old Portuguese citadel, the Kechla. Safi is the chief town of the *contrôle* civil of Adba-Ahmar and the nearest port to Marrakesh. Trade reached 102,000,000 fr. in 1938 (imports 25,000,000, exports 77,000,000).

The population was (1936) 25,159, including 23,328 natives and 1,831 Europeans; (1944) 35,574, including 32,710 natives and 2,864 Europeans; (1952) 69,748.

In the early 1940s Safi became the second port of Morocco. The port was deepened, permitting eight ocean steamers to dock at one time. A rail line was built to the port from the Kowibgha phosphate deposits, which became the most important item of export.

The town was the site of one of the U.S. landings on Nov. 8, 1942, and for many months of the North African campaign was an important port for the landing of war supplies.

SAGA. The word saga is used in Icelandic for any kind of narrative. written or oral, whether anecdote, story or history. But in English. as in other languages in which it has been borrowed. this word has a narrower sense and is applied to biographies written in Iceland. or occasionally in Norway, during the middle ages. The sagas are thus a branch of literature distinct from annals and summaries of history, many of which were also written in Iceland during the 12th and 13th centuries. Several classes of sagas are distinguished.

Kings' sagas are the oldest class. The heroes described in them were rulers of Korway and of dependencies of Norway who lived between the 9th and 13th centuries. The oldest of the kings' sagas now known is the so-called First Saga of St. Olaf, which is a life of St. Olaf, king of Norway (d. 1030), and was written about 1180. It survives only in fragments, but these are sufficient to show its form and style. In form it closely resembled the popular lives of European saints, many of which had been translated into Icelandic in the 12th century. The style was halting and unpractised. The sources were, for the most part, oral. They consisted partly of popular tales about miracles worked through Olaf's agency and partly of verses composed in honour of Olaf during his lifetime and handed down orally. In these verses the battles and great achievements of Olaf were commemorated and they provided an outline of his career, giving the saga its chief value as history. This First Saga was used as a source, directly or indirectly, by authors who wrote later lives of Olaf. The most important of these later lives was written by Snorri Sturluson (1179–1241), who incorporated it in his *Heimskringla* (Orb of the World), which is a collection of biographies of rulers of Norway from the 9th century to the 12th.

Sagas of several other Norse rulers were written late in the 12th century and early in the 13th. They included sagas about Olaf Tryggvason (d. 1000), about Haakon the Good (d. *c.* 963), and about the earls of the Orkney Islands. The Morkinskinna (Rotten Skin) was written about 1220 and contains detailed sagas about kings who ruled Norway after the death of St. Olaf.

During the 13th and 14th centuries these early kings' sagas were often revised and combined with other works. The greatest of these compilations is the Book of Flatey, a magnificent manuscript written about 1390, which contains lives of the Korse kings combined with those of Icelandic heroes.

Icelanders' Sagas.—The terms "Icelanders' sagas" (Icelandic: fslendinga *sögur*) and "family sagas" are applied to biographies of heroes who are supposed to have lived in Iceland in the 10th and 11th centuries. Many of these heroes had visited the British Isles and lands as distant as Greece and Russia; some had emigrated to Greenland and others were said to have landed on Wineland the Good. as the Icelanders called the American continent.

The oldest of the Icelanders' sagas were written in the first years of the 13th century and were strongly influenced by the kings' sagas in structure, style and material. The sources were many

and varied, and included summaries of history and genealogies written in Iceland early in the 12th century, popular tales and poems preserved orally.

The value of Icelanders' sagas as history is difficult to assess. For a time they were accepted as trustworthy records, but it became widely agreed that they are, in the first place, works of art based upon historical and pseudohistorical sources. Such questions cannot, however, be discussed in general terms, for the aims and sources of the author of every saga must be considered separately.

Among the oldest of the Icelanders' sagas may be mentioned the *Fóstbrœðra* Saga (Saga of the Foster-brothers), a great part of which is placed in the wastes of Greenland. *Hallfreðar* Saga (Saga of Hallfred) is the tale of the favourite poet of King Olaf Tryggvason. The *Kormáks* Saga (Saga of Kormák) and the *Bjarnar* Saga *Hítdœlakappa* (Saga of Bjorn) are early love stories.

These early Icelanders' sagas are somewhat primitive, but the art of saga writing developed rapidly during the 13th century, reaching its zenith soon after the middle of that century. The most perfect saga of this class in structure is the *Laxdœla* Saga (Saga of the Men of Laxbrdal), a story in which women, love and romance play an unusually great part. The Gisla Saga (Saga of Gisli) belongs to the same period and is the story of an upright man, outlawed and unjustly persecuted, The Grettis Saga (Saga of Grettir the Strong), written rather later, is also an adventurous story of outlawry. Undoubtedly, the greatest of all sagas is the *Njáls* Saga (Saga of Burnt Njáll), written toward the end of the 13th century. There is no more moving tragedy in early Germanic literature and it is among the greatest prose narratives of the world.

Few of the Icelanders' sagas can be assigned to authors whose names are known. An exception is the *Egils* Saga (Saga of Egill), the story of the viking poet of the 10th century. It has lately been shown that this saga was probably written by Snorri Sturluson.

Bishops' Sagas.—At the beginning of the 13th century several sagas were written about bishops of the two Icelandic sees, Skálaholt and Hólar. These included sagas about Thorlbk (d. 1193) and Páll (d. 1211), bishops of Skálaholt, and about Jón, bishop of Hólar (d. 1121). Later bishops' sagas were those about Bishop Árni of Skblaholt (d. 1298) and Bishop Laurentius of Hólar (d. 1331).

Sagas of Later Times.—Numerous sagas were written about lay chieftains who lived in Iceland during the 12th and 13th centuries. Most of these were combined at the end of the 13th century in the *Sturlunga* Saga (Saga of the Sturlungar). The largest section of this compilation is the fslendinga Saga (Saga of the Icelanders), a history of the Icelanders beginning with the year 1183 and covering a great part of the 13th century. The author of the *Íslendinga* Saga was Sturla Thordarson (1214–84), nephew of Snorri Sturluson.

Heroic Sagas.—The term "Heroic sagas" (Icelandic: Fornaldar sogur) is applied to sagas about heroes of Scandinavia and continental Germania who lived before Iceland was peopled. The Ynglinga Saga (Saga of the Ynglingar) contains legends of the early kings of the Swedes and was written by Snorri Sturluson as an introduction to the Heimskringla. The *Skjöldunga* Saga (Saga of the Skjoldungar) was also written early in the 13th century and contained legendary tales about kings of the Danes.

Most sagas of this class date from the late 13th and 14th centuries. Their sources were often ancient heroic poems, such as those preserved in the Poetic Edda (see EDDA). One of the best known is the Volsunga Saga (Saga of the Volsungs), which contains a prose version of the legends of Sigurd and Brunhild. The *Hrólfs* Saga (Saga of Hrólf Kraka) is also based partly on heroic poetry, and contains interesting legends about the Danes. The *Heiðreks* Saga (Saga of Heiðrek) consists of numerous stories of devious origin, some of them about battles between Goths and Huns in the dark ages. Fantastic as they are. some of these heroic sagas preserve memories of historical events which would otherwise have been forgotten.

Romantic Sagas.—These are prose narratives based upon foreign romances. Many of them were written in Norway under the patronage of King Haakon Haakonarson (1217–63). They were later transcribed in Iceland and revised. They gained wide popularity and gave rise to original compositions in similar style. One of the best known, and perhaps the oldest, of the romantic sagas is the Tristrams Saga (Saga of Tristram), written in Norway in 1226, and based upon a French poem of the 12th century.

The *Karlamagnús* Saga (Saga of Charles the Great) contains prose versions of a number of French poems about Charles and his champions, including the Chanson de Roland (Song of Roland). Most of the romantic sagas are post-classical, dating from the 14th and later centuries.

(See ICELANDIC LITERATURE.)

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SAGAING, a town, district and division of Burma, lying to the west of Mandalay on both sides of the Irrawaddy. The district has an area of 1.878 sq.mi.; pop. (1941) 387,270, showing an increase of 51,305 in the decade. The chief crops are sesame, millet, rice. peas, wheat and cotton. It lies in the heart of the dry belt, and the rainfall ranges from about 25 to 35 in. In the hot season the maximum shade temperature rises to a little more than 100° F. The lowest readings in the cold season average about 56° F.

Sagaing. the headquarters town, is opposite Ava, a few miles below Mandalay; pop. (1953) 15,439. It was formerly a capital of Burma. The Ava bridge (3.940 ft.), completed in 1934, with its western end at Sagaing, carries the Mandalay-Myitkyina railway and also road traffic. The steamers of the Irrawaddy Flotilla company call daily.

The Sagaing division (pop. [1956 est.] 2,210,983) includes the districts of Upper and Lower Chindwin, Shwebo, Sagaing, Katha, Bhamo, Myitkyina and Naga Hills.

SAGASTA, PRÁXEDES MATEO (1827–1903), Spanish statesman, born July 21, 1827, at Torrecilla de Cameros, in the province of Logroiio. From the first he displayed Liberal inclinations. He entered the Cortes in 1854 as a Progressist deputy for Zamora. Exiled after O'Donnell's coup *d'état* (1856), he returned to sit in the *cortes* 1859–63. Exiled again after conspiring with Prim and the Progressists against Isabella, he took part in the rising at Cadiz which culminated in the revolution of Sept. 1868, was minister several times under Serrano and then under King Amadeo, 1868–72. Sagasta headed the most conservative groups of the revolutionary politicians against Ruiz Zorrilla and against the federal republic in 1873; and in 1874 he vainly attempted to crush the Carlists and to check the Alphonsist military conspiracy that overthrew Serrano (Dec. 1874). After the restoration of the Bourbons, Sagasta was premier in 1885–90 and again in 1892–95.

His attempt to conciliate both the Cubans and the United States by a tardy offer of colonial home rule, the recall of Weyler, and other concessions, did not avert the disastrous war with the United States, and his party was defeated (March 1899). A trimmer par excellence, abler in opposition than in office, Sagasta returned with the Liberals to power in March 1901; in Dec. 1902 he was defeated on a vote of censure and resigned office, dying at Madrid on Jan. 15, 1903.

SAGE, RUSSELL (1816–1906), U.S. financier, was born Aug. 4, 1816, in Oneida county, N.Y. He began his career in the grocery business. In 1853 he purchased the Troy and Schenectady railroad from the city of Troy, N.Y., and sold it to the New York Central railroad. He participated in the development and reorganization of railroads in the northwest. Sage moved to New York city in 1863, becoming a dealer in "puts" and "calls" and the "call money" market. He worked with Jay Gould, manipulating the stock of the Union Pacific and other companies, and was Whig representative in congress (1853–57). Sage died July 22, 1906, leaving his estate to his wife, MARGARET OLIVIA SLOCUM SAGE (1828–1918). Mrs. Sage established the Russell Sage foundation in 1907. During her life she made public gifts of $40,000,000, and when she died Nov. 4, 1918, she left $36,000,000 to

be distributed to various public institutions. (J. R. LT.)

SAGE, the common name applied to plants of the genus *Salvia* of the mint family, especially to S. *officinalis,* the leaves of which are used for seasoning. See SALVIA.

SAGEBRUSH, the name given to various shrubby species of *Artemisia* native to plains and mountain slopes of western North America. The common sagebrush (*A.* tridentata) is a much-branched shrub, usually 3 ft. to 6 ft., but sometimes 12 ft. high, with silvery gray, bitter-aromatic foliage, the small, wedge-shaped leaves mostly with three teeth at the outer end. This shrub is very abundant on semiarid plains, mainly between 1,500 ft. and 6,000 ft. altitude, where it is often a conspicuous and characteristic feature of the vegetation. It occurs from Montana and western Nebraska to British Columbia and California.

SAGINAW, a city of Michigan, U.S., and seat of Saginaw county, is located 10 mi. S. of Bay City and 92 mi. N.W. of Detroit, on both banks of the Saginaw river 15 mi. from its entrance into Saginaw bay (Lake Huron). It is a centre of farming and manufacturing and a port of entry. Nearby communities include Chesaning, Carrollton and Frankenmuth.

Saginaw means "land of the Sauks" in the language of the Chippewa Indians who once dominated the valley after driving out the Sauks in the 16th century. A post was established in 1816 by the American Fur company and Fort Saginaw was constructed on the west bank of the river in 1822. Although the fort was abandoned the following year, a settlement known as Saginaw City grew up around the fur-trading post and received its charter in 1870. East Saginaw, established in 1849 and chartered 1859, joined with Saginaw City in 1889 to form Saginaw. In 1936 the city adopted a council-manager form of government.

Saginaw was a major lumbering centre from 1834 when a steam sawmill began operations until about 1890, by which time the pine forests were depleted. Salt deposits, coal and oil are productive mineral resources of the area and their development helped to offset the decline in lumber trade. Served by major railroads, highways and an airport. Saginaw became a wholesale and trading centre for northeastern Michigan. It manufactures automotive parts, particularly steering gears, malleable and gray iron, graphite, baking machinery, mobile homes, truck trailers and paper products. The county contains approximately 4,500 farms averaging 45 ac. in size and producing sugar beets, beans and wheat. One of the world's largest bean elevators is in Saginaw. Parks include the Ezra Rust and Hoyt parks and Ojibway Island. The Schuch hotel contains a museum of Indian artifacts.

Population of the city in 1960 was 98,265 and the Saginaw standard metropolitan statistical area comprising Saginaw county had a population of 190,752. For comparative population figures see table in MICHIGAN: Population. (MA. R.)

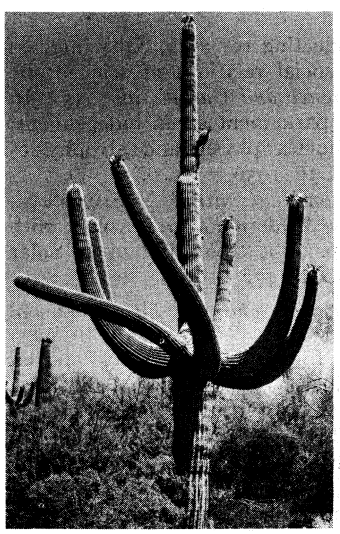
SAGITTARIUS (the "Archer"), in astronomy, a constellation and sign of the zodiac. In mythology, Sagittarius was pictured as a centaur preparing to shoot an arrow. The southernmost zodiacal constellation, it appears rather low in the south in the early evenings of the late summer for observers in middle northern latitudes. Six of its stars outline the inverted Milk Dipper, which has its handle thrust into the Milky Way, Near the western border of Sagittarius is the winter solstice, the southernmost point of the sun's apparent annual course around the heavens. Also in this region is the direction of the centre of our spiral galaxy, some 30,000 light-years distant from Earth. This area is accordingly one of exceptional complexity and interest as viewed with the naked eye and with the optical and radio telescope. The great star cloud in the central region of Sagittarius is one of the brightest features of the Milky Way. See CONSTELLATION.

(R. H. BR.)

SAGO, a food starch prepared from a deposit in the trunk of several palms, the principal source being the sago palms (*Metroxylon rumphii* and M. sagu), native to the Indonesian archipelago, the sago forests being especially extensive in the island of Ceram. The trees flourish only in low marshy situations, seldom attaining a height of 30 ft., with a thickset trunk. They attain maturity and produce an inflorescence (flower spike) at the age of 15 years, when the enarmous pith of the stem is gorged with starch. If the fruit is allowed to form and ripen, the whole of this starchy core material passes into the developing fruits, leaving the stem a mere hollow shell; and the tree after ripening its fruit dies. Accordingly the palms are cut down as soon as the inflorescence appears, the stems are divided into sections and split up and the starchy pith extracted and grated to a powder. The powder is then kneaded with water over a strainer, through which the starch passes, leaving the woody fibre behind. The starch settles in the bottom of a trough, in which it is floated, and after one or two washings is fit for use by the natives for cakes and soups. That intended for exportation is mixed into a paste with water and rubbed through sieves into small grains, whence it is known according to size as pearl sago, bullet sago, etc.

A large proportion of the sago imported into Europe comes from Borneo, and the increasing demand has led to a large extension of sago-palm planting. Sago is also obtained from various other Indonesian palms such as the Gomuti palm (*Arenga pinnata*), the Kittul palm (Caryota urens), the cabbage palm (Corypha umbraculifera), besides *Corypha* utan, *Raphia flabelliformis* and Phoenix *pusilla,* also from *Mauritia flexuosa* and *Guilielma gasipaes,* two South American species. It is also obtained from the pith of species of Cycas.

SAGUARO (Cereus giganteus or *Carnegiea* gigantea), a remarkable tree cactus, rising to 50 ft. in height, called also giant cactus and monument cactus, native to arid districts in southern Arizona, southeastern California and Sonora, Mex. It has a stout, woody, vertically ribbed stem, one to two feet in diameter, sometimes rising unbranched, like a green, fluted column, whence the name monument cactus; more frequently it bears a few large. stout. widely diverging candelabralike branches, but occasionally it bears numerous branches which rise vertically from near the base like a group of organ pipes. Close to the top of the stem or branches it bears white flowers which are followed by crimson edible fruits. In Arizona, of which it is the floral emblem or state flower, a desert tract containing numerous fine living specimens of the tree was set apart and is now known as Saguaro National monument. See also CACTUS.



RUTHERFORD PLATT

SAGUARO (CEREUS GIGANTEUS)

SAGUENAY, a river of Quebec, Can., which drains the waters of Lake St. John into the St. Lawrence river about 120 mi. northeast of Quebec city. Flowing E.S.E., the Saguenay, in the first third of its 105-mi. length (475 mi. long from the head of the Peribonca river), descends about 300 ft. in a turbulent stream. Thereafter, the valley is virtually a fiord through which the river, without shoals (average depth, about 800 ft.) or obstructions, continues between precipitous cliffs which culminate in the majestic capes Trinity and Eternity, more than 1,600 ft. high. The upper river is an important source of hydro-electric power, used primarily for aluminum production at Arvida. The river is navigable from its mouth at Tadoussac, the oldest European trading post in Canada, to Chicoutimi, above which the rapids begin. Ha Ha bay. about 20 mi downstream from Chicoutimi is a fiordlike arm of the Saguenay into which the Ha Ha river and the Rivière Mars empty near Port Alfred at the head of the bay. (J. D. I.)

SAGUNTO, formerly Murviedro, a Spanish town 18 mi. N. of Valencia on the Valencia-Barcelona coast railway. Pop. (1950) 26.987 (mun.). The well-preserved Roman theatre looks across the Huerta de Valencia to the Mediterranean. Sagunto is the ancient Saguntum, an ancient Greek or Greek-Iberian town, founded by colonists from Zacynthus (whence its name). About the year 228 B.C. the Romans, disquieted by the enormous growth of Cartha-

ginian power in Spain, concluded an alliance with Saguntum and further required the Carthaginian general, Hasdrubal, not to pass the Ebro. These conditions were observed until 219 when Hannibal judged it safe to begin the war by attacking Saguntum. Confident in Roman protection, the town made a desperate resistance for eight months. at the end of which it was taken by storm. Rome complained to Carthage. requiring the surrender of Hannibal and the members of the council present with him; the council, though doubtful of the wisdom of Hannibal's action, naturally refused, and the second Punic War began. Saguntum never recovered its old importance, and in 138 B.C. was definitely eclipsed by the foundation of Valentia by D. Iunius Brutus, and its population by Lusitanian war-captives who were given the Latin franchise.

SAHA, MEGHNAD N. (1893–1956), Indian physicist noted for his development of the thermal ionization equation (which, in the perfected form due to E. A. Milne, has remained fundamental in all work on stellar atmospheres) and for his application of it to the interpretation of stellar spectra.

Born on Oct. 6, 1893. in Bengal, Saha received his first training in Calcutta, and carried out postgraduate work at Imperial college, London. After returning to India, lie became professor of physics at Allahabad (1923–38) and at Calcutta (1938–55). He was elected a fellow of the Royal society in 1927 and was president of the United Provinces Academy of Sciences and of other Indian scientific botiies. He was mainly instrumental in the foundation of the Calcutta Institute of Nuclear Physics, of which he became honorary director.

In his later years, while not neglecting research, Saha increasingly turned his attention to the social relations of science; he founded the outspoken journal Science *and* Culture in 1935. In 1951 he was elected to the Indian parliament as an independent. He continued publishing papers on nuclear physics and astrophysics until his death in New Delhi on Feb. 16, 1956.

Among his works are: *A Treatise on Heat,* with B. N. Srivastava, 3rd ed. (1950), and *A Treatise* on *Modern Physics,* vol. i, with N. K. Saha (1934). An important paper is "Ionization in the Solar Chromosphere," *Phil. Mag.,* vol. 40, p. 472 (1920).

See S. N. Sen (ed.), *Professor Meghnad Saha: His Life, Work and Philosophy* (1954). (B. E. J. P.)

SAHAPTIN, a large American Indian linguistic stock, spoken in what is now southeastern Washington, west central Idaho, part of eastern Oregon and north-central California. The four major divisions, all mutually unintelligible, were: northern Sahaptin, spoken by the Yakima, Klikitat, Kittitas, Wanapam, Tenino, Umatilla and Walula tribes; Nez Percé; Cayuse-Molala; and Klamath-Modoc. Cayuse-Molala was formerly called Waiilatpuan and considered a separate stock. Similarly. Klamath-Modoc was separated under the name Lutuamian. Further studies have shown these to be merely divergent branches of Sahaptin.

Earlier the spelling Shahaptian was sometimes used; also, the name occasionally was employed as a designation for the Nez Percé tribe.

See Melville Jacobs, "A Sketch of Northern Sahaptin Grammar" in *University of Washington Publications in Anthropology,* vol. 4, no. 2 (1931). (V. F. R.)

SAHARA, from the Arabic word *sahrá* (wilderness!. is the great desert of north Africa, the world's largest desert. It stretches right across Africa from the Atlantic coast through Egypt to the Red sea, beyond which the desert continues into Arabia and Iran. Around its edges there are transitional areas where rainfall is greater and true desert conditions gradually disappear. so that nowhere has it precise boundaries.

Its greatest west-east extension exceeds 3,000 mi.. and it is seldom less than 1.300 mi. wide. Its total area. perhaps 3,500,000 sq.mi., occupies between a quarter and a third of the African continent. Despite the physical unity of the whole area it includes numerous political divisions.

Geographical Divisions.—The Saharan plateau has an average elevation of 1,000 ft. and is not uniform in character. Across it runs a high central ridge of varying width, including the high mountains of Ahaggar anti Tibesti. Geographically five main subdivisions may be recognized, a central area, surrounded by northem, western, southern and eastern areas *(see* map).

The western or Atlantic Sahara is of monotonous relief, generally below 1,500 ft. and with large portions less than 600 ft. above sea level. The central Sahara extending from Mauritania eastward is made up of the Chech Erg, the great Tanezrouft, the Ahaggar massif (with its associated plateaus of Ahenet, Mouydir and the Tasili des Ajjer) and the Fezzan. The Ahaggar is formed of Archaean and Palaeozoic rocks and reaches 9,842 ft. in the peak of Tahat which is sometimes snow-capped. The northern Sahara consists of the Great Western Erg and the Great Eastern Erg, the oasis country of Touat and Gourara, and the Hammada el-Homra to the east. A depression along the south side of the Saharan Atlas is marked in the west by the Oued Draa and to the east by a line of chotts (salt lakes), of which the Chott Djerid, in southern Tunisia, is the largest. Near Biskra these chotts are lower than sea level, and the Gulf of Gabès (Qabes), an arm of the Mediterranean sea, represents a now submerged portion of the depression. The southern Sahara merges gradually on its southern sides into the semidesert areas of the interior of former French West Africa. It extends from the mountains of Mauritania through the Adrar des Iforas and the Air massif, to the massifs of Tibesti and Ennedi. The highest points in Tibesti. Emi Koussi and Mt. Tousside, an extinct volcano, reach 11,204 and 10,712 ft. respectively. The eastern Sahara extends from the Mediterranean coast to the latitude of Khartoum. In the west is the Libyan desert of uniform relief, with large parts in the north only 600 ft. above sea level; near the coast is the Jebel el Akhdar range, but otherwise this area consists of 500,000 sq.mi. of almost level dunes and sandy wastes. over which no routes pass except those going by way of the Kufra oases. In Egypt the desert is known as the Western desert. Between the Nile and the Red sea is the Arabian (or Eastern) desert in Egypt and the Nubian desert in the northeast of the Sudan.

Geology, Structure and **Physiographical** Evolution.—Though much work remains to be done, the main features of geology and structure are now fairly well understood. The oldest rocks, of Archaean and Pre-Cambrian Age, were folded and denuded to form the Saharan platform, upon which later deposits have been laid. There have been numerous dislocations, the more marked of which have been accompanied by volcanic activity; several of the highest peaks in the central Sahara are the remains of extinct volcanoes of Tertiary and Quaternary Age. Elsewhere vertical movements of the land have caused the renewal of erosion which has resulted in the cutting of deep valleys and gorges. such as those of the Tasili des Ajjer. During Cretaceous and later times much of the Sahara was submerged. and extensive areas are covered by sandstones, notably the Nubian sandstone of Cretaceous Age, and by limestones laid down in areas of the sea. There are also large basins now occupied by sediments of continental origin deposited by wind or in shallow fresh or saline waters. The horizontally bedded Cretaceous and other rocks form plains, plateaus and escarpments that are dissected by former river valleys and are in striking contrast to the volcanic topography of other areas. The Sahara as a whole is quite distinct from the Atlas mountains of French North Africa which belong, tectonically! to Europe.

The theory of a marine origin for the vast quantities of sand in the Sahara has been disproved, since the sand is of Quaternary, or, at the oldest, Pleistocene, Age and there is no evidence of any marine transgression since pre-Tertiary times. During the Quaternary Ice Age in Europe. the Sahara's climate must have been wetter, so that erosion took place as in other moist temperate or subtropical regions, and there was a proper system of rivers. The vegetation may have been grass with trees. With the retreat of the ice sheets from Europe, vegetation disappeared and arid conditions were established, so that the soil was dried out and became subject to large-scale wind erosion.

Three main types of surface and scenery are commonly recognized today—the erg, the reg and the hammada. The erg is the desert of shifting sand dunes, which lie in the bottom of the great basins where the ancient rivers piled up most alluvium; the Great Western and Eastern Ergs, between Béni-Abbès and Ghadames, are the most difficult of all Saharan areas and are the parts most carefully avoided by modern trans-Saharan routes. The Libyan

desert also constitutes an extensive area of unmitigated sandy waste. The reg desert consists of wind-scoured plains strewn with pebbles, boulders and gravels. The hammada are rocky plateaus with bare rock outcrops and are often cut by deeply eroded valleys and gorges; they are common around the Ahaggar and Tibesti and, at lower altitudes, in the western Sahara

Climate. — Climate is the fundamental basis for the definition of the Saharan region which consists of those areas with rainfall of less than 10 in a year in the northern districts (south of the Atlas mountains) and 1 j in. in the south (in about the latitude of Timbuktu and Agadès, where evaporation is much greater). The limits of the true desert, with perhaps less than five inches of rainfall a year, are rather narrower. The whole area is marked by a general lack of rainfall with great variations from year to year and a tendency for such rain as falls to come in sudden storms at very irregular intervals. Adrar has recorded 3 7 in in a few hours and Ain Sefra 3 in in two days El-Goléa had only one fall of rain in seven years and Tidikelt only one in ten years. The total rainfall recorded at In Salah in four years amounted to only 0.4 in. Absolute desert occurs in the extensive flat areas of the Tanezrouft or "land of thirst," to the west of the Ahaggar.

The Sahara is one of the hottest, if not the hottest, regions of the world, mean annual temperatures exceeding 80° F. over a high proportion of it and, in parts, 8j° F. June, July and August are especially hot months. Shade recordings of 136 4° F. have been reported from Azizia in Tripolitania, and the surface of the ground may sometimes exceed 170° F. There are, however. great differences between day and night temperatures, sometimes as much as 50°–60°, so that while the desert may be a furnace at midday, there is a rapid loss of heat from the ground after sunset, and the nights are usually cool and refreshing. The sky is generally cloudless, and the relative humidity very low, sometimes less than 10%. The most common winds are the northeast trades, though in the western Sahara winds often blow from the west.

In recent years meteorological stations have been established at various points on the edge of the Sahara and after 1932 regular observations were made at the Jules Carde observatory at Tamanrasset (Fort Laperrine) in the Ahaggar mountains, 4,429 ft above sea level. Figures for this station are given in the table to illustrate some climatic variations of the Sahara.

Vegetation. — Areas from which all plant life is absent form only a small part of the Sahara: the Tanezrouft, for example, and the Hammada of Tinghert, south of Ghadames. Sand deserts are not, however. the most barren parts of the Sahara, mobile dunes can carry little plant life, but the vegetation of the sandy stretches in the basins of the great rivers of Quaternary times can draw on some of the most copious underground water reserves.

Nevertheless plant life is usually poorly developed. It consists of two very distinct types: the permanent, such as betoum (Atlantic turpentine tree, *Pistacia* atlantica) and acacia trees, and thorny shrubs like tamarisks and jujubes; and the ephemeral — delicate herbs whose seeds germinate immediately after rain, grow rapidly, flower for a brief period, set fruits and seeds and then die. This ephemeral vegetation is widely known by the inhabitants of the desert as acheb.

The natural vegetation of the oases was probably the oleander with tamarisks. Among introduced plants the date palm is of outstanding importance. Its fruits provide food for local consumption and for trade, and the crushed seeds food for camels.

Fauna. — Domesticated animals have been introduced to all the oases, principally camels, sheep and goats, but the wild fauna of the desert is, like the vegetation, highly specialized Gazelles, desert antelopes and wild goats are common on the northern and southern edges of the desert; jackal, fox and badger also occur. Bustards are found on the south side of the Saharan Atlas; ostriches are much more scarce than formerly Horned vipers, scorpions and lizards are common, as are locusts, flies and ticks The Egyptian monitor (Varanus *niloticus*), looking like a small crocodile survives in certain areas such as in the tributaries of the Igharghar.

Peoples and Settlements. — Settlement was undoubtedly widespread when the desert area was wetter and better-covered with vegetation. There is evidence of Neolithic and Palaeolithic culture, and rock drawings have been found showing animals that no longer live in the Sahara. Within historic times it is suggested that there may have been drastic changes, because of the Roman military settlements established in places which are now desert or semidesert. But their decline may perhaps have been caused as much by the neglect of the water supply and irrigation systems as by climatic changes. In some cases colonies have been reestablished during the 20th century. especially by the French, on the sites of these abandoned settlements.

The first inhabitants were probably Negroes, who retreated in the face of the advancing Berbers with their swift-moving camels (*méharis*). After the death of Mohammed the Berbers were pushed back by the Arabs who also used camels and who made Islam a unifying element throughout the Sahara. Arabic became the chief language, though Berber pockets survived, chiefly in upland areas in the central Sahara. Slavery was introduced and remained a lucrative trade long into the 20th century. From the mixture of Negro, Berber and Arab there emerged the three great ethnic groups of today: the Tuareg, the Tibbu (Tebu) and the Moors (qq *v.*).

The Tuareg are camel nomads living in the central parts of the desert. There are several confederations; in the north the Ajjer, the Tasili and the Ahaggar and in the south the Iforas of the Adrar, the Ioulemedden of the middle Niger and the Kel Oui and Kel Gress of the Air They are known as the "people of the veil." because all male Tuareg wear a *litham,* or veil, which they lift only in order to eat. The society is matriarchal, and the women enjoy a degree of liberty unknown elsewhere among Moslem peoples.

The Tibbu of the eastern Sahara closely resemble the Tuareg but have mixed greatly with negroid peoples. They are light or dark bronze in colour and are probably of Hamitic stock. Their language closely resembles Kanuri, spoken in Kanem and in Bornu in northeastern Nigeria.

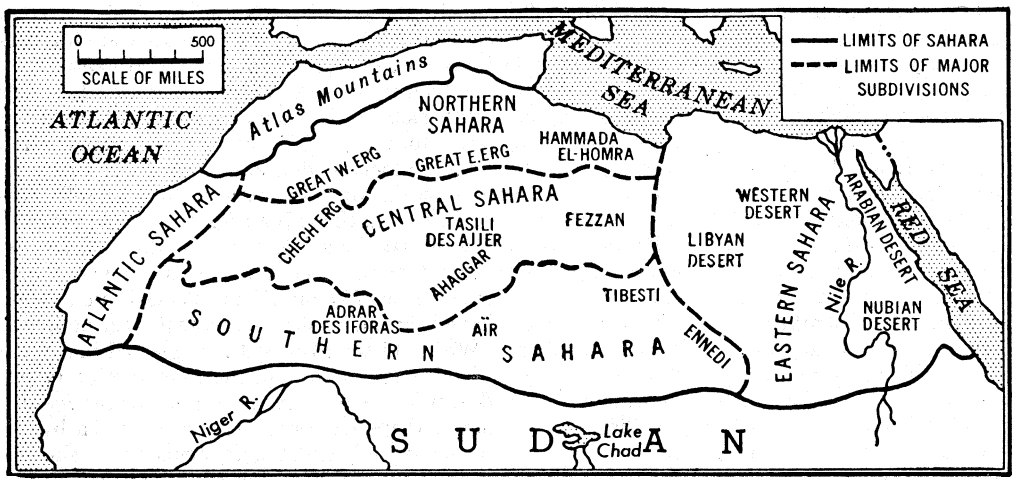
The Moors or *Beidan* (or whites, as compared with the black peoples of the Sudan) live in the western Sahara They are mostly nomads, a mixture of Berber and Arab, with the Berber element predominant. Unlike the Tuareg they have been completely Islamized and are a very cultured people.

Other smaller groups include the Chaanba, who are Arab-speaking nomads and the traditional enemies of the Tuareg. and the Mozabites, a group of heretical Moslems who settled in the Mzab, and whose commercial wisdom has given them an importance out of all proportion to their numbers. In the oases Negroes are still the most numerous. They are the descendants of the original inhabitants and of slaves introduced later. Three classes are recognized. the free men, the proprietors; the Haratin, the tradesmen; and the Negroes or slaves.

Of greater significance than differences of race or language is the distinction between nomadic and sedentary peoples. Pastoral nomads are most numerous on the edges of the desert and around the mountainous areas. The poorer the desert, the more scattered the population. Though the nomads depend most upon their camels, sheep and goats are more numerous, the range of grazing is determined by the availability of fodder and drink-

Seasonal Climatic Variations as Observed at Tamanrasset

	Jan	Feb	March	April	May	June	July	hug	Sept	Oct	Nov.	Dec.	Year
Mean temperature (°F)	54	58	64	72	78	83	84	83	79	74	65	58	71 (mean)
Mean daily maximum temperature (° F)	67	72	79	86	92	95	96	95	91	86	79	71	84 (mean)
Mean daily minimum temperature (° F)	40	43	49	58	64	70	72	71	67	60	51	44	57 (mean)
Mean rainfall (in)	0 3	0 0	0 0	0 2	0 5	0 2	0 1	0 4	0 1	0 1	0 0	0 0	1 9 (total)
Mean number of rain days	1	0 4	0 4	0 7	2	3	2	3	3	5	0 6	0 5	17 (total)
Relative humidity (%)	31	25	23	20	24	21	23	25	24		28	31	25 (mean)
Absolute temperatures, maximum (° F)	79	82	90	96	98	101	99	100	97		86	81	101
Absolute temgeratures, minimum (F)	20	25	32	42	45	59	62	62	56	47	36	27	20



PRINCIPAL GEOGRAPHICAL SUBDIVISIONS OF THE SAHARA

ing water. The Regibat of the Spanish Sahara will migrate 400 mi. to the Chech Erg in search of water for their camels. With the pacification of many areas, razzias or raids by nomads on oasis cultivators are less common than formerly.

The sedentary peoples account for about two-thirds of the total population of the desert. They live in the oases and cultivate with the aid of irrigation. Methods of irrigation include springs, wells, shadoofs, *foggaras* and artesian wells. The shadoof consists of a beam, pivoted between uprights, bearing a weight at one end and a bucket at the other. *Foggaras* are man-made subterranean channels, dug not quite horizontally to tap underground water ahich is led to the oasis by gravity and supplies a limited but regular amount; they are especially common in Touat and Gourara. Artesian wells are most used around Ouargla (Wargla) and in the Oued Rir, south of the Chott Melrir, uhere there are more than 1,000 wells supplying 69,000 gal. a minute and irrigating 1,750 000 palms. Unfortunately the withdrawal of these quantities of nater has caused a drop in the water table. but measures have now been taken to overcome this drawback. In all Saharan oases the date is the chief tree and the main source of food. In its shade are grown citrus fruits, figs, peaches, apricots, vegetables and cereals such as wheat, barley and millets.

Commerce and Communications. — Saharan commerce is of two types: the supplying of wheat, barley, wool and manufactured goods to the desert peoples in exchange for dates; and the long-established trans-Saharan trade, always the monopoly of the nomads. Salt and ivory were carried across the desert in very early times, and salt is still an important product. especially from Taoudéni and Bilma. In 1950 the Sahara produced more than 14,000 tons of salt, the equivalent of more than 100.000 camel loads which move in huge caravans on *azalaïs*, particularly on the salt route from Taoudéni to Timbuktu. Many other caravan routes remain important despite the introduction of new methods of communication. They include those from Tripoli to Ghat and to Murzuk, Bilma and Lake Chad; from Ouargla to In Salah, Tamanrasset, Zinder and northern Nigeria; from Colomb-Béchar to Tessalit and the upper Niger valley; and from southern Morocco through Atar to Nioro or Senegal. In the eastern Sahara the routes centre on the oases of Faya (Largeau) and Kufra and also link Egypt westward and southwestward with the desert. Camel traffic is important in the market centres such as Biskra, Ghardaïa and Agades on the desert edge.

Certain routes are commonly used by motor vehicles. Regular though infrequent buses use two roads—one crossing the Tanezrouft to Gao and Niamey in six days and the other passing through the Ahaggar to Agadès and Zinder. Railways reach to the edge of the Sahara from the north, west and south but do not penetrate far. There have been many proposals for a trans-Saharan railway. The most advanced, from Colomb-Béchar via the Tanezrouft to Gao on the Niger, has stopped 60 mi. south of Colomb-Béchar because of the high cost of construction and the economic uncertainty of the scheme. Numerous air routes between Europe and tropical and southern Airica cross the desert using airports on the fringes, as those at Tripoli and Kano.

Political Divisions. — Until 1961 most of the western and central areas of the Sahara were under French administration. Following the French occupation of Algiers in 1830 they advanced gradually southward. Control of the line of the northern Saharan oases was established when Laghouat and Ghardai'a, in the Mzab valley, were occupied in 1852 and Touggourt (Tuggart) and Ouargla in 1854. Dreams of a vast empire in the northern half of Africa were entertained, as the French also penetrated inland in west and equatorial Africa and established the protectorate of Tunisia in 1881. As early as 1879 plans for a trans-Saharan railway were being discussed, while official missions, notably that of Fernand Foureau and A. F. J. Lamy from 1898 to 1900, helped to establish French claims in the Sahara. These were iurther recoenized bv the Anglo-French agreements of 1890, 1898 and 1904, by which various boundaries were fixed and many of the existing political divisions established. The French portions oi the Sahara consisted, in 1961, of the Saharan *départements* of Oasis and Saoura (comprising the former southern territories of Algeria).

The Spanish Sahara, consisting of Rio de Oro and Sekia el Hamra, is on the Atlantic coast. In the eastern parts of the Sahara are Libya, the territory of which formed an Italian colony irom 1912 until World War II, after which it was placed partly under British and partly under French trusteeship until 1951, when it became an independent state—the United Kingdom of Libya—made up of the three provinces of Tripolitania, Cyrenaica and the Fezzan; the independent state of Egypt; and the Sudan, until 1954 the condominium of the Anglo-Egyptian Sudan.

Exploration. — The Egyptians penetrated the Libyan and Nubian deserts in places, and the Carthaginians and Phoenicians knew parts of the northern Sahara and Rio de Oro on the west coast. Roman Africa extended up the Nile to the Second Cataract (Wadi Halia), but the attempt to discover the sources of the Nile in A.D. 66 did not extend beyond the swamps of the Bahr el Jebel.

The Mohammedan conquest of North Airica largely eliminated European influence in the Sahara, although Jewish and Genoese merchants acquired considerable knowledge of the desert during mediaeval times.

The real opening up of the Sahara took place during the 19th century. In 1819 Joseph Ritchie and G. F. Lyon went from Tripoli to Murzuk and into the Fezzan. In 1822 D. Denham, H. Clapperton and W. Oudney crossed the desert irom Tripoli and were the first Europeans to see Lake Chad. Maj. A. Gordon Laing went from Tripoli to Timbuktu in 1825 but was murdered on his return journey. In 1827 and 1828 René Caillié, disguised as an Arab, travelled from Sierra Leone to Timhuktu, where he explored the middle Niger valley and then crossed the Sahara to Morocco.

The first scientific expedition was that of Heinrich Barth, who travelled extensively between Tripoli and Lake Chad from 1850 to 1855. G. Rohlfs explored parts of the western Sahara between 1862 and 1867 and later travelled from Tripoli to Siwa and Alexandria. In 1878 he attempted to reach Wadai but penetrated only as far as the Kufra oases. Henri Duveyrier explored the Ghat-Murzuk route between 1859 and 1861 and revealed many facts about the Tuareg

Several explorers were murdered, including Eugène Joubert and R. Dourneaux-Dupéré at Ghadames, on their way to Timhuktu from Algeria (1874); Erwin von Bary travelling from Tripoli to Timbuktu through Air (1877); and Col. Paul Flatters, who was killed by the Tuareg in 1881 while making a survey for a proposed French trans-Saharan railway. Timbuktu was reached from Morocco in 1881 by H. Oskar Lenz.

In the last decade of the 19th century, and following the Anglo-French agreement of 1890, the desert was conquered by the French, and since then many of its unknown regions have been explored. Especially important was the mission of F. Foureau and A. F. J. Lamy of 1898–1900, which crossed the desert from Biskra via Agadès and Zinder to Lake Chad, where contact was made with parties led by O. Meynier from the Niger and E. Gentil from the Congo. The military conquest followed in succeeding years. Gen. M. J. F. H. Laperrine was given command of the northern oases and concentrated on making the routes safe from Tuareg raids. He defeated the Ahaggar Tuarez at Tit in 1902 and secured their complete submission by 1905. He then turned his attention to the Tuareg of the Tasili des Ajjer, who were supported by the Senussi of Tripnlitania, who themselves were helped hv the Turks. He was succeeded bv another brilliant soldier, Captain Charlet, but was recalled in World War I to deal with numerous revolts, during which the monk C. E. de Foucauld, one of the Tuareg's

best friends. was murdered. Laperrine himself was killed during a flight to survey the possibilities of air services between North and West Africa. Comdr. Jean Tilho carried out military operations against the Senussi of Tibesti and explored Borku, Ennedi and Tibesti, returning in 1917 through Wadai and Darfur. Many French and other travellers and scientists have added greatly to the knowledge of the Sahara in the 20th century. These include E. Arnaud, M. Cortier, E. F. Gautier. R. Chudeau. W. J. Hardinp King, H. Vischer, A. M. Hassanein Bey, A. Buchanan and F. J. Rennell Rodd. By 1955 it was doubtful if any more discoveries of first magnitude would be made, though large areas remained unexplored.

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(R. W. SL.)

SAHARANPUR, a city and district of India, in the Meerut division of Uttar Pradesh. The city, situated on a stream called the Damaula Nadi, is about 95 mi. north-northeast of Delhi. Pop. (1961) 185,019. It is an important railway junction. and there are railway workshops and a large woodcarving industry.

The DISTRICT OF SAHARANPCR has an area of 2.132 sq.mi. It forms the most northerly portion of the doab, or alluvial tableland, between the Ganges and Jumna rivers. The population in 1961 was 1.608.011: The district contains the towns of Roorkee and Hardwar (*qq.v.*).

SAHOS or SHOHOS, Africans of Hamitic stock living to the west of Massawa. Probably akin to the Gallas and Afars, they are mostly Mohammedans, a few being Christians.

SAICHŌ (767–822), eminent Japanese Buddhist monk who established the Tendai sect in Japan. He is also known as Dengyō Daishi, his posthumous name and title. His zeal for reform and the location of his monastery on Mt. Hiei (788) northeast of the new imperial capital Heian-kyō (Kyoto), established in 794, strengthened his affiliation with the court. Sent to China in 804, he returned the next year and introduced the highly eclectic Tendai (Chinese T·ien-t'ai) teachings. His co-operation with the court brought generous patronage and his monastery soon became the most powerful, a centre of Buddhist learning and discipline from which emerged most of the new sects during the next five centuries. He foreshadowed later Japanese Buddhist trends by his reverence for the native Shinto deities and emphasis on the patriotic mission of Buddhism to serve and protect the state. Although frequently engaged in polemics, his contribution was more significant as an effective leader and organizer than as a religious thinker. (D. H. SH.)

SAID HALIM, PRINCE (1863–1921), Turkish statesman, the son of Halim Pasha and the grandson of Mohammed Ali, the founder of the last Egyptian dynasty, was born in Cairo and was educated in Turkey, completing his studies in Geneva, Switz. Exiled because of his sympathy with the Young Turkish movement, he affiliated himself to the Committee of Union and Progress in Paris, Fr. After the revolution of July 1908 he returned to Constantinople and was nominated senator. At various times from 1908 to 1918 he was president of the council of state, minister for foreign affairs and general secretary to the Union and Progress party.

On June 17, 1913, he became grand vizier, in which capacity he endeavoured to settle the questions of Armenian reforms, Mosul oil and the participation of English, French and Russian capital in the Baghdad railway. He also endeavoured to establish close relations with Greece. Said Halim favoured a Turko-German alliance but sought to keep Turkey neutral in World War I. On its entry into the war he tendered his resignation, which was refused, and he remained in office until Feb. 1917. After the armistice of Mudros, Oct. 31, 1918. Said Halim was imprisoned by the British in Malta. Released in 1921, he was assassinated in Rome, Italy. on Dec. 6. 1921.

SAIGA (Saiga *tatarica*), a desert-dwelling antelope inhabiting the Khirghiz steppe. A century ago it extended as far west as Poland. During the later Tertiary period the saiga was widely distributed in Europe and Alaska.

SAIGON, the capital and river port of Vietnam, lies on the right bank of the Saigon river, which forms, with the Donnai river, a delta on the South China sea.

Relations with France began in the 18th century when French missionaries were sent to the town. In 1859 Saigon was captured by the French and in 1862 it came under French administration as part of the French colony of Cochin-China. On Jan. 1, 1932, Saigon and Cholon (*q.v.*) were merged for administrative purposes to form the prefecture of Saigon-Cholon, which, on Oct. 22, 1956, was re-titled the prefecture of Saigon. After the Indochinese war (1946–54), the city sheltered many refugees, particularly from the north. Saigon has been the capital of South Vietnam since July 20, 1954, following the convention of Geneva.

Under French administration. and especially during the 20th century, Saigon grew rapidly The population, which in 1907 was 228,471, was estimated at 498,100 by 1943 and 1,400,000 in 1960.

French influence is apparent in the spacious layout of the town, which looks more European than Asiatic. The boulevards are lined with magnificent trees whose branches. meeting overhead, form a leafy tunnel. There are many squares and public parks; the two most important parks are the Tao-Dan and the Thao-Cam Vien, which includes the botanical and zoological gardens. Saigon's three principal thoroughfares, Phan-thanh-Gian (formerly Général Lizé), Hong-thap-Tu (Chasseloup Laubat) and Tran-hung-Dao (Galliéni), link Saigon with Cholon, and at the same time give access to the provinces of the Donnai and Mekong river deltas.

Very little remains of the buildings which comprised the Vietnamese citadel before the arrival of the French. Among notable public buildings of the modern city are the Romanesque-style cathedral and the Vietnamese museum in the botanical gardens at the end of boulevard Thong Nhut (Norodom). The museum, which was opened in 1929 under the name of Musée Blanchard de la Brosse, owes its foundation to the Agricultural and Industrial committee (1865) which became the Society of Indochinese Studies in 1883. The geological and archaeological finds of this society were kept together and the museum houses two distinct collections, one of archaeological evidence of the Indian peoples (Khmer, Cham and Thai) and the other of the arts deriving from the Chinese civilization (Tibetan, Japanese and Funanese).

The first university buildings were erected after the end of the Indochinese War. There are faculties of letters, science, law and medicine. In addition there are advanced schools for teaching, arts and crafts, fine art and architecture.

Saigon uses its waterways for communications and trade and is connected by canals with the Mekong delta. Although about 75 mi. from the sea, Saigon is sheltered from the typhoons which regularly occur on the coast during the rainy seasons, and after Singapore is one of the chief commercial ports of the far east. Saigon is connected by the chief shipping lines with Marseilles, Kobé, Nouméa and with Atlantic ports via Manila, Hawaii and

Puerto Rico, etc. There is only one airport, at Tan-son-Nhut, 4½ mi. from the city. In addition to lines operating locally, there are services to Tokyo and to Paris. (N.-V.-P.)

SAIGŌ TAKAMORI *(1827–1877)*, Japanese rebel, a member of the warrior class and one of the best known of the leaders of the movement that overthrew the Tokugawa shogunate and restored power to the emperor, was born at Kagoshima in Kyushu on Dec. *7, 1827.*

On the Meiji restoration in *1868,* Saigō immediately assumed an important position in the new government. He left it in 1873, ostensibly over differences within the government on matters of foreign policy—though some historians regard his departure mainly as part of a factional struggle for power under the emperor—and retired to Kagoshima, where he founded a school and gathered around him a group of young men sympathetic to his personality and views on government.

In *1877* Saigō led an uprising, known as the Satsuma rebellion, intending to replace the existing incumbent government with one headed by himself. His forces were crushed and, rather than fall into enemy hands, he ordered one of his subordinates to put him to death with his sword, Sept. *14, 1877.*

Saigō became a national hero despite the rebellion, personifying to the Japanese the loyal subject who risks all to serve the emperor as he saw best.

See also SATSUMA REBELLION. (T. C. SH.)

SAIKAKU: *see* IHARA SAIKAKU.

SAILFISH, a large, powerful fish of the open seas, in which the bones of the upper jaw are consolidated and prolonged to form a rounded spear and the dorsal fin is greatly enlarged to form a saillike superstructure. Sailfishes (*Istiophorus* species), closely related to the marlins are classified with them in the family Istiophoridae. Like their relatives, sailfishes are strong and far-ranging snimmers, whose streamlined bodies cut the water at considerable speeds (perhaps *60* m.p.h. for short distances). The upper part of the torpedo-shaped body is a rich blue, the remainder a bright silver; the sides are often marked with vertical lines of lavender dots. The sail, deep purple at the base, blends into dark blue and is more or less spotted with dark dots. The fish folds the sail into a groove on the back when swimming rapidly and unfurls it nhen sunning itself, when breaking the surface or when fighting a sportsman's line. The spear is perhaps used to stun prey, such as mackerel, sierra, sauries and squid.

Sailfishes are widely distributed in the warm waters of all oceans and seasonally visit temperate regions as far south as the Cape of Good Hope and as far north as Massachusetts. There is much uncertainty regarding the number of species.

Two well-known species are the Atlantic sailfish (*Istiophorus albicans*), averaging less than *50* lb. in weight, and the Pacific form (**I.** *greyi*), averaging about *100* lb. Large specimens on record, caught with rod and reel, are an Atlantic sailfish *10* ft., *4* in. long and weighing *123* lb.; and a Pacific form *10* ft., 9 in. and *221* lb. Even though sailfishes are only fair quality as food, they are among the most highly prized of big game fish.

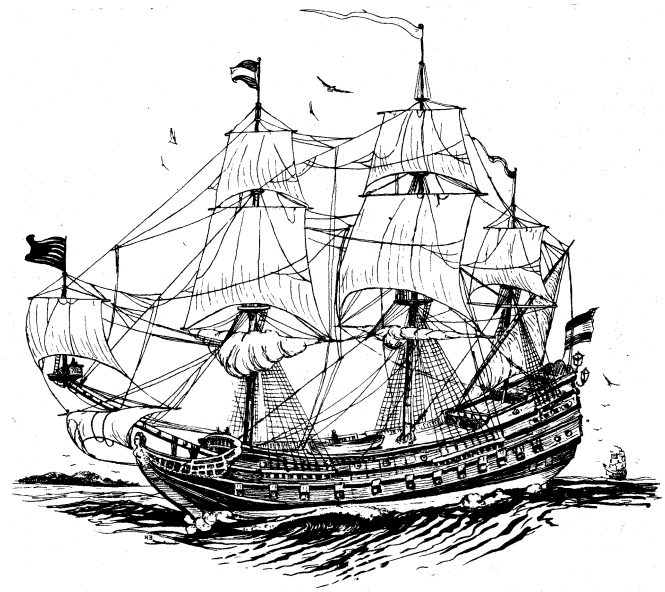
(L. A. WD.)

SAILING: *see* RIGGING; YACHTING; etc.

SAILS. The origin of sailcloth is obscure, although it can be assumed that primitive man first used the skins of animals as sails for his raft or canoe. The next probable step was to use woven mats of reeds stretched on poles. Sailcloth is mentioned by Homer in the *Odyssey,* in which he states that Calypso brought Odysseus "a web of cloth to make him sails."

Sailcloth was woven from flax fibre during the period when England, France and Spain were striving for supremacy. Fibre flax, grown chiefly in the U.S.S.R. and European countries, is still used for sails, although cotton has replaced it for better quality canvas. Cotton sails became popular in Europe after the U.S. racing yacht "America," using cotton sails, decisively defeated a fleet of British yachts in *1851.*

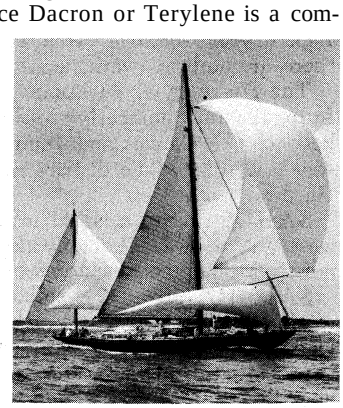
Cotton sailcloth has the advantage over flax in that it can be woven more closely, and therefore will not stretch out of shape as easily nor lose as much wind through the pores of the material.



17TH-CENTURY SHIP

Sails made of cotton, however, are very stiff, which makes them difficult to handle, and many a fingernail has been torn to the quick in furling cotton duck.

The chief modern users of quality sailcloth are yachtsmen. Less expensive grades of canvas are used in making awnings, covers, bags, tarpaulins, etc. Generally speaking, cotton supplanted not only flax but also hemp, ramie, jute and combinations of these materials as a fabric for quality sailcloth. Modern racing sails are made from Egyptian cotton, American cotton, Dacron (or Terylene, its British equivalent), nylon and Orlon, but the latter two synthetic fabrics were losing favour in the late 1950s since the stretch in nylon is hard to control and Orlon abrades and deteriorates comparatively rapidly. Egyptian cotton is superior to American cotton because the fibres are longer and stronger, and their greater degree of natural twist is conducive to producing a tightly woven fabric. It can be distinguished from American duck by its warm creamy colour. Since Dacron or Terylene is a comparatively new fabric, it had not been fully tested by the latter 1950s, but it is believed by many yachtsmen to be superior to any other fabric for sailcloth.



MORRIS ROSENFELD, N.Y.

YACHT "BOLERO"

Sail canvas formerly came in bolts of *90* yd. with a standard width of *22* in.; it was also available in widths of *14, 16,* 18, *20* and *24* in. It mas designated by weight from *00,* the heaviest, through 0 up to *12,* the lightest. On square-rigged vessels the courses and topsails were made of no. 0 and no. *1,* the topgallants of no. 3, the royals of no. *4* and the skysails of no. 5 *(see* RIGGING).

The modern standard width is 28½ in.. and other widths of *18,* 22, 36 and *40* in. are available. The latter two widths are termed spinnaker cloth. The U.S. designation is obtained from the weight of a piece of material *36* by 28½ in. In England this designation is obtained from the neight of a piece of material measuring *36* to *36* in. Thus if 1 sq.yd. neighs *12* oz. it is designated 12-oz. cloth.

Sailmaking.— The finest sails are still hand sewn, especially if the cloth weighs 13½ oz. or over. Machine sewing punches the needle through the material, which splits and weakens the yarns. The less expensive sails and sails for small craft, however, are machine sewn with a zigzag stitch.

The basic steps in manufacturing a sail may be outlined as follows: *(1)* The sailmaker studies the sail plan or measures the vessel's rig. (2) He calculates the stretch and the amount of draft,

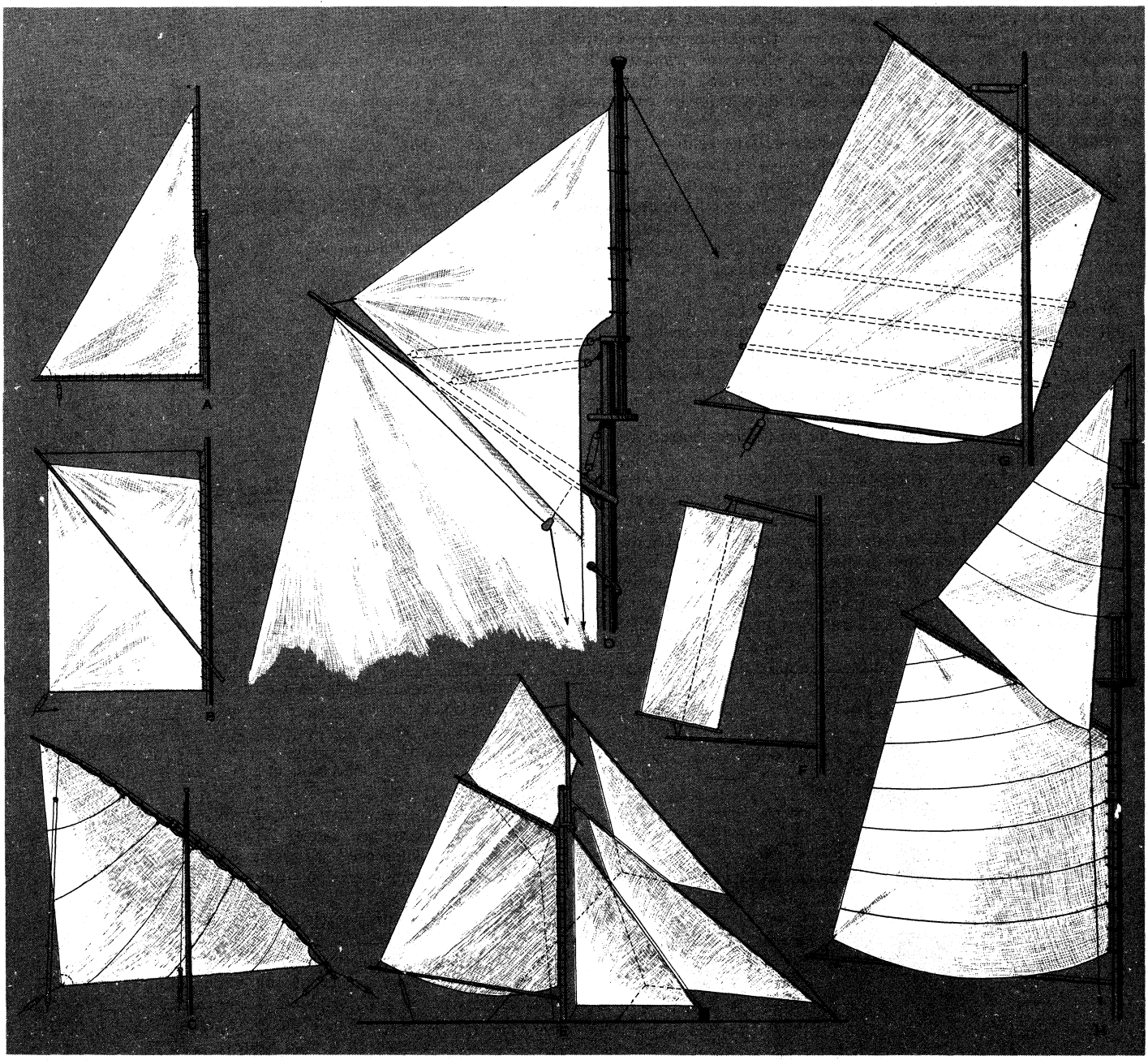


FIG. 1.— FORE-AND-AFT SAILS
(A) Sliding gunter; (B) spritsail; (C) lateen; (D) gaff topsail; (E) rig as used on cutter with mainsail, gaff topsail, staysail, jib and jib topsail; (F) ringtail; (G) balance lugsail; (H) spanker and jib-headed topsail

i.e., the curvature of the surface. (3) The actual plan of the sail is chalked out to full scale on the floor of the sail loft. (4) The cloths are laid down over this plan and their actual length and shape is marked on each individual cloth. (5) The cloths are numbered and then cut to the dimensions outlined by the markings. (6) Next the cloths are sewn together. If the sail is hand sewn, a flat stitch is used on a double flat seam in which the edge of one cloth overlaps the cloth next to it from $\frac{1}{2}$ to $1\frac{1}{2}$ in., depending on the material. A special sail twine is used as thread, and after the needle is threaded the twine is waxed so it will hold the right-hand twist then given to the twine. This twist helps the thread to mesh with the fabric. The sailmaker sews from right to left, using an inverted thimble held in a leather palm and a special three-sided sail needle. The cloths are prevented from slipping off the sailmaker's lap by a bench hook attached to the right side of his bench. The size of the sail needle depends on the weight of the material and the type of sewing. For the usual flat stitch. 10 to 12 stitches are taken within the distance corresponding to the length of the needle. (7) After all the cloths are sewn together, patches are attached to the corners and tabling (hems on the edges) is sewn on the luff (forward edge) and the foot—the places where the greatest strain develops. (8) The finishing touches are next applied. The luff rope is sewn inside the leading edge of the sail to prevent the sail from stretching out of shape. Strong ropes (boltropes) are sewn to the luff and foot, and various fittings, such as metal slides, grommets, reef points, cringles, etc., are attached to the sail.

Some Types of Sails.—The two major categories of sails are square sails and fore-and-aft sails. The first type is generally set in a position across the longitudinal axis of the ship; the second type of sails are set along this axis. Square sails drive the craft forward by the pressure of the wind on the afterside of the sail only; with fore-and-aft sails both sides may be used for forward propulsion. (See Figs. 1, 2 and 3.)

Sails are divided further into groups of primary and secondary sails. Primary sails are those that supply the chief propelling

force in ordinary weather; secondary sails are those that aid the primary sails either by helping to balance the ship or by providing additional driving power. There are six classes of primary sails: square sails, gaff sails, jib-headed sails (Bermuda or Marconi), spritsails. lugsails and lateen sails. Secondary sails are variations of these basic types.

Many sailing vessels also group their sails as follows: cruising sails for ordinary weather, summer sails for tropical weather, storm sails for extremely heavy weather and racing sails.

The name of a sail is frequently derived from the name of the piece of rigging on which it is set, or from its location mith reference to a near-by piece of gear. Thus the main topgallant sail hangs from the topgallant yard of the main mast (fig. 2), the jib topsail stands above the other jibs and so on.

Masts.—Many sails are named with reference to the nearest mast, therefore the names of the masts and their location are important. Siarting at the bow in a two-masted vessel the masts are termed the foremast and the mainmast; when the after mast is considerably smaller they are named the mainmast and the mizzenmast.

In all three-masted vessels the names of the masts are foremast, mainmast and mizzenmast.

Square-rigged vessels (those that have t o or more masts rigged with square sails) having four or five masts usually refer to the last mast as the spanker mast, unless it is considerably smaller than the others, when it is named the jigger mast. There is no fixed rule regarding the names of the masts of square-rigged vessels having five or more masts, though the terms foreward mainmast, after mainmast and middlemast are used. With sails fore-and-aft on vessels having four masts the mast names are: fore, main. mizzen, jigger and spanker.

One authority gives the following names for the masts of a six-masted, fore-and-aft vessel: fore, main: mizzen, jigger, spanker and pusher or driver. For the "Thomas W. Lawson"—the only seven-masted vessel ever built—the mast names are given as fore, main, mizzen, jigger, spanker, pusher and driver. Other authorities state that the seven masts were named for the days in the week. but that this method was later abandoned in favour of numbering from one to seven.

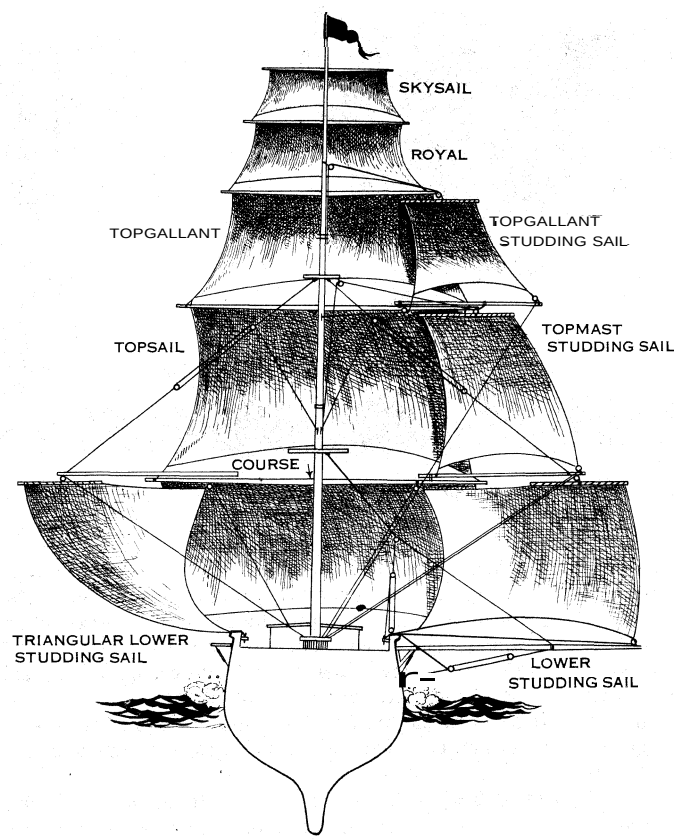


FIG. 2.— SQUARESAILS
Studding sails are shown with their rigging, seen astern

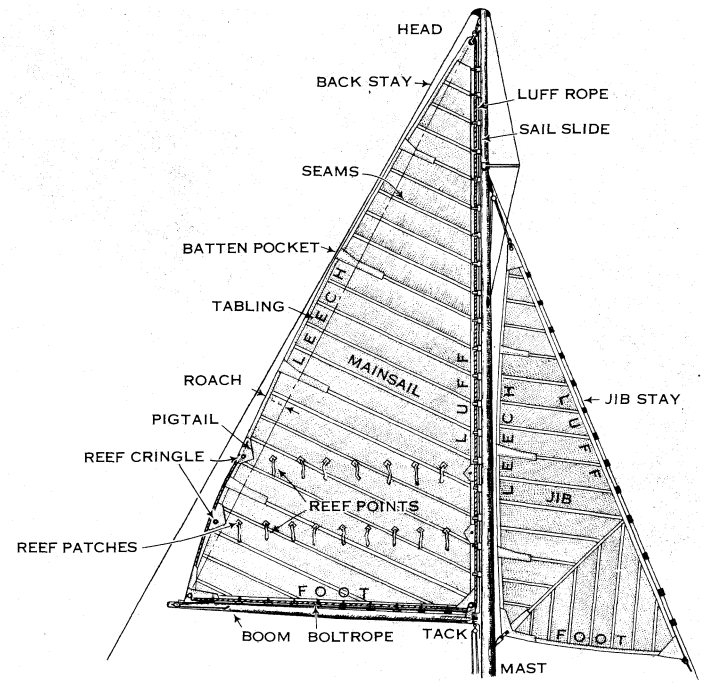


FIG. 3.— PARTSOF MAINSAIL AND WORKING JIB

The names and locations of the working sails of a full-rigged ship are illustrated in the article on RIGGING.

See also SHIP.

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SAINFOIN (*Onobrychis viciaefolia)* is a low-growing perennial plant of the pea family (Leguminosae), mith a woody rootstock. whence proceed the stems, which are covered with fine hairs and bear numerous long pinnate leaves, the segments of which are elliptic.

The flowers are borne in close pyramidal or cylindrical clusters on the end of long stalks. Each flower is about half an inch in length with lanceolate calyx teeth shorter than the corolla, which is pink, with darker stripes of the same colour. The pods or legumes are flattened, wrinkled, somewhat sickle shaped and crested, and contain a single olive-brown seed. It is sparingly naturalized in the eastern Cnited States.

In Great Britain the plant is a native of the calcareous districts of the southern counties. It is native through central Europe and Siberia.

SAINT, a term applied in the Old Testament to any Israelite as one of the chosen people of God. In the New Testament it was used of any member of the Christian churches; for example, St. Paul addresses his letter to the Philippians "To all the saints in Christ Jesus who are at Philippi." It was not until about the 6th century that the word became a title of honour specially given to the dead whose cult was publicly celebrated in the churches: and it is in this sense that the term is understood in this article.

The cult of the saints in the public worship of the Christian church began with the primitive church practice of paying honour to those who willingly endured death at the hands of persecutors rather than deny the Christian faith; *i.e.,* martyrs. The title of martyr at first was bestowed generally on those who distinguished themselves as witnesses for Christ, then the term mas given to those who suffered for Christ, and, in the latter half of the 3rd century, it was restricted to those witnesses who endured death in loyalty to Christ. (*See* MARTYRS. EARLY CHRISTIAN.)

After that of St. Stephen. the earliest and most complete ex-

tant account of a martyrdom is the *Martyrium Polycarpi,* the Smyrna congregation's account of the martyrdom of St. Polycarp (d. *c.* 155). important because it contains the first-known reference to an annual festival of a martyr. In the letter it is stated that a martyr's passion and death are considered as analogous to the passion and death of Christ.

Veneration of martyrs took place first at the place of their torments and burial; from thence it often spread to other localities, and even became world-wide as the church grew. The power of deciding true martyrdom and of granting consequent permission to worship in any particular case belonged originally to the bishop of the area where the martyr gave witness to Christ. The bishop made an investigation of a reported martyrdom, inquiring into the motive of death; and after concluding that the person had died a true martyr for the faith, the bishop permitted his cult and sent the name of the person with an account of the martyrdom to other churches, in order that, with approval of the respective bishops, the worship of the martyr might be carried on in those churches also.

This geographical restriction of cult is evident from exploration of ancient Christian cemeteries in which are found paintings only of martyrs who suffered in the region near the cemetery. At the same time, the practice of notifying other churches explains the rapid and almost universal veneration of certain martyrs, for example St. Lawrence (d. 258) or St. Cyprian of Carthage (d. 258).

At the centre of veneration of the martyrs was the eucharist, celebrated in an atmosphere of triumph. Often it took place over the tomb of the martyr. Hence, there arose the practice of constructing altars like graves and of providing them with relics. The first churches were dedicated to the martyrs. The word *martyrium,* designating first a church built over the grave of a martyr, later was used for churches in general, even for those churches not dedicated to martyr saints. Even today the relics of the saints that are sealed into every altar stone or antimension (in the Eastern Church, a silk or linen cloth used as a portable altar or as covering for the true altar) must include relics of at least one martyr. The martyr's body was guarded with great care in the beginning, but translation of the remains and severing of the body for relics later came into practice as Greek innovations.

Taking the name of a martyr, as an act of reverence, was another custom that arose and soon became established. St. Dionysius of Alexander (d. 265) relates, for example, that two favourite names in his time were Peter and Paul.

Veneration paid to the martyrs was not given to others—not even to the Blessed Virgin Mary—until later. Thus, veneration of the confessor saints, as they are called *(see* CONFESSOR), is not so ancient as cult of the martyrs. The term confessor was given originally to those who confessed Christ when questioned in the presence of enemies of the faith, thus exposing themselves to danger and suffering, but did not endure martyrdom. After the early Christian period the word took on another meaning, being applied to anyone who had led a life of heroic virtue and had died a holy death in peace. This is the meaning of confessor as understood here; and, according to common opinion, confessors so understood first received public ecclesiastical honour some time in the 4th century. In the east, for example, Hilarius and Ephraem, and in the west St. Martin of Tours and St. Hilary of Poitiers, were venerated in the 4th century. The first persons to be considered confessors were the ascetics, perhaps due to the fact that they were seen to resemble the martyrs by their acts of self-denial and their lives of heroic virtue.

Worship of confessor saints grew and expanded according to time and place. Nevertheless, cult of neither martyr saints nor confessor saints was ever lawful unless carried on with ecclesiastical permission, despite the fact that in both cases it was dependent primarily on the consciousness of the faithful as a whole.

Roman Catholic Church.—Throughout the 1st millennium of the Christian era bishops on their own authority could allow public veneration of martyrs or confessors for determined localities. (In certain areas, however, it was a prerogative of the primates and patriarchs.) This was carried on even beyond the 12th century, as is evidenced by the fact that in 1215 Peter of Trevi was canonized by the bishop of Anagni. According to the present discipline in the Roman Catholic Church, however, canonization is beyond the power of a bishop, and it is a procedure distinct from that of beatification, a stage prior to canonization. Canonization, as taught today, is a solemn declaration by the pope that a person has attained the beatific vision and that veneration of the person as a saint is imposed on the entire church. In this judgment, according to the common doctrine, the Roman pontiff is infallible.

Beatification—the declaration that a person is blessed—on the other hand, is not an infallible judgment, and it grants only restricted authorization to venerate. Beatification, thus, implies a permission, while canonization connotes a precept that is universal. The medieval centuries had no such distinct procedures. The titles *beatus* and *sanctus,* technically different in meaning and application in the Roman Catholic Church today, were used with no distinction in the middle ages.

The history of the development of law concerning canonization and beatification, and the procedures laid down in the Code of Canon Law, are described in the article CANONIZATION.

Dogmatically the veneration of saints in the Roman Catholic Church can be understood only in the light of the dogma of the unique mediatorship of Jesus Christ (I Tim. ii, 5). Jesus Christ alone, according to Roman Catholic teaching, redeemed men by His death on the cross. Furthermore, no divine gift can come to man except through man's Redeemer. Hence, all the prayers of those on earth and of the saints in heaven are efficacious only through Christ.

The saints, who are specially pleasing to God, join their prayers to the prayers of those who invoke them, and their aid to men is through the merits of Christ, man's Redeemer and one Mediator. The Council of Trent states it thus:

> The saints, reigning together with Christ, pray to God for men. It is a good and useful thing to invoke the saints humbly and to have recourse to their prayers and to their efficacious help to obtain favors from God through His Son Jesus Christ, Our Lord, who alone is our Redeemer and Savior.

Intercession of the saints was unanimously taught by the early Fathers. For example, St. Cyril of Jerusalem, in his *Catecheses,* says:

> We then commemorate those who have fallen asleep before us, patriarchs, prophets, Apostles, and martyrs, in order that God, by their prayers and intercessions, may receive our petitions.

St. Jerome, in his work against Vigilantius, writes:

> If apostles and martyrs, while still in the flesh and still needing to care for themselves, can pray for others, how much more will they pray for others after they have won their crowns, their victories, their triumphs.

And against the Manichaean Faustus, St. Augustine of Hippo states:

> Faustus blames us for honoring the memory of the martyrs, as if this were idolatry. The accusation is not worthy of a reply. Christians celebrate the memory of the martyrs with religious ceremony in order to arouse emulation and in order that they may be associated with their merits and helped by their prayers.

From the second Council of Nicaea (787) came the theological terms *dulia* and *latria* to indicate a distinction between the worship paid the saints and that paid to God. The two terms correspond, more or less, with the English words veneration and adoration. *Latria* is the worship reserved to God alone and *dulia* is worship given to the saints.

Another term, *hyperdulia,* was composed in the middle ages as a technical theological word to designate the special worship paid to the Blessed Virgin Mary because of her special gifts and holiness bestowed on her by God.

Closely connected with veneration of the saints in the Roman Catholic Church is the cult that is paid to the relics and images of saints, a worship that is referred to the holy person whom the image represents or to whom the relic belonged by contact. St. Thomas Aquinas, in the *Summa Theologica,* states briefly the principle underlying this veneration of relics and images:

> It is manifest that we should show honor to the saints of God as being members of Christ, the children and friends of God and our

intercessors. Wherefore in memory of them we ought to honor every relic of theirs in a fitting manner: principally their bodies which were temples and organs of the Holy Ghost dwelling and operating in them, and as destined to be likened to the body of Christ by the glory of the Resurrection. Hence God himself fittingly honors such relics by working miracles at their presence.

Orthodox Eastern Church. — Veneration of the saints is also a practice in the Orthodox Eastern Church, the liturgy of which takes account of the feasts of the saints throughout the year and establishes the manner of celebrating the feasts. Moreover, the Orthodox venerate images of the saints, called icons, and they show reverence to the relics of saints; the latter are placed in the antimension, as in the Roman Catholic Church they are placed in the altar stone.

The teaching of the Eastern Church concerning the state of those who have passed out of this world is different from that of the Roman Catholic Church. Though the Orthodox pray for their dead and offer prayers to the saints, the church teaches that all the dead are asleep, awaiting the coming of the Day of Judgment, when the good will receive their reward of heaven and the wicked will be judged deserving of hell. The saints too appear to be in this middle state, although they are invoked. In fact, prayers to the'saints play as large a part in Orthodox as in Roman Catholic devotions, and stories of miraculous apparitions of the Blessed Virgin Mary and of the saints are equally numerous.

The process of canonization in the Orthodox Eastern Church is less juridical than that in the Roman Catholic Church *(see* CANONIZATION).

The Menaion, a liturgical work of 12 volumes (one for each month) contains the proper of the immovable feasts of Christ and the saints, corresponding to the *Proprium Sanctorum* of the Roman Catholic breviary *(see* BREVIARY). For each day, it includes a *synaxarion,* a short narrative of the life of a saint or exposition of a feast, taken from the menology (a liturgical book containing the lives of the saints, arranged by months) and read after the sixth ode of the canon for the day.

The Eastern Church also celebrates the Feast of All Saints, on the Sunday after Pentecost. In the churches representations of the saints are found on the iconostasis (the screen separating the sanctuary from the nave); in private homes icons are used.

The saint that occupies the first place of honour among the Orthodox, after the Blessed Virgin, is St. John the Baptist, venerated as the precursor of Our Lord. Greatly beloved, and particularly so in the Russian Church, is St. Nicholas, the saint who helps those in need. The protector of trade, virginity and the family is St. Paraskeva. Among the modern saints is the Russian St. Serafim Sarovskij (canonized in 1903), who is held in special honour.

Anglican Communion. — Teaching in regard to worship and invocation of saints is one of the distinguishing differences between the Roman Catholic Church and the churches of the Reformation. According to Protestant doctrine, worship of the saints tends to detract from the position of Christ himself. Though the churches of the Reformation do not teach the nonexistence of saints, they maintain that to pray to the saints and to ask their intercession is to contradict the commands of our Lord when he taught us how to pray directly to the Father. The saints should be considered ideal examples of the faith, but men ought not to invoke their intercession by name.

The Anglican Church, like other churches of the Reformation, rejects doctrinally the worship and invocation of the saints. Its teaching and faith are contained in the Thirty-Nine Articles drawn up under Queen Elizabeth I in 1562 and amplified by the Book of Common Prayer. Article xxii states:

> The Romish doctrine concerning purgatory, pardons, worshipping and adoration, as well of images as of relics, and also invocation of saints, is a fond thing, vainly invented, and grounded upon no warranty of Scripture, but rather repugnant to the Word of God.

Nevertheless, Anglican doctrine allows the *veneration* of the saints provided veneration does not become worship or invocation. On the one hand, there is no solid reason for stating that the departed saints cannot hear our prayers, if no solid reason for stating that they can: hence a private practice of addressing them cannot be condemned. It cannot be known whether or not they know individual men on earth, for there is no revelation or other knowledge on this matter. Thus, honour can be given to the saints. and Anglicans pray that they may "follow the blessed saints in all virtuous and godly living."

Under the influence of the Oxford movement, veneration of saints was revived in the Church of England. Nor are the Thirty-Nine Articles considered representative of the ritual and doctrinal position of the Protestant Episcopal Church in America, despite the fact that they are included in the American Book of Common Prayer.

In the Episcopal Church some teach that the saints do intercede for men; moreover, the saints bear witness to man's efforts to serve God on earth, and they aid men by their prayers.

Patron Saints. — During the middle ages the practice arose of bestowing on a saint honour for possessing definite attributes and then of considering the saint as an intercessor with special power regarding particular human needs. Thus, the saints became. in time, special patrons even of countries, cities and vocational groups. This practice of patron saints has continued up to the present day.

A group of 14 saints, the auxiliary saints or holy helpers, are venerated for the efficacy of their prayers on behalf of human necessities. They are: St. George (April 23); St. Blaise (Feb. 3); St. Erasmus (June 2); St. Pantaleon (July 27); St. Vitus (June 15); St. Christopher (July 25); St. Denis (Oct. 9); St. Cyriacus (Aug. 8); St. Acacius (May 8); St. Eustace (Sept. 20); St. Giles (Sept. 1); St. Margaret (July 20); St. Barbara (Dec. 4); and St. Catherine of Alexandria (Nov. 25).

In addition to the auxiliary saints, there are many others who are invoked for special needs, among them St. Peregrinus Laziosi (May 1), cancer patients; St. Dympna (May 15), the mentally ill; St. Anne (July 26), women in labour; St. Ottilia (Dec. 13), the blind; St. Roch (Aug. 16), invalids.

Patron saints exist also for various occupations: St. George (April 23), farmers; St. Florian (May 4), firemen; St. Andrew (Nov. 30), fishermen; St. Apollonia (Feb. 9), dentists; St. Ferdinand III (May 30), engineers; St. Francis de Sales (Jan. 29), journalists; St. Thomas More (July 9), lawyers; St. Albert (Nov. 15), scientists; St. Barbara (Dec. 4), miners; St. Luke (Oct. 18), physicians; St. Michael (Sept. 29), policemen; St. John Baptist de la Salle (May 15), teachers.

Most nations also have one or more patron saints, examples being: the Immaculate Conception (Dec. 8), United States; St. George (April 23), England; St. Boniface (June 5), Germany; St. James (July 25), Chile; Our Lady of Lujan (May 3), Argentina; St. Patrick (March 17), Ireland; St. Francis of Assisi (Oct. 4), Italy; St. Joseph (March 19), Canada; St. Lawrence (Aug. 10), Ceylon; Our Lady of Guadalupe (Dec. 12), Mexico.

The literature dealing with the lives and legends of the saints is discussed in the article HAGIOLOGY. The great collection known as the *Acta Sanctorum* is dealt with in BOLLANDISTS.

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(W. T. EL.)

ST. ALBANS, CHARLES BEAUCLERK, 1ST DUKE OF, created 1684 (1670–1726), a natural son of Charles II by Nell Gwynne was born in London on May 8, 1670. Charles was made Baron Hedington and earl of Burford in Dec. 1676. He took service with the emperor Leopold I, being present at the siege of Belgrade in 1688. After the battle of Landen in 1693, William III made him captain of the gentlemen pensioners, and four

years later gentleman of the bedchamber. His Whig sentiments prevented his advancement under Anne, but he was restored to favour at the accession of George I. He died at Bath on May 10. 1726.

Charles' wife Diana, daughter and heiress of Aubrey de Vere, last earl of Oxford, was a well-known beauty, who became lady of the bedchamber to Caroline, princess of Wales, and survived until Jan. 15, 1742.

ST. ALBANS, HENRY JERMYN, EARL OF **(c.** 1604–1684), son of Sir Thomas Jermyn of Rushbroke, Suffolk, was vice chamberlain and then master of the horse to Queen Henrietta Maria. He accompanied Henrietta Maria in 1644 to France, where he continued to act as her secretary. In the same year he was made governor of Jersey, and conceived the idea of ceding the Channel Islands to France as the price of French aid to Charles against the parliament. When Charles. II. went to Breda, Jermyn remained in Paris with Henrietta Maria, who persuaded her son to create him earl of St. Albans in 1660. Gossip even asserted a secret marriage between the queen and Jermyn. At the Restoration St. Albans received various appointments, and he contributed to the close secret understanding between Charles II. and Louis XIV., taking part in the preliminaries of the Treaty of Dover in 1669. In 1664 he obtained a grant of land in London near St. James's Palace, where Jermyn street preserves the memory of his name, and where he built the St. Albans' market on a site afterwards cleared for the construction of Regent street and Waterloo place. The earl, who was a friend and patron of Abraham Cowley, died in January 1684.

ST. ALBANS, a cathedral city, market town and municipal borough in the St. Albans parliamentary division of Hertfordshire, Eng.. 19 mi. N.N.W. of Marble arch. London. by road. centred on the junction of Watling street with the road from London via Barnet to the midlands. Pop. (1951) 44.098. Area 8.0 sq.mi. The diocese of St. Xlbans covers Hertfordshire and Bedfordshire.

The city is named after the first English martyr, St. Xlban, and the Abbey church (cathedral) stands on the hill which is the traditional site of the martyrdom, *c.* A.D. 303. The present church, built after the Conquest by Paul de Caen (1077) of Roman bricks from the ruins of nearby Verulamium (*q.v.*), succeeded the Saxon church of the monastery founded by Otia of Mercia, about 793, on the site of a still earlier church. The most famous Saxon abbot was Ulsinus who, in 948, founded three churches. St. Stephen's, St. Michael's and St. Peter's. planned and laid out the town, and founded the market which is still held. The school (not a monastic school) was already flourishing by 1100, and an early headmaster was Alexander Neckam (*q.v.*), foster brother of Richard I. Nicholas Breakspear, afterward Pope Adrian IV, was the son of an abbey tenant. The church was reconsecrated in 1116. Of this church, the tower, the transepts and the east end of the nave remain. The west front and part of the nave were pulled down for rebuilding by John de Cella (1195–1214), but his money was exhausted and the work was completed by his successor, William de Trumpington, in Early English style. During the second half of the 13th century, the Lady chapel and the sanctuary were built, but in 1323, five Norman pillars on the south side of the nave, the roof of the south aisle and part of the cloisters collapsed. This part of the abbey was repaired in Decorated style. The high altar screen was completed in 1484 by William Wallingford, though it was probably commenced by John Wheathampstead or Bostock, friend of Humphrey, duke of Gloucester, who is buried in the abbey. After the Dissolution, the school was housed in the Lady chapel. and remained there until a jail was built in St. Albans. and the prisoners transferred from the Great gateway, which had been used as the town jail. The school took over this building in 1871 and it still remains part of the premises. By the 19th century, the abbey was in urgent need of restoration, and this was carried out, first by Sir George Gilbert Scott, and then a more extensive reconstruction was financed by Lord Grimthorpe. His alterations have been much criticized, but they made the structure safe. The extreme length of the abbey is 550 ft., while the nave, 292 ft., is the longest Gothic nave in Christendom.

The abbey played a large part in English history. As their power greu, the abbots obtained the right to destroy the Saxon royal borough of Kingsbury. on a neighbouring hilltop, and it finally disappeared in the reign of Stephen. The constant visits of kings and nobles, English and foreign, led to the development of a famous school of history, in charge, first, of Roger of Wendover, and later, of Matthew Paris. In 1213, the first draft of Magna Carta was read to an assembly of clergy and nobles in the abbey by Archbishop Stephen Langton. Later the town was occupied by troops of the dauphin. After the battle of Poitiers, the captured King John of France was held in the abbey as a prisoner until his ransom was paid. In the time of the Peasants' revolt, 1381, the Great gate of the monastery was stormed by the townsfolk. and Abbot Thomas de la Mare was forced to grant a charter, which was later revoked when the revolt collapsed. John Ball, the famous preacher, was executed at St Albans. The clock tower, a town belfry almost unique in England, was built between 1402 and 1411, but the bell is older.

During the Wars of the Roses, two battles were fought at St. Albans. In 1455, the Lancastrians were defeated by the earl of Warwick. the duke of Somerset was killed and Henry VI captured. In 1461, Queen Margaret defeated Warwick, set Henry free and allowed her soldiers to sack the town.

Like other abbeys, St. Albans declined in wealth and importance during the late 15th and early 16th centuries. Cardinal Thomas Wolsey was for a time abbot but never visited the abbey. It was dissolved in 1539 and St. Albans became a borough, its first charter being dated 1553. The Gorhambury lands of the abbey came eventually into the possession of Sir Nicholas Bacon, lord keeper to Elizabeth I, who visited him there several times. His son, Sir Francis Bacon, Baron Verulam, is commemorated by a statue in St Michael's church, which is within the site of Verulam and contains much ancient work. During the Civil War, the town was the headquarters of the army of the earl of Essex.

Sarah Jennings, later duchess of Marlborough, was baptized in the abbey and spent many years, both as a girl and with her husband, John Churchill, at her family home in St. Albans, founding some still existing almshouses. In the 18th century the town became notorious for bribery and corruption at parliamentary elections, and in 1852 the separate borough representation was abolished. The diocese was formed in 1877 and St. Albans became a cathedral city.

Many old buildings are to be seen in the streets, though many others have been pulled down or altered in the 20th century. The most important industry is printing. One of the earliest printing presses was set up in the town by the "Scolemaster Printer," and operated from about 1479 to 1486. One of his books, *The* Book of *St. Albans,* contains the first example of colour printing in England. Other local trades are horticulture (seeds and orchids), musical instruments, clothing, electrical apparatus, chronometer making and a large variety of other light industries.

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ST. ALDWYN, MICHAEL EDWARD HICKS BEACH, 1st Earl (1837–1916), English statesman, who served twice as chancellor of the exchequer. The son of Sir Michael Hicks Beach, 8th bart., whom he succeeded in 1854, he was born in London on Oct. 23, 1837, and was educated at Eton and Christ Church, Oxford.

St. Aldwyn entered parliament as Conservative M.P. for East Gloucestershire in 1864, and was made chief secretary for Ireland in 1874 and a member of the cabinet in 1877. From 1878 to 1880 he was colonial secretary. In 1885 he was elected for West Bristol, and became chancellor of the exchequer and leader of the house of commons. After W. E. Gladstone's brief Home Rule ministry in 1886 he entered Lord Salisbury's next cabinet as Irish secretary, making way for Lord Randolph Churchill as leader of the

house and chancellor of the exchequer; but bad eyesight compelled him to resign in 1887 and meanwhile George Goschen replaced Lord Randolph as chancellor of the exchequer. From 1888 to 1892 Hicks Beach returned to active work as president of the board of trade, and in 1895 he again became chancellor of the exchequer. In 1899 he lowered the fixed charge for the national debt from £25,000,000 to £23,000,000—a reduction imperatively required, apart from other reasons. by the difficulties found in redeeming consols at their then inflated price. When compelled to find means for financing the war in South Africa, he insisted on combining the raising of loans with the imposition of fresh taxation; and besides raising the income tax each year, up to *1s. 3d.* in 1902, he introduced taxes on sugar and exported coal (1901), and in 1902 proposed the reimposition of the registration duty on corn and flour which had been abolished in 1869 by Robert Lowe. On Lord Salisbury's retirement in 1902 Hicks Beach also left the government. He accepted the chairmanship of the Royal Commission on Ritualistic Practices in the Church, and he did valuable work as an arbitrator. A firm advocate of free trade, he did much by his campaign against Joseph Chamberlain's protectionist program to prevent A. J. Balfour from committing his party to protection.

He was raised to the peerage as Viscount St. Aldwyn in 1906 and mas created an earl in 1911. He died in London on April 30, 1916.

SAINT-AMANT, MARC ANTOINE DE GERARD, SIEUR DE (1594–1661), French poet, was born near Rouen in the year 1594, the son of a merchant. He obtained a patent of nobility, and attached himself to different great noblemen—the duc de Retz and the comte d'Harcourt among others. He saw military service and sojourned at different times in Italy. in England —a sojourn which provoked from him a violent poetical attack on the country, *Albion* (1643)—in Poland, where he held a court appointment for two years, and elsewhere. Saint-Amant's later years were spent in France; and he died at Paris on Dec. 29, 1661. Saint-Amant has left a not inconsiderable body of poetry. His *Albion* and Rome ridicule set the fashion of the burlesque poem, a form in which he was excelled by his follower Paul Scarron.

In his later years he devoted himself to serious subjects and produced an epic. *Moïse sauvé* (1653). His best work consists of Bacchanalian songs. his *Débauche* being one of the most remarkable convivial poems of its kind.

The standard edition is that in the *Bibliothèque Elzévirienne,* by M. C. L. Livet, 2 vol. (1855).

ST. ANDREWS, a city, royal burgh, university town and seaport of Fifeshire. Scot. Pop. (1951) 9.457. It is on a bay of the North sea, 13 mi. S.E. of Dundee by road and ferry. It occupies a plateau of sandstone rock about 50 ft. high, breaking off on the north in precipitous cliffs. The Eden enters St. Andrews bay northwest of the golf links, which rank among the finest in the world.

St. Andrews originated in a Celtic ecclesiastical settlement that may have been first formed by St. Kenneth in the 6th century. In the 8th century a new church was built by Angus MacFergus, king of the Picts, and dedicated to St. Andrew, who was adopted as the patron saint of the Pictish and thereafter of the Scottish nation. Relics of the saint were brought there and acquired such celebrity that the place. first called Mucross ("the headland of the wild boar") and then Kilrymont ("the cell of the king's mount"), came to be known as St. Andrews. About 908 the bishop of the Scots transferred his seat there from Dunkeld. In the early 12th century the bishopric of St. Andrews was regarded as the most important in the kingdom and was in due course raised to the dignity of an archbishopric in 1472 when its holder was recognized as primate of Scotland.

The mediaeval cathedral and priory of St. Andrews began with a foundation of Augustinian canons established between 1127 and 1144 by Bishop Robert in association with the so-called church of St. Regulus that still survives. In 1160 a larger cathedral and priory church was begun by Bishop Arnold and eventually consecrated in 1318. Built partly in the Norman arid partly in the early Gothic style it was considerably the largest church in Scotland with an internal length of 3j7 it. The cathedral and priory were enclosed by an elaborate precinct wall. In addition to the Augustinian~St. Andrews in the middle ages contained communities of Dominicans (c. 127j) and Observantine Franciscans (c. 1450). The bishops and archbishops resided in a formidable castle founded on a rocky headland to the northwest of the cathedral in about 1200 by Bishop Roger. An organized municipality or burgh was founded by Bishop Robert about 1140.

St. Andrews was granted most of the privileges of a royal burgh by King Malcolm IV about 1160 and grew into one of the largest towns in mediaeval Scotland. The parish church of the Holy Trinity was rebuilt to a commensurate scale on a central site in 1410 by Bishop Wardlaw.

As the ecclesiastical capital of the country. St. Andrews was the centre of many of the most critical episodes in the Scottish Reformation. After the triumph of the Reformers in 1j60 the cathedral and priory were abandoned and fell into ruins but the town remained a place of considerable importance until the close of the 17th century. In the 18th century it underwent a serious decline from which it was rescued mainly through the activity of Sir Hugh Lyon Playfair, provost from 1840 to 1861. Already well-known as a golfing centre, especially since the foundation of the Royal and Ancient club in 1754, St. Andrews acquired the favourable reputation as a holiday resort which it still retains. During the 20th century it consolidated its position as an educational centre and as the commercial and administrative focus of the adjoining region of Fife. St. Andrews is the seat of a presbytery of the Church of Scotland and gives its name to a bishopric of the Scottish Episcopal church (but combined with Dunkeld and Dunblane and with its seat at Perth) and to an archbishopric of the Roman Catholic church (but combined with Edinburgh and with its seat in the latter city).

Of the buildings of the mediaeval city comparatively little remains. The cathedral largely vanished apart from the east and west gables and part of the south wall, but the priory precinct wall was preserved throughout practically its entire length. Also to be seen are the north transept (1525) of the Dominican church and a great part of the castle. Holy Trinity church, after undergoing considerable alteration in 1799, was well restored in 1907–09 and is one of the most impressive churches in Scotland. The town is notable for its wide and handsome streets and retains many interesting domestic buildings of the 16th and 17th centuries and the fine gateway of the West Port (1589).

The university of St. Andrews. the oldest in Scotland. owed its origin to a society of scholars formed in 1410. A charter of incorporation was issued in 1412 by Bishop Henry Wardlaw and in 1413 the full privileges of a university were conferred by the antipope Benedict XIII. The first buildings consisted of a "College and Chapel of St. John" appropriated to the use of the university in 1419 and in 1430 associated with a "Pedagogy" on an adjacent site. In 1450 St. Salvator's college was founded and richly endowed by Bishop Kennedy. In 1512 St. Leonard's college was estahlished and between 1537 and 1554 the early Pedagogy was erected into St. Mary's college. Following the Reformation, in 1579, St. Mary's college was assigned to the study of theology and in 1747 the other two colleges were combined as the United College of St. Salvator and St. Leonard. University college, Dundee, founded in 1881, was in 1897 affiliated to the University of St. Andrews and in 1954 (following the act of 1953) joined with the University Advanced Medical school (1898) and Dental school (1914) as a constituent college of the university entitled Queen's college.

In 1892 women were admitted to all courses of instruction in the university.

The buildings of the university include the splendid tower and church of St. Salvator's college. the church of St. Leonard's college, and the courtyard of St. Mary's college, all of which date from the middle ages. The University library, which was refounded by King James VI in 1612, is partly housed in the original building. within which the Scottish parliament met in 164j. The library contains over 400.000 printed books. some of great rarity, and important collections of manuscripts. The university expanded greatly during the 20th century and by the latter 1950s included some 2,000 students. of whom approximately 1.200 pur-

sued their studies in St. Andrews itself and the remainder in Dundee.

SAINT ARNAUD, JACQUES LEROY DE (1801–1854), marshal of France, was born at Paris on Aug. 20, 1801. He entered the army in 1817, retired from the service in 1827 and re-entered it at 30 as a sublieutenant. He took part in the suppression of the Vendée *kmeute,* and was for a time on General (Marshal) Bugeaud's staff. But his debts and the scandals of his private life compelled him to go to Algeria as a captain in the foreign legion.

In 1848 he was placed at the head of a brigade during the revolution in Paris. On his return to Africa, it is said because Louis Napoleon considered him suitable to be the military head of a coup d'état, an expedition was made into Little Kabylia, in which St. Arnaud provided his superiors with the pretext for bringing him home as a general of division (July 1851). He succeeded Marshal Magnan as minister of war and superintended the military operations of the coup d'ktat of Dec. 2, 1851, which placed Napoleon III on the throne. A year later he was made marshal of France and a senator, remaining at the head of the war office till 1854, when he set out to command the French in the Crimea, his British colleague being Lord Raglan.

Saint Arnaud died on board ship on Sept. 29, 1854, shortly after commanding at the battle of the Alma. His body was conveyed to France and buried in the Invalides.

See ***Lettres du Maréchal de Saint Arnaud*** (1855; 2nd ed. with memoir by Sainte-Beuve, 1858).

ST. ASAPH, a cathedral village-city of Flintshire, north Wales, on the Chester-Holyhead trunk road, and 15 mi. W. of Flint by road. Pop. (1951) 9,860. Its Welsh name, Llanelwy, is derived from the Elwy, between which river and the Clwyd it stands. Asaph, to whom the cathedral (the smallest in Great Britain, excluding converted parish churches) is dedicated, was bishop there in the 6th century. The small, irregularly built town also has a parish church, remains of a Perpendicular chapel near Ffynnon Fair (St. Mary's Well) and almshouses founded in 1678 by Bishop Isaac Barrow. The hill on which St. Asaph stands is Bryn Paulin, with early associations. The early cathedral, of wood, was burned by the English in 1247 and 1282, and that built by Bishop Anian in the 13th century (Decorated) was mostly destroyed during the raids of Owen Glendower (*c.* 1402). Bishop Richard Redman's building (c. 1480) was completed by the erection of the choir about 1770. Further restoration took place in the 19th century. The church is plain, cruciform, chiefly Decorated but partly Early English, with a square tower; it has a library of nearly 2,000 volumes, some of which are rare and which include the Welsh translation of the Bible by Bishop William Morgan, who is buried in the cathedral. In 1920 the bishop of St. Asaph was enthroned in his cathedral as the first archbishop of the disestablished Church in Wales.

SAINT AUGUSTINE, a city of Florida. U.S., the oldest city in the U.S., and the seat of St. Johns county, is in the northeastern part of the state 75 mi. S. of the Georgia border, on the Intracoastal waterway. It is connected with Anastasia Island on the Atlantic ocean by the Bridge of Lions across Matanzas river and is served by the Florida East Coast railway, which also has its headquarters and shops there.

In 1564 France established Fort Caroline near the mouth of the St. Johns river. A year later, in order to defend and maintain Spanish sovereignty over Florida, Adm. Pedro Menéndez de Avilés destroyed the French colony and founded St. Augustine. Throughout the following 256 years it was the northernmost outpost of the Spanish colonial empire except for 20 years, 1763–83, when Florida belonged to England.

Since 1821 it has been a part of the United States. A plaza, narrow streets, stucco houses, balconies, patios and gates from the wall that once protected the town are evidences of its heritage. A symbol of Spanish power is the grim and massive Castillo de San Marcos, a rectangular bastioned fortress with walls 30 ft. high and from 9 to 12 ft. thick, surrounded by a moat 40 ft. wide.

St. Augustine was plundered by Sir Francis Drake and besieged by James Oglethorpe; it became a refuge for Loyalists during the American Revolution and during the Indian wars provided a prison for captured Seminoles, including Osceola. The Federals occupied it the last three years of the American Civil War.

In the 1880s Henry M. Flagler, an oil magnate, became interested in developing the east coast of Florida as a resort area. Among the notable structures he erected in St. Augustine were the luxury hotel Ponce de Leon, and the Memorial Presbyterian church. Both were designed by the architects John M. Carrère and Thomas Hastings.

St. Augustine is the site of a Roman Catholic cathedral and of the oldest Episcopal church in the state. The city has had a council-manager form of government in effect since 1915. There are numerous shrines and museums. The economy is based on tourism, commercial fishing and some industry.

For comparative population figures *see* table in FLORIDA: Population. (A. J. H.)

ST. AUSTELL, a market town and urban district in the Truro parliamentary division of Cornwall, Eng., 11½ mi. S.S.W. of Bodmin by road. Pop. (1951) 23,655. Area 28.7 sq.mi. To the north, the high ground on which St. Austell stands culminates in Hensbarrow Downs (1,034 ft.). The town is the centre of the china clay (kaolin) district, and many people are employed in the industry, exports being made to the Potteries and Lancashire and abroad; huge white spoil heaps abound.

Nearby is Menacuddle well, a good example of an Early English baptistery. The harbours of Mevagissey, Par and Charlestown are in the district.

ST. BARTHOLOMEW (ST. BARTHELEMY), French West Indian island, 17" 55' N. and 63° 60' W., about 130 mi. N.W. of Guadeloupe, of which it is a dependency. The horns of an irregular crescent enclose the bay of St. Jean, pointing north; the surface culminates in a central limestone hill 1,003 ft. high. It is 10 sq.mi. in area, and timberless. Gustavia, on the southwest coast has a small but safe harbour. Lorient is the only other town. The inhabitants, mainly of French and Negro descent, are English-speaking, and numbered 2,079 in 1954.

St. Bartholomew was occupied by France in 1648 and ceded to Sweden in 1784. In 1877 it was again acquired by France at the cost of £11,000.

ST. BARTHOLOMEW, MASSACRE OF. This was the name given to the massacre of the Huguenots, which began in Paris on St. Bartholomew's Day, Aug. 24, 1572. The initiative for the crime rests with Catherine de' Medici. Disquieted by the growing influence of Admiral Coligny, who against her wishes was endeavouring to draw Charles IX into a war with Spain, she resolved to have him assassinated. The attempt failed, however, and Catherine then determined to massacre all the Huguenot leaders.

After holding a council with the Catholic leaders, including the Duke of Anjou, Henry of Guise, the Marshal de Tavannes, the Duke of Nevers, and René de Birague, the keeper of the seals, she persuaded the king that the massacre was a measure of public safety, and on the evening of Aug. 23 succeeded in wringing authorization from him.

The massacre began early on Sunday morning, and continued in Paris till Sept. 17. Once let loose, it was impossible to restrain the populace. From Paris the massacre spread to the provinces till Oct. 3. The Duc de Longueville in Picardy, Chabot-Charny (son of Admiral Chabot) at Dijon, the Comte de Matignon (1525–97) in Normandy and other provincial governors refused to authorize the massacres. François Hotman estimates the number killed in the whole of France at 50,000. Catherine de' Medici received the congratulations of all the Catholic powers, and Pope Gregory XIII commanded bonfires to be lighted and a medal to be struck.

See H. Mariéjol, "La Réforme et la Ligue" (1904), in vol. vi of the ***Histoire de France,*** by ***E.*** Lavisse, which contains a complete bibliography of the subject.

ST. BENOÎT-SUR-LOIRE, a village of France, in the *département* of Loiret, on the Loire, 22 mi. E.S.E. of Orléans. Pop. (1954) 509.

St. Benoît has a huge basilica, only survival of a 7th-century

monastery to nhich the relics of St. Benedict were brought from Monte Cassino In the crypt is a modern shrine containing the remains of St Renedict which attract many pilgrims The establishment was important during the middle ages, partly because of its school.

In 1562 it was pillaged by the Protestants and. though the buildings were restored by Richelieu. the abbey declined. The basilica (1025–1218) has a narthex of two stories and two sets of transepts surmounted by a square central toner.

SAINT BERNARD PASS, actually two passes across the main chain of the Alps, both traversed by motor roads. The Great St. Bernard (8.100 ft.) leads (53 mi.) from Martigny (anc. *Octodurus*) in the Rhone valley (Switzerland) to Aosta (anc. Augusta Praetoria) in Italy. It was knonn in Roman times. The hospice on the pass was founded (or refounded) by St. Bernard of Menthon (d. *c.* 1081), and since the 12th or early 13th century has been in charge of a community of Austin canons, the mother house being at Martigny. In former days the servants of the canons, and the famous dogs, saved many lives, especially of Italian workmen. In May 1800, Napoleon led his army over the pass, which was then traversed by a bridle road only. The Little St. Bernard (7 178 ft.) also nas known in Roman times, and the hospice refounded by St. Bernard, though later it was in charge of the military and religious order of SS. Maurice and Lazarus. The pass leads (39 mi.) from Bourg St. Maurice in the Isère valley (Savoie) to Aosta.

There is no certain mention of the road over the pass of the Great St. Bernard (*Alpis Poenina,* Poeninus *Mons*) before 57 B.C. nhen Julius Caesar sent Servius Galba over it. Even in Strabo's time it was impassable for wheeled traffic. Augusta Praetoria originally had but two gates, one opening toward the Little St. Bernard (*Alpis* Graia), the other toward Eporedia (Ivrea), but none toward the Alpis Poenina. The military arrangement of the German provinces rendered the construction of the road necessary, and it is mentioned as existing in AD. 69. Remains of it cut in the rock, about 12½ ft. in nidth, still exist near the lake at the top of the pass. On the plain at the top of the pass is the temple of Jupiter Poeninus (Penninus).

The Little St. Bernard was known to the Romans as Alpis Graia. It derived its name from the legend that Hercules, returning from Spain with the oxen of Geryon, crossed the Alps by this route, though the legend rather suits the route through the Maritime Alps. According to some modern scholars, Hannibal passed this way over the Alps (see HANNIBAL). In any case it was the principal pass over the Alps into Gallia Comata until the pass of the Alpis Cottia (Mont Genèvre) was opened by Pompeius in 75 B.C., and became the principal route, though the road was only completed under Augustus by Cottius in 3 B C.

SAINT BONIFACE, a city in Manitoba, Can., situated at the confluence of the Seine and Red rivers opposite Winnipeg, and part of the Winnipeg metropolitan area. Pop. (1961) 37.600.

The city was founded in 1818 by the missionaries Provencher and Dumoulin upon the site of an earlier, unsuccessful settlement by Swiss mercenaries, who gave the place its present name in honour of the patron saint of Germany.

As a Catholic religious centre it attracted French-speaking colonists from the east as well as local métis (Indian mixed bloods). It was incorporated as a town in 1883 and as a city in 1908. Railways and roads converged there to bridge the Red river for Winnipeg, creating conditions favourable to industrial development. There are meat-packing plants, flour mills, paint and soap works and oil refineries. Large numbers of livestock move daily into its famous stockyards.

St. Boniface is the centre of French-Canadian culture in the west; it has a French-language radio station and a French-language college affiliatedwith the University of Manitoba. Principal among its buildings are the Roman Catholic basilica and large hospitals overlooking the Red river. The basilica is the oldest church in western Canada. Besides the French-speaking community. there are large British. Ukrainian. German and Polish groups. The city suffered severely from a disastrous flood in 1950. (W. H. PR.)

SAINT BRIEUC, a town of western France, capital of the *département* of Côtes-du-Nord, 63 mi. N.W. of Rennes by the railway to Brest. Pop. (1954) 32,965. St. Brieuc is named after the missionary St. Briocus, who came from Wales in the 5th century. and whose tomb afterward attracted crowds of pilgrims. The place was defended in 1375 by Olivier de Clisson against the duke of Brittany, and later attacked by the same Clisson in 1394, the cathedral suffering greatly in both sieges.

In 1592 the town was pillaged by the Spaniards, in 1601 ravaged by the plague and in 1628 surrounded by walls of which no traces remain. Between 1602 and 1768 the states of Brittany several times met at St. Brieuc. It stands 290 ft. above the sea. about 2 mi, from the English channel and less than 1 mi. from the right bank of the Gouet, at the mouth of which is its seaport, Le Légué. St. Brieuc is the seat of a bishopric in the province of Rennes, and has a 13th-century cathedral, partially rebuilt in the 18th. and afterward restored.

SAINT CATHARINES, county seat of Lincoln county, Ontario, Can., on the old Welland canal 2 mi. south of Lake Ontario. The first settlement was about 1790 and by 1797 part of the present site was known as Shipman's Corner. St. Catharines became a town in 1845 and a city in 1876. Known as the garden city, St. Catharines adjoins the towns of Thorold and Merritton in a continuously built-up area extending along the old canal where it climbs the Niagara escarpment. In the late 19th century St. Catharines was famed for its mineral springs but in modern times it is a manufacturing centre and the warehousing and distribution centre for the Niagara fruit belt in which it is located. Its larger industries produce automobile parts, heavy electrical apparatus, structural engineering goods and service, light and heavy hardware and hosiery.

Pop 11961) 84.472. (G. FN.)

SAINT CHARLES, a suburb of St. Louis, Mo. See SAINT LOUIS (No.).

SAINT CLAIR, LAKE, is an expansive shallow basin in the St Clair–Detroit river waterway which connects Lakes Huron and Erie and forms the boundary between the state of Michigan and the province of Ontario. The nearly circular lake is 26 mi. long, north to south, and 24 mi. wide, and has a surface area of 490 sq.mi. The area of its drainage basin, exclusive of lake surface (and exclusive of the upper Great Lakes) is 7.430 sq.mi. The principal irregularity of the shoreline is the large delta of the St. Clair river, with seven channels. The lake has low and marshy shores and a gently sloping bottom with a maximum natural depth of about 21 ft. Ship channel improvements provide a minimum depth of 25 ft. across the lake from the mouth of the St. Clair river south channel to the head of the Detroit river. The mean surface altitude of the lake is 575 ft.—6 ft. below the level of Lake Huron and 2½ ft. above that of Lake Erie. As in the connecting rivers, the monthly mean level of water surface has fluctuated through a range of about 3 ft. during the navigation seasons.

There are no port cities of importance on Lake St. Clair, but Detroit, Mich., and Windsor, Ont., have dock facilities on the Detroit river a few miles downstream from the lake.

For a discussion of the regional relationships of Lake St. Clair see GREAT LAKES, THE. See also SAINT CLAIR RIVER.

(J. L. HH.)

SAINT CLAIR RIVER, the outlet for Lake Huron, which in turn receives the waters from lakes Superior and Michigan, forms part of the boundary between the state of Michigan, U.S., and the province of Ontario, Can. Flowing in a southerly direction into Lake St. Clair with a fall of about 5.8 ft. in 40 mi., the river discharges through seven mouths, the one known as the south channel being used for deep-draft vessels, while several of the other channels are used for small craft. The south channel was improved by the dredging of separate channels to provide a minimum depth of 25 ft. for St. Lawrence seaway traffic. The river has a velocity near its upper end of more than 5 m.p.h. through the rapids section, and a velocity of about 2 m.p.h. through the channels entering Lake St. Clair.

The river level fluctuates nith the levels of the lakes above and

below. From the year 1910 on, the difference between the highest and lowest monthly mean levels during the navigation season (generally from March to Dec.) has been about 4 ft.

Near the head of the river are the cities of Port Huron, Mich., and Sarnia, Ont., both of which handle some water-borne commerce but the great bulk of the traffic moves through the river without intermediate stop. This traffic is composed principally of iron ore, grain and limestone down bound and coal up bound.

There are several small towns and industrial plants along the shores of the river. For a discussion of the regional relationships of the St. Clair river see GREAT LAKES, THE. See also SAINT CLAIR, LAKE. (J. L. HH.)

SAINT CLAIR SHORES, a city of Michigan, U.S., in Macomb county, 10 mi. N.E. of Detroit is located on the western shore of Lake St. Clair. It is about 7½ mi. long and 1½ mi. wide, with a total area of 10½ sq.mi. First settled in the 18th century by the French, who laid out farms along the Detroit river and Lake St. Clair, it remained a farming area until after 1920. By mid-20th century it had developed as a suburban residential community. Its excellent boat harbours support its claim as the boating capital of Michigan. Many of its subdivisions along the lake provide canals from the lake terminating in boat-wells at the rear of residences.

Private beaches for residents are also available. It was first incorporated as a village in 1925, as a city in 1950 and adopted a council-manager form of government in 1951. The population rapidly increased from 10,405 in 1940 to 76,657 in 1960. (P. P. M.)

SAINT CLOUD, a town of northern France, in the *départe*ment of Seine-et-Oise, on the left bank of the Seine, 2 mi. W. of the fortifications of Paris. Pop. (1954) 20,407. The town is named after Clodoald or Cloud, grandson of Clovis. He had granted the domain to the bishops of Paris, who possessed it as a fief till the 18th century. At St. Cloud Henry III and the king of Navarre (Henry IV) established their camp during the league for the siege of Paris and there the former was assassinated. The castle was acquired in 1658 by the duke of Orleans, who built the palace which perished in 1870. It was at St. Cloud that Bonaparte executed the coup d'état of the 18th Brumaire (1799), and there he celebrated his marriage with Marie Louise. In 1815 it was the scene of the signing of the capitulation of Paris. Seized by the Prussians at the beginning of the investment of Paris in 1870, St. Cloud was sacked during the siege. St. Cloud, built on a hill slope overlooking the river, the Bois de Boulogne and Paris, is a favourite resort.

SAINT CLOUD, a city and seat of Stearns county in the central part of Minnesota, U.S., is located at the junction of the Mississippi and Sauk rivers, 65 mi. N.W. of Minneapolis. The fertile surrounding country produces dairy products and grain in particular. Extensive ledges of high quality granite have given St. Cloud the nickname of the "granite city," and its chief industries are granite quarrying and granite products. It also has smaller printing and metal industries and extensive railroad shops are maintained there.

St. Cloud is the seat of the second largest Minnesota state college (established 1869), and of the state reformatory (1887), a U.S. veterans hospital (with 350 ac. of ground), a Roman Catholic cathedral and several schools and charitable institutions under religious auspices. Nearby are located two Roman Catholic colleges—St. John's university (1857) at Collegeville, for men; and the College of St. Benedict (1913) at St. Joseph, for women. The population is predominantly of German descent, and Roman Catholicism is the main religion of the community.

St. Cloud was settled in 1851, platted in 1854, by John L. Wilson of Maine and named for the French city, incorporated as a village in 1868, and chartered as a city in 1889. Since 1912 it has had a commission form of government. Before the coming of the railroad it was the terminus of the Hudson's Bay company for unloading furs brought down from the Red River valley in wooden oxcarts. During the Sioux uprising of 1862 in the Minnesota river valley, the men of St. Cloud hastily erected fortifications, and the settlement served as a refuge for thousands of homesteaders who fled from the Sioux attack.

For comparative population figures see table in MINNESOTA: Population. (R. W. F.)

SAINT CROIX (SANTA CRUZ), the largest (80 sq.mi.) of the Virgin Islands (*q.v.*), purchased by the United States from Denmark in 1917. The island was discovered Nov. 14, 1493, by Columbus who called it Santa Cruz, a name still sometimes used. After the fierce aboriginal Carib Indians were exterminated, it was occupied and partly settled in turn by small numbers of Spanish, Dutch, English and French. It was held by the Knights of Malta (1651–65). The island was virtually deserted (1695–1733) when the Danish West India and Guinea company purchased it. By 1742 there were 1,900 slaves.

Denmark acquired the island in 1754 and, after an insurrection of the slaves, emancipated them in 1848. About 90% of the 14,935 inhabitants (1960) are of Negro and Negro-white descent. The literacy rate is high.

The island is served by a network of asphalt roads. There is air service to all parts of the Caribbean from the Alexander Hamilton airport. Frederiksted is a west coast port and Christiansted, the chief town (sometimes called Bassin), is located on the northeast coast. Hills rise abruptly from the northern shore (highest point Mt. Eagle 1,165 ft.) and give way to fertile rolling lands, lagoons and beaches to the south. The climate is healthful with a mean annual temperature of 74° F. and an average rainfall of 45.7 in.

The tourist trade, rum, sugar cane and cattle raising constitute the island's basic economy. Despite appropriations by the United States, housing, potable water, sewage, road construction and maintenance and a higher standard of living remain continuing problems. After the fall of Batista in Cuba, Jan. 1, 1959, and the subsequent unrest under Castro the number of tourists increased. (R. W. LN.)

SAINT CROIX RIVER, 129 mi. long, forms the international boundary between Maine in the U.S. and New Brunswick in Canada. It arises as the outlet of the Chiputneticook lakes, which are also the boundary, and discharges into Passamaquoddy bay. From the mouth upstream for approximately 10 mi. it is a tidal estuary, navigable to Calais, Me., where power dams block the channel.

SAINT CROIX RIVER of Wisconsin flows 164 mi. southwestward across the state emptying into the Mississippi at Prescott, Wis., about 20 mi. south of St. Paul. For 130 mi. upstream from its mouth it forms the boundary between Wisconsin and Minnesota. (C. M. DA.)

SAINT CYR-L'ÉCOLE, a town of France in the *départe*ment of Seine-et-Oise, 3 mi. W. of Versailles at the end of the old park of Louis XIV. Pop. (1954) 6,570.

Its importance is due to the famous military school (*école spéciale* militaire) in which officers for the cavalry and infantry were trained. Established in 1808 in a convent where Racine's Esther and *Athalie* were first acted, the military school was destroyed during World War II.

SAINT DAVID'S (Tyddewi), cathedral village of Pembrokeshire, Wales, situated near the sea, southeast of St. David's head, the most westerly promontory of south Wales. Pop. (1951) 1,505. St. David's is 16 mi. N.W. of Haverfordwest and 16 mi. S.W. of Fishguard by road. The little town, locally known as "the city," stands in a lofty position near the cathedral close, and consists of four streets focusing on the square, called Cross square, the ancient market place still possessing its market cross (restored 1873). The origin of the fine cathedral and its village "city" in an area so remote under modern conditions is of special interest. Northwestern Pembrokeshire, like most western promontories of Britain, France and Spain, is remarkably rich in old stone monuments (menhirs, dolmens and stone circles), a fact pointing in all probability to its being on the coastwise and transpeninsular route frequented by prehistoric traders from the Mediterranean to Ireland. (*See* PEMBROKESHIRE.) The little boats of old were driven hither and thither at the mercy of wind and tide, and so the coast in these parts became dotted with alternate landing places, *e.g.,* Porth y Rhaw, St. Non's Bay, Porth Clais, Porth Stinian,

Whitesand Bay, which seem to have made the neighbourhood important in pre-Christian times, as one may judge from folk tradition, monuments on the headland, etc.

The pre-Christian tradition was continued by the Celtic saints moving between Ireland and Wales. In early mediaeval days the same route grew important, as pilgrims moved to and from the shrine of St. Iago de Compostella in northwestern Spain. (See Hartwell Jones, "Celtic Britain and the Pilgrim Movement," Y Cymmrodor, 1912.) The little landing places on the shore had Christian chapels, where prayers were possibly said for safe voyages. The most important ruins at present are those of St. Justinian and St. Non. At a focal point behind a group of these small ports, in the quiet sheltered, well-watered valley of the Alun, the fine cathedral (from Norman times with the double dedication to St. David and St. Andrew) was built, and on the high plateau around, as if sheltering it still further, the "village-city" grew. Throughout the middle ages the cathedral was the centre of pilgrimage and the mediaeval roads (often marked by sacred wells) may be traced across Pembrokeshire focusing on St. David's. Two pilgrimages to St. David's were popularly thought to equal one to Rome, and three pilgrimages to St. David's one to Jerusalem. The early holders of the see ventured, while the central government was weak, to exercise metropolitan rights over much of south Wales, but the increasing power of the Norman penetration reached St. David's, and Anselm's forcible appointment of Bernard—a Norman monk—to be bishop in 1115 made St. David's a suffragan see of Canterbury. A conciliatory step, it would appear, was the canonization of David about 1120. Gerald de Barri (Giraldus Cambrensis) strove vainly to regain the ancient power of St. David's from 1199–1203.

The Cathedral. — The cathedral church is partly built of a beautiful purple-hued sandstone, quarried locally. Its central tower, rebuilt after the original had fallen in 1220, was restored by Sir George Gilbert Scott who also designed the west front and did an extensive restoration of the cathedral. The earliest and main portion of the existing fabric, the fourth on the site, was erected under Bishop Peter de Leia (1176–98) in the transitional Norman-English style. Bishop David Martin (1296–1328) built the Lady chapel; Bishop Henry de Gower (1328–47) made many additions in the Decorated style, including the stone rood screen and southern porch; and Bishop Edward Vaughan (1509–22) roofed over the space between the choir and Lady chapel now known as the Trinity chapel. The cathedral suffered severely during the changes brought about by the Reformation and at the hands of Bishop William Barlow (1536–48) and again during the civil wars of the 17th century. Subsequent restorations took place. The interior of the nave, separated by six wide bays from the aisles, is imposing with its triforium and clerestory. It has an elaborate roof of Irish oak, the gift of Treasurer Owen Pole (c. 1500). The nave is divided from the choir by Bishop Gower's fine stone screen. while the choir contains the richly carved stalls erected by Bishop Tully (1460–81), the episcopal throne and an oaken screen separating choir and presbytery. Bishop Vaughan's chapel contains fine Tudor fan-vaulting, and the Lady chapel decorated sedilia.

To the north of the cathedral is the ruined shell of the beautiful chapel, with an adjoining tower, that formed part of the college of St. Mary, founded by John of Gaunt and Bishop Adam Houghton in 1377. On the west bank of the Alun stand the ruins of the episcopal palace erected by Bishop Gower (c. 1342). The palace was built for residential purposes rather than for defense and occupies three sides of a quadrangle 120 ft. square, and, though roofless and deserted for nearly three centuries, retains most of its principal features. The great hall possesses a traceried wheel window, the chief portal is still imposing, and the chapel retains its curious bell turret, while the peculiar but graceful arcaded parapet of the roof extends intact throughout the whole length of the building. Partially dismantled by Bishop Barlow (c. 1540), the palace was occasionally occupied by succeeding bishops prior to the civil wars. The close contains the deanery and other residences of the cathedral clergy, mostly on the sites of ancient buildings. It was formerly surrounded by a wall, traces of which survive; there were four gateways but the Tower gate alone remains.

ST. DENIS, RUTH (RUTH DENNIS) (1877–), whose active dance career spanned half a century, was one of the most important pioneers of 20th-century American dance. Her personal influence was enormous, and through the pupils she shared with her husband, Ted Shawn (*q.v.*), it extended into almost every phase of the dance art in the United States.

Born in Newark, N.J., Ruth St. Denis was a comparatively successful vaudeville and musical-comedy dancer and also an actress before she became a serious dance artist and innovator. A cigarette poster accidentally seen in 1904, while she was touring in David Belasco's production of Du Barry, turned her attention to Egypt and the orient. Careful study of Hindu philosophy and art led to the production of her ballet, Radha, in 1906. Its success brought her a triumphant three-year tour of Europe.

Returning to the United States, she produced *Egypta* and a Japanese dance drama, *O-Mika*. In 1914 she met and married the young dancer Ted Shawn, who shared her serious, idealistic approach to the dance. Together they founded the Denishawn school. which fostered many figures of later importance in modern American dance.

The Denishawn company toured widely in the United States, and visited the orient in 1925–26. Never divorced, she and her husband separated in 1931. After brief semiretirement, she soon resumed performing her famous solos. Deeply concerned with the spiritual aspects of her art, Ruth St. Denis devoted herself intensively to the furtherance of dance in religion.

See her autobiography, ***Unfinished Life*** (1939); Walter Terry, "Ruth St. Denis," ch. 6 in ***The Dance in*** *America* (1956). (LN. ME.)

ST. DENIS, a suburb 5½ mi. N. of Notre Dame de Paris, capital of an arrondissement in the *département* of Seine. Pop. (1954) 79,611. St. Denis, an important junction on the northern railway, stands in a plain on the right bank of the Seine, which is there joined by the canal of St. Denis. It has numerous metallurgical works where railway material, naval engines and the like are constructed, distilleries of spirits, glassworks, potteries and manufactories of drugs, chemical products, oils, nickel plate and pianos. The name and fame of the town are derived from the abbey founded by Dagobert I on the spot where St. Denis, the apostle of Paris. was interred.

St. Denis, the ancient Catalliacum, was a town of no pretensions till the foundation of its abbey, which became one of the most powerful in France. The rebuilding of the church, begun in the 12th century by Suger, was completed in the 13th century. Among the many domains of the abbey was the French Vexin. It uas held during the later middle ages by the French kings and vassals of the abbey, and to this fact is due their adoption of the oriflamme or red banner of St. Denis as the royal standard. Louis XIV reduced the abbey to the rank of a priory and at the Revolution it was suppressed. the tombs being violated and the church sacked (1793). Louis XVIII caused all the articles belonging to St. Denis to be brought back to their original site, and added numerous other monuments from the suppressed abbeys, but it was not until after 1848 that, under the direction of Viollet-le-Duc, the basilica recovered its original appearance. St. Denis, which was the key of Paris on the north, was more than once pillaged in the Hundred Years' War, suffering especially in 1358 and 1406. A sanguinary battle, in which the Catholic leader Constable Anne de Montmorency found victory and death, was fought between Huguenots and Catholics in the neighbourhood on Nov. 10, 1567.

The church exhibits the transition from the Romanesque to the Gothic style. The west front was built between 1137 and 1140. The right-hand tower is almost pure Romanesque; that on the left was Gothic, but its spire was struck by lightning in 1837. The porch formed by the first three bays contains some remains of the basilica of Pepin the Short and Charlemagne, by whom the church was rebuilt. The nave proper (235 ft. long and 57 wide) has seven bays, and dates, as well as most of the choir and transepts, from the reign of St. Louis. The secondary apse (rond-point) and its semicircular chapels (consecrated in 1144) are considered as the first perfected attempt at Gothic. The transepts have fine facades, the north of the 12th, the south

of the 13th century, each with two unfinished towers; if the plan had been fully carried out there would have been six towers beside a central spire in lead. Tho church contains a series of tombs of the kings and princes of the royal houses of France. The most remarkable are those of Louis XII and Anne of Brittany, executed from 1516 to 1532; of Henry II and Catherine de Médicis, a masterpiece by Germain Pilon (1564–83); of Louis of Orléans and Valentine of Milan, from the old church of the Celestines at Paris (1502–15); of Francis I and Claude of France, one of the most splendid tombs of the Renaissance, executed under the direction of Philibert Delorme (1550–60); and that of Dagobert, which, though considerably dilapidated, ranks as one of the most curious of medieval (13th-century) works of art. In the apse some stained glass of the time of Suger remains.

The crypt dates partly from the 10th or 11th century. In the centre is the vault where the coffin of the king used to lie until, to make room for that of his successor, it was removed to its final resting place. It is at present occupied by the coffin of Louis XVIII, the last sovereign whose body was borne to St. Denis. Besides fine statues, the crypt contains the Bourbon vault, in which among other coffins are deposited the remains of Louis XVI and Marie Antoinette.

See F. de Guilhermy, *Monographie de l'église royale de St. Denis* (1848).

SAINTE ANNE DE BEAUPRÉ, a village of Montmorency county, Quebec, Can., is about 20 mi. N.E. of Quebec city at the junction of the Ste. Anne and St. Lawrence rivers. Laid out along the St. Lawrence, the village is located on a narrow agricultural plain with hills in the background. Pop. (1956) 1,865. The shrine of Ste. Anne de Beaupré is a notable Roman Catholic place of pilgrimage where numerous miraculous cures have been recorded. Settled about 1650, the first chapel was built in 1658, according to tradition, by French sailors who, having been shipwrecked in the St. Lawrence, promised, if saved, to build a small chapel where they would reach land.

The first reported miracle, the curing of a local resident's rheumatism, occurred that same year. The Huron Indians, in 1670, were the first pilgrims to visit the chapel. In the 20th century the shrine was visited by pilgrims from all over Canada and the United States. The basilica of Ste. Anne de Beaupré, of 12th century Roman gothic style, is 373' ft. long, 200 ft. wide and 100 ft. high. It has five naves, 10 small chapels and can accommodate approximately 9,000 worshipers. Begun in 1923, it had not been finished by the 1960s.

Sainte Anne de Beaupré is the headquarters of the French Canadian Rédemptorists and the seat of their college. An attraction of the village is a huge cyclorama depicting the day of the Crucifixion. (P. CA.)

SAINTE-BEUVE, CHARLES AUGUSTIN (1804–1869), French critic, was born at Boulogne-sur-Mer on Dec. 23, 1804. He was a posthumous child. His father, a native of Picardy, and controller of town-dues at Boulogne, was a man of literary tastes; his mother was half English, her father, a mariner of Boulogne, having married an Englishwoman. Charles Augustin was sent to a boarding school in Paris to attend the classes of the Collbge Charlemagne, and then of the Collège Bourbon. He then studied medicine, but after four years abandoned it to join the staff of the new Liberal newspaper, *The Globe*, in which he published the excellent articles on the French poetry of the 16th century afterwards separately published as *Tableau historique et critique de la poésie française au XVIe sikcle* (2nd ed., 1842). In 1829 he made his first venture as a poet with the *Vie, poésies, et pensées de Joseph Delorme.* His own name did not appear; but Joseph Delorme, that "Werther in the shape of Jacobin and medical student,?' as Guizot called him, was the Sainte-Beuve of those days himself. In 1830 came his second volume of poems, the *Consolations.* But the critic in him grew to prevail more and more and pushed out the poet. Sainte-Beuve was at this time a devoted Catholic and a little later for a very short period a disciple of Lamennais. But he gradually separated from his Catholic friends, and at the same time a coldness grew up between him and Victor Hugo, whose warm friendship he had won by an early article on *Odes et Ballades.* He became the lover of Madame Hugo, and a definite separation between the former friends ensued in 1834. In 1831 the *Revue des deux mondes* was founded, and from the first Sainte-Beuve was one of the most active and important contributors. He brought out his novel of *Volupté* in 1834, his third and last volume of poetry, the *Pensées d'août,* in 1837. He had long meditated work on Port-Royal, which took shape in a series of lectures delivered at Lausanne in 1838. The book occupied him at intervals until 1848—Port *Royal* (5 vols. 1840–48; 5th ed., 1888–91).

In 1840 Victor Cousin, then minister of public instruction, appointed him one of the keepers of the Mazarin library, an appointment which gave him rooms at the library, and a competence, and leisure for study. With a Greek teacher, M. Pantasides, he read and re-read the Greek poets. Articles on Homer, Theocritus, Apollonius of Rhodes, and Meleager in the *Revue des deux mondes* were fruits of his new Greek studies. Eut in general his subjects were taken from the great literature of his own country. Seven volumes of *Portraits,* contributed to the *Revue de Paris* and the *Revue des deux mondes,* exhibit his work in the years from 1832 to 1848, a work constantly increasing in range and value. In 1844 he was elected to the French Academy as successor to Casimir Delavigne, and was received there at the beginning of 1845 by Victor Hugo.

In March 1848 was published an account of secret-service money distributed in the late reign, and Sainte-Beuve was put down as having received the sum of one hundred francs. The sum appears to have been in reality paid for alterations to a smoky chimney in the library, but Sainte-Beuve was annoyed at the imputation and resigned his chair. He lectured for a time at Liége, but returned to Paris within a year. Dr. Véron, the editor of the *Constitutionnel,* proposed to him that he should supply that newspaper with a literary article for every Monday; and thus the famous *Causeries du lundi* were started. Sainte-Beuve now lived in the small house in the Rue Montparnasse (No. 11), which he occupied for the remainder of his life, and where in 1850 his mother, from whom he seems to have inherited his good sense, tact and finesse, died at the age of eighty-six. For three years he continued writing every Monday for the *Constitutionnel;* then he passed, with a similar engagement, to the *Moniteur.* In 1857 his Monday articles began to be published in volumes, and by 1862 formed a collection in 15 volumes; they afterwards were resumed under the title of *Nouveaux lundis,* which now make a collection of 13 volumes more.

In 1854 he was nominated to the chair of Latin poetry at the college of France. He was rudely interrupted by the students, and resigned; he was then appointed lecturer on French literature at the École Normale Supérieure Here he lectured for four years During this period his contributions to the *Moniteur* were intermittent. He now returned to a regular Monday article for the *Constitutionnel.*

The Empire was tardy in acknowledging his merits, and it was not until 1865 that he received the senatorship with its income sufficient to make him independent, and his health was failing him. He could seldom attend the meetings of the senate; the part he took there, however, on two famous occasions--when the nomination of Ernest Renan to the college of France came under discussion in 1867, and the law on the press in the year following—offended the majority in that conservative assembly and delighted those who "belonged," to use his own phrase, "to the diocese of free thought." He gave further pleasure in this diocese by leaving the *Moniteur* at the beginning of 1869, and contributing to a Liberal journal, the *Temps.* This defection finally alienated him from the Bonapartists, and lost him the friendship of the Princess Mathilde His literary activity suffered little abatement, but pain made him at last unable to sit to write; he could only stand or lie. He died in his house in the Rue Montparnasse on Oct. 13, 1869.

The root of Sainte-Beuve's criticism is his single-hearted devotion to truth. What he called "fictions" in literature, in politics, in religion, were not allowed to influence him. Some one had talked on his being tenacious of a certain set of literary opinions. "I hold very little," he answers, "to literary opinions; literary

opinions occupy very little place in my life and in my thoughts. What does occupy me seriously is life itself and the object of it." "I am accustomed incessantly to call my judgments in question anew. and to re-cast my opinions the moment I suspect them to be without validity." "What I have wished" (in *Port-Royalj* "is to say not a word more than I thought, to stop even a little short of what I believed in certain cases. in order that my words might acquire more weight as historical testimony." To all exaggeration and untruth, from whatever side it proceeded. he had an antipathy. "I turn my back upon the Michelets and Quinets, but I cannot hold out my hand to the Veuillots."

But Sainte-Beuve could not have been the great critic he was had he not had, at the service of this his love of truth and measure. the conscientious industry of a Benedictine. "I never have a holiday. On Monday towards noon I lift up my head, and breathe for about an hour; after that the wicket shuts again and I am in my prison cell for seven days." The *Causeries* were at this price. They came once a week. and to write one of them as he wrote it was indeed a week's work.

To mental independence. industry, measure and lucidity, his criticism adds the merit of happy temper and disposition. Sainte-Beuve has more, as a critic. than the external politeness which once at any rate distinguished his countrymen: he has a personal charm of manner due to a sweet and humane temper. He complained of *un peu de dureté,* "a certain dose of hardness." in the new generation of writers. The personality of an author had a peculiar importance for him; the poetical side of his subjects, however latent it might be, always attracted him and he always sought to extricate it. This was because he had the instincts of the true poetic nature. As a guide to bring us to a knowledge of the great personalities in French literature he is unrivalled.

BIBLIOGRAPHY.—*See* his "Ma Biographie" in *Nouveaux lundis,* xiii, *Lettres a la princesse* (1873); *Correspondance* (1877–78) and *Nouvelle Correspondance* (1880); the Vicomte d'Haussonville's *Sainte-Beuve* (1875); Scherer, *Etudes critiques sur la littérature contenzporaine,* iv (1863–95); G. Michaut, *Sainte-Beuve avant les Lundis* (1903); *L.* F. Choisy, *Sainte-Beuve, L'Homme et le poète* (1921); *G.* Michaut, *Sainte-Beuve* (1921); *L.* F. Mott, *Sainte-Beuve* (1925).

SAINTE-CLAIRE DEVILLE, HENRI ÉTIENNE (1818–1881), French chemist whose most important work was in inorganic and thermal chemistry, was born on March 11. 1818, on the island of St. Thomas: West Indies, where his father was French consul.

In 1844 having graduated as doctor of medicine and doctor of science, he was appointed to organize the new faculty of science at Besançon, where he acted as dean and professor of chemistry from 1845 to 1851. He succeeded A. J. Balard at the École Normale, Paris, in 1851, and in 1853 became professor at the Sorbonne in place of J. B. A. Dumas (*q.v.*). He died at Boulogne-sur-Seine on July 1, 1881.

He began his experimental work in 1841 with investigations of oil of turpentine and tolu balsam, in the course of which he discovered toluene (*q.v.*). In 1849 he discovered nitrogen pentoxide, the first of the so-called anhydrides of the monobasic acids to be isolated. In 18j5 he devised a method by which aluminum (*q.v.*) could be prepared on a large scale by the aid of sodium, the manufacture of which he also developed. His best-known contribution to chemistry is his work on the phenomena of reversible reactions (*see* REACTION KINETICS).

ST. ELMO'S FIRE, the glow accompanying the brushlike discharges of atmospheric electricity which usually appears as a tip of light on the extremities of pointed objects such as church towers or the masts of ships during stormy weather. It is commonly accompanied by a crackling or fizzing noise.

St. Elmo's fire, or corona discharge. is commonly observed on the periphery of propellers. along the wing tips, windshield and nose of aircraft flying in dry snow. ice crystals, or in the vicinity of thunderstorms. The discharge may be sufficiently strong to cause a noisy disturbance in the radio, called static. which may obliterate all other signals. The corona discharge from an aircraft may initiate a lightning discharge which. striking the airplane: may cause small structural damage. impair the radio or temporarily blind the pilot. Various flight procedures, in addition to mechanical and electrical devices designed to reduce the charge accumulation, are utilized as safeguards in preventing or minimizing discharges.

The name St. Elmo is an Italian corruption. through *Sant' Ermo,* of St. Erasmus. the patron saint of Mediterranean sailors, who regard St. Elmo's fire as the visible sign of his guardianship. (E. J. MR.)

STE.-MARIE-AUX-MINES or MARKIRCH. a town of France in the *département* of Haut-Rhin intersected by the Lièpvrette, an affluent of the Rhine. Pop. (1954) 6.451. The once productive silver: copper and lead mines of the neighbourhood were worked from the 9th till the 19th century. The main industries of the place are weaving and dyeing. The river was at one time the boundary between the German and French languages; the German-speaking inhabitants on the right bank were Protestants and subject to the counts of Rappoltstein, while the French inhabitants were Roman Catholics and under the rule of the dukes of Lorraine.

ST. EMILION, a town of southwestern France, in the *département* of Gironde, 2½ mi. from the right bank of the Dordogne and 27 mi. E.N.E. of Bordeaux by rail. Pop. (1954) 845. The town derived its name from a hermit who lived there in the 7th and 8th centuries. The town has remains of ramparts of the 12th and 13th centuries. The parish, once collegiate church, dates from the 12th and 13th centuries. A Gothic cloister adjoins the church. A belfry (12th. 13th and 15th centuries) commanding the town is built on the terrace, beneath which are hollowed in the rock the oratory and hermitage of St. Emilion. and adjoining them a large ancient monolithic church. Remains of a monastery oi the Cordeliers (1jth and 17th centuries) and of a building (13th century) known as the Palais Cardinal, are also to be seen. St. Emilion is celebrated for its wines.

SAINTE-PALAYE, JEAN BAPTISTE LA CURNE (or LACURNE) DE (1697–1781), French scholar. was born at Auxerre on June 6, 1697. His father, Edme, had been gentleman of the bedchamber to the duke of Orleans, brother of Louis XIV, a position which descended to his son. In 1724 he had been elected an associate of the Académie des Inscriptions et Belles-Lettres, and from this time he devoted himself exclusively to the work of this society. He began a series of studies on the chroniclers of the middle ages for the *Historiens des Gaules et de la France* (edited by Dom Bouquet): Raoul Glaber, Helgaud, the *Gesta* of Louis VII, the chronicle of Morigny, Rigord and his continuator, William le Breton, the monk of St. Denis, Jean de Venette, Froissart and the Jouvencel. His *Glossaire de la langue française* was ready in 1756, but remained in manuscript for more than a century. He died on March 1, 1781.

See the biography of La Curne, with a list of his published works and those in manuscript, at the beginning of the tenth and last volume of the *Dictionnaire historique de l'ancien langage françois, ou glossaire de la langue frangoise depuis son origine jusqu'au siècle de Louis XIV,* published by Louis Favre (1875–82).

SAINTES, a town of western France, capital of an *arrondissement* in the *département* of Charente-Maritime, 47 mi. S.E. of La Rochelle by the railway from Nantes to Bordeaux. Pop. (1954) 21,1j4. Saintes (*Mediolanum* or *Mediolanium*), the capital of the Santones, was a flourishing town before Caesar's conquest of Gaul; in the middle ages it was capital of the Saintonge. Christianity was introduced by St. Eutropius, its first bishop, in the middle of the 3rd century. Charlemagne rebuilt its cathedral. The Normans burned the town in 845 and 854. Richard Coeur de Lion was besieged and captured there by his father Henry II. In 1242 St. Louis defeated the English there, but the town was not permanently recovered from the English until the reign of Charles V. It has Roman remains, of which the best preserved is the arch of Germanicus, dating from the reign of Tiberius. This formerly stood on a Roman bridge destroyed in 1843. when it was removed and reconstructed on the right bank of the river. Ruins of baths and of an amphitheatre are also to be seen. The large amphitheatre dates probably from the close of the 1st or beginning of the 2nd century and was capable of holding 20,000 spectators. Saintes was a bishop's see till 1790; the cathedral of St. Peter, built in the early 12th century, was rebuilt in the 15th

century and again after it had been almost destroyed by the Huguenots in 1568. It has a 15th century tower. The church of St. Eutropius (6th century, rebuilt in the 11th having had its nave destroyed in the Wars of Religion) stands above a large, well-lighted crypt adorned with richly sculptured capitals and containing the tomb of St. Eutropius (4th or 5th century). The fine stone spire dates from the 15th century. Notre-Dame (11th and 12th centuries) has a noble clock tower and is now desecrated. The old *hôtel* de *ville* (16th and 18th centuries) contains a library. Small vessels ascend the river as far as Saintes, which carries on trade in grain, brandy and wine, has iron foundries and railway works and manufactures earthenware and tiles.

ST. ÉTIENNE, an industrial town of east-central France, capital of the department of Loire, 310 mi. S.S.E. of Paris and 36 mi S.S.W. of Lyons by rail. Pop. (1946) 177,966. At the close of the 12th century St. Btienne was a parish of the Pays de Gier belonging to the abbey of Valbenoite. By the middle of the 14th century the coal trade was developing, and in the early 15th century Charles VII allowed the town to build fortifications. The manufacture of firearms for the state was begun at St. Btienne under Francis I and was put under the surveillance of state inspectors early in the 18th century. The manufacture grew rapidly. The first railways opened in France were the line between St. Btienne and Andrézieux on the Loire in 1828 and that between St. Btienne and Lyons in 1831. In 1856 St. Btienne became the administrative centre of the department.

St. Btienne stands on the Furens, which flows through'it from southeast to northwest, partly underground, and is important for the silk manufacture. The town is the seat of a prefect, of tribunals of first instance and of commerce, of a chamber of commerce and of a board of trade-arbitrators and has schools of mining, chemistry and dyeing, etc.

The town owes its importance chiefly to the coal basin which extends between Firminy and Rive-de Gier over an area 20 mi. long by 5 mi. wide and is second only to those of Nord and Pas-de-Calais in France. The mineral is of two kinds—smelting coal, said to be the best in France, and gas coal. There are manufactures of ribbons, trimmings and other goods made from silk and mixtures of cotton and silk. This industry dates from the early 17th century and is carried on chiefly in small factories (electricity supplying the motive power). The attendant industry of dyeing is carried on on a large scale. The manufacture of steel and iron and of heavy iron goods such as armour-plating is important. Firearms are manufactured at the national factory under the direction of artillery officers. Private firms make both military rifles and sporting-guns, revolvers, etc. Other industries are the manufacture of elastic fabrics, glass, cartridges, liqueurs, hemp cables, etc. Weaving machinery, cycles, automobiles and agricultural implements are also made.

ST. EUSTATIUS and **SABA,** two Netherlands West Indian islands located respectively 9 mi. and 16 mi. N.W. of St. Kitts. Politically, they are part of the colony of Curacao (*q.v.*). St. Eustatius (area: 7 sq.mi.; pop. 1950, 955) is composed of volcanic hills and intervening valleys. There is an open roadstead off Oranjestad on the west. Saba (5 sq.mi.; pop. 1950, 1,110) is a volcanic cone rising 2,851 ft. from the sea. Its town, Bottom, can be approached from the shore 800 ft. below only by steps in solid rock known as "the Ladder." Some of the best boats in the Caribbean are built there; the wood is imported and the vessels, when completed, are lowered over the face of the cliffs. Many men from both islands are employed as seamen on ships elsewhere, so that women predominate by 50% in Saba and more than 20% in St. Eustatius. Remittances home are an important factor in the islands' economy. (L. W. BE.)

SAINT-EVREMOND, CHARLES DE MARGUETEL DE SAINT-DENIS, SEIGNEUR DE (1610--1703), was born'at Saint-Denis-le-Guast, near Coutances, on April 1, 1610. Hz served through a great part of the Thirty Years' War, distinguishing himself at the siege of Landrecies (1637), when he was made captain. During his campaigns he studied the works of Montaigne and the Spanish and Italian languages. In 1639 he met Gassendi in Paris, and became one of his disciples. He was present at Rocroy, at Nordlingen and at Lerida. For a time he was personally attached to Condé, but offended him by a satirical remark and was deprived of his command in the prince's guards in 1648.

During the Fronde, Saint-Bvremond was a steady royalist. The duke of Candale (of whom he has left a very severe portrait) gave him a command in Guienne, and Saint-Bvremond, who had reached the grade of *maréchal* de camp, is said to have saved 50,000 livres in less than three years. He was one of the numerous victims involved in the fall of Fouquet. His letter to Marshal Créqui on the peace of the Pyrenees, which is said to have been discovered by Colbert's agents at the seizure of Fouquet's papers, seems a very inadequate cause for his disgrace. Saint-Évremond fled to Holland and to England, where he was kindly received by Charles II and was pensioned. After James II's flight to France Saint-Évremond was invited to return, but he declined. Hortense Mancini, the most attractive of Mazarin's attractive group of nieces, came to England in 1670, and set up a salon for love-making, gambling and witty conversation, and here Saint-Évremond was for many years at home. He died on Sept. 29, 1703, and was buried in Westminster abbey.

Saint-Bvremond empowered Des Maizeaux to publish his works after his death, and they were published in London (2 vols., 1705), and often reprinted. His masterpiece in irony is the so-called Conversation du *maréchal d'Hocquincourt* avec le *père Canaye* (the latter a Jesuit and Saint-Evremond's master at school).

His ***Oeuvres mêlées,*** edited from the MSS. by Silvestre and Des Maizeaux, were printed by Jacob Tonson (London, 1705, 2 vols.; 2nd ed., 3 vols., 1709), with a notice by Des Maizeaux. His correspondence with Ninon de Lenclos, whose fast friend he was, was published in 1752; *La Comédie* des *académistes,* written in 1643, was printed in 1650. Modern editions of his works are by Hippeau (Paris, 1852), C. Giraud (Paris, 1865), and a selection (1881) with a notice by M. de Lescure.

ST. GALL, a canton in northeast Switzerland, bordered by the principality of Liechtenstein and by Vorarlberg (Austria). It entirely surrounds the canton of Appenzell, which formerly belonged to the abbots of St. Gall. Five other cantons lie along its north, west and south borders.

Its area is 777.2 sq.mi., of which about 88% are reckoned "productive," forests covering about 165 sq.mi. and vineyards only about 1 sq.mi. The altitude above sea level varies from 1,309 ft. (the Lake of Constance) to 10,667 ft. (the Ringelspitz) in the extreme south. There are nearly 3 sq.mi. of glaciers but slightly over one-quarter of the unproductive area consists of lakes, including portions of the Lake of Constance, of the Wallensee, and of the Lake of Ziirich, together with several small lakes wholly within its limits. The canton is mountainous in the south near its borders with the Grisons and Glarus, but towards Thurgau the surface is characterized by hummocky hill country. Considerable low-lying alluvial plains occur along the courses of the Linth and Rhine, particularly in those sections of the rivers which form, in part, its frontiers on the east and southwest. Within the canton, the most important streams are the upper River Thur and the lower and middle portions of its principal tributary, the Sitter. It has ports on the Lake of Constance (Rorschach) and of Zurich (Rapperswil), while Weesen is the chief town on the Wallensee. Probably the most fashionable watering place is Ragatz, receiving the hot mineral waters (95° F.) of Pfafers by means of a 3 mi. conduit. The main railway lines from Zurich past Sargans for Coire, and from Sargans past Rorschach for Constance skirt its borders, while the capital is on the direct railway line from Ziirich past Wil to Rorschach, and communicates by rail with Appenzell and with towns in the Toggenburg (*q.v.*). In 1930 the population of the canton was 286.362 of whom 279,230 were German-speaking, 4,989 Italian-speaking and 993 French-speaking, while there were 170,445 Catholics, 114,545 Protestants and 704 Jews; in 1950 the population was 309,106. The capital of the canton is St. Gall, population (1950) 68,011; the other most populous places (1950 census) are Rorschach (pop. 11,325), Altstatten (pop. 8,603), Gossau (pop. 8,316) and Wattwil (6,336). In the southern and more Alpine portion of the canton the inhabitants mainly follow pas-

toral pursuits, while in the central and northern regions agriculture is frequently combined with manufactures.

The canton is one of the most industrial in Switzerland. Cotton spinning is widely spread, though the characteristic industry is the manufacture of muslin, embroidery and lace, chiefly at the capital and at Altstatten; the value of the embroidery and lace exported from the canton, though fluctuating, normally amounts to about one-seventh of the total export trade of Switzerland. Ores of iron and of manganese are raised in the Gonzen mine near Sargans. The canton is divided into 14 administrative districts, which comprise 91 communes.

The existing constitution dates from 1890. The legislature (Grossrat) of 174 deputies is elected on the principle of proportional representation. Each commune of 1,500 Swiss inhabitants or less has a right to one member, and as many more as the divisor 1,500 justifies. Members hold office for three years. The seven members of the executive (Regierungsrat) also hold office for three years and are elected by the combined communes. The two members of the federal *Ständerat* are named by the legislature, while the 13 members of the federal Nationalrat have, since 1911, been elected by a scheme of proportional representation, using the popular vote. The right of "facultative referendum" and of "initiative" as to legislative projects has, since 1875 and 1890 respectively, belonged to any 4,000 electors, but in case of "initiative" in constitutional matters (1861) 10,000 must sign the demand. The canton of St. Gall, a great part of which formerly belonged to the abbots of St. Gall, is one of the later political units, having been formed in 1803, from numerous districts, some of which, *e.g.*, Gaster, Uznach and Gams, had been controlled by the adjacent and older cantons since the 11th century.

ST. GALLEN (Fr. **ST. GALE**), capital of the Swiss canton of that name, is situated in the upland valley of the Steinach, 2,195 ft. above sea-level. Its population is almost all German-speaking, while the Protestants and Catholics each comprise about half the population, with a small number of Jews. In 1920 the population was 70,437; in 1930 63,947, and in 1941 62,360, a decrease due partly to World Wars I and II.

St. Gallen owes its origin to St. Gall, an Irish hermit, who in 614, built his cell in the forest which then covered the site, and lived there till his death in 640. About the middle of the 8th century the collection of hermits' dwellings was transformed into a regularly organized Benedictine monastery. For the next three centuries this was one of the chief seats of learning and education in Europe. About 954 the monastery and its buildings were surrounded by walls as a protection against the Saracens, and this was the origin of the town.

In 1311 St. Gallen became a free imperial city, and about 1353 the gilds, headed by that of the cloth-weavers, obtained the control of the civic government, while in 1415 it bought its liberty from the German king Sigismund. This growing independence did not please the abbots, who had been made princes of the Empire in 1204, and there followed a long struggle between them and their rebellious subjects of St. Gallen and Appenzell. In 1411 the Appenzellers became "allies" of the Swiss confederation, as did the town of St. Gallen a few months later, this connection becoming an "everlasting" alliance in 1454, while in 1457 the town was finally freed from the abbot. After further conflicts, the abbot in 1490 concluded an alliance with the Swiss which reduced his position almost to that of a "subject district." The townsmen adopted the Reformation in 1524, and this new cause of difference further envenomed their relations with the abbots. Both abbot and town were admitted regularly to the Swiss diet, but neither succeeded in its attempts to be received a full member of the Confederation. In 1798 and finally in 1805 the abbey was secularized, while out of part of its dominions and those of the town the canton Santis (now St. Gall) was formed, with St. Gallen as capital.

St. Gallen is by rail 9 m. S.W. of Rorschach, its port on the lake of Constance, and 53 m. E. of Zurich. The older or central portion of the town retains the air of a small rural capital, but the newer quarters present the aspect of a modern commercial centre. Its chief building is the abbey church of the celebrated old monastery (dating in its present form from 1756–1765). It has been a cathedral church (Catholic) since 1846. The famous library is housed in the former palace of the abbot, and is one of the most renowned in Europe by reason of its rich treasures of early mss. and printed books. Other portions of the monastic buildings are used as the offices of the cantonal authorities, and contain the extensive archives both of this monastery and of that of Pfafers.

See *Dict.* geogr. de *la Suisse,* vol. iv. (1906).

SAINT-GAUDENS, AUGUSTUS (1848–1907), American sculptor, was born in Dublin, Ireland, on March 1, 1848, the son of a French father, a shoemaker by trade, and an Irish mother, and was taken to America in infancy. He was apprenticed to a cameo-cutter, studying in the schools of Cooper Union (1861) and the National Academy of Design, New York (1865–1866). His earliest work in sculpture, made upon the eve of his departure, in 1868, for Paris, was a bronze bust of his father, Bernard P. E. Saint-Gaudens. After some delay he was admitted as a pupil of Jouffroy in l'École des Beaux-Arts, and two years later, with his fellow-student Mercié, he went to Italy, where he remained three years. While in Rome he executed his statues "Hiawatha" and "Silence." Returning in 1873 to New York he made, the following year, an admirable bust of the statesman, William M. Evarts, and was commissioned by John La Farge to execute a relief of adoring angels for St. Thomas' Episcopal Church, New York, a work which immediately won the esteem of his brother artists. The church was destroyed by fire a few years later. His statue of Admiral Farragut, Madison Square, New York, was ordered in 1876, exhibited at the Paris salon of 1880 and unveiled in 1881. It was received with enthusiasm and from its first appearance Saint-Gaudens was recognized as a new leader in his art. To this period also belong the "Randall" of the "Sailors' Snug Harbour," Staten Island, and the beautiful caryatides for the Vanderbilt fireplace, preserved in the Metropolitan Museum.

At all times throughout his life the sculptor found diversion from more serious tasks in modelling portraits of friends in low relief. Among these we may note the medallions and placques of Bastien-Lepage and Dr. Henry Shiff (1880); Homer Saint-Gaudens and the children of Prescott Hall Butler (1881); Mrs. Stanford White (1884); Robert Louis Stevenson (1887); William M. Chase and the children of Jacob H. Schiff (1888); Kenyon Cox (1889), etc. Yet another form of sculpture was developed in his high-reliefs of Dr. Henry Bellows (1885) and Dr. McCosh (1889); and the lovely "Amor Caritas," which, with variations, long occupied his mind. His noble statue of Lincoln was unveiled in 1887 in Lincoln park, Chicago, and was at once accepted as the country's ideal. In Springfield, Mass., his unique "Deacon Chapin," known as "The Puritan," appeared also in 1887. The Adams memorial (1891) in Rock Creek cemetery, Washington, D.C., is considered by many to be Saint-Gaudens' greatest work; indeed not a few rate it as America's highest artistic achievement. The mysterious draped figure with shadowed face is often called "Grief," but the sculptor had no such intention; "Peace" or "Nirvana" better convey the meaning. The Garfield memorial in Fairmount park, Philadelphia, was completed in 1895. The Shaw memorial in Boston, a monument to Robert G. Shaw, colonel of a negro regiment in the Civil War, was begun in 1884 and occupied the master intermittently for more than 12 years, being dedicated in 1897. It is a large relief in bronze, measuring some 15 by 11 ft., and containing many marching soldiers, led by their young officer on horseback. The year 1897 saw likewise the completion of the "Logan" on a fiery steed, in Grant park, Chicago.

Another famous equestrian statue is the "General Sherman" which was begun in 1892 and dedicated in 1903. Standing at the entrance of Central park at 59th Street and Fifth Avenue, New York, this golden group of the mounted commander led by a beautiful winged "Victory" is one of the most impressive of the city's monuments. The "Sherman" was shown with other works of Saint-Gaudens at the Paris Exposition of 1900, receiving there the highest honours. The sculptor was made an officer of the Legion of Honour and corresponding member of the Institute of

France. A bronze copy of his "Amor Caritas" was purchased by the French Government. Other important works are the Peter Cooper memorial, New York; the "Parnell," in Dublin; the Phillips Brooks monument in Boston and a fine seated figure of Lincoln, recently erected on Chicago's lake front. Saint-Gaudens died at Cornish, N.H., on Aug. 3, 1907. He is rightly regarded as America's greatest sculptor and his work continues to exert a powerful and beneficent influence in the United States. In 1877 he married Augusta F. Homer and left a son, Homer Saint-Gaudens, now director of fine arts of the Carnegie Institute, Pittsburgh, Pa. His brother Louis (1854–1913) also a sculptor, assisted Augustus Saint-Gaudens in some of his creations.

See Royal Cortissoz, *Augustus Saint-Gaudens* (1907); Lorado Taft, *History of American Sculpture* (1903) and *Modern Tendencies in Sculpture* (1921); Kenyon Cox, *Old Masters and New* (1905); C. Lewis Hind, *Augustus Saint-Gaudens* (1908); Homer Saint-Gaudens, *The Reminiscences of Augustus Saint-Gaudem* (1913). (L. T.)

ST. GAUDENS, a town of France, capital of an arrondissement in the department of Haute-Garonne, 1 m. from the river Garonne, 57 mi. S.S.W. of Touiouse on the railway to Tarbes. Pop. (1936) 4,684. St. Gaudens derives its name from a martyr of the 5th century. at whose tomb a college of canons was established. It was important as a capital of the Nébouzan. as the residence of the bishops of Comminges and for its cloth industry. The church, once collegiate, dates chiefly from the 11th and 12th centuries, but the main entrance is flamboyant Gothic.

SAINT-GERMAIN, COMTE DE (c. 1710–*c.* 1780) called *der Wundermann, a* celebrated adventurer. Of his parentage and place of birth nothing is definitely known; the common version is that he was a Portuguese Jew. He knew nearly all the European languages, and spoke German, English, Italian, French (with a Piedmontese accent), Portuguese and Spanish. Grimm affirms him to have been the man of the best parts he had ever known. He was a musical composer and a capable violinist. His knowledge of history was comprehensive, and his accomplishments as a chemist, on which be based his reputation, were in many ways real and considerable. He pretended to have a secret for removing flaws from diamonds, and to be able to transmute metals. The most remarkable of his professed discoveries was of a liquid which could prolong life, and by which he asserted he had himself lived 2,000 years.

Saint-Germain is mentioned in a letter of Horace Walpole's as being in London about 1743, and as being arrested as a Jacobite spy and released. Walpole says: "He is called an Italian, a Spaniard, a Pole; a somebody that married a great fortune in Mexico and ran away with her jewels to Constantinople; a priest, a fiddler, a vast nobleman." At the French court, where he appeared about 1748, he exercised for a time extraordinary influence and was employed on secret missions by Louis XV.; but, having interfered in the dispute between Austria and France, he was compelled in June 1760, on account of the hostility of the duke of Choiseul, to remove to England. He appears to have resided in London for one or two years, but was at St. Petersburg in 1762, and is asserted to have played an important part in connexion with the conspiracy against the emperor Peter III. in July of that year, a plot which placed Catherine II. on the Russian throne. He then went to Germany, where, according to the *Mémoires authentiques* of Cagliostro, he was the founder of freemasonry, and initiated Cagliostro into that rite. He was again in Paris from 1770 to 1774, and after frequenting several of the German courts he took up his residence in Schleswig-Holstein, where he and the Landgrave Charles of Hesse pursued together the study of the "secret" sciences. He died at Schleswig in or about 1780–1785, although he is said to have been seen in Paris in 1789.

Andrew Lang in his *Historical Mysteries* (1904) discusses the career of Saint-Germain, and cites the various authorities for it. Saint-Germain figures prominently in the correspondence of Grimm and of Voltaire. *See* also Oettinger, *Graf Saint-German* (1846); F. Bülau, *Geheime Geschichten und räthselhafte Menschen,* Band i. (1850–60); Lascelles Wraxall, *Remarkable Adventures* (1863); and U. Birch in the *Nineteenth Century* (January 1908).

SAINT-GERMAIN, CLAUDE LOUIS, COMTE DE (1707–1778), French general, was born on April 15, 1707, at the Chbteau of Vertamboz. He entered the army, but left France, apparently on account of a duel, and fought in the armies of the elector palatine and the elector of Bavaria. Then, after a brief service under Frederick the Great of Prussia, he joined Marshal Saxe in the Netherlands, and was created a field-marshal of the French army. On the outbreak of the Seven Years' War (1756) he was appointed lieutenant-general, but he fell a victim to court intrigues and professional jealousy. He resigned his commission in 1760 and accepted an appointment as field-marshal from Frederick V. of Denmark, being charged in 1762 with the reorganization of the Danish army. On the death of Frederick in 1766 he returned to France. bought a small estate in Alsace near Lauterbach, and devoted his time to religion and farming. In October 1775 he was appointed minister of war by Louis XVI., but his efforts to effect economies and to introduce Prussian discipline in the French army brought on such opposition that he resigned in September 1777. He died in his apartment at the arsenal on Jan. 15, 1778.

ST. GERMAIN, TREATY OF (*see* also VERSAILLES, TRIANON, and NEUILLY, TREATIES OF). Austria and Hungary had up to 1918 formed a diplomatic unit, but in Oct. 1918 they were virtually two separate states. The Armistice of Nov. 4 still recognized Austria-Hungary as a diplomatic unit, but Austria was proclaimed a Republic Nov. 12, as was Hungary Nov. 16. The Armistice concluded by the Powers direct with Hungary (Nov. 13) recognized that Power's *de facto* independence of Austria.

All the Powers, except the United States, early asserted that the "Fourteen Points," etc., did not apply to the settlements with Austria and Hungary. In Jan. 1919 it was known that even Wilson favoured including in Italy part of the Slovene population of Istria and Carniola, and would make Italy further concessions. On April 14 he agreed to grant Italy the Tirol south of the Brenner Pass, with about 250,000 Germans, as well as the Trentino, as already agreed by France and Great Britain. It was known also that the Czechoslovak State would include over 3,000,000 Germans. Austria was to be reduced to some two-thirds of her German-speaking territories. In mid-April the French Prime Minister Clemenceau obtained from the Allies the further important decision to prohibit union between Austria and Germany without the unanimous consent of the Council of the League. This was embodied in the draft treaty with Germany of May 6, and formed article 80 of the Treaty of Versailles of June 28, appearing as article 88 of the Treaty of St. Germain, and article 72 of the Treaty of Neuilly.

On May 2 the Austrian delegation was invited to Paris. On June 2 they were presented with a very imperfect draft treaty, followed by a more detailed one on July 20. Austria made great protests, turning mainly on two points. She asserted the applicability of the "Fourteen Points" to her case, and her right therefore to retain all her German subjects. President Wilson alone was willing to extend the application of the "Fourteen Points" to Austria; the treaty assigned 3,500,000 Germans to Czechoslovakia, about 250,000 to Italy. The other main point of dispute was how far Austria must accept the responsibilities of old Austria-Hungary. The Allies finally decided that the Austrian Republic was not a new State but an old one lopped off certain outlying provinces and endowed with a new government. The Allies recognized this government *de facto* by accepting their credentials on May 22 and *de jure* on Sept. 10, by signing the treaty with them at St. Germain-en-Laye. It came into force On July 16 1920.

Part I. The Covenant, and Part XIII. Labour, are as in the Treaty of Versailles.

Part II. of the Austrian Treaty details the borders of the new Austrian State.

Part III. Political Clauses for Europe.—This deals with technical details such as the financial obligations of the former Austrian empire affecting Italy, Yugoslavia, Czechoslovakia and Rumania. Articles 49–50 arranged for a plebiscite in two areas of the Klagenfurt basin. This plebiscite, taken in 1920, went in Austria's favour. West Hungary, with about 333,000

souls, was transferred from Hungary to Austria but ultimately, in 1921, without its chief town (see BURGENLAND). Further clauses in Part III dealt with the protection of racial and religious minorities. Article No. 88 prohibits Austria from alienating her independence (*i.e.*, joining Germany) otherwise than with the consent of the Council of the League of Nations.

Part IV. Austrian Interests Outside Europe.—As in the Treaty of Versailles this part provides for a total renunciation of state properties immovable and movable outside Europe, and also of treaties, capitulations, concessions, etc., in the following countries: Morocco, Egypt, Siam and China.

Part V. Military, Naval and Air Clauses followed the general lines of the similar clauses in the Treaty of Versailles but showed somewhat more consideration to Austria. A long-service voluntary force not exceeding 30,000 was allowed. The manufacture of arms, etc., was confined to a single factory (article 132). The naval clauses were very drastic; the whole Austro-Hungarian navy was broken up or distributed among the Allies, Austria only retaining four patrol boats on her inland waters. The air clauses were as in the German treaty.

Part VI. Prisoners of War and Graves, *Part XI.* Aerial Navigation, were as in the German Treaty, with a few very small alterations.

Part VII. Penalties provided for the trial before Allied military tribunals of Austrian offenders against the laws and customs of war. This provision was not executed.

Part VIII. Reparations; *Part IX.* Financial Clauses; *Part X.* Economic Clauses.—By article 177 Austria accepted responsibility for herself and her Allies for causing loss and damage to the Allied (Entente) governments by the war. The rest of the "Reparation Chapter" followed the corresponding section in the German treaty. No lump sum was fixed, but discretion mas, in effect, given to the Reparation commission to fix it. Austria handed over her whole commercial fleet and much livestock to the Allies. Czechoslovakia, Yugoslavia, Poland and Rumania had, however, to contribute to expenses incurred by the Allies in liberating their territory from Austria. The financial clauses involved many complex questions as to the allocation of pre-war debt and the distribution of war debts. All these provisions were somewhat relaxed by the Supreme council on March 17, 1921, and the process was completed by Austria placing her finances under control of the league in Sept. 1922 (see AUSTRIA).

Part XII. Ports, waterways and railways, merely stressed some points in the corresponding section of the German treaty.

See *Treaty Series*, No. II (Cmd. 400 of 1919); also H. W. V. Temperley (ed.), *A History of the Peace Conference of Paris;* vol. iv. and v. (Institute of International Affairs, London, 1921).

ST. GERMAIN-EN-LAYE, a town of northern France, in the department of Seine-et-Oise, 13 mi. W.N.W. of Paris by rail. Pop. (1946) 22,013. Built on a hill on the left bank of the Seine and on the edge of a forest 10,000 to 11,000 ac. in extent, St. Germain has a bracing climate, which makes it a summer residence for Parisians. A monastery in honour of St. Germain, bishop of Paris, was built in the forest of Laye by King Robert. Louis VI built a castle close by. Burned by the English, rebuilt by Louis IX, and again by Charles V, this castle was completed by Francis I. A new castle was begun by Henry II and completed by Henry IV; it was subsequently demolished, except the so-called Henry IV pavilion. The old castle has been restored. James II of England died at St. Germain.

ST. GERMANS, a village in the Bodmin parliamentary division of Cornwall, Eng., on the St. Germans or Lynher creek. 22 mi. E.S.E. of Bodmin by road. Pop. (1951) 2,084. It is an agricultural district with market gardens and quarries and is also a holiday centre. St. Germanus, bishop of Auxerre in France, founded a monastery there in the 5th century and before 931 it was the seat of the Cornish bishopric founded by Athelstan. The see was transferred to Creditou in *c.* 1043 and to Exeter *c.* 1050. In the 12th century a priory of Augustinian canons was established at St. Germans, and the present church of St. Germanus, consecrated in 1261. was built. Mostly the original Norman, it has Early English, Perpendicular and Decorated additions and the east window is by E. Burne Jones. After the suppression of the monasteries the crown retained the borough until 1610. Elizabeth I created it a parliamentary borough and from 1563 until 1832 it returned two members. In the villages of the district, Callington was granted a market in 1267 and the pannier market still exists; Cotehele house, above the Tamar near Calstock, is a beautiful Tudor house (1485–1539) formerly the seat of the Edgcumbe family and given to the National trust in 1947; St. Germans has a row of six gabled almshouses, probably 17th-century work.

ST. GILLES, a town of southern France, in the department of Gard, on the canal from the Rhone to Cette, 12½ mi. S.S.E. of Nîmes by road. Pop. (1946) 4,473. In the middle ages St. Gilles, the ancient *Vallis Flaviana,* was the seat of an abbey founded in the 7th century by St. Aegidius (St. Gilles). It acquired wealth and power under the counts of Toulouse, who added to their title that of counts of St. Gilles. The church was founded 1116. The lower part of the Romanesque front (12th century) has three bays decorated with columns and bas-reliefs. There is a 12th century crypt. St. Gilles was the seat of the first grand priory of the Knights Hospitallers in Europe (12th century) and was their place of embarkation for the east. In 1226 the countship of St. Gilles was united to the crown. In 1562 the Protestants ravaged the abbey, which they occupied till 1622, and in 1774 it was suppressed. The town has an important trade in wines.

ST. GOTTHARD PASS, an important motor and railway route from northern Europe to Italy. It takes its name from St. Gotthard, bishop of Hildesheim (d. 1038), but does not seem to be mentioned before the early 13th century perhaps because the access to it lies through two very narrow Alpine valleys much exposed to avalanches. The hospice on the summit is first mentioned in 1331, and from 1683 onward was in charge of two Capuchin friars. But in 1775 the buildings near it were damaged by an avalanche, while in 1799–1800 everything was destroyed by the French soldiery. Rebuilt in 1834, the hospice was burnt in March 1905. The mule path (dating from about 1293) across the pass served for many centuries. The carriage road was only constructed between 1820 and 1830. Beneath the pass is the St. Gotthard tunnel (pierced in 1872–1880, 9¼ mi. in length, and attaining a height of 3,786 ft.), through which runs the railway (opened in 1882) from Lucerne to Milan (175½ mi.). The railay runs first along the northern and eastern shores of Lake Lucerne, from Lucerne to Flüelen (32¼ mi.), and then up the Reuss valley past Altdorf and Wassen, near which is the first of the famous spiral tunnels, to Goschenen (56 mi. from Lucerne). Here the line enters the tunnel and gains, at Airolo, the valley of

A SECTION OF THE ST. GOTTHARD PASS IN THE FREMOLA VALLEY

the Ticino or the Val Leventina, which it descends, through several spiral tunnels, till at Biasca (38 mi. from Goschenen) it reaches more level ground. Thence it runs past Bellinzona to Lugano (304 mi from Biasca) and reaches Italian territory at Chiasso, 35 mi. from Milan. The railway is now the property of the Swiss Government.

ST. HELENA, an island and British colony in the South Atlantic, 15° 55′ 26″ S., 5° 42′ 30″ W. (Ladder Hill observatory). Area 47.3 sq.mi., extreme length, southwest to northeast, 10½ mi., extreme breadth 6½ mi. The island is wholly of volcanic origin,

the activity being long extinct, while subaerial denudation has greatly modified it and marine erosion has formed perpendicular cliffs 450 to 2.000 ft. high on the east, north and west sides. Its principal feature, a semicircular ridge of mountains, with the culminating summit of Diana's peak (2,704 ft.), is the northern rim of a great crater; the southern rim having been breached hypothetically forms the centre of the ring. From the crater wall outward water-cut gorges stretch in all directions, widening as they approach the sea into valleys, some of which are 1,000 ft. deep. These valleys contain small streams. Springs of pure water are abundant. Along the enclosing hillsides caves have been formed by the washing out of the softer rocks. The lavas are basalts, andesites, trachytes and phonolites; there is much volcanic ash, tuff, scoriae, etc., and conspicuous features are formed by rocks, representing a late period of activity. Such features are Ass's Ears, Lot and Lot's Wife and the Chimney. There are several subsidiary craters. The only practicable landing place is on the leeward side at St. James's bay. From the head of the bay a narrow valley extends for 1½ mi. The greatest extent of level ground is in the northeast of the island, where are the Deadwood and Longwood plains, more than 1,700 ft. above the sea.

Although the island is within the tropics, its climate is healthful and temperate. This is due to the southeast tradewind and to the effect of the cold waters of the South Atlantic current. The temperature varies on the sea level from 68° to 90° F. in summer and 57° to 84° in winter. The higher regions are about 10° cooler. The rainfall varies considerably.

Flora and Fauna. — St. Helena has three vegetation zones: (1) the coast zone. extending inland for 1 mi. to 1½ mi., now "dry, barren, soilless. lichen-coated, and rocky," with little save prickly pears, wire grass and *Mesembryanthemum;* (2) the middle zone (400–1,800 ft.). extending about ¾ mi. inland, with shallower valleys and grassier slopes—the English broom and gorse. brambles, willows. poplars and Scotch pines being the prevailing forms; and (3) the central zone, about 3 mi. long and 2 mi. wide, the home. for the most part. of the indigenous vegetation. Many of the endemic species have become extinct. but by 1955 some of the rarer ones were protected. The indigenous vegetation shows affinities with that of Africa, and its exotic appearance gives the island almost the aspect of a botanic garden; for example, the oak, thoroughly naturalized. grows next to the bamboo and banana. Common trees include the endemic cabbage tree (Senecio), the cedar and the eucalyptus. The New Zealand flax (Phormium) was introduced from that country with great commercial success, and encouragement has been given by the government to the cultivation of lily bulbs (Lilium *longiflorum*).

Besides domestic animals the only land mammals are rabbits, rats and mice, the rats being especially abundant. The only endemic land bird is a small plover called the wirebird, Charadrius sanctae-helenae. Introduced birds now common on the island include the avadavat, Java sparrow, cardinal, ground dove, partridge (the Indian *chukar*), ring-necked pheasant and guinea fowl. Among sea birds are the sooty tern, white-winged tern and noddy. There are no freshwater fish but of 65 species of seafish caught 17 are peculiar to St. Helena; economically the more important kinds are gurnard, eel, cod, mackerel, tunny, bullseye, cavalley, flounder, hogfish, mullet and skulpin.

History. — The island was discovered on May 21, 1502, by the Portuguese João de Nova Castella, on his voyage home from India, and by him named St. Helena. The Portuguese found it uninhabited. imported livestock, fruit trees and vegetables, built a chapel and one or two houses and left their sick there to be taken home, if recovered, by the next ship, but they formed no permanent settlement. Its first known permanent resident was Fernando Lopez, a Portuguese in India, who had turned traitor, and had been mutilated by order of Alphonso d'Albuquerque. He preferred being marooned to returning to Portugal in his maimed condition, and was landed at St. Helena in 1513, with three or four Fegro slaves. By royal command he visited Portugal some time later. but returned to St. Helena. where he died in 1546. In 1584 two Japanese ambassadors to Rome landed at the island. The first Englishman known to have visited it was Thomas Cavendish, who touched there in June 1588 during his voyage around the world. Another English seaman. Captain Kendall, visited St. Helena in 1591, and in 1593 Sir James Lancaster stopped at the island on his way home from the east. In 1603 the same commander again visited St. Helena on his return from the first voyage equipped by the East India company. The Portuguese had by this time given up calling at the island, which appears to have been occupied by the Dutch about 1645. The Dutch occupation was temporary and ceased in 1651, the year before they founded Cape Town. The (British) East India company appropriated the island immediately after the departure of the Dutch, and in 1659 they dispatched a small force of troops and others under John Dutton to form a settlement. The company was confirmed in possession by a clause in their charter of 1661. The fort built by the company was named after the duke of York (James II).

On New Year's day, 1673, the Dutch succeeded in capturing St. Helena. but they were ejected the following May 5 by Sir Richard Munden. By a new charter granted in Dec. 1673 the East India company were declared "the true and absolute lords and proprietors of the island." Thereafter St. Helena was in the undisturbed possession of Great Britain, though in 1706 two ships anchored off Jamestown were carried off by the French. In 1673 the inhabitants had numbered about 1,000, of whom nearly half were Negro slaves. In 1810 the company began to bring in Chinese from their factory at Canton. During the company's rule the island prospered; homeward-bound vessels, numbering hundreds in a year, anchored in the roadstead and stayed for considerable periods refitting and revictualling. Large sums of money were thus expended in the island, where wealthy merchants and officials had their residence. The plantations were worked by slaves, who were subjected to very barbarous laws until 1792, when a new code of regulations ensured their humane treatment and prohibited the importation of any new slaves. Later it was enacted that all children of slaves born on or after Christmas day 1818 should be free, and between 1826 and 1836 all slaves were set at liberty.

Among the governors appointed by the company to rule at St. Helena was one of the Huguenot refugees, Capt. Stephen Poirier (1697–1707), who attempted unsuccessfully to introduce the cultivation of the vine. A later governor (1741–42) was Robert Jenkins (*q.v.*) of "Jenkins' ear" fame. William Dampier visited the island in. 1691 and 1701; Halley's mount commemorates the visit paid by the astronomer Edmund Halley in 1676–78.

In 1815 the British government selected St. Helena as the place of detention of Napoleon Bonaparte. He was brought to the island in October of that year and lodged at Longwood, where he died in May 1821. During this period the island was strongly garrisoned by regular troops, and the governor, Sir Hudson Lowe, was nominated by the crown. After Napoleon's death the East India company resumed full control of St. Helena until April 22, 1834, on which date it was, in virtue of an act passed in 1833, vested in the crown. As a port of call the island continued to enjoy a fair measure of prosperity until about 1870.

Afterward the great decrease in the number of vessels visiting Jamestown deprived the islanders of their principal means of subsistence. When steamers began to be substituted for sailing vessels and when the Suez canal uas opened (1869) fewer ships passed the island and fewer still found it necessary to call. The withdrawal in 1906 of the small garrison, hitherto maintained by the imperial government, was another cause of depression, but during World War I the island was again garrisoned. During the South African War (1899–1902) some thousands of prisoners were detained at St. Helena, which has also served as the place of exile of several Zulu chiefs, an ex-sultan of Zanzibar and others. In 1922 Ascension Island (*q.v.*), up to that time under the care of the British admiralty, was made a dependency of St. Helena. Similarly, Tristan da Cunha (*q.v.*) and the associated islands of Nightingale, Inaccessible and Gough, became dependencies of St. Helena in 1938. The island was of strategic importance in the naval operations of World War II.

Population. — When discovered the island was uninhabited. The majority of the population are of mixed European (British, Dutch, Portuguese), East Indian and African descent. The origi-

nal European settlement was made by John Dutton with a few soldiers and followers sent in 1659 by the (British) East India company to annex the island. Subsequently more soldiers and settlers were sent from England, and their numbers were augmented by members of the crews of ships returning to Europe from the east. From 1840 onward for a considerable period there was an influx of freed slaves of West African origin. The estimated population of the colony proper in 1953 was 4,895, of whom about one-third live at Jamestown, the port and capital. Longwood, where Napoleon died in 1821, is $3\frac{1}{2}$ mi. E. of Jamestown. Most of the population is Anglican in religion. St. Helena is the seat of an Anglican bishopric (within the province of South Africa) established in 1859. Ascension and Tristan da Cunha are in the diocese.

Education is compulsory and is provided free for all children between the ages of j and 1 j years. There were 11 primary schools and 1 secondary school in 1953, and the total number of pupils was 1,223.

Letters patent of 1939 provide for an executive council consisting of the government secretary and the colonial treasurer ex *officio* and such other nominated members as may be approved; and for an advisory council consisting of six persons not holding any office under the crown, two nominees of the friendly societies and one representing the phormium flax industry. The governor makes ordinances, as there is no legislative council, but power is reserved to the sovereign in council to legislate by order. The governor also acts as chief justice.

Economy.— Less than a third of the area of the island is suitable for farming. The principal crops are phormium flax and potatoes. Cattle and sheep are raised—but there is no outside market—and lace making is carried on. Local trade received a severe blow when, with completion of the Suez canal, ships en route from Europe to the orient ceased to call at the island. The principal exports are phormium fibre, tow rope and twine, and small quantities of wool and lily bulbs are sold. St. Helena's ten-year development program (revised 1951) was financed entirely from an allocation of £200,000 under the Colonial Development and Welfare act of 1945. The only banking institution is the government savings bank. Bank of England notes and the coinage of the United Kingdom are legal tender, but South African currency also circulates and is acceptable. The colony's revenue in 1952 was $127,536 and the expenditure £142,022. There is an insular mail steamship service to England and to South Africa, and direct cable communication with Cape Town and Porthcurno, Eng. (for London).

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ST. HELENS, a municipal, county and parliamentary borough, Lancashire, England, 12 mi. E.N.E. by road of Liverpool. Pop. (1951) 110,260. Area 12.4 sq.mi. The town's modern development began with the opening of coal mines in the 17th century and was furthered when glass works were started in 1773. It is one of the world's biggest glass-making centres, employing nearly 20,000 workers in the 1950s. The industry is based on field sand found in southwest Lancashire. Other important manufactures include patent medicines, iron and brass foundries, pottery and textiles. There is a trading estate at Parr. St. Mary's church (rebuilt after a fire in 1916) occupies the site of "Sainct Elyn's Chapell" after which the town is named. The Gamble institute houses a technical school and a public library. The town was incorpordted in 1868; became a parliamentary borough in 1885 (returning one member) and a county borough in 1888.

ST. HELIER, capital of Jersey, Channel Islands. About 1150 an abbey was built on an islet in St. Aubin's bay and dedicated to St. Helier, a legendary hermit said to have been martyred on a neighbouring rock. The monks acquired land on the main island opposite and opened a market, around which shops and taverns sprang up. When the court began to meet there on market days, further houses were built. What had been a tiny fishing hamlet became a town, but quite a small one. In 1685 it had only 210 houses.

Its more rapid growth began in the 18th century with the building of the harbour, followed by an inrush of French aristocrats fleeing from the Revolution. Then in modem times came a great invasion of Englishmen fleeing from income tax. It became a busy commercial centre, which by 1951 had 25,360 residents.

In the Royal square, the former market place, where in 1781 the battle of Jersey was fought and the last French invasion defeated, stand the Town church (mainly 14th and 15th century), the Royal court (built 1865), the public library (1886) and the States' chamber (1887), while Fort Regent (1815) frowns down from the hill above. On another hill Victoria college (1852), a public school with 330 boys, commemorates a visit of Queen Victoria.

The abbey fell into ruins after the Reformation and was replaced in Elizabeth's reign by Elizabeth castle. Its first governor was Sir Walter Raleigh. There Charles II took refuge twice during the civil wars. (See also CHANNEL ISLANDS and JERSEY.)

(G. R. B.)

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ST. HUBERT, a small town of Belgium in the province of Luxembourg and in the heart of the Ardennes. Pop. (1939) 3,02 j. Its abbey church contains the shrine of St. Hubert, and has an annual pilgrimage. According to tradition the church and a monastery attached to it were founded in the 7th century by Plectrude, wife of Pippin of Herstal. The second church was built in the 12th century, but burned in the 16th century. The present building has been restored in modern times and presents no special feature. The spot where St. Hubert is supposed to have met the stag with the crucifix between its antlers is about 5 mi. from the town. St. Hubert is the patron saint of huntsmen.

ST. HYACINTHE, a city and port of entry of Quebec, Canada, and capital of St. Hyacinthe county, 50 mi. E.N.E. of Montreal, on the Yamaska river and on the Canadian National railway. Pop. (1951) 20,236. It is the seat of a Roman Catholic bishop and contains a classical college, a technical school, a dairy school, two monasteries and several other educational and charitable institutions. Manufactures include organs, leather. shoes, silks, furniture, woollens and mill machinery. The city is a distributing centre for the surrounding district.

ST. IMIER, a town in the west of the canton of Berne, Switz., on the railway from Biel to La-Chaux-de-Fonds. It lies at the foot of Mont Soleil (4,240 ft.), which is ascended by a funicular railway. It is the centre of the watchmaking industry, a health resort, and a place for winter sports. The inhabitants, (1950) 5,972, are French-speaking and generally Protestant.

SAINTINE, JOSEPH XAVIER (1798–186j), French novelist and dramatist, whose real surname was BONIFACE, was born in Paris on July 10, 1798. In 1823 he produced a volume of poetry in the manner of the Romanticists, entitled *Poèmes,* odes, *et épîtres.* In 1836 appeared *Picciola,* the story of the comte de Charney, a political prisoner in Piedmont, whose reason was saved by his cult of a tiny flower growing between the paving stones of his prison yard. This story is a masterpiece of the sentimental kind and has been translated into many European languages. Saintine also wrote a great number of plays.

Saintine died on Jan. 21, 186 j.

ST. IVES, a municipal borough and fishing port in the St. Ives parliamentary division of Cornwall, Eng., 20 mi. N.E. of Land's End and 8 mi. N. by E. of Penzance by road. Pop. (1951) 9,051. Area 6.7 sq.mi. It lies on the north coast, its little harbour sheltered from the Atlantic by The Island, a strip of land running out to a granite knoll. The picturesque old town, with its winding streets and colour-washed stone cottages housing fishermen and artists, with their boats, clusters along this strip and round the harbour; the ground rises steeply behind, and to the southeast a modern residential quarter extends around the sandy bay for about $2\frac{1}{2}$ mi. to Carbis Bay. Fishing and tin-mining were important until the late 19th century when pilchards ceased to visit the waters and many miners emigrated. The beautiful sandy beaches and

the mild climate inspired the inhabitants to make St. Ives a holiday centre, and this trade has superseded the others.

The name St. Ives commemorates St. Eia, a 5th-century woman missionary who, according to tradition, floated over from Ireland on a leaf (coracle) and was later martyred. The present church of St. Ia is of the 15th century with a noble tower. Perkin Warbeck was proclaimed King Richard IV when he anchored in St. Ives bay in 1497. In 1639 a charter of incorporation was granted with provision for four fairs annually, tao weekly markets and a grammar school, but as the town declared for parliament in the Civil War its charter was withdrawn by Charles II. The present charter was granted in 1690. The guildhall was completed in 1940.

ST. IVES, a market town and municipal borough in Huntingdonshire, England, mainly on the left bank of the Ouse, 6 mi. E. of Huntingdon. Pop. (1961) 4,076. Area 3.3 sq.mi. The river is crossed by a 15th-century bridge with a chapel over the centre pier that was restored in 1689. The church of All Saints is Perpendicular, with earlier portions and a rebuilt spire. Oliver Croinwell lived in Old Slepe hall (demolished 1848) for five years, and his statue stands in the market place, the centre of the town. St Ives was noted for its eight-day fair beginning on Monday in Easter week. granted to the abbot of Ramsey by Henry I. In the reign of Henry III merchants from Flanders came to the fair, uhich had become so important that the king granted it to be continued beyond the eight days if the abbot agreed to pay a fee of £50 yearly for the extra days. The fair, with a market on Monday granted to the abbot in 1286. survives and was purchased by the town in 1874, the year of incorporation, from the duke of Manchester. The markets, extremely important to St. Ives as an agricultural centre. were substantially altered to give greater facilities for auction sales The Norris library and museum. opened in 1933, is mainly devoted to books and collections relating to the county.

SAINT JEAN (ST. JOHNS), the county seat of St. Jean county, Que.. Can.. 20 mi. S.E. of Montreal and on the west bank of the Richelieu river. Pop. (1961) 26,988, of which over 88% was French-speaking. Fort St John was established on the site in 1748. Later the city uas important as a trading centre on the canal system which connected Sorel. on the St Lawrence below Montreal, to Lake Champlain and thence to the Hudson river in New York state, and as the terminus of the first railway in Canada from Montreal. Its excellent location in respect to rail, road and canal routes. markets and available labour force, helped to maintain it as an important commercial and industrial centre Manufacturing is important, the principal products being sewing machines, ribbons, wooden articles, bricks, textiles and metallurgical products. (W. F. Ss)

ST. JEAN-DE-LUZ, a coast town of southwestern France, in the *département* of Basses-Pyrénées, at the mouth of the Nivelle, 14 mi. S.W. of Bayonne on a branch of the Southern railway. Pop (1954) 8,476. From the 14th to the 17th century St. Jean-de-Luz enjoyed a prosperity due to its mariners and fishermen. Its vessels were the first to set out for Newfoundland in 1520 In 1558. the Spaniards attacked and burned the town In 1627, houever. it was able to equip 80 vessels, which succeeded in saving the island of RC from the duke of Buckingham In 1660 the treaty of the Pyrénées was signed at St. Jean-de-Luz. At that time the population numbered 15,000. The cession of Newfoundland to England in 1713, the loss of Canada, and the silting-up of the harbour contributed to the decline of the town's maritime trade. St. Jean-de-Luz is situated in the Basque country on the bay of St. Jean-de-Luz, the entrance to which is protected by breakuaters and moles. It has a 13th-century church, the chief features of uhich are the galleries in the nave, which, by the Basque custom, are reserved for men.

ST. JOHN, OLIVER (c. 1598–1673), English statesman and judge, was the son of Oliver St. John of Cayshoe, Bedfordshire, and great-grandson of the first Lord St. John of Bletso. He was educated at Queens' college. Cambridge, and was called to the bar in 1626. He got into trouble with the court over a seditious publication and became closely associated with the future parliamentary leaders. He was employed as a lawyer by the earl of Bedford and was a member of the Providence Island company with the earl of Warwick, Lord Saye and John Pym. In 1637, as counsel for John Hampden, he made a notable speech defending Hampden's refusal to pay ship money. In 1638 he married, as his second wife. Elizabeth Cromwell, a cousin of Oliver Cromwell, to whom his first wife also had been distantly related. The marriage led to an intimate friendship with Cromwell. St. John was member for Totnes in both the short and the long parliament, uhere he acted in close alliance with Bedford, Hampden and Pym and led the attack on ship money (*q.v.*). In 1641. with a view of securing his support, the king appointed St. John solicitor general. Nonetheless he took an active part in promoting the impeachment and attainder of the earl of Strafford and in preparing other bills brought forward by the popular party in the commons.

During the civil war St. John gradually became a recognized leader of the Independents and in the quarrel betueen the parliament and the army in 1647 he sided with the latter. Throughout he enjoyed Cromwell's confidence.

In 1648 St. John was appointed chief justice of the common pleas. He refused to act as one of the commissioners for the trial of Charles I. In 1651 he went to The Hague on an unsuccessful mission to negotiate a union between England and the Netherlands. In the same year he was sent with other commissioners to settle the government of Scotland and to prepare the way for its union with England Otherwise, during the Commonaealth and Protectorite he largely confined himself to his judicial duties, having no great sympathy for the new order. After the Restoration he published an account of his past conduct (*The Case of Oliver St* John, 1660), which saved him from any more severe vengeance than exclusion from public office. He retired to his house in Northamptonshire till 1662, when he went to live abroad. He died on Dec. 31, 1673.

SAINT JOHN, the capital of St. John county and the largest city in New Brunswick. Can. Pop. (1961) city, 55.153; metropolitan area, 95,563.

Situated on a rocky peninsula at the mouth of the St. John river, the city has enjoyed importance as a port and as the gateway to the vast timber resources of the St. John river valley. The sheltered harbour has a depth of 32 ft. at low tide and 58 to 60 ft. at high tide, and is ice-free throughout the year. The river enters the harbour through a narrow rock gorge. making a 17-ft. descent to the ocean at low tide. At slack tide ships may pass through the gorge. With the rising tide ocean waters force themselves upstream, giving rise to the phenomena called the "reversing falls." (See also FUNDY, BAY OF.)

The site was visited in 1604 by Sieur de Monts and Champlain, but it was not until 1635 that Charles de la Tour established a trading post called Fort St. Jean, a fortification which was subsequently renamed, abandoned and rebuilt several times. In 1713 Acadia was ceded to England and in 1758 Col Robert Monckton refortified the site, calling it Fort Frederick. In 1783 a large body of United Empire Loyalists landed at Saint John, establishing Parr Tonn on the peninsula and Carleton across the harbour. By royal charter in 1785 the two areas became the city of Saint John the oldest incorporated city in present-day Canada.

Under protective British tariffs the city flourished during the early and middle 1800s. Wooden shipbuilding was a major industry and the lumber and fish trades boomed. Railway connections nith Moncton were completed in 1860, and in 1890 with Montreal via the Canadian Pacific railnay's "short line" through the state of Maine. The city's growth was checked by the disastrous fire in 1877 and by the decline of the lumber trade and wooden ships in the late 1800s.

The city is an important distributing centre and a major Canadian winter port A pulp and paper plant, oil and sugar refineries. a large brush factory. a large dry dock and a variety of light manufacturing industries are located in the area. The municipal airport gives connections with Halifax and hlontreal, and there is regular boat service across the Bay of Fundy to Digby, Nova Scotia. (C. W. Rn.)

SAINT JOHN ISLAND, the smallest (20 sq.mi j of the Virgin Islands (*q.v.*) purchased by the United States from Denmark in 1917. It was discovered by Columbus. Nov. 17, 1493. The fierce aboriginal Carib Indians were exterminated. but th

island was not settled until 1717 by planters from Saint Thomas Island (*q.v.*), 4 mi. E. In 1733 the population consisted of 208 whites and 1,087 slaves. The latter launched a formidable insurrection on Nov. 13, 1733 that was not crushed until July 1734. Denmark emancipated the slaves in 1848. The predominantly Negro population (1960, 923) is concentrated in the two settlements: Cruz bay and Coral bay (the best harbour refuge in the West Indies) at the western and southeastern ends of the island respectively.

Some cattle are raised and bay leaves (for bay rum) gathered from the forest around Bordeaux mountain (1.277 ft.).

The Caneel Bay Tourist development and the preservation of a large part of this mountainous island by the United States national park service serve to attract an increasing number of tourists.

(R. W. LN.)

ST. JOHN OF JERUSALEM, KNIGHTS OF THE ORDER OF THE HOSPITAL OF, known also later as the KNIGHTS OF RHODES and the SOVEREIGN ORDER OF THE KNIGHTS OF MALTA. The history of this order divides itself naturally into four periods: (1) from its foundation in Jerusalem during the first crusade to its expulsion from the Holy Land after the fall of the Latin kingdom in 1291; (2) from 1309–1310, when the order was established in Rhodes, to its expulsion from the island in 1522; (3) from 1529 to 1798, during which its headquarters mere in Malta; and (4) its modern development, as reconstituted after its virtual destruction in 1798.

Early **Development.**—Ever since Jerusalem became a centre of Christian pilgrimage. a hospital or hospice for pilgrims had existed there; and early in the 11th century one of these was restored, served by Benedictines and later dedicated to St. John the Baptist. When, in 1099, the crusaders surrounded the Holy City, the head of this hospital was a certain Gerard who is said to have assisted them during the siege. After the capture of the city he used his popularity to enlarge and reconstitute the hospital and adopted for his order the Augustinian rule. Donations and privileges were thereafter showered upon the new establishment in both Syria and Europe. In 1113 Pope Paschal II took the order and its possessions under his immediate protection (bull of Feb. 1 j to Gerard). his act being confirmed in 1119 by Calixtus II and subsequently by other popes. Gerard was indeed, as Pope Paschal called him. the institutor of the order, if not its founder. It retained, however, during his lifetime its purely eleemosynary character. The armed defense of pilgrims may have been part of its functions, but its organization as an aggressive military force was the work of Raymond du Puy who succeeded as grand master on the death of Gerard (Sept. 3, 1120). The statesmanlike qualities of Raymond rendered his long mastership epoch-making for the order; and from 1137, when the knights accepted custody of the newly fortified castle of Bait Jibrin, they took a regular part in the wars of the Cross. During the second crusade Raymond was present at the council of the leaders held at Acre in 1148, which resulted in the ill-fated expedition against Damascus. The failure at Damascus was repaired five years later by the capture of Ascalon (Aug. 1153), in which the grand master and his knights had a conspicuous share.

Meanwhile. in addition to its ever-growing wealth, the order had received from successive popes privileges which rendered it, like the companion order of the Temple, increasingly independent of and obnoxious to the secular clergy. During the 30 years of Raymond's rule the hospital, which Gerard had instituted to meet a local need. had become universal, and establishments were formed east and west. After Oct. 1158, when his presence is attested at Verona, this master builder of the order disappears from history; he died some time between this date and 1160 when the name of another grand master. Gilbert d'Assailly, appears.

Organization of the Order.—The rule of the hospital, as formulated by Raymond du Puy, was based upon that of the Augustinian canons (*q.v.*). Its further developments, of which only the salient characteristics can be mentioned here. were closely analogous to those of the Templars (*q.v.*), whose statutes regulating the life of the brethren. the terms of admission to the order. the maintenance of discipline and the scale of punishments, culminating in expulsion are, *mutatis mutandis,* closely paralleled by those of the Hospitallers.

Within the order were the three classes of knights, chaplains and serving brothers. The dominant class was that of the knights, in whose hands lay all power within the order. At its head was the master who held office for life. His powers were limited only by the statutes and customs and by the chapter general which, however. mas only an occasional body summoned by himself. He was assisted in the exercise of his authority by the great officers of the order—prior, preceptor, marshal, hospitaller. drapier and treasurer—to whom were added. shortly after 1300, the turcopolier and admiral. The unit of provincial administration was the priory (England constituted one. while in Italy there were seven), and within each of these there mere a number of commanderies (there were 36 in England at the end of the middle ages). As the order increased in size, the brethren came to be grouped in nations or tongues, and in the 14th century the division of the order into its seven tongues (Provence, Auvergne, France. Italy, Spain. England, Germany) was a recognized feature of its constitution. One of the great officers was placed at the head of each tongue; priories and commanderies were reserved for the brethren of the tongue concerned. and disputes were settled within the assembly of the tongue. From the later middle ages the Hospitallers were rather a federation of national societies than a united cosmopolitan order.

In two important respects the knights of St. John differed from the Templars. The latter were a purely military organization; the Hospitallers, on the other hand. were at the outset preponderatingly a nursing brotherhood. and though this character was subordinated during their later period of military importance. it never disappeared. It continued to be a rule of the order that in its establishments it was for the sick to give orders. for the brethren to obey. The chapters were largely occupied with the building. furnishing and improvement of hospitals, to which were attached learned physicians and surgeons who had the privilege of eating with the knights. The revenues of particular properties were charged with providing luxuries (*e.g.*, white bread) for the patients, and the various provinces of the order with the duty of forwarding blankets, clothes, wine and food for their use. The Hospitallers. moreover, encouraged the affiliation of women to their order. which the monastic and purely military rule of the Templars sternly forbade.

The Knights in Syria.—As the wealth and military resources of the orders grew, so did their influence in the affairs of the Latin states. The military feudal class among the Syrian Franks had never been sufficiently numerous to ensure effective settlement, and it was continuously impoverished by a variety of causes. As a result the orders acquired castles which lay magnates could no longer afford to maintain. and with the buildings the knights secured the appurtenances—lands and rights over tenants. The Hospitallers acquired Bait Jihrin in 1137, Krak (Crac) des Chevaliers and an extensive border area to the north and east in 1142, Arca and Jebel Xkkar in 11 jo. Chastel Ruge in 1177 and Margat, which later became the headquarters of the order, in 1186. To this extent the military orders were replacing the feudal aristocracy as landlords. It was a change in the balance of power which weakened the monarchy of Jerusalem, for the orders were not bound to the king by the same ties of allegiance as were the feudatories.

The role which the orders were enabled to play in the affairs of the kingdom was reflected in events. The Templars refused to take part in invasions of Egypt led by King Amalric I. but the Hospitallers encouraged the project, supplied the king with an important contingent of his army and bargained with him for the price of that support almost as an independent power. In the problems of regency and succession which followed the death of Amalric in 1174, the masters of the military orders emerged as figures of the first importance, and when Baldwin V died in 1185 all the castles of the kingdom were given into their custody.

These problems weakened the kingdom at a time when Saladin's power was advancing and prepared the way for the disasters of 1187: the annihilation of the Christian army at Hattin and the loss of Jerusalem (see CRUSADES). The Hospitallers played a full

part in the vain military effort to avert these defeats. After Hattin, Saladin spared the lives of nearly all his prisoners except the Templars and Hospitallers whom he massacred in cold blood. This uncharacteristic act is a measure of the respect in which the knights were held by the Moslems. The Hospitallers were again prominent in the ensuing third crusade and especially distinguished themselves in King Richard of England's victory at Arsuf (1191). During the following decade there was a steady development of the property and privileges of the order.

During the 13th century the Latin states in Syria were less securely established than they had been during the 12th century: the settlement grew progressively weaker until, with the loss of Acre in 1291, it was finally extinguished. The authority of the monarchy was compromised by the succession of women and by the civil war provoked by the conduct of the emperor Frederick II in Syria and Cyprus, and was never subsequently resurrected. The way was left clear for certain groups, such as Baronial families, Italian merchant communities and the military orders, to follow their particular interests unchecked by higher authority.

In this way the Hospitallers played a part in weakening Latin Syria. They were engaged in frequent disputes with diocesans and with the Templars. From 1199, in opposition to the Templars, they supported an Armenian claimant to the principality of Antioch and were not reconciled to its prince Bohemund IV until 1231. They held aloof from the efforts of Frederick II to recover Jerusalem. In 1240–41 they and the Templars gave differing advice to the crusaders Thibaut IV of Champagne and Richard of Cornwall in their efforts to negotiate a truce with the Moslems. The two orders again took different sides in the war between the Venetians and Genoese which devastated Acre between 1256 and 1258. In 1236 it had come to the attention of Pope Gregory IX that, in pursuance of their own private quarrels, the knights were contemplating alliance with the sect of the Assassins, and he sternly rebuked them both on this account and because of their backsliding from the ideals of their order *(see* his letters translated in E. J. King's *The Knights Hospitallers in the Holy Land,* pp. 234–236).

It must be emphasized that in these respects the knights were no worse than their contemporaries in Syria and that there is another side to the picture. The order was to the fore in all the major attacks made on the Moslems during the 13th century. It played a distinguished part in the invasions of Egypt by the forces of the fifth crusade in 1218–21 and by those of St. Louis in 1249–50. It joined the expeditions led by Andrew II of Hungary (1217) and by Thibaut of Champagne (1239). It maintained the great strongholds of Krak and Margat, which up to their loss (1271 and 1285 respectively) continued to serve as bulwarks against Moslem attack and as bases from which Christian raids were organized. The order accepted the custody of the exposed city of Ascalon in 1243 and that of the fortified monastery on Mount Thabor in 1257. At all times it spared neither men nor resources to hold the Moslems at bay.

In the years 1258–60 there were signs of the military orders composing their differences, but it was already too late. In 1260 Bibars, the Mameluke sultan of Egypt, was already free from the Tatar threat, and in 126j he began the series of conquests which culminated in the fall of Acre in 1291 and in the expulsion of the Franks from Syria. The headquarters of the order were moved to Cyprus. Under a great, master Guillaume de Villaret, the order was drastically reformed by a series of statutes between 1301 and 1304. In 1309 a new chapter in its history began when the knights conquered Rhodes from the Byzantines: the order was to rule that island as a sovereign power for more than two centuries.

The Knights in **Rhodes.**—The character and aims of the order were profoundly affected by their newly acquired sovereignty. The Hospitallers ruled an island too narrow to monopolize their energies but occupying a position of vast commercial and strategic importance. Close to the Anatolian mainland, commanding the outlet of the archipelago and lying in the direct trade route between Europe and the east, Rhodes had become the chief distributing point in the lively commerce which. in spite of papal objections, Christian traders maintained with the Moslem states; the Hospitallers were thus divided between their duty as sovereign, which was to watch over the interests of their subjects, and their duty as Christian warriors. which was to combat the infidel. In view of the fact that the crusading spirit was everywhere declining. it is not surprising that their policy was henceforth directed less by religious than by political and commercial considerations. Not that they altogether neglected their duty as protectors of the Cross: they became a naval power and maintained a fleet of galleys until the loss of Malta; their consuls in Egypt and Jerusalem watched over the interests of pilgrims; their hospitals were still maintained for the service of the sick and the destitute. But, side by side with this, secularization proceeded apace; even toward the infidel the attitude of the knights was necessarily influenced by the fact that their supplies of provisions were mainly drawn from the Moslem mainland. By the 15th century their crusading spirit had grown so weak that they even attempted to negotiate a commercial treaty with the Ottoman sultan; the project broke down on the refusal of the knights to accept the sultan's suzerainty.

Throughout its occupation of Rhodes. the hospital was always ready to give all possible support to any major attack on the Moslems. In 1344 its galleys took part in the conquest of Smyrna, a town which the knights continued to hold until 1402. They contributed to the force that Peter I of Cyprus led to the temporary capture of Alexandria in 1365. A contingent was at the disaster of Nicopolis in 1396. They showed courage and great military skill in defending Rhodes. In 1440 and 1444 they repelled attacks launched from Egypt. In 1480 the garrison, commanded by the grand master Pierre d'Aubusson, held at bay an Ottoman fleet and army. A still greater attack was mounted in 1522 by Suleiman the Magnificent. Reinforcements failed, the Christian powers sent no assistance. and the knights capitulated! withdrawing with all the honours of war to Crete.

Their occupation of Rhodes had postponed for about two centuries the appearance of the Ottomans as a first-rate naval power in the Mediterranean, a debt which Europe never sufficiently acknowledged. When the emperor Charles V received news of the final siege he exclaimed: "Kothing in the world has been so well lost as Rhodes!" He would give no help in the plans for its recovery. but instead he gave to the hospital the Island of Malta and the fortress of Tripoli.

The Knights in Malta.—The settlement of the Hospitallers in Malta was contemporaneous with the Reformation, which profoundly affected the order. In England the refusal of the grand prior and knights to acknowledge the royal supremacy led to the confiscation of their estates by Henry VIII, and though not formally suppressed, the English organization practically ceased to exist. The knights of Malta, as they came to be known. nonetheless continued their vigorous warfare. In 1550 they defeated the redoubtable corsair Dragut, but in 1551 their position in Tripoli, always precarious, became untenable and they capitulated to the Turks and concentrated their forces in Malta. On May 18. 1j65, the Ottoman fleet appeared off the island and one of the most famous sieges in history began. It was ultimately raised in September on the appearance of a large relieving force dispatched by the Spanish viceroy of Sicily, after 25,000 of the enemy had fallen. The memory of the grand master Jean Parisot de la Vallette, the hero of the siege, who died in 1j68, is preserved in the city of Valletta which was built on the site of the struggle.

In 1571 the knights shared in the victory of Lepanto. This crowning success, however. was followed during the 17th century by a long period of depression due to internal dissensions and culminating during the Thirty Years' War! the position of the order being seriously affected by the terms of the peace of Westphalia (1648). The character of the order at this date became more exclusively aristocratic, and its wealth, partly acquired by commerce and partly derived from the contributions of the commanderies scattered throughout Europe, was enormous. The wonderful fortifications. planned by French architects and improved by every grand master in turn, the magnificent churches, chapels, *auberges* and the great library founded in 1650 were the outward and visible signs of the growth of a corresponding luxury in the private life of the order. Nevertheless, under Ramon Perellos

(1697–1720) and Antonio Manoel de Vilhena (1722–36), the knights restored their prestige in the Mediterranean by victories over the Turks. In 1741 Emmanuele Pinto, a man of strong character, became grand master. He expelled the Jesuits, resisted papal encroachments on his authority and, refusing to summon the general chapter, ruled as a despot. Emanuel, prince de Rohan (d. 1797), who was elected grand master in succession to Francisco Jimenes de Texada in 1775, made serious efforts to revive the old spirit of the order. The last great expedition of the Maltese galleys was worthy of its noblest traditions: they were sent to carry supplies for the sufferers from the great earthquake that destroyed Messina in 1783. They had long ceased to be effective fighting ships and survived mainly as gorgeous state barges in which the knights sailed on ceremonial pleasure trips.

The French Revolution was fatal to the order. Rohan made no secret of his sympathy with the losing cause in France, and Malta became a refuge-place for the *émigrés*. In 1792 the vast possessions of the order in France were confiscated; six years later the Directory resolved on the forcible seizure of Malta itself. When Napoleon occupied the island on his way to Egypt in 1798 the grand master Ferdinand von Hompesch organized no resistance, and the knights' long rule of the island came to an end. With this the history of the order of St John practically ends

The Order in Modern Times.—After their expulsion from Malta, the knights ceased to be a territorial power and lost their *raison d'être* as a military order. After 1814 Malta was retained by the British, and subsequent French expansion into North Africa extinguished the Barbary corsairs. But the order continued to exist, although much reduced in size, and to fulfil the original purpose of its founder. Since its first beginnings it had never ceased to serve the poor and sick, and from the early 19th century the order, in all its forms has continued to discharge this Christian work in accordance with its own splendid tradition.

After establishing itself temporarily, first at Catania and then at Ferrara, the order moved to Rome in 1834, where its headquarters remained. The pope, as first superior of the order. appointed a grand master in 1801, but between 1805 and 1879 appointed only lieutenant masters. But the renown gained by the order in the relief of suffering was such that in 1879 the pope re-established the mastership. The third of the restored line. Prince Ludovico Chigi della Rovere Albani, died in 1951. The order, organized into the Italian and German tongues, still retained certain diplomatic privileges and at mid-20th century had accredited representatives with five governments, including that of Spain.

In addition, there remained two orders of St. John of Jerusalem of Protestant origin. During the Reformation in Germany the master and knights of Brandenburg adopted the new religion. They remained divided from the main order, but joined with it again in 1763. This bailinick of Brandenburg was suppressed in 1810, but it was restored by the king of Prussia 43 years later. It was not recognized by the order in Rome. but continued as an independent Protestant body. It supports a number of hospitals in Germany and in many respects provided a model for the second Protestant order. that in England.

The grand priory of England, like other religious orders in that country. came to an end as a result of the religious settlement of Henry VIII and Elizabeth I. The grand masters in Malta continued to appoint titular grand priors of England, but the order had neither roots nor property there Its restoration in the 19th century was due to the initiative taken by the French knights, whose organization was temporarily revived between 1814 and 1848. The Greek War of Independence raised hopes that the order might regain Rhodes; English support was needed and as a means to this end the French worked for the revival of the English priory, so that in 1831 Sir Robert Peat became prior of the Venerable Tongue of England. The English knights hoped to become a Protestant branch of the main order, but the lieutenant masters in Rome ruled that Protestants could not he admitted. and in 1858 the English knights proclaimed themselves an independent order. By its constitution of 1871 (which subsequently was little amended) it became the Order of St. John of Jerusalem in England under the headship of its own prior. Between 1861 and 1888 that office was held by William Drogo Montagu, seventh duke of Manchester, and during that period the philanthropic work of the order assumed the modern forms: the life saving medal was instituted in 1874; the ophthalmic hospital was founded in Jerusalem in 1882; and the St. John's Ambulance brigade followed in 1888, growing from an association which the order had founded ten years earlier. Also in 1874, the order acquired the site and remains of the priory at Clerkenwell which had been the headquarters of the Hospitallers in England from the 1140s until 1559. It became an imperial order, incorporated by royal charter as the Order of the Hospital of St. John of Jerusalem in the British realm. The reigning monarch is its sovereign head, and it has subordinate commanderies in certain of the dominions. From 1888 the prince of Wales (after 1901 King Edward VII) was its grand prior, until in 1910 that office was assumed by Arthur duke of Connaught. The British order added to its lustre by outstanding work in the medical field in World Wars I and II.

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ST. JOHN RIVER, the largest river in New Brunsmick, Can., discovered by De Monts and Champlain in 1604, and named after St. John the Baptist. It is 418 mi. long and drains a basin of 21,600 sq.mi., of which 14.000 are in the provinces of New Brunswick and Quebec, and the remainder in the state of Maine. The river rises in northwestern Maine and flows northeasterly to the New Brunswick border from whence it gradually turns southeastward and for 80 mi. forms the international boundary. Just above Grand Falls the river enters Canada and flows through New Brunswick into the Bay of Fundy at Saint John. The lower 81 mi. are tidal and navigable for large steamers as far as Fredericton. Hydroelectric power development totaled 213,000 hp. in 1556 (170.000 hp. at Grand Falls and Beechwood on the St. John; the remainder on its tributaries, the Tobique, Aroostook and Madawaska rivers). (C. W. RD.)

ST. JOHN'S, the provincial capital of Newfoundland. Can., lies on the east coast of the island and is the most easterly city of the North American continent. The city's population in 1961 was 55,153 and that of the metropolitan area was 95,563. The people of St. John's are almost entirely of Irish and English origin. Nearly half are adherents of the Roman Catholic Church and the remainder belong to several Protestant churches, chiefly the Anglican and the United Church of Canada.

The city stands on the steep, western slope of its excellent landlocked harbour which opens suddenly in the lofty coast. The entrance, known as The Narrows, guarded by Signal hill (500 ft.) and South Side hills (620 ft.), is about 1,400 ft. wide, narrowing to 600 ft. between Pancake and Chain rocks.

At an early date the harbour of St. John's was recognized as one of the most outstanding in this part of North America and was used as a haven for fishing vessels. The earliest allusion to the name St. John's was in a letter written in 1527 by an English ship captain who mentioned that he had stopped at the harbour called "St. John's" (from St. John the Baptist) and found Norman, Breton and Portuguese ships anchored there. In early years settlement was discouraged by the English government in order to protect the fishery for the exploitation of the home fishermen (see NEWFOUNDLAND: *History*) and permanent settlement was not established until the beginning of the 17th century. In spite of this delay, St. John's is one of the oldest cities in North America. During its history frequent conflagrations swept through the town, destroying extensive areas.

St. John's occupies a most important position in the economic and cultural life of the province. Within the economic structure of Newfoundland the city is outstanding in retail and wholesale trade and is important also in service trade and performs a promi-

nent role in transportation. Its substantial and varied commodity exchanges in the shipping trade are especially noteworthy. It is the major terminal point for rail, highway and air transportation systems. (C. N. F.)

ST.-JOHN'S-WORT, any low, shrubby plant of the genus *Hypericum* of the St.-John's-Wort family (Hypericaceae), having usually yellow flowers, and opposite, often stalkless leaves that are dotted with transparent glands. Of over 300 species, widely distributed in temperate and tropical regions, more than 40 are found in the United States, chiefly in the eastern part. Among them are some cultivated for their showy flowers: *H. frondosum (aureum),* H. *densiflorum* and H. *prolificum,* all from the eastern and southeastern states.

Over 50 species, mostly of Eurasian origin, are cultivated in British gardens. especially H. *perforatum* and the tutsan (H. *androsaemum*), both once widely used in medicine. Aaron's-beard, the rose of Sharon (H. *calycinum*) from the Mediterranean region, is naturalized in Great Britain and has evergreen leaves and very showy yellow flowers. Mostly perennials, all are easily grown from seed in any ordinary garden soil, preferably in a shady situation; in the U.S. many species are hardy north to New York and New England. (N. TR.)

SAINT JOSEPH, a city of southwestern Michigan, U.S., and seat of Berrien county, is situated on Lake Michigan at the mouth of the St. Joseph river about 60 mi. across the lake northeast of Chicago. In the 1670s Father Jacques Marquette and René Robert Cavelier Sieur de La Salle visited the region, and, thereafter the river's mouth became the site of a French military and trading post because of its strategic location. In the early 19th century the soil and climatic conditions of the area attracted settlers from New England and New York who early turned to fruit and grape cultivation. St. Joseph was incorporated as a village in 1834; its eastern portion gained incorporation as Benton Harbor (*q.v.*) in 1869; and in 1891 both communities received separate city charters. The two cities, connected by a wide thoroughfare and a ship canal, are integrated economically and culturally and are virtually a unit. In the mid-19th century St. Joseph's importance as a port city was curtailed by expanding midwestern railroad facilities. From that time it has continued to serve as a regional marketing centre for fruit growers, a resort with beaches and mineral springs and an industrial centre specializing in canning and in manufacturing automotive parts, castings and rubber goods. For comparative population figures see table in MICHIGAN: *Population.* (E. O. *E.*)

SAINT JOSEPH, a city of northwestern Missouri, U.S., on the east bank of the Missouri river, 55 mi. N.W. of Kansas City; the seat of Buchanan county. Rich in historical tradition, St. Joseph is known as the city "where Southern hospitality meets Western democracy." A post was established there in 1826 by Joseph Robidoux, a French-Canadian trapper from St. Louis. The site was regarded as a sacred area by local Indians, who called the river "road to paradise" and the high bluffs above "Blacksnake hills." In 1836, by the Platte Purchase. the Sac. Fox and Iowa tribes surrendered their lands and six counties were added to northwestern Missouri; subsequently there was an influx of white settlers. Robidoux laid out the town in 1843 and named it after his patron saint; it was made the county seat in 1846 and was chartered as a city in 1851. With the coming of the railroad era, complementing the already thriving steamboat traffic, St. Joseph appeared destined to become the metropolis of the trans-Mississippi West. In 1859 the Hannibal-St. Joseph, a land-grant railroad, was completed and in April 1860, it delivered the first mail pouch to the rider who launched the brief but spectacular history of the Pony Express (*q.v.*).

St. Joseph boomed as a major outfitting centre for emigrants headed for the gold fields of California and other points on the Pacific coast. Before and during the American Civil War the frontier town was on the fringe of the bloody guerrilla warfare in Kansas and Missouri and was visited by such border outlaws as W. C. Quantrill and Jesse James, who was killed in his home there in 1882. Between 1860 and 1900 St. Joseph enjoyed its greatest period of expansion but mas eclipsed by Omaha, Neb., and Kansas City when trans-continental railroads passed it by. In the mid-20th century the city again grew fairly rapidly, partly by annexation (for comparative population figures see table in MISSOURI: *Population).* The population of the city in 1960 was 79,673 and of the standard metropolitan statistical area (Buchanan county) 90,581. Corn, tobacco, blue grass, small grains. livestock and fruit are produced and marketed there. Major industries include meat packing, milling, cereal and dairy products, clothing, foundry, machine-shop and electrical products and wholesale distribution. The state hospital for the mentally ill is in St. Joseph. (Jo. L. H.)

SAINT JOSEPH RIVER, the name of two rivers in the United States, both of which rise in south-central Michigan. The larger of the two flows generally westward for 210 mi. to empty into Lake Michigan at a point between Benton Harbor and St. Joseph, Mich. Midway in its course it swings southward into northern Indiana past the cities of Elkhart and South Bend. At Elkhart the average flow is 3,350 cu.ft. per second. The maximum rate of flow, an average of 9,380 cu.ft. per second, comes in February; the minimum flow, 620 cu.ft. per second, in September. The St. Joseph has been dammed at Union City, Mich., for water-power development. The river is also an important source of urban and industrial water supply.

The other St. Joseph river flows southward over 100 mi. through Michigan, Ohio and Indiana to join the St. Mary's river. The two form the Maumee river at Fort Wayne, Ind.; the Maumee in turn flows northeastward to empty into Lake Erie. Except for Fort Wayne, there are no large cities in the St. Joseph basin. (R. R. D.)

SAINT-JOSSE-TEN-NOODE (Flemish SINT-JOOST-TEN-NODE), a northeastern commune of Brussels (*q.v.*), Belg. Pop. (1955) 25,310. In the mid-19th century it changed from a rural area to a residential and cominercial suburb of Brussels. The Botanical gardens date from 1826 and the Charlier museum was a patrician residence, bequeathed with its contents to the commune. The dukes of Burgundy had a castle there and royal processions entered the capital through the village. Charles Rogier (*q.v.*) lived there for 50 years and Charles de Bériot from 1841–68. It is a centre of the Belgian film industry. (*Y*.E. D. J.)

SAINT-JUST, ANTOINE LOUIS LÉON DE RICHEBOURG DE (1767–1794), French revolutionary leader, was born at Decize in the Nivernais on Aug. 25, 1767. At the outbreak of the Revolution he was elected an officer in the National Guard of the Aisne. He assumed a stoical demeanour united to a tyrannical policy. He entered into correspondence with Robespierre, who, flattered by his worship, admitted him to his friendship. Thus supported, Saint-Just became deputy to the National Convention, where he made his first speech on the condemnation of Louis XVI — gloomy, fanatical, remorseless in tone — on Nov. 13, 1792. In the convention, in the Jacobin club, and among the populace he was dubbed the "St. John of the Messiah of the People."

In the name of the Committee of Public Safety he drew up reports to the convention upon the absorbing themes of the overthrow of the party of the Gironde (report of July 8, 1793), of the Hébertists, and finally, of that denunciation of Danton which consigned him and his followers to the guillotine. Camille Desmoulins said of Saint-Just — the youth with the beautiful countenance and the long fair locks — "He carries his head like a Holy Sacrament." "And I," savagely replied Saint-Just, "will make him carry his like a Saint Denis." The threat was not vain: Desmoulins accompanied Danton to the scaffold.

Saint-Just proposed that the National Convention should, through its committees, direct all military movements and all branches of the government (report of Oct. 10, 1793). This was agreed to, and Saint-Just was despatched to Strasbourg to superintend the military operations. It was suspected that the enemy without was being aided by treason within. Saint-Just "organized the Terror," and soon the heads of all suspects sent to Paris were falling under the guillotine. But there were no executions at Strasbourg, and Saint-Just repressed the excesses of J. G. Schneider, who, acting as public prosecutor to the revolu-

tionary tribunal of the Lower Rhine, had ruthlessly applied the Terror in Alsace. Schneider was sent to Paris and guillotined. The conspiracy was defeated, the frontier was delivered and Germany invaded. On his return Saint-Just was made president of the convention. Later, with the army of the north, he placed before the generals the diletnma of victory over the enemies of France or trial by the dreaded Revolutionary tribunal; and before the eyes of the army he organized a force charged with the slaughter of those who should seek refuge by flight. He succeeded again, and Belgium was gained for France (May, 1794).

Meanwhile affairs in Paris looked gloomier than ever, and Robespierre recalled Saint-Just to the capital. Saint-Just proposed a dictatorship. At the famous sitting of the 9th Thermidor, he presented as the report of the committees of General Security and Public Safety a document expressing his own views, a sight of which had been refused to the other members of committee the previous evening. Then the storm broke. He was interrupted, and the sitting ended with an order for Robespierre's arrest! which entailed that of Saint-Just. On the following day, July 28, 1794, 22 men, nearly all young, were guillotined. Saint-Just maintained his proud self-possession to the last.

See *Oeuvres de Saint-Just, précédées d'une notice historique sur sa vie* (1833–34); E. Fleury, *Études révolutionnaires* (2 vol., 1851), with which *cf.* articles by Sainte-Beuve *(Causeries du lundi,* vol. v), Cuvillier-Fleury *(Portraits politiques* et *révolutionnaires)*; E. Hamel, *Histoire de Saint-Just* (1859), which brought a fine to the publishers for outrage on public decency; F. A. Aulard, *Les Orateurs de la Législative et de la Convention* (2nd ed., 1905); M. Leneru, *Saint-Just* (1922). Thr *Oeuvres complètes de Saint-Just* were edited with notes by C. Vellay (1908).

ST. KILDA (Gaelic *Hirta,* "the western land"), the largest of a small group of seven islets of gabbro and similar rocks in the Outer Hebrides. Inverness-shire. Scot. It is in the civil parish of Harris and lies 40 mi. W. of North Uist. It measures 3 mi. from east to west and 2 mi. from north to south. Except at the landing place on the southeast, the cliffs rise sheer out of deep water, and on the northeastern side the highest eminence, Conagher, forms a precipice 1,397 ft. high. The 36 inhabitants, an industrious Gaelic-speaking community, were in 1930 evacuated at their own request and were settled mainly in Morvern, County Argyll. The island was practically cut off from the world for eight months of the year and is now seldom visited. It was in the possession of the Macleods for hundreds of years, except for the period 1779–1871, and now belongs to the marquess of Bute. On St. Kilda is the largest gannetry in the world, and puffins, fulmars and other sea birds breed. There are also a subspecies of starling and of wren and two species of mice. The Soay sheep were probably introduced by the Vikings.

ST. KITTS or ST. CHRISTOPHER, an island, forming, with Nevis and Anguilla, one of the colonies in Leeward Islands of the West Indies. It is a long oval with a narrow neck of land projecting from the southeastern end: total length 23 mi., area 68 sq.mi. Mountains traverse the central part from northwest to southeast, the highest being Mount Misery (3,792 ft.). The island is well watered, fertile and healthy, and its climate is cool and dry (temperature between 78° and 85° F.: average annual rainfall 38 in.). The rim of land formed by the skirts of the mountains, and the valley of Basseterre are cultivable. The higher slopes of the hills afford pasturage; the summits are crowned with dense woods. Sugar is the chief product and export, followed by sea-island cotton. Primary education is free and compulsory. In 1950 there were 17 government and 2 subsidized private primary schools and three government-aided secondary schools. Basseterre (pop. [1960] 15,742), on the southwest coast, is the island's port as well as capital of the presidency. St. Kitts was discovered in 1493 by Columbus but was not occupieci until 1623, when Thomas Warner made the first English settlement in the West Indies there. It was seized by the French three times between 1666 and 1782 and held for short periods, but remained British from 1783.

The island had a population of 38,291 in 1960, mostly Negro. (L. . BE.)

ST. LAURENT, LOUIS STEPHEN (1882–). Canadian statesman, was born on Feb. 1, 1882, at Compton, Que. He studied at St. Charles college, Shzrbrooke, and at Laval university, Quebec, Que. He was called to the bar at Quebec in 1905 and became one of Canada's leading lawyers, serving two terms as president of the Canadian Bar association. On Dec. 10, 1941, he entered federal politics as minister of justice, succeeding Ernest Lapointe, leading representative of French-speaking Canadians in the Mackenzie King administration.

In the face of widespread opposition in French-speaking Canada, St. Laurent defended the government's limited use of military conscription in 1914. By his forthright attitude, he maintained Quebec's place in the wartime government and thereby avoided a serious split within the Canadian population. In the election of June 1945, his position was overwhelmingly endorsed by the electorate of his province. He took a leading part at the San Francisco conference (1945) that created the Cnited Nations, and in 1946 became Canada's secretary of state for external affairs.

Despite a personal preference to return to his law practice, St. Laurent was persuaded to accept the leadership of the Liberal party in Aug. 1948, and succeeded Mackenzie King as prime minister on Nov. 15, 1948. He was one of the main architects of the North Atlantic Treaty organization (*q.v.*). His government gave instant and substantial military support to the United Nations intervention in Korea in 1950. The St. Laurent government declined to support the British and French intervention at Suez in 1956, but took a leading part in establishing the United Nations emergency force to restore peace and order there. A firm believer in the British Commonwealth of Nations, St. Laurent's influence contributed greatly to keeping India and Pakistan within that voluntary association of free nations. His bold initiative removed the obstacles to the joint construction of the St. Lawrence seaway (*q.v.*) by Canada and the United States.

By the union of Newfoundland with Canada, the St. Laurent government completed the grand design of the fathers of confederation. His government was responsible for giving final jurisdiction to the supreme court of Canada, thereby ending appeals to the judicial committee of the United Kingdom privy council. He strengthened the unity and fostered the development of the Canadian nation by instituting measures for the equalization of provincial revenues, enlarged social security: grants to universities and the establishment of the Canada council for the promotion of arts and letters.

After winning overwhelming victories in the 1919 and 1953 elections, the St. Laurent government was defeated by a narrow majority on June 10, 1957. He served as leader of the opposition until a national Liberal convention chose Lester B. Pearson to succeed him as Liberal leader in Jan. 1958. He then retired from public life and resumed his law practice in the city of Quebec. (D. C. T.)

SAINT LAURENT, a suburban city of Quebec, Can., on the northwest side of Montreal island; part of the Montreal metropolitan area. Industries include the manufacture of aircraft, railway cars, foundry products, chemicals and textiles. Pop. (1961) 49,805. Founded in 1845 on the site of a mission which dated back to 1720, the village of St. Laurent became a town in 1893 and was incorporated as a city in 1955. In 1952, in an exchange with Montreal, St. Laurent ceded part of its eastern section to the larger city.

In 1954, after residential developments had nearly filled the available land, St. Laurent city annexed St. Laurent parish, thus quadrupling its area. (M. C. BA.)

SAINT LAWRENCE RIVER, the greatest North American river draining to the Atlantic coast. At its head is the Great Lakes basin which has a land and water area of about 291,900 sq.mi. and discharges into the St. Lawrence an average yearly volume of 235,000 cu.ft. per second. The tremendous storage capacity of the Great Lakes stabilizes the supply of water contributed to the river to an unusual extent; the maximum and minimum mean monthly outflow of the lakes since 1860 has ranged from 315,000 cu.ft. per second (May 1870) down to 154,000 cu.ft. per second (Feb. 1936). This maximum-minimum ratio of about 2 to 1 makes the St. Lawrence one of the world's most dependable rivers.

While the St. Lawrence drainage area extends as far as the headwaters of the St. Louis river. a stream which flows into Lake Superior at its western extremity (Duluth. Minn.), the St Lawrence river has its head at the eastern end of Lake Ontario. The river thus becomes the connecting link betneen the Great Lakes basin and the Atlantic ocean. It has, however, a number of major rivers which are direct tributaries—the Ottawa, St. Maurice, Saguenay and Richelieu (draining Lake Champlain). The drainage area in Canada, excluding the Great Lakes section. is estimated by official sources as 198,000 sq.mi.

In determining the length of the St. Lawrence river the figure arrived at depends upon the locality taken as the mouth. On many official maps and the U.S. navy's *Sailing Directions for the Gulf and River St. Lawrence* it is extended as far seaward as the eastern part of the Gaspé peninsula. where the west end of Anticosti Island serves as the transition point between the river and gulf of St. Lawrence. From northern to southern shore is about 70 mi., and the distance to Lake Ontario at Kingston, Ont., is 72j statute miles. A more restrictive definition, one which is preferred in geographical terms places the mouth between Pointe des Monts and Cap-Chat on the northern and southern shores, respectively. This locality is about 595 mi. downstream from Lake Ontario. There the river is 25 mi. wide; seaward from this point the width increases rapidly as the left shore turns abruptly northward.

The St. Lawrence was discovered in 1535 when Jacques Cartier, a French explorer, entered what is now known as the Gulf of St. Lawrence via the Strait of Belle Isle. On Aug. 10. feast day of St. Lawrence (a Christian martyr who died Aug. 10. 258) Cartier discovered a bay on the mainland north of Anticosti Island. which he named for the saint. Noting the current in the strait which now bears his name, Cartier continued westward up the river until he reached the present site of Montreal. He referred to the river as the River of Canada but through usage it gradually became the St. Lawrence. No settlement was established along the river until 1599 when Pierre Chauvin settled Tadoussac at the mouth of the Saguenay. In 1608 Samuel de Champlain laid the foundation for Quebec, the first permanent settlement.

The St. Lawrence is one of the principal routes through the highlands of eastern North America and its course is the focal centre of one of Canada's most important economic and culture areas—the St. Lawrence lowlands. This area lies between the Laurentian upland or Canadian shield to the north and Appalachian highlands and Adirondack mountains on the south. It extends from Quebec city westward to the vicinity of the Thousand Islands near the head of the river. These islands mark the zone where the Pre-Cambrian rocks of the Canadian shield extend south of the St. Lawrence and form the Xdirondacks in New York state. About midway on the long axis of the lowland is Montreal; here the width of the lowland is about 70 mi. The area is underlain by sedimentary rocks—limestone, shale and sandstone—in contrast to the older, harder rocks of the adjacent highlands. Following the retreat of the continental ice sheet of the Pleistocene period, the sea invaded the lowland and formed the Champlain sea. Marine sediments deposited during this period of inundation produced deep, fertile soils over the lower levels of the lowland. The soil materials in the higher sections are of glacial origin including fluvioglacial outwash.

For purposes of analysis the St. Lawrence and its borderlands divide conveniently into three segments: the upper river (above Montreal), the middle river (Montreal to Quebec), and the lower river (the estuary).

The Upper River.—This section extends 182 mi. from Kingston, at the outlet of Lake Ontario. to Montreal. Que. From its head to a point where it crosses the 45° parallel N.. a distance of 114 mi., the St. Lawrence forms the boundary between the United States and Canada (New York state and the province of Ontario). The remainder of its course to the sea lies wholly in Canada. A former system of 14-ft. navigation canals and the present 27-ft. seaway, constructed to avoid the series of rapids in the river, are located entirely within this upper segment of the St. Lawrence. At Lake Ontario the surface elevation of the river is about 245 ft. above sea level and at Montreal it is about 20 ft. The international power dam and two control dams constructed in connection with the seaway development have eliminated some of the upper rapids. including the well-known Long Sault rapids, and in their place is a broad, man-made water body of about 100 sq.mi. named Lake St. Lawrence. In the construction of this lake about 38,000 ac. of land were inundated. and it was necessary to relocate several river-front communities. Flooding of the area began on July 1, 1958, and the new level was achieved within several days.

Downstream from Lake St. Lawrence and above Montreal the river broadens in two areas to form Lake St. Francis. about 28 mi. long, and Lake St. Louis, about 15 mi. long. To utilize the hydroelectric power potential resulting from a difference of about 82 ft. in the water level of these two lakes: a power canal 15 mi. long was completed in 1932. It later became part of the St. Lawrence seaway (*q.v.*).

At the head of Lake St. Louis is the confluence of the Ottawa river, a stream which served as an outlet to the sea for the postglacial upper Great Lakes before rise of land to the north diverted their discharge to Lake Erie and to the present upper course of the St. Lawrence. Part of the Ottawa's flow discharges into the St. Lawrence below Montreal and thus creates an island on which the city of Montreal is located.

The Middle River.--Montreal developed at the head of navigation on the St. Lawrence—the point where further progress upstream was blocked by the Lachine rapids. Completion of the St. Lawrence canals in the 1800s and the seaway in 1959 permitted small and medium-sized ocean vessels to continue past Montreal but the port remains the terminal point for the larger merchant ships of the world. A ship channel 35 ft. in depth extends from Jlontreal to a point 40 mi. below Quebec city. Of the 200 mi. of the middle river, about 113 mi. is dredged canal. Montreal is one of the great seaports of the world and is accessible for ocean vessels for an average of $7\frac{1}{2}$ months of the year.

From Montreal to Quebec, a distance of 160 mi., the St. Lawrence has a low gradient and a mean width of more than a mile. In the harbour of Montreal the elevation is 20 ft.; about midway to Quebec, at Three Rivers, mean sea level is reached. Three Rivers hence becomes the upstream limit of tidal conditions. About 45 mi. do nstream from Montreal is the port of Sorel, at the mouth of the Richelieu river and at the head of Lake St. Peter. The Richelieu-Lake Champlain route provides a shallow-draft waterway which connects with the Hudson river. In the large impounded section of the St. Lawrence called Lake St. Peter the river widens to more than 8 mi. but has a natural depth of only about 11.ft. At the head of the lake, near Sorel, is a delta with many islands formed from river deposits.

Three Rivers (Trois-Rivieres), about 77 mi. above Quebec. is at the mouth of the St. Maurice river. This river valley is Canada's leading pulp and paper-producing region, and Three Rivers is the capital of this industry. In the 1950s this ocean port handled more traffic than Quebec. Below Three Rivers the St. Lawrence follows an irregular course and narrows to less than three-quarters of a mile at Quebec bridge, about 7 mi. upstream from the city, and between Quebec and Levis. Because of the narrowness of the river. the ebb current has a velocity up to j.8 knots and the flood current 4.7 knotsw

The Lower River.—At the head of the estuary section of the St. Lawrence stands the city of Quebec. In the language of the Algonkin Indians its name means "where the river narrows." Once the capital of Canada, the city is now the capital of the largest province. The city is divided into an Upper Town and Lower Town by steep cliffs, and commanding a site 340 ft. high is the famous old fortress named the Citadel.

Tidal action is increased in the long funnel-shaped estuary, with the result that spring tides in Quebec harbour rise from 16 ft. to 19 ft. and neap tides about 13 ft. The regular navigation season is about eight months. from April 15 to December 15, although there is some all-winter navigation east from Quebec city along the north shore of the St. Lawrence. The length of the estuary to Pointe des Monts is 253 statute mi.; to Anticosti Island is an additional 130 mi. St. Paul Island in Cabot strait is 620 statute

(538 nautical) mi. from Quebec.

Below Quebec the St. Lawrence has a littoral lowland which is more extensive on the south shore, with a resulting greater population and agricultural development than on the narrow, discontinuous lowland on the opposite shore. The Island of Orleans, near the head of the estuary, narrows the river into two channels, the main one lying to the south of the island. Waters of the St. Lawrence are considered fresh to the lower end of this island. At Father point, near Rimouski on the south shore and about 180 mi. below Quebec. is the pilotage station for the St. Lawrence river. Pilotage is optional but payment of the fee is compulsory.

At a number of points below Quebec there is ferry service across the river from spring to fall. In the estuary ice conditions vary greatly from sector to sector. the most difficult being from Île aux Coudres to Quebec (j5 mi.).

Along the north shore of the lower estuary, the towns of Baie Comeau and Seven Islands (Sept-Îles) are the principal centres. Paper and aluminum are produced at the Baie Comeau, and Seven Islands is the terminus of the 360-mi. railroad extending to the rich Labrador-Quebec iron-ore deposits.

The fisheries of the St. Lawrence are of relatively minor importance compared with those of the Maritime provinces and Newfoundland. Nevertheless, the river and estuary remain well known for several salt-water species which frequent these waters at certain periods of the year. Sea sturgeon abound in the estuary; there is intensive commercial fishing from the Island of Orleans to Rivière du Loup. Atlantic salmon spawn in the many tributaries of the St. Lawrence seaward of Île aux Coudres. The American eel (Anguilla rostrata) is among the most important species caught in the fresh or brackish waters of the river. The mature fish are caught in the fall as they begin their journey to the Sargasso sea to spawn. Other prominent species in the lower river and estuary are catfish, cod, herring and smelt.

The St. Lawrence has two major hydroelectric power developments in its upper course. The Beauharnois dam in the late 1950s had an installed capacity of 1,400,000 h.p. The international power dam, constructed jointly by the state of New York and province of Ontario concurrently with the seaway development, has an installed capacity of 2,200,000 h.p.

See also GREAT LAKES. THE; SAINT LAWRENCE SEAWAY.

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SAINT LAWRENCE SEAWAY, a major improvement of the St. Lawrence waterway which made a highly important interior section of North America accessible for the first time to deep draft, ocean-going vessels, and also permitted the large Great Lakes freighters to extend their range of operations to the ports on the lower St. Lawrence. The waterway was completed for the opening of the navigation season on the St. Lawrence river and Great Lakes in April 1959 and was formally dedicated June 26, 1959.

The project which brought about this development was a joint undertaking of the governments of the United States and Canada to provide 27-ft. navigation channels between Montreal and Lake Erie. A related United States project, scheduled for completion in 1964, provided for widening and deepening the connecting channels of the Great Lakes (the Detroit, St. Clair and St. Mary's rivers) to make them commensurate in depth with those of the seaway.

Strictly speaking, the seaway is the St. Lawrence river portion of the waterway, but the Welland ship canal was officially incorporated into the project through legislation, and improvements were made in it as a part of the total seaway undertaking. However, the broader concept of the '(seaway," and one which is in general usage, includes the entire system of lakes, locks, canals and rivers which have converted over 6,600 mi. of mainland Great Lakes shore line of the United States and Canada into another seacoast.

History of Navigation on the St. Lawrence. Since 1535, when the explorer Jacques Cartier was turned back from his quest for the Northwest passage by the Lachine rapids of the St. Lawrence, men have made plans and built works to provide a through waterway from the Atlantic to the "inland seas."

Segments of the pre-seaway canal system were begun in the early 1700s. After union of the provinces of Upper and Lower Canada in 1841, work was undertaken to deepen all of the canals along the St. Lawrence route to 9 ft. and the project was completed in 1848. Following the Acts of Confederation in 1867 the Canadian government decided upon a program for'the improvement of the canal system to a depth of 14 ft., with locks to be 270 ft. by 45 ft. The enlargement and deepening was carried out in stages, and the canal system was opened for traffic in 1901 although some work was not completed until 1913. Improvement of the Welland canal, a 27-mi. waterway built to overcome the 326-ft. difference in the levels of Lakes Erie and Ontario, was carried out concurrently with work on the St. Lawrence canals and a 14-ft. channel was completed in 1887. The Welland ship canal, completed in 1932, was built with a controlling depth of 25 ft.; it included eight locks which had dimensions equal to those built as a part of the seaway project.

The 14-ft. St. Lawrence canals system as it existed for over a half century prior to the seaway was entirely a Canadian facility. To overcome the obstacles to navigation in the 112-mi. section of the river between Montreal and the head of the Galop rapids, a series of six canals was built along the north shore to bypass eight rapids. The canal segments totaled 47 mi. in length, and 21 locks accounted for a total lift of 209 ft. of the 225-ft. difference in river levels between Montreal and Lake Ontario. The maximum lift of any single lock was 23.5 ft. Lock dimensions varied slightly, the smallest, and hence the controlling lock for ship dimensions, being 43 ft. 8 in. wide and 270 ft. long, with a depth over the lock sills restricting the draft to 14 ft. The maximum over-all length for a vessel using this lock was 259 ft. The maximum cargo which could be carried through this canal system was about 1,600 tons for ocean vessels and about 2,800 tons for "canallers," a vessel especially designed for transporting bulk cargo through the canals. Ocean vessels could load down to their ocean draft of about 20 or 21 ft. upon reaching Montreal, since the St. Lawrence ship channel, with a depth of 35 ft., extended up the river to this port.

International negotiations toward establishing a deep waterway from the sea to the Great Lakes date back at least to 1905 when an International Waterways commission was created. After lack of U.S. congressional approval prevented international agreements in 1932 and again in 1941, the governments of Canada and the province of Ontario began to plan for a joint seaway and power project. In 1951 the (Canadian) St. Lawrence Seaway authority was established. Negotiations followed which resulted in agreement for the joint development of power in the International rapids section by Ontario and New York state power agencies. Legal obstacles followed but in June 1954 the U.S. supreme court upheld the action of the Federal Power commission in granting a license to the New York State Power authority.

Meanwhile, bills were introduced in 1953 in congress to provide for United States participation in construction of the seaway. Enactment of the Wiley-Dondero bill in May 1954 created the St. Lawrence Seaway Development corporation to construct part of the seaway in United States territory and authorized the agency to issue revenue bonds up to $105,000,000 to finance its activities. In 1957 the amount was increased to $140,000,000. The two public power entities began their joint project in Aug. 1954, and soon thereafter the work of the two seaway authorities was started. The total cost for construction of the bipurpose undertaking, which was over $1,000,000,000, marks it as the greatest peacetime task that two nations have ever jointly attempted.

The Present Seaway.— The seaway project in the St. Lawrence river consisted of constructing seven locks, dredging long sections of channel, constructing protective dikes, digging canals and raising and building bridges. The related power project required construction of a power dam and two control dams and the relocation of several towns, railroads and highways as a result of

BY COURTESY OF POWER AUTHORITY OF THE STATE OF NEW YORK

VIEW OF ST. LAWRENCE RIVER NEAR MASSENA, N.Y.. SHOWING THE ST. LAWRENCE POWER DAM (RIGHT). LONG SAULT DAM (UPPER CENTRE) AND THE WILEY-DONDERO CANAL WITH THE EISENHOWER AND SNELL LOCKS (LEFT)

flooding areas bordering part of the river course.

Limitations on the maximum size of ships operating through the seaway are imposed by channel depth, lock dimensions and overhead clearances. The 27-ft. depth restricts vessel drafts to 25 ft. for minimum safe clearance. All locks are 800 ft. long and 80 ft. wide and have a 30-ft. depth over the sills. Because of these dimensions normal traffic is limited to ships not more than 715 ft. in length with a beam no longer than 72 ft. However, ships having a length up to 730 ft. and a beam up to 75 ft. can be accommodated. Minimum clearance for fixed bridges is 120 ft. above water level. The seaway dimensions permit ocean-going vessels with cargo capacities up to 8,000 or 9,000 tons to enter the Great Lakes and allow the transit of bulk-cargo "lakers" with capacities of up to about 25,000 tons.

The seaway route from Montreal to the head of Lake St. Francis is a-holly in Canada; and all works were carried out by the Canadian seaway agency. A canal about 16 mi. long leads from Montreal harbour to Lake St. Louis, and two locks—St. Lambert and Côte Ste. Catherine—overcome a drop of about 45 ft. in water levels between these two areas. At the head of Lake St. Louis the seaway bypasses the Beauharnois power dam to enter a 16-mi. power canal. Two locks—the Upper and Lower Beauharnois—each have a lift of approximately 41 ft. The power canal, which extends to Lake St. Francis, was completed in 1932 with a navigable depth of 27 ft. in anticipation of the seaway.

The international boundary extends along the St. Lawrence river from the head of Lake St. Francis to Lake Ontario. At the lower end of this section, the seaway route is constructed through United States territory in order to bypass the power dam, a structure divided evenly by the international boundary. The United States navigation works consist of the 10-mi. Wiley-Dondero ship channel and two locks—Bertrand H. Snell (lower, 45-ft. lift) and Dwight D. Eisenhower (upper, 42-ft. lift). These facilities were opened July 4, 1958. The upper end of the ship channel terminates in Lake St. Lawrence. This head pond was created by flooding about 38,000 ac. of land above the power dam.

The major structure in the $600,000,000 power project is a dam with 32 generators (16 belonging to each power entity), which have a total capacity of 1,880,000 kw. (2,200,000 h.p.). The half owned by the Hydro-Electric Power Commission of Ontario is named the Robert H. Saunders—St. Lawrence generating station, and the portion constructed by the Power Authority of the State of New York is called the Robert Moses power dam. In addition to the power structure. it was necessary to build tuo control dams—Long Sault and Iroquois—to maintain the level of the head pond at an operating level of about 242 ft. above sea level. This provides a drop of nearly 90 ft. to the level below the dam.

At the head of Lake St. Lawrence, about 25 mi. above the pouer dam, are the Iroquois dam and the Iroquois canal and lock. The latter is the fifth Canadian lock on the St. Lawrence and has a lift of 2 to 6 ft. to the level of the Thousand Islands section of the river. It was the first seaway lock opened to commercial traffic. having been placed in service in May 1958. Iroquois dam controls and regulates the outflow from Lake Ontario. The International Joint commission has agreed on maintaining this lake at an elevation of 244 to 248 ft.

From the Iroquois facilities to Lake Ontario. about 77 mi., is the Thousand Islands section of the seaway. The improvements required were channel enlargement and lowering of scattered rock shoals. Both the power and seaway entities participated in this work.

The Welland ship canal entrance on Lake Ontario is 157 mi. W. of the head of the St. Lawrence river. Deepening of the canal channel to 27 ft. mas carried out by the Canadian seaway agency. The eight locks—three are double for upbound and down-bound traffic—required no alteration to serve deep-draft vessels.

Tolls for use of the seaway are used to liquidate the cost of the project within a so-year period as required by legislation. The toll rates established were based on an estimated total cost of $471,000,000 (U.S., $131,000,000; Canada, $340,000,000) at the time the project was completed. The composite toll system is based partly on the gross registered tonnage of the ship and partly on the actual cargo tonnage. The division of the toll revenues for transit between Montreal and Lake Ontario is 71% to Canada and 29% to United States. All tolls derived from transit of the Welland ship canal accrue to Canada. Pleasure craft and passenger vessels also are assessed for transit of any segment.

The seaway's primary economic benefit is to the shipping industry; upon its completion the size of general-cargo and bulk-cargo vessels which could utilize the St. Lawrence river route was

increased greatly. From some Great Lakes ports the all-water route to western European ports is shorter than the transatlantic routes from the U.S. east coast, and all lake ports are hundreds of miles nearer Europe than are the ports of the Gulf Coast. In the late **1950s** the Great Lakes-overseas commerce was overshadowed by bulk cargo between the Great Lakes and lower St. Lawrence ports. Leading commodities in this traffic are down-bound grains and upbound iron ore. Ice conditions limit the navigation season on the seaway to about **230** to **240** days, from mid-April to early December.

See also GREAT LAKES, THE; SAINT LAWRENCE RIVER.

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(A. G. BT.)

ST. LEGER, SIR ANTHONY (c. 1496–1559), lord deputy of Ireland, eldest son of Ralph St. Leger, a gentleman of Kent, was educated in Europe and at Cambridge. He quickly gained the favour of Henry VIII, and was appointed in 1537 president of a commission for inquiring into the condition of Ireland. In 1540 he was appointed lord deputy of Ireland. His first task was to repress disorder, and he at once proceeded with severity against the Kavanaghs, permitting them, however, to retain their lands, on their accepting feudal tenure on the English model. By a similar policy he exacted obedience from the O'Mores, the O'Tooles and the O'Conors in Leix and Offaly; and having conciliated the O'Briens in the west and the earl of Desmond in the south, the lord deputy carried an act in the Irish parliament in Dublin conferring the title of king of Ireland on Henry VIII and his heirs. Conn O'Neill, who in the north had remained sullenly hostile, was brought to submission by vigorous measures. For the most part, however, St. Leger's policy was one of moderation and conciliation — rather more so, indeed, than Henry VIII approved. St. Leger's personal influence was proved by an outbreak of disturbance when he visited England in **1544,** and the prompt restoration of order on his return some months later. St. Leger retained his office under Edward VI, and again effectually quelled attempts at rebellion by the O'Conors and O'Byrnes. From **1548** to 1550 he was in England. He was recalled from Ireland in 1551. Under Mary he was again lord deputy from 1553 to 1556, when he was recalled on a charge of falsifying accounts.

St. Leger died (March **16,** 1559) before the investigation was completed.

His great-grandson, SIR WILLIAM ST. LEGER, took part in "the flight of the earls" (*see* O'NEILL) in 1607, and spent several years abroad. Having received a pardon from James I and large grants of land in Ireland, he was appointed president of Munster by Charles I in **1627.** He supported Strafford, actively assisting in raising and drilling the Irish levies destined for the royalist service. In the Great Rebellion of **1641** he executed martial law in his province with great severity, hanging many rebels, often without much proof of guilt. He died at Cork on July 2, **1642.**

A biography of Sir Anthony St. Leger will be found in *Athenae Cantabrigienses*, by C. H. Cooper and T. Cooper (1858); *see* also *Calendar of State Papers relating to Ireland, Hen. VIII–Eliz.; Calendar of Letters and Papers of the Reign of Henry VIII; Calendar of State Papers (Domestic Series), Edward VI–James I; Calendar of Carew MSS.;* J. O'Donovan's edition of *Annals of Ireland by the Four Masters* (7 vol., 1851); Richard Bagwell, *Ireland under the Tudors* (3 vol., 1885–90); J. A. Froude, *History of England* (12 vol., 1856–70). For Sir William St. Leger, see *Strafford's Letters and Despatches* (2 vol., 1739); Thomas Carte, *History of the Life of James, Duke of Ormonde* (6 vol., 1851); *History of the Irish Confederation and the War in Ireland*, ed. by Sir J. T. Gilbert (1882–91).

ST. LEONARDS, EDWARD BURTENSHAW SUGDEN, 1ST BARON (1781–1875), lord chancellor of Great Britain, was born on Feb. 12, 1781, the son of a hairdresser of Duke street, Westminster. After practising for some years as a conveyancer, he was called to the bar by Lincoln's Inn in **1807,** having already published his well-known *Practical Treatise of the Law of Vendors and Purchasers of Ertates* (14th ed., **1862).** His parliamentary career was notable for his opposition to the Reform bill of **1832.** He was appointed solicitor general in **1829,** and was lord chancellor of Ireland in **1835** and again from **1841** to **1846.** Under Lord Derby's first administration in **1852** he became lord chancellor as Lord St. Leonards. He devoted himself with energy and vigour to the reform of the law; in **1855** he was offered the great seal again, but had to refuse. He was learned and lucid, though inclined to be waspish and overbearing. He died at Thames Ditton on Jan. 20, **1875.** He was the author of various important legal publications, many of which passed through several editions.

See J. B. Atlay, *Lives of the Victorian Chancellors*, vol. ii (1906); E. Manson, *The Builders of Our Law, etc.*, 2nd ed. (1904).

ST. **LÔ,** a town of northwestern France, capital of the *département* of Manche, 47½ mi. W. by S. of Caen by rail. Pop. (1954) 11,287. St. LB, called *Briovera* in the Gallo-Roman period, owes its present name to St. Lô (Laudus), bishop of Coutances (d. **568).** In the middle ages St. Lô became an important fortress and a centre for the weaving industry. In 1574 the town, which had embraced Calvinism, was stormed by the Catholics and many of its inhabitants massacred. In 1800 it was made capital of its department in place of Coutances.

In the *hôtel de ville* is the "Torigni marble," the pedestal of an ancient statue, with inscriptions relating chiefly to the annual assemblies of Gallic deputies held at Lyons under the Romans.

SAINT LOUIS, the chief city of Missouri, U.S., 200 years old in **1964,** is a mid-continental focal point of transport and manufacture. The incorporated area extends almost **20** mi. on the west bank of the Mississippi river, within 3½ mi. of the mouth of the Missouri river on the north. By the census bureau definition, St. Louis is the central city of a standard metropolitan statistical area of **3,191** sq.mi., comprising, in addition to the city itself, the separately established St. Louis county, with **98** incorporated communities, and St. Charles and Jefferson counties in Missouri as well as Madison and St. Clair counties in Illinois. Among the separately incorporated Missouri municipalities in the metropolitan area are Clayton, Kirkwood, Maplewood, St. Charles, University City and Webster Groves. For further information on these, and on Illinois cities in the metropolitan area, see *Government*, below.

Migration from the inner city is reflected in the population of the city of St. Louis, which declined from **856,796** in **1950** (when it was eighth in population among C.S. cities) to **750,026** in **1960,** a loss of 12.5%, ranking it tenth. At the same time the metropolitan area nas making considerable gains, its **1960** population of **2,060,103** representing a **19.8%** increase over the **1950** population of **1,719,288.** *See* also *Population Characteristics*, below.

History. — *French* Period. — The original site of St Louis was a shelf of river front under a bluff, bordered by a wide prairie to which the community later spread. The location was chosen by Pierre Laclède Liguest, junior partner in a fur-trading company, organized in New Orleans, which had obtained the exclusive right to trade with the Missouri river Indians and with those west of the Mississippi above the Missouri. The monopoly was granted by the French director-general of Louisiana, who had not yet been informed that the territory had been ceded to Spain in **1762;** it was withdrawn by the Spanish government in **1765** but by that time Laclede was already well established and he and his successors long remained important in the fur trade. The site for the community was well chosen for trade: downstream over **1,000** mi. was New Orleans, La., already a thriving commercial centre and a major fur market; the Great Lakes, Detroit, Mich., and Montreal, Que., were accessible by the Illinois river, entered **38** mi. upstream; the Ohio, joining the Mississippi **180** mi. to the south, was to become important later as a route for settlers from the east.

The village was named by Laclède for Louis IX, the crusader king of France. Clearing of the site began Feb. **15, 1764,** under the direction of Auguste Chouteau, destined to become a leading citizen, though then only in his 14th year. Settlers in addition to the original party began arriving almost immediately; the treaty of **1763,** ending the French and Indian War, had given Great Britain all the territory east of the Mississippi and many of the

French residents of Cahokia and other Illinois villages began to cross the river to the new outpost rather than live under British rule. On the invitation of Laclbde, Capt. Louis St. Ange de Bellerive, the French-Canadian commandant of the surrendered Fort de Chartres, brought over his garrison of 20 men and assumed administrative duties that Spain did not take over until 1770, when the first Spanish lieutenant governor of Upper Louisiana arrived.

Spanish Period.—The change in administrations did not significantly alter the course of the city's history or make any particular impress upon its culture, which remained predominantly French until large numbers of Americans arrived in the 19th century. Laclbde died in 1778 and most of his functions fell upon Auguste Chouteau and his younger brother, Pierre Chouteau. The fur trade was a profitable business, with furs, acquired in exchange for supplies and showy articles of trifling value, bringing as much as 500% profit overseas. Spain's sympathy with the American Revolution drew an attack on St. Louis in 1780 by a Sioux war party under British auspices. This was driven off by a garrison of 29 Spanish soldiers and 281 residents, though not before the death of 15 whites and 7 slaves, mainly in outlying areas. Except for such isolated incidents the community had a peaceful life; close and generally friendly relations were maintained with the Indians, and visiting chiefs often pitched their teepees in the gardens of their business hosts. In 1788 the Mississippi was cleared of pirates. The increased trade made St. Louis the centre of wealth and culture in the upper valley, in spite of its isolation; although by 1800 its population was still somewhat less than 1,000, some of its homes had good libraries and furniture, glass and china brought from France.

American Period.—Under the Louisiana Purchase (*q.v.*), St. Louis passed from France to the U.S. (the territory having previously been retroceded to France in 1800). On March 10, 1804, Capt. Amos Stoddard of the U.S. army officially took possession of Upper Louisiana for the U.S. In 1804 congress created the district of Louisiana, with St. Louis as district headquarters; in 1805 the territory of Louisiana was created, with St. Louis again the seat of government; and in 1812 the territory of Missouri was created, with St. Louis still the territorial capital. It was incorporated as a town in 1809. Population growth was slow: by 1815 it probably did not exceed 2,609, and in 1821, when Missouri was admitted to the union, there were 621 buildings and a population of 5,600. In 1822 St. Louis was incorporated as a city by the state legislature. As a result of urban-rural friction St. Louis ceased to be the capital upon the coming of statehood.

After the Louisiana Purchase, St. Louis became the crossroad of westward expansion of the U.S. and was also the starting point for exploring parties, one of the best known being that of Meriwether Lewis and William Clark in 1804–06. Jefferson Barracks on the Mississippi became an important military post; among the officers stationed there were U. S. Grant, Robert E. Lee and Jefferson Davis. Early in the 19th century fur trading, which had been carried on mostly by individual traders, began to be done by companies. In 1809 the Missouri Fur company was organized by William Clark, Manuel Lisa, Pierre and Auguste Chouteau, Sylvestre Labadie and others, and a branch of John Jacob Astor's American Fur company was established in the city in 1822.

In the War of 1812 the settlement raised 500 mounted rangers to patrol a cordon of 22 stations or family blockhouses along a 75-mi. line from Fort Bellefontaine to Kaskaskia, thus confining Indian forays to petty pilfering and raids on isolated homesteads. In the Mexican war of 1846 young St. Louisans volunteered enthusiastically, interest being heightened by a well-developed trade in mules and silver with the southwest. Cholera struck the city in 1832 and a recurrence in 1849 cost more than 4,000 lives. Fire spreading from burning steamboats made 1849 a year of disaster along the water front as well, hundreds of buildings being destroyed; this area, however, was rebuilt more substantially, with wider and better streets. In spite of these reverses, the census of 1850 showed a population of 77,860.

The American Civil War and Afterward.—In a border state where slavery was legalized, St. Louis was bitterly divided throughout the Civil War and was kept under martial law, Although early settlers had come mainly from Virginia, the Carolinas, Tennessee and Kentucky, they were followed by New Englanders and other northeners who, with the vigorous support of German-born residents, swung the balance to the Union side. A state-wide delegate convention held in St. Louis early in 1861 voted against secession and called for peaceful adjustment, impossible after the firing on Fort Sumter. Gov. Claiborne F. Jackson, having rejected President Lincoln's call for troops from Missouri, set up Camp Jackson in the neighbourhood of Olive and Grand avenues and assembled 800 militiamen. Meantime, discovery of Confederate arms shipments labeled "ale" and "marble" raised fear of an attack on the large Federal arsenal. Suspecting disaffection among regular army officers, Capt. Nathaniel Lyon supplemented a small Federal force by home guards made up largely of German voters who had been organized in political marching clubs during Lincoln's presidential campaign. Camp Jackson surrendered without bloodshed until pistol shots from a crowd of spectators drew fire from the raw recruits, leaving about 15 dead, including some of the captive militiamen, and 5 more mortally injured. Sympathy was further alienated from the Gnion cause the following day, May 11, when more newly enlisted "Wide Awakes." excited by a pistol shot killing one of their marchers, wheeled and fired down a city street, killing four of their own number and two civilians. Only the return of Gen. W. S. Harney, who marched four regiments of regulars into the heart of the city, restored order and stemmed a rush to leave the community.

War orders for clothing and supplies gave impetus to the city's commercial growth, already accelerated by the building of railroads in the 1850s. An earlier stimulus to the economy had been steamboat traffic, beginning in 1817 and declining by 1870. The city also developed as an outfitting point for trade with the southwest and the 1849 California gold rush. In the ten years up to 1870 population almost doubled, reaching 310,864. Eads bridge across the Mississippi, completed in 1874, gave access to the city for trains from Cincinnati; previously passengers from the east had been ferried.

A world's fair, the Louisiana Purchase exposition, was held in St. Louis in 1904. The city grew steadily in the late 19th and early 20th centuries, with both commerce and industry becoming increasingly important. World Wars I and II stimulated industrial development of the area. Other modern developments are discussed in Government, below.

Historic Sites.—A permanent Jefferson National Expansion memorial, administered by the national park service since 1935, was begun with the clearing of derelict buildings from 40 blocks along the river front. It includes a design by Eero Saarinen for a 500-ft, stainless-steel arch on the old levee, symbolizing the gateway to the west. The oldest of the three remaining landmarks is the Old Rock house, built on the water front in 1818 for Manuel Lisa's fur trade. Another, the Old Cathedral of St. Louis of France, dates from 1831–34. The national park service rehabilitated the Old Courthouse, which was begun in 1839, and installed a historical museum which includes dioramas of early events. The 198-ft. dome above a 60-ft. rotunda bears frescoes by Carl Wimar, an early day artist. The courtroom where the Dred Scott case was heard occupies one wing.

Population Characteristics.—From the beginning St. Louis has been a cosmopolitan community, indicating the varieties of its heritages by wildly acclaiming the marquis de La Fayette on his visit in 1825, welcoming the Hungarian patriot Lajos Kossuth in 1852, and firing a 100-gun salute on the 100th anniversary of the birth of the German poet Schiller in 1859. The earliest settlers were French Creoles from New Orleans, French Canadians and a handful of Spaniards; after 1804 Americans began settling in the area and soon outnumbered the French. In the 19th century Germans became most numerous among the foreign born, their influx starting in the 1830s in response to glowing reports sent home by Gottfried Duden, a pioneering Prussian. Most numerous after the Germans were the Irish, and after them the British. In the population shift in the middle years of the 20th century a part of the outward movement from the city was compensated for by an influx from rural areas, including a large number of Negroes from the

south. The nonwhite proportion of the population increased from 13.4% in 1940 to an estimated 25% in 1960.

Government. — By a charter of 1876, the city of St. Louis was established as a unit completely independent of the county and free from control of the state legislature except for general laws A new charter in 1914, while retaining this feature, introduced several changes: the number of elective offices was reduced, the appointive powers of the mayor mere increased, the city council was made a unicameral body, the budget system was introduced, the right to municipal ownership of utilities was granted and provisions were made for the use of the initiative, referendum and recall

City boundaries as established in 1876 (and subsequently unchanged) prevented city services from following families moving out to less expensive or more satisfactory housing in suburban surroundings. The rapid, and largely planless, spread of the metropolitan area in the 20th century deprived the city of needed tax income; well-to-do and middle-class out-migrants were usually replaced by in-migrants of lesser means, who came largely from rural areas nhere farm mechanization had reduced the demand for labour. At the same time problems of traffic, parking and transportation were multiplied by persons driving to work in the central city. The complexity of local governmentis indicated by the fact that in 1960 there were 200 municipalities in the standard metropolitan area, and St. Louis county alone had 28 school districts.

A privately financed metropolitan survey in 1958 recommended a functional but not political consolidation of city and county for joint handling of such common services as traffic and health. Three high-speed trafficways from beyond the city limits nere built to bring more traffic into the downtown business district, suffering from the competition of one-stop shopping centres and places, of amusement in outlying areas. New residential apartments for middle-income families were made possible in the vicinity of the business centre by urban renewal and slum clearance projects. Smoke elimination through regulation of the use of highly volatile coal was carried out successfully in the 1940s by an engineer, Raymond R. Tucker, subsequently elected mayor.

A housing rehabilitation program was allotted $4,000,000 from a $110,639,000 bond issue voted in 1955 for public improvements. Included was $10,000,000 for slum clearance. Neighbourhood pilot projects demonstrated that it cost less to rehabilitate some blighted areas than to clear slums and rebuild. In other areas public housing replaced substandard dwellings with apartments for Ion-income families. These buildings are in many instances 8 to 11 stories high and in one 28-block section doubled the density of population, nith consequent traffic, school and other complications. A small public-housing program was undertaken in St. Louis county.

Though the suburbs are not without their fringe of shacks, in the main the old amenities have persisted. University City, the largest residential suburb in the county, borders on St. Louis and shares many of its problems. It was incorporated in 1906 and adopted a council-manager plan of government in 1947. Other nearby communities having a city manager are Webster Groves, Clayton, Berkeley. Olivette and Ferguson. Kirkwood dates from 1853, when 40 families moved there to take advantage of newly opened railroad service. Other county communities include Florissant, Jennings, Richmond Heights, Maplewood and Overland.

The municipality of St. Charles, across the Missouri river, dates from Spanish days, about 1679. It has a considerable industry. In Jefferson county are the twin towns of Festus and Crystal City. (For comparative population figures for the city of St. Louis and these suburbs see table in MISSOURI: Population.)

Illinois communities in this metropolitan complex had an early advantage in heavy industry because of high railroad rates for freight crossing the river; however. many of their residents now commute to daily employment in the central city. The largest of the Illinois suburbs is East St. Louis; ranking next is its neighbour, Granite City; followed by Belleville, Alton (*qq.v.*), Woodriver and Edwardsville. (For comparative population figures for these municipalities see table in ILLINOIS : Population.)

The Economy. — Industry in the St. Louis area profits from adequate supplies of labour, raw materials and water, plus transportation service by many trunk-line railroads and several major highways, airlines and river-barge companies. Natural gas for industry is supplemented by coal from nearby Illinois fields. Almost three-fourths of all possible manufacturing categories are represented and no one industrial group employs more than 6% of the total factory force. Leading industries, ranked by value added by manufacture, are motor vehicles and equipment. beer and other beverages, petroleum refining, electrical industrial apparatus, meat products. organic chemicals, drugs and medicines, iron and steel foundries, paints and allied products, miscellaneous foods, structural and ornamental fabricated metalwork, service and household machines, bakery products, soap and related items and women's outerwear.

Education and Cultural Activities. — Two urban universities and numerous colleges, seminaries and trade schools dram thousands of students to the St. Louis area. St. Louis university, a Roman Catholic co-educational university founded in 1818, includes among others, schools of law, medicine and dentistry. It has branches at Florissant, Mo., St. Mary's, Kan., and East St. Louis. The Pius XII library, built to preserve microfilms of Vatican library treasures, is on the St. Louis campus. Washington university, chartered in 1853, was founded by Rev. William Greenleaf Eliot, grandfather of the poet T. S. Eliot. Its adult-education division, University college, enrolls more than half of the total student body and also operates a civic education centre. This pioneer venture in problems of urban living relies heavily on television programs directed toward small informal discussion groups, known as viewing posts. The centre also conducts civic leadership seminars and consultation services for community organizations. The two universities and the city school system share in an educational television station, KETC.

Other institutions of higher learning in the metropolitan area include, in Missouri, Fontbonne, a Roman Catholic college for women, chartered in 1917; Harris Teachers college, a municipally controlled co-educational institution established in 1857; and Maryville College of the Sacred Heart, a Roman Catholic women's college established in 1827, all in St. Louis; Lindenwood, a Presbyterian women's college established in 1827, in St. Charles; and Webster, a Roman Catholic college founded in 1915, in Webster Groves. The Illinois section of the metropolitan area includes Southern Illinois university branches at East St. Louis and Alton, with their headquarters at Edwardsville; the Principia college at Elsah, a private college founded in 1898, with enrollment limited to sons and daughters of Christian Scientists; and Monticello, at Alton, a private junior college for women, founded in 1835.

The St. Louis public-school system was integrated racially in 1955, without difficulty. The first public high school west of the Mississippi was established in St. Louis in 1856, followed in 1873 by the nation's first public kindergarten, installed by Susan Blow. William T. Harris (*q.v.*), then superintendent, introduced a phonetic system for reading and added natural sciences to the curriculum. He also founded and edited the *Journal* of *Speculative* Philosophy (1867–93), the first periodical of the sort in English.

Works of early artists such as George C. Bingham, Chester Harding and Carl Wimar, together with a large collection of historical writings, are part of the privately endowed Mercantile library (1846). The public library, with many neighbourhood branches, dates from 1865; the Symphony orchestra from 1881; the Academy of Science from 1856. The Missouri Botanical garden (1858), the gift of Henry Shaw, an early merchant, includes the headquarters of the National Council of State Garden Clubs. Relics of the past include the birthplace of Eugene Field (*q.v.*); the Campbell house (1851), an ante-bellum mansion open to the public, with a display of Victorian furnishings and clothing; and the log cabin in which U. S. Grant lived as a farmer for five years. A famous example of the original skyscraper architecture is the Wainwright building (1891), designed by Louis Sullivan.

In the latter part of the 20th century the city had two large daily newspapers, the Post-Dispatch and the Globe *Democrat*, many local and neighbourhood journals, several television stations and a number of radio stations.

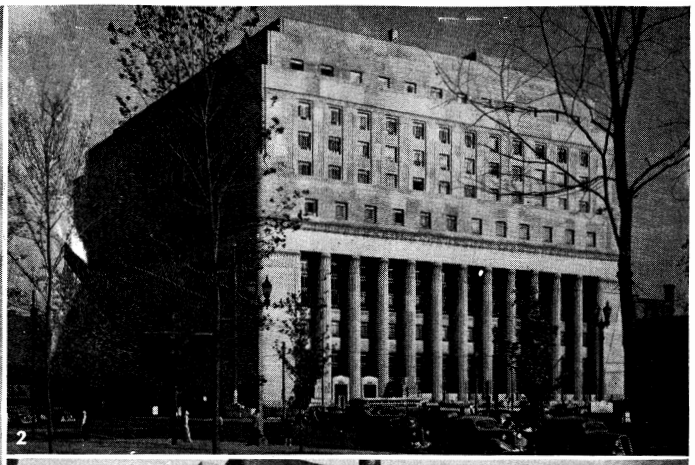
Parks and Recreation. — Of the city's recreational areas,

BY COURTESY OF THE ST. LOUIS CHAMBER OF COMMERCE; PHOTOGRAPH BY P. R. PAPIN AERIAL SURVEYS

THE DOWNTOWN DISTRICT OF ST. LOUIS

view showing the Mississippi river in the upper right hand corner. The two

ST. LOUIS



BY COURTESY OF THE ST. LOUIS CHAMBER OF COMMERCE

PUBLIC BUILDINGS OF ST. LOUIS

1. Civil Courts building. Plaza Commission, architects
2. Federal building (U.S. court and customs house). Mauran, Russell. Crowell, and Mullgardt, architects
3. Federal Reserve Bank building. Mauran, Russell, Crowell, and Mullgardt, architects
4. Municipal auditorium, facing the Memorial plaza. The building has an opera house with a seating capacity of 3,500 persons and an arena seating 12,500 persons. The Plaza Commission, consisting of members of seven firms of architects, designed the building

Forest park is the largest, with 1,380 ac. At one entrance is the Jefferson memorial, housing the Missouri Historical society: one wing is filled with the collected souvenirs of Charles A. Lindbergh's flight across the Atlantic in 1927. On a hill is the City Art museum, its main building designed by Cass Gilbert for the world's fair, which was held at this location. The park contains the St. Louis Municipal Opera theatre (1919), which is an outdoor theatre seating 12,000 persons. There are also a zoo, golf courses and other athletic facilities, including boating and a large ice-skating and roller rink used the year round, and the Jewel Box with flower displays. The county contains a Museum of Transport and maintains the Jefferson Barracks Historical Site park. Alton Lake, on the Mississippi river, provides harbours for small pleasure craft. Cahokia Mounds, a 144-ac. park between East St. Louis and Collinsville, preserves a number of examples of the work of a prehistoric race of Mound Builders. The city is the home of the Cardinal baseball team and many athletic and other events are staged in Kiel auditorium, part of the civic centre. On the adjoining Aloe Memorial plaza, facing Union station, is the Carl Milles fountain "The Meeting of the Rivers." An annual event since 1878 is the Veiled Prophet parade and ball.

See also Index references under "St. Louis, Mo.," in the Index volume.

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SAINT LOUIS, a city and iormer capital of the Republic of Senegal, was the first capital (1895–1902) of French West Africa. a considerable regional market, and the onetime French West African port for overseas and Senegal river trade.

Located at the point nhere the Senegal reaches a dune-covered sand bar. behind which it flows 12 mi. before entering the sea, it is near the climatic division between Sahara and Sudan. Its original site. and later commercial core and locale of the Senegalese government is a bar-shaped island 1¼ mi long. This is connected by tno short bridges, and by a bridge 2,132 ft. long, with a suburb at the mainland terminal of the railroad to Dakar (*q.v.*), 168 mi. south. In 1958 Dakar replaced Saint Louis (the temporary capital) as the seat of government of the Republic of Senegal.

Pop. (1958) 37.104 (commune).

Vessels draning up to 10 ft. can cross the bar and navigate the river during the rains (July–September inclusive), but water traffic has been suppianted by rails. Founded in 1659 by Dieppe merchants, Saint Louis is the oldest colonial establishment in Africa belonging to France. After 1854 it became the base of military expeditions leading to the formation of French West Africa. Made one of the two original communes in Senegal in 1872, its citizens may vote for a representative in the French chamber of deputies.

Institutions include a secondary school on the model of a French *lycée,* a school for sons of Moslem chiefs (specializing in administration, lam and accounting), and a hospital.

See R. Rousseau, "Le site et les origines de Saint-Louis," *La Géographie 44* (1925). (D. WH.; X.)

SAINT LOUIS PARK, a city of Hennepin county, Minn., U.S., on the southwestern edge of Minneapolis (*q.v.*) and a part of the Minneapolis-St. Paul metropolitan area. After World War II it experienced great population growth, as did other cities around Minneapolis.

The first settlers in St. Louis Park were William Laycock and his wife, who built a log cabin on their claim in 1854. Sometime before 1886. the first depot was built by the Minneapolis and St. Louis railway. The village, first called Elmwood, was renamed after that railroad.

Farming was the main industry in the early days but gradually disappeared with the advent of suburban growth. Plans for the development of the city as a manufacturing suburb began as early as 1886. The panic of 1893 bankrupted several flourishing factories. Then new industries moved in and between 1900 and 1913 another cycle of decline and boom was experienced.

From 1914 to 1920 industry was on a reduced scale with the exception of important dairying and truck farming. Chief industries in the second half of the 20th century were metal and wood products.

St. Louis Park was incorporated in 1886 and its residents adopted a home rule charter in 1954; a council-manager form of government went into effect in 1955. For comparative population figures see table in MINNESOTA: Population. (R. W. F.)

ST. LUCIA, the largest of the Windward Islands. in the West Indies, in 13° 54′ N. and 60° 59′ W., 24 mi. S. of Martinique and 21 mi. N.E. of St. Vincent. Area 238 sq.mi., length 27 mi., maximum breadth 14 mi.; circumference 150 mi. It is considered one of the loveliest of the West Indian islands. It is a mass of mountains, rising steeply from the water, their summits bathed in perpetual mist. The highest of these is Mt. Gimie (3,117 ft.), but the Pitons (2.619 ft. and 2.461 ft.) are the chief natural feature—two immense pyramids of rock rising abruptly from the sea with their slopes, inclined at a 60° angle, clothed on three sides with dense verdure. Near Petit Piton is Soufrière, a low-lying volcanic crater. The boiling sulphur springs which give Soufrière its name are at Ventine, 2½ mi. S.E. of the town of Soufrière. Rainfall averages 91 in. a year, the temperature averages 80° F.

History.—St. Lucia was discovered by Columbus in 1502 and named after the saint on whose day it was sighted. The Dutch are said to have built a fort there. but the first attempt to settle was made by Englishmen in 1605. Carib resistance compelled its abandonment. From this time until the island became definitely a British possession in 1814 it was the scene of fiercely recurring struggles between England and France; and 13 British regiments gained the right to inscribe the name St. Lucia on their colours. In the first half of the 17th century it was included in royal grants made by the kings of England and France; but English settlers were long deterred by the unlucky reputation which St. Lucia gained after a second disastrous attempt at colonization in 1638, frustrated by sickness and native hostility. The French were more successful, sending settlers from Martinique in 1650, by nhom a treaty was made with the Caribs ten years later. England defeated the French shortly afternard, and regained the island, but it was restored by the peace of Breda in 1667.

Another British settlement under a grant of 1722 was frustrated by France. In 1748 the two nations agreed to regard St. Lucia as neutral. In 1762 it was captured by Rodney and Monckton, only to be given up once more by the treaty of Paris. In 1778 it again surrendered to the British, who used its harbours as a naval base; and it was from Gros Islet bay that Rodney sailed before his famous victory over de Grasse in April 1782. Between 1782 and 1803 the possession of St. Lucia passed six times between England and France. England having to suppress a vigorous revolutionist part, aided by insurgent slaves, before gaining possession in 1803. confirmed by a final cession in 1814. From this time the island was administered as a crown colony—under Barbados from 1838 to 1885.

Representative government was obtained by the constitution of 1924 which introduced an elective element into the legislative council, and the constitution of 1936 provided for an unofficial majority in the council.

French influence on the development of St. Lucia has been very great, and is illustrated by the preponderance of the Roman Catholic Church and the survival of a French patois. In the years folloning 1763 French planters came from St. Vincent and Grenada and formed cotton and sugar plantations. In 1772 the population was said to number 15,000, mostly slaves. In 1834, when the slaves were emancipated there were in St. Lucia more than 13.000 Negro slaves, 2.600 free Negroes and 2,300 whites. Prosperity was greatly retarded by the frequent wars. by epidemics of cholera and smallpox and by the decline of the sugar-cane industry. Improvement came nith the increase of banana and cocoa cultivation, and resuscitation of sugar-cane cultivation.

The excellent landlocked harbour of Castries, one of the best in the West Indies, gives St. Lucia great strategic importance.

In 1940, as part of its "destroyer-bases" agreement with Great Britain, the United States acquired on 99-yr. lease a naval and air base on Gros Islet bay, 4 mi. from Castries: along with other facilities. These were all relinquished by 1949, but the United States retained the right to re-establish them in the event of war or grave emergency.

Population and Economic Conditions. — The population of St. Lucia was 86.108 in 1960. Castries (pop. [1957 est.] 25,000), the capital, on the N.W. coast. was almost completely destroyed by fire in June 1948, but rebuilding on a carefully planned basis began shortly thereafter. The bulk of the inhabitants of the island are Negroes and mulattoes; the rest are whites or of East Indian extraction. A French patois is generally spoken by most, gradually being supplanted by English. The government subsidizes primary education through grants-in-aid to the island's denominational primary schools (principally Roman Catholic) and two secondary schools.

Government is under an appointed administrator (subordinate to the governor of the Windward Isiands, of which colony St. Lucia forms part). The legislative council is partly appointed, partly elected.

The colony's essentially agricultural economy is dominated by sugar raising. In 1950 St. Lucia produced 10.441 tons of sugar. Although much of the land is held in large estates. there were more than 4.000 individual proprietors in 1949. Fishing is carried on extensively for the local market and provided full-time employment for 1.; 50 persons in 1949 In addition to sugar and sugar products. copra and coconuts, cacao, bananas and lime products are exported to non-West Indian areas. There is also a flourishing charcoal trade with Barbados. In 1950 exports totalled £309,071 in value; imports, principally flour, rice and other foodstuffs and a wide variety of manufactured goods. were valued at £1,093,372.

External communication is by steamer service which is irregular but fairly frequent, and by air. St. Lucia enjoys better air service than any other of the West Indian islands except Jamaica and Trinidad.

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ST. MALO, a seaport of western France. capital of an *arrondissement* in the *département* of Ille-et-Vilaine, 51 mi. N.N.W. of Rennes by rail. Pop. (1954) 13,515.

In the 6th century the island on which St. Malo stands was the retreat of Xbbot Aaron, n-ho gave asylum in his monastery to Malo (Maclovius or Malovius), a Cambrian priest, who afterwards became bishop of Aleth (now St. Servan); the see was transferred to St. Malo only in the 12th century. In the 17th century the maritime power of St. Malo attained some importance. In Nov. 1693 and July 1695 the English vainly bombarded it. The St. Malo shipowners financed the Rio de Janeiro expedition of Duguay-Trouin in 1711 and also lent the king large sums for carrying on the war of the Spanish Succession. In June 1758 the English inflicted great loss on the royal shipping in the harbour of St. Servan, but another expedition in the following September received a complete check. In 1778 and during the wars of the Empire the St. Malo privateers resumed their activity. In 1789 St. Servan was separated from St. Malo, and in 1801 St. Malo lost its bishopric.

St. Malo is situated on the English channel on the right bank of the estuary of the Rance at its mouth. It is a garrison town surrounded by ramparts which include portions dating from the 14th, 15th and 16th centuries but as a whole were rebuilt at the end of the 17th century and restored in the 19th century. The most important of the gates are those of St. Vincent and the Grande Porte, defended by two massive 15th-century towers. The granite island on which St. Malo stands communicates with the mainland on the northeast by a causeway known as the "Sillon" (furrow), commanded by the old 14th and 1jth century castle: flanked with four towers, one of which, the great keep, is an older and loftier structure. In the sea round about lie other granite rocks, which have been turned to account in the defenses of the coast. The rocks and beach are continually changing their appearance, owing to the violence of the tides; spring tides sometimes rise 50 ft. above low-water level, and the sea sometimes washes over the ramparts. The harbour of St. Malo lies south of the town in the creek separating it from the neighbouring town of St. Servan., Including the contiguous and connected basins belonging to St. Servan, it comprises an outer basin, a tidal harbour, two wet-docks and an inner reservoir, affording a total length of quayage of over 2 mi. The wet-docks have a minimum depth of 13 to 1j ft. on sill, but the tidal harbour is dry at low water. The great bulk of trade is with England, the exports comprising large quantities of fruit, dairy produce, early potatoes and other vegetables and slate. The principal imports consist of coal and timber. The Southern railway maintains a regular service of steamers between Southampton and St. Malo. The port carries on shipbuilding and equips a fleet for the Newfoundland cod-fisheries. The industries also include iron- and copper-founding and the manufacture of portable forges and other iron goods and rope. The town is the seat of a sub-prefect and has a tribunal of commerce.

St. Malo is largely frequented for sea-bathing, but not so much as Dinard, on the opposite side of the Rance. The town presents a tortuous maze of narrow streets and small squares lined with high and sometimes quaint buildings. Above all rises the stone spire (1859) of the cathedral, a building begun in the 12th century but added to and rebuilt at several subsequent periods.

SAINT-MARTIN, LOUIS CLAUDE DE (1743–1803), French illuminist who signed his works "LE PHILOSOPHE INCONNU," was born at Amboise on Jan. 18, 1743. He studied law and practised for six months at Tours, but joined the army in 1765. Stationed at Bordeaux. he came under the influence of the Jewish visionary. Martinez Pasqualis. Saint-Martin left the army in 1771 and began to propagate mysticism, first in Paris under Martinez Pasqualis and later in Lyons. where he was active in masonic lodges. His first book, *Des Erreurs et de la vérité* (1775), in which Gnostic theories were used to refute Condillac's materialism, won him the favour of certain literary groups among the nobility. On his return to France in 1788 after visiting England and Italy he settled in Strasbourg, where he met Charlotte dé Boecklin and Rudolphe Salzmann. These two introduced him to the writings of Jakob Boehme. under whose influence he gradually broke loose from that of Martinez Pasqualis. In 1794 he was exiled from Paris and retired to Amboise.

During the French Revolution he was arrested as an aristocrat and was about to appear before the revolutionary tribunal when the overthrow of Robespierre in July 1794 freed him. Two years later he published his *Considérations sur la révolution française*, in which he proposed theocracy as the ideal form of society. Later he came under the influence of Swedenborg. Saint-Martin died at Aunay, near Paris, on Oct. 13, 1803.

His works include *L'Homme de désir* (1790); *Le Nouvel Homme* (1792); *Éclair sur l'association humaine* (1797); *Le Crocodile* (1798), an allegorical poem; *De l'Esprit des choses* (1800); and *Le Ministère de l'homme-esprit* (1802; Eng, trans., *The Ministry of Man and Spirit,* 1864). Other treatises appeared in his *Oeuvres posthumes* (1807).

See A. E. Waite, *The Life of Louis Claude de Saint-Martin* (1901); *R.* Amadou, *Louis Claude de Saint-Martin et le Martinisme* (1946).

SAINT MARYLEBONE, a metropolitan (1899) and parliamentary borough of London, is bounded north by Hampstead, east by St. Pancras, south by Westminster at Oxford street and west by Paddington at Edgware road. Pop. (1961) 68.834. Area 2.3 sq.mi. The boundary corresponds to the Domesday manors of Tyburn and Lilleston (whence Lisson grove). The name derives from the proximity of the old village to the river Tyburn, St. Mary-at-the-bourn. London began to engulf it in the early 18th century, when the Harley-Portland estate, followed by the Portman estate, were laid out in well-planned streets and squares. By 1800 the northern limit of building was the New (Marylebone) road, made in 1756. The present St. Marylebone parish church at York gate was built during 1813–17. The crown estate, Marylebone park. became Regent's park. 1812–30, the brilliant concept of John Nash, who also cut Regent street, with All Souls' church as its apex, to im-

prove access to the park. He incorporated nith it Portland place, built 50 years earlier by the Adam brothers. nhich he completed with the sweep of Park crescent. St. John's Wood, mainly the Eyre estate, was developed during 1830–50 as London's first garden suburb. Oxford street is one of the great shopping centres and behind it are the dependent wholesale fashion and textile trades. In and around Harley and Wimpole streets is the medicai precinct of London. The borough has several hospitals, including the Middlesex (1755). It houses Bedford college, the Wallace collection in Hertford house, the Courtauld institute and the Zoological gardens. Modern developments have brought in administrative headquarters for the British Broadcasting corporation (BBC), British railways, and many great commercial firms. The Tonn hall (1914. 1939) is in Marylebone road. Mme Tussaud's waxworks exhibition (*see* TUSSAUD, MARIE) and the London planetarium adjoin Baker street station. The collection of Sherlockiana, including a reconstruction of the Baker street sitting room, is in the "Sherlock Holmes" inn. Westminster. Lord's cricket ground, in St. John's Wood. is the home of the MCC (Marylebone Cricket club) and of the Middlesex County club. Despite the loss of Queen's hall in 1941. St. Marylebone still retains its musical importance with the Royal Academy of Music, Trinity College of Music and Wigmore hall. (S. J RU.)

SAINT MARYS, a city of western Auglaize county, O., U.S., on the eastern shore of Grand lake (Lake Saint Marys), 95 mi. N. of Cincinnati. On an important portage between rivers connecting the Great Lakes and the Ohio river. it was the site of Girty's Town, the trading post of an American renegade named James Girty, in the 1780s; Ft. Saint Marys. supply post in the Indian wars of the 1790s; Ft. Barbee in the War of 1812; and the negotiation of an important Indian treaty in 1818. Platted in 1823, it became a city in 1903. German and Irish ancestry predominate in the population. Industrial output includes blankets, rubber products, heavy machinery and processed foodstuffs. Grand lake. one of the world's largest artificial bodies of water, constructed (1837–1845) as a reservoir to feed the Miami and Erie canal. is now used for recreation and contains a large warm water fish hatchery. For comparative population figures *see* table in OHIO: *Population.* (D. L. S.)

SAINT MARYS RIVER, a stream, about 63 mi. long, connecting Lake Superior with Lake Huron and forming part of the international boundary between northeastern Michigan, U.S., and Canada. The upper third of the river is at the Lake Superior level, but at Sault Ste. Marie (*q.v.*) it drops about 20 ft. in a distance of about one mile through the Sault Ste. Marie rapids to the level of Lake Huron. The rapids, impassable for navigation, are bypassed by the American and Canadian ship canals which contain a total of five locks and form the world's busiest waterway. The lower river is divided into a series of lakes and channels by large islands. The river is the narrowest part of the Great Lakes system and a natural crossing site which was used by the Indians and visited by early French explorers. (C. M. DA.)

ST. MICHAEL'S MOUNT, a lofty pyramidal island of granite, rising about 400 yd. from the shore of Mount's bay, and included in the West Penwith rural district of Cornwall, Eng. Pop. (1951) 52. It is united with Marazion by a natural causeway passable only at low tide. The Mount, topped by a very ancient building. can be seen from any part of the coast between Mousehole and Cudden point. It was given by Robert, count of Mortain, to Mount St. Michael in Normandy, of which abbey it continued to be a priory until the dissolution of the alien houses by Henry V, when it was given to the abbess and convent of Syon in Middlesex. It came into the possession of the crown after the Reformation and governors were appointed by the monarch.

It was a resort of pilgrims, encouraged by Pope Gregory. in the 11th century and in the 12th century the monastery was rebuilt by Bernard, the abbot of Mount St. Michael. The Mount was captured by Henry Pomeroy in the reign of Richard I. and John de Vere. earl of Oxford, seized it and held it against the king's troops in 1473. Perkin Warbeck occupied it in 1497. Humphry Arundell, governor of St. Michael's Mount, led the rebellion of 1549. During the reign of Elizabeth I it was given to Robert. earl of Salisbury, by whose son it was sold to Sir Francis Basset, whose brother. Sir Arthur Basset, held it against the parliament until July 1646. It was sold in 1659 to Col. John St. Aubyn, and his descendant, Lord St. Levan. has a residence in the castle. In 1955 an arrangement was made between the St. Aubyn family and the National Trust, whereby the latter have taken over the Mount, subject to certain rights in favour of the present Lord St. Levan and his heirs. Of the original monastic buildings. the refectory (Chevy Chase room) is the chief survival. The chapel of St. Michael, which is extra-diocesan, is a beautiful 1 jth-century building with an embattled tower.

The harbour. widened in 1823–24 to allow vessels of 500 tons to enter, has a pier dating from the 15th century.

ST. MIHIEL, a town of northeastern France, in the *département* of Meuse, on the right bank of the Meuse and the Canal de l'Est. 23 mi. S. by E. of Verdun by rail. Pop. (1954) 4,933. St. Mihiel is famous for its Benedictine abbey of St. Michael, founded in 709. The abbey buildings (occupied by the municipal offices) date from the end of the 17th century and the beginning of the 18th century, and the church from the 17th century. The church of St. Étienne, chiefly in the flamboyant Gothic style, contains a magnificent Holy Sepulchre by Ligier Richier. St. Mihiel formerly possessed fortifications and two castles, destroyed in 1635.

Battle of St. Mihiel, 1918.—In his first conference with the commander-in-chief of the French armies, Gen. Pershing visualized the reduction of the St. Mihiel salient as the first U.S. operation in World War I. In accordance with studies made at his headquarters in Sept. 1917, he planned that the decisive U S. effort would be against the German railroad system north and east of the Meuse river and the ore deposits in the vicinity of Metz and Longwy, with the elimination of the St. Mihiel salient as a necessary preliminary. Though early American control of the Woevre sector was agreed (May 19, 1918) the demands for American troops to assist the Allies in meeting the Germans elsewhere limited further steps along these lines to the creation of supply installations. At Bombon, on July 24, the commanders-in-chief, having determined to maintain the offensive, accepted Gen. Pershing's proposal that his army should undertake to reduce the St. Mihiel salient before the autumn rains began about the middle of September. This operation harmonized with the Château Thierry offensive and the British and French attacks against the Amiens and Ypres-Lys salients, made in order to free strategic railroads, preparatory to more extended operations. The counter-offensives against the Marne and Amiens salients in July and Aug. had gained such advantages that it was apparent the emergency which justified the dispersion of American divisions had passed. On Aug. 9, final decision was given for the immediate assembly of the American army for an attack against the St. Mihiel salient.

The American troops in France—at this time over 1,200,000—were sufficient for the offensive, but they were dispersed along the front from Switzerland to the Channel. While the I Army Headquarters, two corps and corps troops and seven divisions were operating in the Marne offensive, other American divisions were holding sectors in the Vosges and Lorraine and several were training as reserves behind the British front. To assemble these combat and service troops into an army and undertake a major operation within the short period available and with the staffs so recently organized was an extremely difficult task. Deficiencies in artillery, aviation and special troops, caused by shipment of an undue proportion of infantry andmachine guns to assist the Allies, were largely met by the French. While the I American army was given a distinct and independent mission, Gen. Pershing suggested, as expedient, that it should function under the nominal direction of Gen. Pétain, the French commander-in-chief, in order to assure co-ordination on the part of the French armies adjacent to the I army and to provide French units needed at the outset for supply services. To all intents and purposes the I army was entirely independent of French command, as all plans were prepared and all movements and operations ordered by the commander of the I army. The initial battle plan approved by Marshal Foch by Aug. 17, contemplated as an ultimate objective the general line:

Marieulles (east of the Moselle), the heights south of Gorzé, Mars la Tour, Etain and the employment of 25 divisions under Gen. Pershing's personal direction. In furtherance of this plan, the scattered divisions, corps and service troops were first gathered in areas about Chaumont and Neufchâteau and then, beginning Aug. 28, the army advanced to its battle position.

The I American army took command of the front from Port-Sur-Seille (east of the Moselle) to Watronville (north of Les Eparges) from the II and VIII French Armies on Aug. 30. On this day, at I American Army headquarters (Ligny-en-Barrois), Marshal Foch discussed with Gen. Pershing a general plan for future operations and proposed employing American divisions under French command in the Champagne and Meuse-Argonne regions with a material reduction of the St. Mihiel forces in order to make available American troops for these new operations. Gen. Pershing could not accept such plans as they would require the immediate separation of the recently formed I American army into several groups delaying further the formation of a distinct American army. Moreover, an enormous amount of preparations had already been made in supplies arid munitions and in construction of roads, railroads, regulating stations and other installations for the supply of the army on a particular front. While willing to accept the employment of the American army as a unit where desired, Gen. Pershing would not entertain proposals for its disruption. At a later conference on Sept. 2, the employment of the American army as a unit was conceded and a decision reached to the effect that after reducing the St. Mihiel salient, the I American army would attack by Sept. 2 j between the Meuse river and Argonne forest. As a result of the decisions, the depth of the St. Mihiel operation was limited to the line Vigneulles, Thiaucourt, Regnieville The number of divisions to be used was reduced and the time shortened. There were 15 American divisions (each equal in size to 2 French divisions) and 4 French divisions available, 6 of which would be in reserve. Furthermore, 2 army corps headquarters and corps troops. practically all army artillery and aviation and the Ist, 2nd and 4th divisions, the first 2 destined for a leading part in the St. Mihiel attack, were all due to be withdrawn and started for the Meuse-Argonne by the fourth day of the battle.

The salient had been held by the Germans since Sept. 1914. It covered the most sensitive section of the enemy's position on the western front; *i.e.,* the Mézières-Sedan-Metz railroad and the Briey Iron Basin; it threatened the entire region between Verdun and Nancy and interrupted the main railroad line from Paris to the east. Its primary strength lay in the natural defensive features of the terrain itself. The western face of the salient extended along the rugged, heavily-wooded eastern heights of the Meuse; the southern face followed the heights of the Meuse for 5 mi. to the east and then crossed the plain of the Woevre, including within the German lines the detached heights of Louvemont and Mont Sec, which dominated the plain and afforded the enemy unusual facilities for observation. The enemy had reinforced the positions by every artificial means during a period of four years. Having concentrated by night movements over 600,000 men on the battlefield, the troops of the I army were deployed in attack positions on the night of Sept. 11. On the south face of the salient was the I corps (4 divisions in line) extending from the Moselle westward. On its left was the IV corps (3 divisions in line) with left facing Mont Sec. These 2 corps were to deliver the main attack, the advance pivoting on the centre of the I corps. The left of the IV corps was to advance toward the heart of the salient where contact would be made with the V corps from the west. On the western face of the salient lay the V corps (3 divisions in line) extended from Mouilly via Les Eparges to Watronville. While the centre division made a deep advance to gain contact with the IV corps on the south, the rest of the corps was to limit its advance while covering the flanks of the centre division. Between the IV and V corps around the apex of the salient, the II French corps (3 divisions in line) covering 24 mi., had the mission of attacking to hold the enemy in the salient. American artillery and aviation were greatly augmented by French artillery and aviation and assisted indirectly by the British independent air force located south of Nancy. The heavy artillery could reach the railroads entering Metz.

Gen. Foch's Army Detachment C held the salient on Sept. 12 with 8 divisions in line and 3 divisions in immediate reserve. While the Germans had an inkling of a possible American attack as early as Sept. 1, the magnitude and imminence were not suspected. An American ruse at Belfort, which comprised extensive preparation for an attack in that region, proved misleading to the enemy. A decision having been made to withdraw in face of a serious attack at St. Mihiel, preparations for a deliberate and methodical withdrawal were under way, some dismounted batteries having been displaced, when the Americans launched their attack at dawn on Sept. 12. After four hours' violent artillery preparation, accompanied by small tanks, the I and IV corps advanced. The infantry of the V corps attacked at 8 A.M. The operation was carried out with precision. Just after daylight of the 13th, elements of the IV and V corps joined at Vigneulles, 11 mi. N.E. of St. Mihiel. The enemy was overwhelmed, and all objectives were reached on the afternoon of Sept. 13. During the 14th and 1 jth, while the two German counterattacks were repulsed by the I corps, the Americans advanced along the Moselle to the line Jaulny-Pagny-sur-Moselle. On Sept. 14–16, local operations continued, American patrols advancing to Dampvitoux. eastern edge of Etang de Lachaussee, Jonville and Fresnes-en-Woevre. The swiftness with which the operation was carried out enabled the Americans to smother the opposition to such an extent that they suffered less than 7,500 casualties during the actual period of the advance. During the battle the Germans engaged four new divisions and drew into local reserve several other divisions.

The Americans captured nearly 16,000 prisoners (over 4,000 in the salient proper), 443 guns and large stores of material and supplies. The moral result of the victory was striking. An American army had suddenly appeared and crushed the enemy in one of his strongest positions. No form of propaganda could overcome the depressing effecton the enemy of this demonstration of ability to organize a large American force in so short a time and drive it successfully through its defenses. The strength of the I American army in the battle totalled over 500.000 Americans and 100,000 French, approximately 2,900 cannons, 400 tanks and 1,000 aeroplanes. (H. A. DR.; J. J. P.)

ST. MORITZ, loftiest (6,037 ft.) and most populous village of the Upper Engadine in the Swiss canton of the Graubunden Pop. (1950) 2.558; about half were German-speaking, the rest chiefly Romansch and Italian About half mere Protestant and half Roman Catholic. It is built above the north shore of the lake of the same name. and is 56 mi. from Coire by the Albula railway. The village is about 1 mi. north of the baths, an electric tramway connecting the two. Both are ordinarily frequented by foreign visitors. The baths (chalybeate, sparkling with free carbonic acid) were already well-known in the 16th century.

ST. NAZAIRE, a town of France, capital of an *arrondissement* in the *département* of Loire-Inférieure, 40 mi. W.N.W. of Nantes by rail and 29 mi. by river. Pop. (1954) 33,513. According to remains discovered, St. Nazaire seems to occupy the site of the ancient *Corbilo,* placed by Strabo among the more important maritime towns of Gaul. At the close of the 4th century the site of Corbilo was occupied by Saxons, and, their conversion to Christianity being effected one or two hundred years later by St. Felix of Nantes, the place took the name of St. Nazaire. Under the Second Empire it was chosen as the site of the new harbour for Nantes, because the ascent of the Loire was becoming difficult. St. Nazaire, on the Loire at its mouth, is a modern town. It possesses a granite dolmen 10 ft. by 5 ft. resting horizontally on two other stones. The harbour, accessible to largest ships, is separated from the estuary by a narrow strip of land and comprises an outer harbour and entrance, two floating docks. three graving docks and the extensive shipbuilding yards of the Loire Co. and of the General Transatlantic Co. whose steamers connect St. Nazaire with Mexico, the Antilles and the Isthmus of Panama. Ships for the navy and the mercantile marine are built, and there are important steelworks, blast furnaces, forges and steam sawmills.

The town is the seat of a sub-prefect and has a board of trade-arbitrators. a chamber of commerce and a tribunal of commerce.

ST. NICOLAS, town. province of East Flanders. Belgium, 12 mi. S.W. of Antwerp, a railway junction on the Antwerp-Ghent line. with linen manufactories of its own, and the central market of Waes; formerly barren and bleak downs, it is now highly productive. Pop. (1955 est) 46.099.

ST. OMER, a town and fortress of northern France. capital of an arrondissement in the *département* of Pas-de-Calais. 42 mi. W.N.W. of Lille on the railway to Calais. Pop. (1954) 17,444.

Omer, bishop of Thérouanne, in the 7th century established the monastery of St. Bertin, from which that of Notre-Dame was an offshoot. In the 9th century the village which grew up round the monasteries nas named St. Omer. In 1559 St. Omer became a bishopric and Notre-Dame was raised to the rank of cathedral. The town and monastery were surrounded by walls by 980. Situated on the borders of frequently disputed territories, St. Omer long continued subject to siege and military disaster.. In 1071 Philip I and Count Arnulf III of Flanders were defeated at St. Omer by Robert the Frisian. In 1127 the town received a communal charter from William Clito, count of Flanders. In 1493 it came to the Low Countries as part of the Spanish dominion. In 1677, after 17 days' siege, Louis XIV forced the town to capitulate; and the peace of Nijmwegen permanently confirmed the conquest. In 1711 St. Omer, on the verge of surrendering to Prince Eugene and the duke of Marlborough owing to famine, was saved by the daring of Jacqueline Robin, who brought provisions into the place. St. Omer ceased to be a bishopric in 1801.

At St. Omer begins the canalized portion of the Aa, which reaches the sea at Gravelines, and under its walls connects with the Neuffossé canal, which ends at the Lys. There are two harbours outside and one within the city. The old cathedral belongs almost entirely to the 13th, 14th and 15th centuries. A heavy square tower finished in 1499 surmounts the west portal. The church contains interesting paintings, a colossal statue of Christ seated between the Virgin and St. John (13th century, originally belonging to the cathedral of Thérouanne) and the cenotaph of St. Omer (13th century). The richly decorated chapel in the transept contains a wooden figure of the Virgin (12th century), the object of pilgrimages. Some arches and a lofty tower are all that remain of the abbey church of St. Bertin. St. Sepulchre (14th century) has a beautiful stone spire and stained-glass windows. There is a fine collection of records in the town hall, which was built of the materials of the abbey of St. Bertin. There are several houses of the 16th and 17th centuries; of the latter the finest is the Hôtel Colbert, once the royal lodging. St. Omer is the seat of a sub-prefect, of a court of assizes, of a tribunal of commerce, of a chamber of commerce, and of a board of trade arbitrators. It was the British headquarters during part of World War I. The industries include the manufacture of linen goods, sugar, soap, tobacco pipes and mustard, the distilling of oil and liqueurs, dyeing, salt-refining, malting and brewing.

The suburb of Haut Pont to the north of St. Omer is inhabited by a special stock, which has remained faithful to the Flemish tongue, its original costume and its peculiar customs, and is distinguished by honesty and industry. The ground which these people cultivate has been reclaimed from the marsh, and the *lègres* (*i.e.,* the square blocks of land) communicate with each other only by boats floated on the ditches and canals that divide them. At the end of the marsh, on the borders of the forest of Clairmarais, are the ruins of the abbey founded in 1140 by Thierry d'Alsace. to which Thomas Becket betook himself in 1165.

SAINTONGE, one of the old provinces of France, of which Saintes (*q.v.*) was the capital, was bounded on the north-west by Aunis, on the north-east by Poitou, on the east by Angoumois, on the south by Guyenne, and on the west by Guyenne and the Atlantic. It now forms a small portion of the *département* of Charente and the greater part of that of Charente Inférieure. Originally occupied by the Gaulish Santones, whose name it preserves, the district subsequently formed part of Aquitania Secunda. It formed the bishopric of Saintes and was divided into two *pagi: Santonicus* (whence Saintonge) and Alienensis (Aunis). Divided between the kings of England and France in 1259 it was wholly ceded to the king of England in 1360, but reconquered by Du Guesclin in 1371. Up to 1789 it was in the same gouvernement with Angoumois, but for judicial purposes Saintonge was under the parlement of Bordeaux and Angoumois under that of Paris.

See D. Massiou, *Histoire* politique, civile et *religieuse* de *la* Saintonge *et* de *l'Aunis,* 6 vol. (1836–39; 2nd ed., 1846); P. D. Rainguet, Biographie saintongeaise (1852). *See* also the publications of the *Société* des archives *hist.* de la Saintonge et de *l'Aunis* (1874 seq.).

ST. PANCRAS, a metropolitan borough of London. England, bounded east by Islington. southeast by Finsbury, south by Holborn and west by St. Marylebone and Hampstead, and extending north to the boundary of the county of London. Pop. (1951) 138.377. Area 4.2 sq.mi. In the centre of the borough are Camden Town and Kentish Town and the three great railway termini of Euston. St. Pancras and King's Cross, with their extensive goods depots and adjacent hotels. To the south of this lies the residential district of Bloomsbury (part of which is in Holborn), one mainly of university buildings and private hotels, and with several fine squares. North of the railway stations are residential districts near Hampstead heath and Regent's park, including Gospel Oak and part of Highgate.

There are considerable open spaces, the largest of which are Waterlow park, parts of Regent's park and of Primrose hill. Parliament Mill fields (bought for the public in 1886) and Kenwood (purchased in 1919). The last contains Kenwood house, bequeathed to the public by Lord Iveagh (d. 1927) together with its noted collection of pictures.

A thoroughfare, called successively Tottenham Court road, Hampstead road, Camden High street, Kentish Town road, and Highgate road, runs from south to north; Euston road crosses it in the south, and Camden road and Chalk Farm road branch from it at Camden Town. The old parish church of St. Pancras in the Fields, near Pancras road. has lost its ancient character as a result of reconstruction. though it retains several early monuments. The new parish church of St. Pancras is in Woburn place. University college (a part of London university). Gower street. was founded in 1826 and provides education in all branches common to universities excepting theology. With the department of medicine is connected the University College hospital (1833) opposite the college. There are several other hospitals: among them the Royal Free hospital (Gray's Inn road), the London Skin hospital (Fitzroy square) and the Elizabeth Garrett Anderson Hospital for Women (Euston road). The site of the Foundling hospital (*q.v.*), in the old Lamb's Conduit fields, has been transformed into a permanent open-air study and play centre for children through a fund initiated for the purpose by Lord Rothermere. Other institutions are the British Medical association in Tavistock square (1925), the Royal Veterinary college and the North Western polytechnic (1929). The Mary Ward (formerly Passmore Edwards) settlement, first named for its principal benefactor, was founded largely through the instrumentality of Mrs. Humphry Ward. In Euston road are the British headquarters of the Society of Friends. the nen buildings of which were completed in 1926. Park Village East and Park Village West, at the north end of Albany street and separated by the canal, mere built by John Nash.

St. Pancras with Holborn returns two members to parliament, for St. Pancras North, and Holborn and St. Pancras South. Many of the inhabitants are employed in work connected with the railways. There are also cigarette, furniture and piano-making industries.

St. Pancras is mentioned in Domesday as belonging to the chapter of St. Paul's cathedral. in which body the lordship of the manors of Cantelows (Kentish Town) and Totenhall (Tottenham Court) was invested. Camden Town takes its name from Baron Camden (d. 1794), lord chancellor under George III. King's Cross was so called from a statue of George IV. erected in 1830 and greatly ridiculed and removed in 1845. but an earlier name, Battle Bridge. is traditionally derived from the stand of Queen Boadicea against the Romans, or from one of Alfred's contests with the Danes.

SAINT PAUL, capital city of Minnesota, U.S., seat of Ram-

sey county and a port of entry, is located 2 mi. below the head of navigation on the Mississippi river and adjacent to Minneapolis; it is about 350 mi. N.W. of Chicago. It has 16 mi. of river frontage along a deep S-shaped bend of the Mississippi which flows south to its confluence with the wider Minnesota river, northeast past the business district, and then sharply south again in its broadening valley. The heart of the city, built upon a series of terraces which rise from the river (altitude, 703 ft.) to the surrounding glacial plains (altitude, 900 ft.), presents a striking sky line from the southern and eastern approaches, and various points along the heights within the city afford sweeping views across the river valley. The downtown area, surrounded by hills, grew up with an irregular street pattern which is reminiscent of older eastern cities. St. Paul and Minneapolis (*q.v.*), to the west and north, are contiguous and, though very different in character and development, are often called the Twin cities.

History. — In 1680, Father Louis Hennepin (*q.v.*) passed the site of St. Paul, and in 1766 Jonathan Carver (*q.v.*), searching for the northwest passage, explored a cave near the city. In 1805, Lieut. Zebulon Montgomery Pike (*q.v.*), leader of a U.S. expedition, camped beneath the bluffs of the Minnesota and Mississippi rivers on what is known as Pike Island where he made an unofficial treaty with the Sioux for possession of the region, including the commanding site above him on which Fort Snelling was later built. The first claim in what is now St. Paul was made in 1838 by Pierre "Pig's Eye" Parrant. The landing was known as Pig's Eye until 1841 when Father Lucian Galtier built a log chapel dedicated to St. Paul. In 1849 St. Paul became the capital of the newly formed Minnesota territory. Settlers, mainly from the eastern states, poured into the river town which was incorporated in 1854, its population by 1860 exceeding 10,000.

Industrial and *Commercial* Growth. — St. Paul's historic importance in the development of the upper midwest was as a commercial centre located near the head of navigation on the Mississippi river. Furs were its first products for the outside market, with groceries and dry goods assuming early importance. The first private bank in the territory was established in St. Paul in 1852 and the First National Bank of St. Paul nas organized in 1863. In 1862 the first train left the city on the 10-mi. track of the St. Paul and Pacific railroad. In 1883 a great celebration marked the completion of the Northern Pacific railroad to the west coast. and 11 years later the Great Northern railroad, under the leadership of James J. Hill (*q.v.*), was completed. Banking in St. Paul has continued its close affiliation with the railroads whose development gave it the name, "gateway to the great northwest."

St. Paul's manufacturing developed slowly in a diversified pattern based upon the resources and needs of the surrounding country. Boots and shoes ranked first among the industries in the 1870s. In 1882 the Union Stock Yards company was established by the railroads. By mid-20th century the livestock market, now in suburban South St. Paul was one of the world's largest public livestock markets in salable receipts. There are numerous printing and publishing houses including an important law publishing firm. Among the largest employers are manufacturers of automobiles, electronic communications equipment, abrasives and magnetic tape, refrigerators, construction equipment, advertising specialties and beer. Tno large oil refineries and three chemical plants were brought to the St. Paul area by the development of industrial sites along the river to the south of the city.

Population and Administration. — St. Paul is in the Minneapolis-St. Paul standard statistical metropolitan area comprising the counties of Anoka, Dakota, Hennepin. Ramsey and Washington, which according to the federal census of 1960 had a population of 1,482,030. The population of St. Paul proper was 311,349 in 1950 and 313,411 in 1960. Its period of greatest growth mas between 1880 and 1895 when the population increased from approximately 40,000 to 140,000. During this period also the proportion of foreign born reached its peak, with Germans and Irish leading in numbers. This phase of immigration underlies the character of the modern city, though by 1930 when the population was 271,606 the foreign born included a high percentage of Scandinavians and also east Europeans, Italians and Mexicans. St. Paul is the seat of a Roman Catholic archdiocese which was built up by Archbishop John Ireland (*q.v.*) who greatly influenced the development of the city. Roman Catholics in the early 1960s numbered about two-fifths of the population, though Protestant, Jewish and Orthodox faiths were well represented.

Under the commission plan of government, adopted by the voters in 1912, city officials are elected for two-year terms. The legislative council consists of the mayor and six commissioners who serve as administrators of the various city departments. Judges of the municipal court are also elected officials as are the seven members of the board of education who serve without pay.

Transportation. — St. Paul is served by nine first-class railroads which own and operate a terminal switching line in the city. By mid-20th century it had become one of the largest trucking centres in the nation. The rafting industry, carrying logs and lumber down the river, was important to St. Paul until about 1900. The last raft left in 1914, but river traffic attained a new significance in the late 1950s with 25 barge lines carrying about 2,000,000 tons of bulk commodities such as coal, grain, oil and fertilizers between the Port of St. Paul and Mississippi river markets and Gulf ports. St. Paul and Minneapolis are jointly served by the Wold-Chamberlain International airport.

Education, Culture and Recreation. — St. Paul has five liberal arts colleges, all with active building programs and growing enrollments: the College of St. Thomas, for men (Roman Catholic, 1885); Macalester college (Presbyterian, 1885); Concordia junior college (Lutheran, 1905); Hamline university (Methodist, 1854); and Bethel College and Seminary (originally established in 1871 as Scandinavian Department of Baptist Union Theological Seminary of The University of Chicago) since 1947, a four-year college. The University of Minnesota Institute of Agriculture has a large campus in the northeast corner of the city. Luther Theological seminary and St. Paul seminary (Roman Catholic) are in St. Paul, and the William Mitchell College of Law gives a full degree through evening courses. Parochial and private schools are well represented, and a recognized program for pupils of all levels of ability was instituted in the city's public schools.

An Italian Renaissance building, built in 1916, houses both the public library and the James Jerome Hill reference library, a private corporation with especially extensive collections in economics, science and technology. The Minnesota Historical society, founded in 1849, has an outstanding collection of manuscripts and printed materials and also a museum relating to the region. The science museum of the St. Paul institute, founded in 1906, supported 50% by public funds, houses exhibits of anthropology, geology and related sciences. The St. Paul Gallery and School of Art, supported 13% by public funds, has, since 1926, encouraged crafts and local arts. St. Paul has long been known as a musical city. The Schubert club, founded in 1882, provides a distinguished concert series and sponsors a scholarship program, and the St. Paul Civic Opera association has, since 1934, encouraged local talent through its productions. More than 1,000,000 people attend the annual state fair, held in the grounds near the Institute of Agriculture. and since 1886, when the first ice palace was built, the St. Paul Winter carnival has been a colourful annual event. Perhaps the most distinctive of the city's entertainment events is the biennial Festival of Nations first sponsored in 1932 by the International institute and featuring dances, handicrafts and foods of many nations. A distinctive social service in the city is the Wilder Charities, established in 1910 under a trust fund by Amherst H. Wilder "for the benefit of the poor of the city." The Municipal auditorium, built in 1907, and enlarged in 1932, seats 15,000 and the Municipal stadium, built in 1954, holds 10,000.

Buildings and Parks. — A city of quiet, tree-shaded streets and middle-class homes, St. Paul is crowned by Summit avenue which, progressing westward from the bluffs overlooking the business district, reveals along its 49-mi. length the changing styles of residential and church architecture, beginning with the impressively located baroque Cathedral of St. Paul which overlooks the city and the mansion of James J. Hill, built in 1887, passing the bold and symbolic structure of Mount Zion temple, completed in 1954, and ending with the homes of the mid-20th century. Among

the landmarks is the home of Gov. Alexander Ramsey, a fine example of the dignified domestic architecture of the 1880s. The Federal Courts building (1900) is a delightfully bizarre example of French Renaissance architecture. In the concourse of the 19-story functional City hall and Ramsey County courthouse, erected in 1931, stands the huge rotating onyx figure of the Indian God of Peace by the Swedish sculptor, Carl Milles. The Woman's City club overlooks the river. The First National bank has, since 1931, with the Cathedral of St. Paul and the capitol building (designed by Cass Gilbert and inspired by Italian High Renaissance) both on the bluffs behind it, dominated the sky line. Extensive clearing, begun in 1956, has beautified the capitol approach which gives, from its height, a spectacular vista of the city and the valley beyond.

St. Paul has 11 major parks, the most interesting of which are Como park, begun in 1872, with its lake, greenhouse and zoo, and Indian Mounds park, where Indian burial mounds dot the margin of the bluff which gives a sweeping view across the southward course of the river and of the city to the east. (MA. C. B.)

SAINTPAULIA: *see* AFRICAN VIOLET.

SAINT PAUL ROCKS, also known as Rochedos São Paulo and as St. Peter and St. Paul, a number of islets in the Atlantic, nearly 1° N. of the equator and 540 mi. from South America, in 29° 15′ W. The whole space occupied does not exceed 1,400 ft. in length by about half as much in breadth. Besides seafowl the only land creatures are insects and spiders. Fish are abundant, seven species being collected by the "Challenger" expedition (*q.v.*). Darwin considered the rocks not of volcanic origin but later investigators maintain that they probably are eruptive.

(J. L. TR.)

ST. PETER PORT, the chief town of Guernsey, one of the Channel Islands. Pop. (1951) 16,799. It lies on a steep slope above its harbour, on the east coast of the island. The harbour is enclosed by breakwaters, the southernmost of which connects with the shore and continues beyond an islet on which stands Castle Cornet (12th century). A sea wall extends more than a mile toward the port of St. Sampson. To the south of the town is Fort George. The old boundaries of the town are marked by five stones. St. Peter's, the town church, standing low by the side of the quay, dates from various periods, with possible remnants of Norman walls, and has fine details of the 14th and 15th centuries. The Elizabeth college for boys was founded by Queen Elizabeth I. Hauteville house, the residence of Victor Hugo from 1856 to 1870, is preserved as he left it, and the authorities of the city of Paris are now its trustees. Among other works which he produced in this island fastness was *Les Travailleurs de la Mer* (1863), unsurpassed even among the works of its author for splendour of imagination and for pathos.

The original harbour was built under King Edward I, if not earlier; it was added to under Queen Elizabeth I and outside this harbour lay a roadstead, landward of the islet of Castle Cornet. Most of this roadstead was enclosed by breakwaters in the mid-19th century, and the large harbour thus formed has had its quayage increased by the completion in 1930 of a jetty projecting out into the pool. A large export trade in fruit, vegetables and flowers is carried on, and it is a popular port for visiting yachts from England and continental Europe. (B. C. DE G.)

ST. PETERSBURG: *see* LENINGRAD.

SAINT PETERSBURG, a resort city, is located on the west coast of Florida, U.S., in Pinellas county. Occupying the tip of Pinellas peninsula in Tampa bay, it is connected by the 7-mi. Gandy bridge with the mainland toward Tampa, 20 mi. N.E., and by the 15-mi. Sunshine skyway, consisting of five bridges and six causeways, with the mainland south-southwest toward Bradenton and Sarasota. Bridges and causeways to the west provide access across Boca Ciega bay to island beaches along the Gulf of Mexico. The population in 1960 was 181,298 (for comparative population figures *see* table in FLORIDA: *Population*). St. Petersburg is designated by the census bureau as a central city of the Tampa-St. Petersburg standard metropolitan statistical area (*see* TAMPA).

Known as the "Sunshine city," St. Petersburg was named for the birthplace in Russia of Peter A. Demens who with John C. Williams of Detroit founded the Florida city. In 1888 Demens completed a railway connecting it with the St. Johns river, then the main artery of traffic to interior Florida. Settlers and tourists were attracted by development projects of the Hamilton Disston corporations which owned much of the surrounding area. The city was incorporated in 1892 and adopted a council-manager form of government in 1931. There are several hundred small, diversified industries and branch shops and plants of national corporations. A large number of retired persons live in the city.

A one-half mile municipal pier has fishing balconies, a museum, a solarium and pools. Bays, harbours and marinas about the city accommodate a large fleet of pleasure craft which frequently participate in races and regattas. Other recreational and entertainment attractions are band concerts, major-league baseball teams in spring training, fishing, golf and other out-of-door sports.

The public-school system is headed by the St. Petersburg junior college, founded in 1927. Among other educational institutions are the Admiral Farragut Naval academy (preparatory), the Law College of Stetson university, and the Florida Presbyterian college, established in 1959 and opened in 1960. (A. J. H.)

SAINT-PIERRE, CHARLES IRÉNÉE CASTEL, ABBÉ DE (1658–1743), French writer, was born at the Château de Saint-Pierre l'Église near Cherbourg on Feb. 18, 1658. His father was *bailli* of the Cotentin, and Saint-Pierre was educated by the Jesuits. In Paris he frequented the salons of Madame de la Fayette and of the marquise de Lambert. He was presented to the abbacy of Tiron, and was elected to the Academy in 1695. In the same year he gained a footing at court as almoner to Madame. But in 1718, in consequence of the political offence given by his *Discours sur la polysynodie,* he was expelled from the Academy. He died in Paris on April 29, 1743.

Saint-Pierre's works are almost entirely occupied with an acute criticism of politics, law and social institutions. They had a great influence on Rousseau, who left elaborate examinations of some of them, and reproduced not a few of their ideas in his own work. His *Projet de paix perpétuelle,* which was destined to exercise considerable influence on the development of the various schemes for securing universal peace which culminated in the Holy alliance, was published in 1713 at Utrecht, where he was acting as secretary to the French plenipotentiary, the Abbé de Polignac. His works were published at Amsterdam in 1738–40 and his *Annales politiques* in London in 1757. A discussion of his principles, with a view to securing a just estimation of the high value of his political and economic ideas, is given by S. Siégler Pascal in *Un Contemporain égaré au XVIII^e siècle. Les Projets de l'abbé de Saint-Pierre, 1658–1743* (1900).

ST. PIERRE and **MIQUELON,** the largest islands of two small groups 10 mi. off the south coast of Newfoundland; united area about 93 sq.mi. Both islands are rugged masses of granite, with a few small streams and lakes, a thin covering of soil and scanty vegetation. Area of St. Pierre group, 10 sq.mi.; Miquelon group, 83 sq.mi. The population of the two islands in 1957 was 4,827, the capital city of St. Pierre having 4,222 people.

The islands were occupied by the French in 1604 and fortified in 1696. In 1702 they were captured by the British and held until 1763, when they were given back to France as a fishing station. They are thus the sole remnant of the French colonies in North America. Taken by the Ehglish in 1778, restored to France in 1783, again captured and depopulated by the English in 1793, recovered by France in 1802 and lost in 1803, the islands have remained in undisputed French possession since 1814 (treaty of Paris). Their importance is due to their proximity to the Grand Banks. Primary education is free, with two schools for boys and three for girls, besides private schools.

Fishing activities of the archipelago have been limited to coastal fishing in dories. Salted and dried cod is exported to the Antilles, but production is not sufficient for the economy of the islands. As a result of a subsidy from France, however, a company was formed in 1951 to produce frozen fish fillets and by-products of fish. St. Pierre also has a fur industry (fox and mink). The pelts, shipped to the markets of the world, are of good quality.

Communication between St. Pierre and Canada is maintained by

a French vessel, property of the government. This boat transports passengers. mail and freight on the St. Pierre-Halifax line during the winter and on the St. Pierre-Sydney line during the summer. Nonscheduled air transport is furnished by a Canadian company, Maritime Central Airways. A small steamer with accommodation for passengers and freight provides transportation between the islands of St. Pierre and Miquelon. Administration of the islands and public services is carried out by a governor, assisted by a private council. In 1946 a general council, composed of 14 members elected by universal franchise, assumed a large part in the administration of this territory. It acquired power particularly over the local budget and the fixing of customs, tariffs and all other taxes. The territory of St. Pierre and Miquelon is represented in the French parliament by a member in the national assembly and by a senator in the council of the republic. It elects, as well, a representative to *l'assemblée de l'union française.*

See Henrique, *Les Colonies françaises, t.* ii (1889); Levasseur, *La France,* t. ii (1893); *L'Année coloniale,* yearly from 1899. (C. CY.)

ST. QUENTIN, a manufacturing town of northern France, capital of an *arrondissement* in the *département* of Aisne, 32 mi. N.N.W. of Laon by rail. Pop. (1954) 52,148. St. Quentin (anc. *Augusta Veromanduorum)* stood at the meeting-place of five military roads. In the 3rd century it was the scene of the martyrdom of Gaius Quintinus. The date of the foundation of the bishopric is uncertain, but about 532 it was transferred to Noyon. Towards the middle of the 7th century St. Eloi (Eligius), bishop of Noyon, established a collegiate chapter at St. Quentin's tomb, which became a famous place of pilgrimage. The importance of the town was increased during the middle ages by the rise of its cloth manufacture. The town was surrounded by walls in 883. It became under Pippin, grandson of Charlemagne, one of the principal domains of the counts of Vermandois, and in 1080 received from Count Herbert IV a charter which was extended in 1103. From 1420 to 1471 St. Quentin mas occupied by the Burgundians. In 1557 it was taken by the Spaniards *(see* below). Two years later the town was restored to the French, and in 1560 it was assigned as the dowry of Mary Stuart. During the Franco-Prussian War St. Quentin repulsed the German attacks of Oct. 8, 1870; and in January 1871 it was the centre of the great battle fought by General Faidherbe. In World War I St. Quentin was held by the Germans from the end of Aug. 1914 to Oct. 1, 1918.

The town stands on the right bank of the Somme, at its junction with the St. Quentin canal (which unites the Somme with the Scheldt) and the Crozat canal (which unites it with the Oise). The collegiate church of St. Quentin, a fine Gothic building of the 12th, 13th, 14th and 15th centuries, damaged during World War I, was reopened in 1920. It has no west façade but terminates at that end in a tower and portal of Romanesque architecture; it has double transepts. The choir (13th century) has remains of a choir screen of the 14th century. Under the choir is a crypt of the 11th century, containing the tombs of St. Quentin (Quintin) and his fellow-martyrs Victoricus and Gentianus. The hôtel-de-ville of St. Quentin (only slightly damaged) is a Gothic building of the 14th, 15th and 16th centuries, with a flamboyant façade, adorned with curious sculptures. St. Quentin is the seat of a subprefect, of a tribunal of commerce, of a board of trade-arbitrators, and a chamber of commerce. The town has recovered its industrial activity and is the centre of a district which manufactures cotton and woollen fabrics. St. Quentin produces chiefly window-curtains and carries on the spinning and preliminary processes and the bleaching and finishing. Other industries are the making of embroideries by machinery and by hand, and the manufacture of iron goods, machinery and chemical products. Trade is in grain, flax, cotton and wool.

1. **Battle of** 1557.—An army of Spaniards under Emmanuel Philibert of Savoy, invading France from the Meuse, joined an allied contingent of English troops under the walls of St. Quentin, which was then closely besieged. Admiral Coligny threw himself into the town, and the old Constable Montmorency prepared to relieve it. On St. Lawrence's Day, Aug. 10, the relieving column reached the town without difficulty, but time was wasted in drawing off the garrison, for the pontoons intended to bridge the canal had marched at the tail of the column, and when brought up mere mismanaged. The besiegers, recovering from their surprise, formed the plan of cutting off the retreat of the relieving army. Montmorency had thrown out the necessary protective posts, but at the point which the besiegers chose for their passage the post was composed of poor troops, who fled at the first shot. Thus, while the constable was busy with his boats, the Spanish army filed across the Bridge of Rouvroy, some distance above the town, with impunity, and Montmorency, in the hope of executing his mission without fighting, refused to allow the cavalry under the duc de Nevers to charge them, and miscalculated his time of freedom. The Spaniards, enormously superior in force, cut off and destroyed the French gendarmerie who formed the vanguard of the column, and then headed off the slow-moving infantry south of Essigny-le-Grand. Around the 10,000 French gathered some 40,000 assailants with forty-two guns. The cannon thinned their ranks, and at last the cavalry broke in and slaughtered them. Yet Coligny gallantly held St. Quentin for seventeen days longer, Nevers rallied the remnant of the army and, garrisoning Péronne, Ham and other strong places, entrenched himself in front of Compiègne, and the allies, disheartened by a war of sieges and skirmishes, came to a standstill. Soon afteruards Philip, jealous of the renown of his generals and unwilling to waste his highly trained soldados in ineffective fighting, ordered the army to retreat (Oct. 17), disbanded the temporary regiments and dispersed the permanent corps in winter quarters.

2. **The Battle of** 1871.—This was fought between the German I. Army under General von Goeben and the French commanded by General Faidherbe. The latter concentrated about St. Quentin on Jan. 18, and took up a defensive position on both sides of the Somme Canal. The Germans, though inferior in numbers, were greatly superior in discipline and training, and Goeben boldly decided to attack both wings of the French together on the 19th. The attack took the customary enveloping form. After several hours' fighting it was brought to a standstill, but Goeben, using his reserves in masterly fashion, drove a wedge into the centre of the French line between the canal and the railway, and followed this up with another blow on the other bank of the canal, along the Ham road. This was the signal for a decisive attack by the whole of the left wing of the Germans, but the French offered strenuous resistance, and it was not until four o'clock that Faidherbe made up his mind to retreat. By skilful dispositions and orderly movement most of his infantry and all but six of his guns were brought off safely, but a portion of the army was cut off by the victorious left wing of the Germans, and the defeat, the last act in a long-drawn-out struggle, was sufficiently decisive to deny to the defenders any hope of taking the field again without an interval of rest and reorganization. Ten days later the general armistice was signed. *(See* further FRANCO-GERMAN WAR.)

ST. QUENTIN, BATTLE OF (sometimes called "Cambrai-St. Quentin"), the attack by British troops against the German Hindenburg position in World War I (Sept.–Oct. 1918).

The first in the series of Allied advances to the Hindenburg position (sometimes known as the battle of Amiens) began in Aug 1918. At 4:20 A.M. on Aug. 8, the Canadian corps (right) and Australian corps (left), supported by 435 British tanks, began to advance in the area east of Amiens and south of the Somme. Rapid progress was made. Later in the day troops of the French IX and XXXI corps on the right and the British III corps on the left (north of the Somme) also attacked but met stubborn opposition. During this first day the Germans lost about 28.000 men, 400 guns and nearly 100 aircraft, against less than 10,000 Allied casualties.

On Aug. 9 the British III corps made substantial gains north of the Somme and captured 2.960 prisoners but in general little further progress was made, and the day was characterized by small isolated actions rather than a co-ordinated advance. Operations on Aug. 10 were equally disappointing. On Aug. 11 slight progress was made. but in the afternoon, because of the exhaustion of the troops and the stubborn resistance of the Germans, the advance was halted until the heavy artillery had been moved forward. The total German casualties between Aug. 6 and 12 were esti-

mated at 75.000; those of the Allies were 24.232.

The offensive was continued on Aug. 20. There followed the battles of Albert, Bapaume. Second Arras. Scarpe and the U.S. action of the Saint-Mihiel salient. By the last week in Sept. 1918 the stage was set for the Allied assault on the Hindenburg position and the final advance to victory.

The attack was made on the front of the 3rd (Gen. Sir J. Byng), 1st (Gen. Sir H. Horne) and 4th (Gen. Sir H. Rawlinson) armies, in all 41 divisions supported by 1,500 heavy guns. 1.100 aircraft and 14 battalions of tanks. Opposed to these were 27 German divisions in front line and 14 in reserve. The attack began on Sept. 27 and, by the evening of Sept. 28, British and Canadian troops of the 3rd and 1st armies had advanced 6 mi. Early on Sept. 29 troops of the 4th army joined in the attack and the 3rd and 1st armies advanced a further *2* mi. By Oct. 8 the Germans were in full retreat on a wide front, morale began to crack and the British took many prisoners.

On Sept. 28 Ludendorff had reported to Hindenburg that the situation was irretrievable; on the following day Hindenburg told a council of war that an armistice was essential. On Oct. 4 German and Austrian notes were sent to President Wilson of the U.S. proposing an armistice.

See Sir James E Edmonds and R. Maxwell Hyslop (compilers), the official British *History of the Great War—France and Belgium 1918,* vol. iv and v (1947). (C. N. B.)

SAINT-RÉAL, CÉSAR VICHARD, ABBÉ DE (d. 1692), French man of letters whose lively writings did much to bring about a new view of history and entitle him to be regarded as a forerunner of Montesquieu and of Voltaire. Born in Savoy (after 1638; perhaps in 1643 or 1644), the son of a magistrate, he went to Paris about 1663. Gabriel Guéret. in 1669, could describe him as the constant counselor of Racine and Boileau and as being regarded in their circle as an authority on literary taste. In 1674, however. he returned to Savoy and attached himself to the errant duchess Mazarin (Hortense Mancini), whom in 1676 he followed to England and whose reconciliation with the court he tried to negotiate on his return to France. He died in Chambéry in Sept. 1692.

Saint-Réal is said to have been a man of original views, great powers of persuasion and doubtful morals. His views on the real motives of human activity resemble La Rochefoucauld's, and his treatise *De l'usage de l'histoire* (1671) suggests that he had absorbed a reverence for Machiavelli from Italian historiographers, His most popular work was *La Conjuration des Espagnols contre la république de Venise* (1674), which inspired Thomas Otway's *Venice Preserved.* His other works include *Dom Carlos* (1672; one of the sources of Schiller's *Don Carlos*); a remarkable *Vie de Jésus-Christ* (1678); a translation of the first two books of Cicero's letters to Atticus (1691); and numerous further essays on historical subjects. Several collections of his works appeared in the 18th century, the last of them in eight volumes (1757).

See G Dulong, *L'Abbé de Saint-Rial* (1921); A. Adam, *Histoire de la littérature française au XVII^e siècle,* vol. iv *(1954).* (W. *G.* ME.)

SAINTS, BATTLE OF THE. This battle was fought between the fleets of England and France in the channel between the islands of Dominica and Guadeloupe on April 12, 1782. It takes its name from the Saints Islands in the channel. The French had 35 battleships under the Comte de Grasse based on Martinique, and their object was to give the British fleet the slip and capture Jamaica. The British fleet of 36 ships was based on St. Lucia and was under Adm. George Rodney. On April 8 the signal came that the French were out. At dawn on April 9 the British van under Viscount Hood was close to De Grasse. who ordered his store ships to Guadeloupe with two escorting battleships. Hood was soon in action with the French rear, and his position was awkward in that he only, of the English, had made the Saints passage, the centre and rear being becalmed under the lee of Dominica. De Grasse was thus in a position to attack him with all his force, but he merely cannonaded his enemy from a distance. The British van suffered enough to make it necessary subsequently for it to change places with the rear, under Drake, but the arrival of Rodney caused De Grasse to withdraw and the French battleship "Cato" was put out of action. During the ensuing night and day the French gained somewhat and seemed likely to get clear away, but on the night of the 10th two battleships collided. One was abandoned and, on the 11th, the other fell far behind and De Grasse turned to help her. Thus a general action was joined on April 12. the French by then having only 30 effective ships. The two fleets approached one another on opposite courses with the French being nearer the wind. The fight began early and about 10 o'clock the wind shifted and gaps appeared in the French line. Rodney grasped the possibilities of the situation, and decided to risk it. There were no signals for the movement so, relying on the force of example, Rodney took his flagship, the "Formidable," stationed in the centre, through a gap in the rear of the French centre. He was followed by the five ships immediately astern. all raking the French as they passed. A similar movement took place in the rear. Captain Affleck, in the "Bedford," passing through the head of the same French squadron, was followed by Hood with the entire British rear.

The French were thus broken into three bodies, De Grasse, in the "Ville de Paris," with other ships of the centre being isolated and captured. (G.A.R.C.; J.G.B.)

SAINT-SAENS, CHARLES CAMILLE (1835–1921), French composer. pianist and organist known for his symphonic poems and his opera, *Samson et Dalila.* Born on Oct. 9, 1835, in Paris, he studied the piano with C. M. Stamaty and gave his first recital as a child prodigy in 1846. At the Paris conservatoire he studied the organ under F. Benoist and composition under J. F. Halévy. His first symphony was performed in 1853. He was appointed organist at the church of Saint-Merry in Paris, in the same year, and at the Madeleine in 1857. About this time he met Liszt who described him as "the finest organist in the world." From 1861 to 1865 he was professor of piano at the École Niedermeyer where his pupils were Gabriel Fauré and André Messager. In 1865 he played his first piano concerto at Leipzig, and in 1871, after the Franco-German War, he founded, with the singer, Romain Bussine, the Société Nationale de Musique, with the motto, *Ars Gallica,* which promoted performances of the main French orchestral works of the following generation. In the same year he produced his first symphonic poem, *Le Rouet d'Omphale;* other later symphonic poems were *Phaëton, Danse Macabre* and *La Jeunesse d'Hercule.* Following the production of his first operas, *La Princesse jaune* (1872) and *Le Timbre d'argent* (1877), his biblical opera, *Samson et Dalila,* rejected in Paris on account of its subject, was given in German at Weimar on Dec. 2, 1877, on the recommendation of Liszt. Despite its success, the prejudice in France and elsewhere against the portrayal of biblical characters on the stage persisted, and early performances in London, New York and Brussels had to be given in concert form. It was first given in Paris on the stage on Oct. 31, 1890, at the Théâtre Eden, and subsequently became Saint-Saëns' most popular dramatic work.

In 1878 Saint-Saens lost his elder son, who fell to his death from a window, and six weeks later his younger son died in infancy. It is possible that he imputed these tragedies to his wife's negligence: certainly he separated from her three years later, and undertook over the following years extensive tours throughout Europe, the United States, South America, the near east and the far east. On these tours he played the piano in the performances of his five concertos and other works and conducted his symphonic works. As a pianist he mas admired by Wagner for his brilliant technique and was the subject of a study by Marcel Proust. From about 1880 until the end of his life his large number of works covered all fields of dramatic and instrumental music. Between 1879 and 1911 he wrote ten operas, including *Henry VIII, Les Barbares* and *Déjanire,* and between 1915 and 1921 a series of works for wind instruments and piano. His third symphony (1886), dedicated to the memory of Liszt, shows a romantic tendency. The *Carnaval des Animaux* for small orchestra, written in 1886 but not publicly performed in his lifetime, is a humorous work with realistic effects, conceived as "a zoological fantasy." *Africa,* for piano and orchestra (1891), and the *Caprice Arabe* for two pianos (1894) show an oriental in-

fluence. Among the best of his later works are the fifth piano concerto (1896) and the second cello concerto (1902). He gave his last concert in Dieppe in 1921, and died in the same year at Algiers. on Dec. 16.

Under the influence of Liszt, Saint-Saens developed the symphonic poem and wrote for the piano in an elegant. virtuoso style. The clarity of his orchestration long remained a model. Though he lived through the period of the Wagnerian influence he remained unaffected bv it, adhered to the classical models and upheld a conservative iheai in French music, admired for its polished craftsmanship and sense of form. In his essays and memoirs he described the contemporary musical scene in a shrewd and often an ironic manner.

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SAINTSBURY, GEORGE EDWARD BATEMAN (1845–1933), English man of letters, was born at Southampton on Oct. 23, 1845. He was educated at King's college school, London, and at Merton college, Oxford (B.A. 1868), and spent six years in Guernsey as senior classical master of Elizabeth college (1868–74). From 1874 to 1876 he was headmaster of the Elgin educational institute. He began his literary career in 1875 as a critic for the *Academy,* and for ten years was actively engaged in journalism, becoming an important member of the staff of the *Saturday Review.* Some of the critical essays contributed to the literary journals were afterward collected in his *Essays in English Literature, 1780–1860* (2 vol., 1890–1895), *Essays on French Novelists* (1891), *Miscellaneous Essays* (1892) and *Corrected Impressions* (1895). His first book, *A Primer of French Literature* (1880), and his *Short History of French Literature* (1882; 6th ed., 1901) were followed by a series of editions of French classics and books and articles on the history of French literature, which made him the most prominent English authority of his day on the subject. His studies in English literature were no less comprehensive and included: the valuable revision of Sir Walter Scott's edition of Dryden's *Works* (18 vol., 1882-1893); *Dryden* (1881) in the "English Men of Letters" series; *History of Elizabethan Literature* (1887); *History of Nineteenth Century Literature* (1896); *A Short History of English Literature* (1898; 3rd ed., 1903); an edition of the *Minor Poets of the Caroline Period* (3 vol., 1905-1921); a collection of rare poems of great value; and editions of English classics. He edited the series of "Periods of European Literature," contributing the volumes on *Tile Flourishing of Romance and the Rise of Allegory* (1897) and *The Earlier Renaissance* (1901). From 1895 to 1915 he was professor of rhetoric and English literature at Edinburgh university. During this period he produced two of his most important works, *A History of English Prosody From the 12th Century to the Present Day* (i, 1906; ii, 1908; iii, 1910) and *The Later Nineteenth Century* (1900). Saintsbury also wrote *A History of Criticism* (3 vol., 1906–1921), *The History of English Criticism* (1911) and *A History of the French Novel* (1917-1919).

Saintsbury died on Jan. 28, 1933.

SAINT SERVAN, a town of western France, in the *département* of Ille-et-Vilaine. on the right bank of the Rance, south of Saint-Malo. Pop. (1951) 12,077. Southwest of the town is the tower of Solidor. This stronghold, erected toward the close of the 14th century by John IV, duke of Brittany, for the purpose of contesting the claims to the temporal sovereignty of the town of Josselin de Rohan, bishop of Saint-Malo, consists of three distinct towers formed into a triangle by loopholed and machicolated curtains. To the west St. Servan terminates in a peninsula on which stands the "Cité." Nearby is a modern chapel which replaced the cathedral of St. Peter of Aleth, the seat of a bishopric from the 6th to the 12th century. The Cité occupies the site of the city of Aleth, which at the close of the Roman empire supplanted Corseul as the capital of the Curiosolites. Aleth was a bulwark of Druidism in those regions and was not Christianized until the 6th century when St. Malo became its first bishop. On the removal of the bishopric to Saint-Malo. Aleth declined and nas almost destroyed by Louis IX in 1235. The houses that remained standing became the nucleus of the new community of St. Servan. It nas not until the French Revolution. however, that St. Servan became a separate commune from Saint-Malo. North of the town is a net dock, forming part of the harbour of Saint-Malo. The dock is used chiefly by coasting and fishing vessels, a fleet starting annually for the Newfoundland codfisheries.

SAINT-SIMON, CLAUDE HENRI DE ROUVROY, COMTE DE (1760–1825), French socialist, was born in Paris on Oct. 17, 1760. He fought in the War of American Independence, was imprisoned in the Luxembourg during the Terror, and, on his release, amassed a small fortune by land speculation. He was also the originator of schemes to unite the Atlantic and Pacific by a canal, and to construct a waterway from Madrid to the sea. He continued his experiments throughout his life with the result that he was completely impoverished, and for some years before his death he was obliged to work nine hours a day to earn £40 a year. In 1823 he attempted suicide. He died two years later, on May 19, at Paris. Although a prolific writer his work attracted little attention while he lived and it was only after his death that his influence became considerable.

As a thinker Saint-Simon was deficient in system, clearness and consecutive strength; but his influence on modern thought is undeniable. both as the historic founder of French socialism and as suggesting much of what was afterwards elaborated into Comtism. Apart from the details of his socialistic teaching, his main ideas are simple, and are at once a reaction against the French Revolution and the militarism of Napoleon. So far was he from advocating fresh social revolt that he appealed to Louis XVIII to inaugurate the new order of things. In opposition, however, to the feudal and military system, he advocated an arrangement by which the industrial chiefs should control society. In place of the mediaeval church the spiritual direction of society should fall to the men of science. What Saint-Simon desired, therefore, was an industrialist state directed by modern science in which universal association should suppress war, and society should be organized for productive labour by the most capable men. The social aim is to produce things useful to life.

Although the contrast between labour and capital is not emphasised by Saint-Simon, the cause of the poor is discussed, and in his greatest work, *The New Christianity,* it takes the form of a religion. It was this development of his teaching that occasioned hia final quarrel with Comte Previous to the publication of the *Nouveau Christianisme,* Saint-Simon had not concerned himself with theology; but here. beginning with a belief in God he endeavours to resolve Christianity into its essential elements and finally propounds this precept—"The whole of society ought to strive towards the amelioration of the moral and physical existence of the poorest class; society ought to organize itself in the may best adapted for attaining this end" This principle became the watchword of the entire school of Saint-Simon.

Of the disciples uho propagated his doctrines the most important were Olinde Rodrigues, and Barthélemy Prosper Enfantin (q *v*), who together had received Saint-Simon's last instructions. Their first step was to establish a journal, *Le Producteur,* but it was discontinued in 1826. The sect, however, had begun to grow, and before the end of 1828, had meetings not only in Paris but in many provincial towns An important departure was made in 1828 by Amand Bazard, who gave a "complete exposition of the Saint-Simonian faith" in a long course of lectures at Paris, which were well attended. His *Exposition* de *la doctrine de St. Simon* (2 vols., 1828–1830), which is by far the best account of it, won more adherents. The second volume was chiefly by Enfantin, who along with Bazard stood at the head of the society, but who was superior in metaphysical power, and was prone to push his deductions to extremities. The revolution of July (1830) brought a new freedom to the socialist reformers. A proclamation was issued demanding the community of goods, the abolition of the right of inheritance, and the enfranchisement of women. Early next year the school obtained possession of the *Globe* through

Pierre Leroux (*q.v.*), who had joined the school, which now numbered some of the ablest and most promising young men of France.

The members formed themselves into an association arranged in three grades, and constituting a society or family, which lived out of a common purse in the Rue Monsigny. Before long, however, the sect was split by dissensions between Bazard, a man of logical and solid temperament, and Enfantin, who desired to establish a fantastic sacerdotalism with lax notions as to the relation of the sexes. After a time Bazard seceded, together with many of the strongest supporters of the school. A series of extravagant entertainments given by the society during the winter of **1832** reduced its financial resources and discredited it in character. They finally removed to Ménilmontant, to a property of Enfantin, where they lived in a communistic society, distinguished by a peculiar dress Shortly after the chiefs were tried and condemned for proceedings prejudicial to the social order; and the sect was broken up **(1832)**.

Saint-Simonism.—In the doctrine of the followers of Saint-Simon we find a great advance on the confused views of the master. In the philosophy of history they recognize epochs of two kinds, the critical or negative and the organic or constructive. The former, in which philosophy is the dominating force, is characterized by war, egotism and anarchy; the latter, which is controlled by religion, is marked by the spirit of obedience, devotion and association. The two spirits of antagonism and association are the social principles whose prevalence determines the character of an epoch. The spirit of association, which tends more and more to prevail over its opponent, is to be the keynote of the social development of the future. Under the present system the industrial chief exploits the proletariat, the members of which, though nominally free, must accept his terms under pain of starvation The only remedy for this is the abolition of the law of inheritance, and the union of all the instruments of labour in a social fund, which shall be exploited by association. Society thus becomes sole proprietor, intrusting to social groups and social functionaries the management of the various properties. The right of succession is transferred from the family to the state.

The school of Saint-Simon insists strongly on the claims of merit; they advocate a social hierarchy in which each man shall be placed according to his capacity and rewarded according to his works. This is, indeed, a most special and pronounced feature of the Saint-Simon socialism, whose theory of government is a kind of spiritual or scientific autocracy, degenerating into the fantastic sacerdotalism of Enfantin. With regard to the family and the relation of the sexes the school of Saint-Simon advocated the complete emancipation of woman and her entire equality with man. The "social individual" is man and woman, who are associated in the exercise of the triple function of religion, the state and the family. In its official declarations the school maintained the sanctity of the Christian law of marriage. Connected with these doctrines was their famous theory of the "rehabilitation of the flesh," deduced from the philosophic theory of the school, which was a species of Pantheism, though they repudiated the name. On this theory they rejected the dualism so much emphasized by Catholic Christianity in its penances and mortifications, and held that the body should be restored to its due place of honour.

An excellent edition of the works of Saint-Simon and Enfantin was published by the survivors of the sect (47 vols., Paris. 1865–78). Of his other works the most important are, *Lettres d'un habitant de Genève* (1802); *Du Système Industriel* (1821): *Catéchisme des Industriels* (1823–24); *Nouveau Christianisme* (1825). *See* also Georges Weill, *Un Précurseur du socialisme, Saint-Simon et son oeuvre* (Paris, 1894), and a history of the *École Saint-Simonienne*, by the same author (1896); G. Dumas, *Psychologie de deux messies positivistes St. Simon et Comte* (1905), G. Brunet, *Mysticisme social de Saint-Simon* (1925); E. N. Butler, *The St-Simonian Religion in Germany* (1926); and M. Leroy, *Vie véritable de Saint-Simon* (1925).

SAINT-SIMON, LOUIS DE ROUVROY, DUC DE **(1675–1755)**, French soldier, diplomatist and writer of memoirs, was born at Versailles on Jan. 16, 1675. The peerage granted to his father, Claude de St. Simon, is the central fact in his history. The boy had for godfather and godmother Louis XIV. and the queen. After some tuition by the Jesuits (especially by Sanadon, the editor of Horace), he joined the *mousquetaires gris* in 1692. He was present at the siege of Namur, and the battle of Neerwinden. At this time he chose to begin the crusade of his life by instigating, if not bringing, an action on the part of the peers of France against Luxembourg, his victorious general, on a point of precedence. He fought, however, another campaign or two (not under Luxembourg), and in 1695 married Gabrielle de Durfort, daughter of the maréchal de Lorges, under whom he latterly served. He seems to have regarded her with respect and affection; and she sometimes succeeded in modifying his aristocratic ideas. But as he did not receive the promotion he desired he flung up his commission in 1702. Louis took a dislike to him, and it was with difficulty that he was able to keep a footing at court. He was, however, intensely interested in all the transactions of Versailles, and by dint of a most heterogeneous collection of instruments. ranging from dukes to servants, he managed to obtain the extraordinary secret information which he has handed down.

His own part appears to have been entirely subordinate. He was appointed ambassador to Rome in 1705, but the appointment was cancelled before he started At last he attached himself to the duke of Orleans and, though this was hardly likely to conciliate Louis's goodwill to him, it gave him at least the status of belonging to a definite party, and it eventually placed him in the position of tried friend to the acting chief of the state. He was able, moreover, to combine attachment to the duke of Burgundy with that to the duke of Orleans. Both attachments were no doubt all the more sincere because of his undying hatred to "the bastards," that is to say, the illegitimate sons of Louis XIV. It does not appear that this hatred was founded on moral reasons or on any real fear that these bastards would be intruded into the succession. The true cause of his wrath was that they had precedence of the peers.

The death of Louis seemed to give Saint-Simon a chance of realizing his hopes. The duke of Orleans was at once acknowledged regent, and Saint-Simon was of the council of regency. But he had little real influence with the regent. In 1721 he was appointed ambassador to Spain to arrange for the marriage (not destined to take place) of Louis XV. and the infanta. His own account of the cessation of his intimacy with Orleans and Dubois, the latter of whom had never been his friend, is, like his own account of some other events of his life, obscure. But there can be little doubt that he was practically ousted by the favourite. He survived for more than thirty years; but little is known of his life. His wife died in 1743, his eldest son a little later; he had other family troubles, and he was loaded with debt. When he died. at Paris on March **2, 175j,** he had almost entirely outlived his own generation, and the prosperity of his house.

Saint-Simon was an indefatigable writer, and he began very early to set down in black and white all the gossip he collected, all his interminable legal disputes of precedence, and a vast mass of unclassified and almost unclassifiable matter. Most of his manuscripts came into the possession of the government, and it was long before their contents were published in anything like fulness. Saint-Simon, though careless and sometimes even ungrammatical, ranks among the most striking memoir-writers of France, the country richest in memoirs of any in the world. He has been compared to Tacitus, and for once the comparison is just. In the midst of his enormous mass of writing, phrases scarcely inferior to the Roman's occur frequently, and here and there are passages of sustained description equal, for intense concentration of light and life, to those of Tacitus or of any other historian. As may be expected from the vast extent of his work, it is in the highest degree unequal. But he is at the same time not a writer who can be "sampled" easily, inasmuch as his most characteristic phrases sometimes occur in the midst of long stretches of quite uninteresting matter. The interest of the *Memoirs*, independent of the large addition of positive knowledge which they make, is one of constant surprise at the novel and adroit use of word and phrase. Some of Macaulay's most brilliant

portraits and sketches of incident are adapted and sometimes almost literally translated from Saint-Simon.

The first edition of Saint-Simon (some scattered pieces may have been printed before) appeared in 1788. It was a mere selection in three volumes and was much cut down before it was allowed to appear. Next year four more volumes made their appearance, and in 1791 a new edition, still further increased. The whole, or rather not the whole, was printed in 1829–1830 and reprinted some ten years later. The real creator of Saint-Simon, as far as a full and exact text is concerned, was M. Chéruel, whose edition in 20 volumes dates from 1856, and was reissued again revised in 1872. The standard edition is that edited by A. de Boislisle for the *Grands Ecrivains de la France* Series. For criticism on Saint-Simon there is nothing better than Sainte-Beuve's two sketches in the 3rd and 15th volumes of the *Causeries du lundi.* The latter was written to accompany M. Chéruel's first edition. In English by far the most accurate treatment is in a Lothian prize essay by E. Cannan (Oxford and London, 1885).

SAINT THOMAS, a city and port of entry of Ontario, Can., capital of Elgin county, on Kettle creek, 18 mi. S. of London and 8 mi. N. of Lake Erie. Pop. (1961) 22.469. It is an important station on the Canadian National, New York Central, London & Port Stanley, Chesapeake and Ohio, Wabash, and Canadian Pacific railways. A collegiate institute and Alma Ladies' college are located there. The New York Central railway shops and car-wheel foundry, flour, flax and planing mills, shoe and knitted-goods factories are among the chief industries.

SAINT THOMAS (Portuguese SÃO TOMÉ), an island off the west coast of Africa in that part of the Gulf of Guinea called the Bight of Biafra, lies 137 mi. W.N.W. of Cape López. The southern tip of the island just clears the equator. Its area is 854 sq.km. (330 sq.mi.).

Together with the smaller island of Principe (*q.v.*) 93 mi. N.N.E., and the 11-ac. enclave surrounding the old fortress of São João Baptista at Ouidah in Dahomey republic, St. Thomas forms the Portuguese overseas province of São Tomé e Principe.

Physical Characteristics. — St. Thomas, which is about 20 mi. broad and about 30 mi. from northeast to southwest, is volcanic and has many craters and old lava flows. It rises centrally to 6,640 ft. (Pico de Tomé) and in the west-centre has ten peaks of over 3.500 ft. Some culminate in phonolites resembling upward-pointing fingers, where the softer volcanic rocks have been eroded to expose harder rock which formed the cone of the volcano. From these peaks there are sharp descents to the often sheer west coast, but there are a number of bays on the northeast, east and south coasts. The lowlands in the south have much volcanic ash and cinder and the off-lying Rôlas islet (which is crossed by the equator) is of basalt and has two craters.

Although the climate is tropical and humid, equatorial conditions are modified by the cold Benguela current: by coastal breezes and by altitude. Climatically the island belongs to the southern hemisphere, since its drier season (the *gravana*) is from June to September. Four regions can be distinguished: (1) the hot and humid northeast lowland with about 40 in. annual rainfall; (2) above about 1,300 ft. where temperatures are lower, though variable, and rainfall heavier; (3) above 2,000 ft. where temperatures are yet lower, the nights cold and mist frequent; (4) the southeast lowland where there is no drier season. The lowlands have the reputation of being malarial.

The volcanic soil of St. Thomas is extremely fertile. Rain forest is densely developed above about 3,250 ft. but below that height the land has in most places been cleared for cultivation.

Population and **Administration.**—With many rugged areas unsuitable for habitation, the island has developed clusters of population in the more level and fertile northeast around the provincial capital São Tomé (pop. 7.813). In the west there are fewer people. Of the total population of 55,827 (1950), about 1,100 are Europeans and about 4,300 of mixed ancestry. Among the Negroes, men outnumber women by roughly two to one because of the presence of about 28,000 immigrant plantation labourers who were brought in on long and severe contract terms, largely from Mozambique. In the 1950s efforts were made to encourage fixed labour by making land grants on new roads south of São Tome and by improved education and housing.

With other Portuguese colonies, São Tomé e Principe was in 1951 given the status of an overseas province. The governor resides at São Tomé, which is also the residence of the *curador* who is the legal guardian of the *serviçaes* (labourers). The province has more than 20 elementary schools, a secondary school and a technical school.

Economy. — The earliest crop on St. Thomas was sugar, but this was ruined by Brazilian competition in the late 16th century. The island then served as a food-supply base for ships and as a slave depot. Agriculture revived with the introduction of coffee in 1800 and of cocoa in 1822. Most agriculture is on plantations, one estate alone occupying one-tenth of the island. Coconuts and oil palms are grown in the coastal belt, and their products represent respectively about 10% and 15% of the exports by value. Between about 650–1,300 ft. elevation, especially in the northeast, cocoa is dominant, and until about 1905 St. Thomas was the leading world producer. Production has since declined for many reasons, but cocoa still makes up about two-thirds of the exports by value. Other exports are coffee, grown on higher ground up to about 4.300 ft., and cinchona. Subsistence crops include yams. Fishing, especially for sharks, has some importance.

Communications. — A 12-mi. state-owned railway connects São Tomé with Vila da Trindade in the interior and with several plantations. There are more than 170 mi. of roads. São Tomé has a sheltered harbour on Ana de Chaves bay and clears about 1,400 vessels with a net tonnage of 600,000 annually. Several shipping lines call regularly. The island has two airfields and is linked with Principe and with Luanda, Angola, by daily air services.

History.——St, Thomas was uninhabited when discovered on Dec. 21 (St. Thomas' day), 1470, by the Portuguese navigators João de Santarém and Pedro de Escobar. Attempts at colonization mere made in 1485, but there was no permanent settlement until a number of criminals and young Jews were settled on the island in 1493. The capital was founded a few years later by Álvaro de Caminha. By mid-16th century there were more than 80 sugar mills and 50,000 settlers, but in 1567 the island was attacked by the French, and in 1574 the Angolares began raids which ended only with their subjugation in 1693. In 1595 there was a slave revolt, and in 1641–44 the Dutch, who had plundered the capital in 1600, held the island. The French made another damaging raid in 1709, and, with the loss of the sugar trade to Brazil and internal anarchy, St. Thomas was reduced to a deplorable state.

Revival came with the greatly increased demand for cocoa in the 1890s, when many new plantations were established. As the islanders would not work on them, indentured labourers were brought from the mainland, chiefly from Angola. St. Thomas obtained notoriety when in 1908–09 British observers denounced the treatment of these labourers as indistinguishable from slavery. In consequence, large cocoa and chocolate firms in Europe and the Cnited States refused to import cocoa from St. Thomas or Principe unless recruitment for the plantations was made voluntary. Recruitment was resumed in 1910 under new regulations. To overcome the difficulties of obtaining workers from Angola, recruitment was also begun in Mozambique.

See W. A. Cadbury, *Labour in Portuguese West Africa,* 2nd ed. (1910); H. Galvao and C. Selvagem, *Império Ultramarino Português,* vol. ii (1951); R. J H. Church, *West Africa* (1957).

SAINT THOMAS ISLAND, the most important, commercially, of the Virgin Islands purchased by the United States from Denmark in 1917. Pop. (1960) 16,201.

Saint Thomas lies 40 mi. east of Puerto Rico, 1,442 mi. S.E. of New York city and 1.020 mi. from the Panama canal. It is 12 mi. long, varies in width from 1 mi. to 3 mi. and has an area of 32 sq.mi. It is of volcanic origin. The main ridge, peaks of a submerged range, extends east and west the length of the island. Its hills are steep and rocky and sparsely covered with vegetation, the original timber having been cut away for lumber and charcoal. Two summits, Crown mountain and Signal hill, rise above 1,500 ft. Many of the spurs of the ridge slope down to the shore and form protected bays where the buccaneers of the 17th and 18th centuries found refuge.

The climate of the island is salubrious, particulariy during the first quarter of the year when the trade winds blow. The mean temperature is 78° F., the thermometer rarely falling below 64°

and rarely rising above 91°. The average rainfall is 38.23 in.; the driest weather is in March and the rainy season in October and November. Drinking water is stored in cisterns because of the dearth of wells.

After the abolition of slavery in 1848, agriculture became decadent. Destruction of the once profitable rum export trade as a result of prohibition of liquor in the United States contributed heavily to economic decline. From 1926 to 1933 the annual federal government contribution to the municipal treasury of the U.S. Virgin Islands averaged around $100.000; however, gradual improvement was made after 1931. By the late 1950s federal contributions to grant-in-aid programs had increased to more than $650.000.

Improved hotels and a stimulation of the tourist trade, along with governmental encouragement of small landholdings. were important among the economic developments. There is an agricultural experimental station at Estate Dorothea. Most of the island's agricultural and dairy produce is for local consumption and ship supplies. Native handicraft work and rum distilleries provide the chief direct exports.

St. Thomas Island was discovered and named by Christopher Columbus on his second voyage in 1493. The first colony mas planted in 1657 by the Dutch who soon after abandoned it and migrated to New Amsterdam (New York). The Danes arrived and took formal possession in 1666, but their first colony also failed. The Danish West India company dispatched an expedition under Gov. Jorgen Iversen which landed in St. Thomas harbour on May 25. 1672, and effected a permanent settlement. Later Huguenot refugees from St. Kitts were granted asylum.

In 1755 the king of Denmark acquired the company's rights and made the harbour a free port. The island was temporarily seized by England in 1801–02. and again held in 1807–15. but was restored to and held by Denmark until 1917, when it was sold to the United States.

The chief value of the island is the harbour of Charlotte Amalie, one of the best in the Antilles, important as a United States naval base. It is perfectly landlocked. with a bottlenecked entrance, and has a deserved reputation for refuge. It commands the gateway to the Caribbean through the Virgin passage and is a port of call for passenger steamers from New Tork and European ports bound for the Panama canal and Central America via the Lesser Antilles. There are ample coaling facilities, oil reservoirs, shipyards and machine shops, floating docks and wharves with electric cranes.

Charlotte Amalie. pop. (1960) 12.880 (known as St. Thomas city from 1917 to 1932). the seat of government of the Virgin Islands. lies on three low spurs of the island ridge; the spurs are dubbed Foretop. Maintop and Mizzentop. A single level street parallel to the water front forms a common base for three cone-shaped clusters of nhite dnellings on the green background of the ridges. Government hill is one of the attractive residential sections, the location affording constant enjoyment of the breezes and panorama. The population is predominantly Negro, but there is a considerable minority group of French-Iiorman origin nho have lived there for many generations. English is the prevailing language, but Danish, Dutch, French and Spanish are also common. Air services connect with all parts of the Caribbean.

For general government, see VIRGIN ISLANDS. (M F. DE C.)

SAINT TROND, town, province of Limburg. Belg , 18 mi. northwest of Liège in an important strategic position near the frontier.

Pop (1955 est.) 19,969.

ST. VINCENT, JOHN JERVIS, EARL OF (1735–1823), British admiral who won fame as a commander at the battle of St. Vincent (1797) (*q.v.*), was born at hleaford, Staffordshire, on Jan. 9, 1735. He entered the navy on Jan 4, 1749 and became lieutenant on Feb. 19. 1755; he served in that rank till 1759, taking part in the conquest of Quebec. He was made commander of the "Scorpion" sloop in 1759, and post captain in 1760. During the peace he commanded the "Alarm" (32 guns) in the Mediterranean, and when he was put on half pay he traveled in Europe, taking professional notes everywhere. While the American Revolutionary War lasted, he commanded the "Fourroyant" (80) in the English channel, taking part in the battle of Ushant (1778) and in the various reliefs of Gibraltar. His most signal service was the' capture (April 19, 1782) of the French "Pégase" (74) after a long chase.

In 1783 he entered parliament as member for Launceston, and in the general election of 1784 as member for Yarmouth. In politics he was a strong Whig. On Sept. 24, 1787, he attained flag rank. and was promoted vice-admiral in 1793. From 1793 to 1795 he was in the West Indies co-operating with the army in the conquest of the French islands. On his return he was promoted admiral. In Nov. 179j he took command in the Mediterranean, where he maintained the blockade of Toulon, and aided the allies of Great Britain in Italy.

But in 1796 the occupation of Italy by the French armies closed all the ports to his ships, and Malta was not yet in the possession of Great Britain. Then the addition of the Spanish fleet to the French altered the balance of strength in the Mediterranean. The Spaniards were very inefficient, and Jervis would have held his ground, if one of his subordinates had not taken the extraordinary course of returning to England, because he thought that the dangerous state of the country required that all its forces should be concentrated at home. He was therefore obliged to act on the instructions sent to him and to retire to the Atlantic, withdrawing the garrisons from Corsica and other places. His headquarters were now on the coast of Portugal, and his chief duty was to watch the Spanish fleet at Cadiz. On Feb. 14, 1797, he gained a complete victory against heavy odds. (See ST. VINCENT, BATTLE OF.) For this victory, which came at a critical time, he was made an earl and was granted a pension of £3,000.

St. Vincent's qualities as a disciplinarian were soon to be put to a severe test. In 1797 the grievances of the sailors. which were of old standing, and had led to many mutinies of single ships, came to a head in the great general mutinies at Spithead and the Nore. Similar movements took place on the coast of Ireland and at the Cape of Good Hope. The spirit spread to the fleet under St. Vincent, and there was a danger that some outbreak would take place in his command. The peril was averted, however. He had always taken great care of the health of his men, and was as strict with the officers as with sailors. He carried his strictness with his officers to an extent which aroused the actual hatred of many among them, and exasperated Sir John Orde (1751–1824) into challenging him to fight a duel. Yet he has been credited with having raised the discipline of the navy to a high level. His health broke down and in June 1799 he resigned his command.

When St. Vincent's health was restored in the following year he took the command of the channel fleet, into which he introduced his own rigid system of discipline to the bitter anger of the captains. But he was able to maintain the blockade of Brest for 121 days with his fleet. In 1801 he became first lord and held the office till William Pitt returned to power in 1803. His administration is famous in the history of the navy, for he now applied himself to the task of reforming the corruptions of the dockyards. He was fiercely attacked in and out of parliament, and he gave an opening to his critics by devoting himself so wholly to the reform of the dockyards that he neglected the preparation of the fleet for war. He would not recognize the possibility that the peace of Amiens would not last. Pitt made himself the mouthpiece of St. Vincent's enemies, mainly because he considered him as a dangerous member of the party which was weakening the position of England in the face of Napoleon. When Pitt's second ministry was formed in 1803, St. Vincent refused to take the command of the channel fleet at his request. After Pitt's death he resumed the duty with the temporary rank of admiral of the fleet in 1806, but held it only until the following year. After 1810 he retired to his house at Rochetts in Essex.

The rank of admiral of the fleet was conferred on him in 1821 on the coronation of George IV, and he died on March 14, 1823.

(D. H.; X.j

The *Life* by J. S. Tucker (2 vol.), whose father had been the admiral's secretary (marred by excessive eulogy). *See* W. N. Anson, *Life of John Jervis, Admiral Lord St. Vincent* (1913); also W. L. Clowes, The *Royal Navy* . . . vol. iv. The life by Captain Brenton

is rather inaccurate. The *Naval Career of Admiral John Markham* contains an account of the reforms in the navy. His administrations produced a swarm of pamphlets. Many mentions of him will be found in the correspondence of Nelson.

ST. VINCENT, a British island in the Windward group of the West Indies, lying about 13° 9 N., 61° 14' W., south of St. Lucia and west of Barbados. The island is about 18 mi. long, with a maximum width of 11 mi., and has an area of 133 sq.mi. Beautiful, thickly wooded volcanic hills form its backbone, with picturesque valleys intermingled. The highest summit is the volcano Soufrikre ((4.018ft.) in the north. Two eruptions of Soufrikre, in 1821 and in 1902, were especially disastrous, the latter devastating some of the most fertile parts of the island. The climate is fairly healthful and in winter very pleasant, but hurricanes are not infrequent. Two (in 1780 and 1898) were especially destructive of both life and property. Rainfall averages 101.32 in. annually; the normal temperature range is from 66° to 88° F.

The colony of St. Vincent includes most of the Grenadines (*q.v.*) (area: 17 sq.mi.; 1960 pop. 5,068) and was part of the loosely federated Windward Islands colony until it became a member of The West Indies federation. It had a common governor and shared some judicial institutions with the other Windward colonies. but had its own separate partly-appointed, partly-elected legislative body. Kingstown (1960 pop. 4,296), on the southwestern coast, is the capital as well as the chief port. The colony's population ([1960 census] 79,948j is nearly 75% of Negro descent. Only 2½% is white; the remainder of mixed or East Indian blood. A very few are of almost pure Carib stock. Primary education. free but not compulsory, is provided by 16 government and 22 government-subsidized schools (1949). There are two government secondary schools.

St. Vincent is predominantly agricultural and has a virtual monopoly of the world market for arrowroot, its principal crop. Sugar was formerly the colony's economic backbone but, in contrast with most of the other West Indian islands, became relatively unimportant, with an annual output of 2,000 to 2,500 tons. A distinctive and fancy quality molasses is produced. Sea Island cotton and peanuts and some coconuts, sweet potatoes and cassava are grown. The principal trade is with the United Kingdom, Canada. and the United States.

St. Vincent was discovered by Christopher Columbus on Jan. 22 (St. Vincent's day) 1498. Its Carib inhabitants, however, were left almost undisturbed for more than a century. In 1627 Charles I of England granted the island to the earl of Carlisle, but no effective occupation was made. In 1672 it was regranted to Lord Willoughby. Meanwhile, French and Dutch as well as English settlements were attempted, with the French dominant until the Seven Years' War, when Gen. Robert Monckton occupied it (1762). The treaty of Paris confirmed British possession, and settlement proceeded despite Carib refusal to accept British sovereignty. After some fighting in 1773, a treaty was concluded with the Caribs, who were granted lands in the north as a reserve. In 1779 the island was seized by the French, but was restored to Britain in 1783. In 1795 the Caribs rose, assisted by French from Martinique, and were finally subdued the following year. Most of them were then deported to the Bay Islands (off Honduras). Emancipation of Negro slaves in 1834 was disastrous for the island's economy. In 1848 Portuguese labourers were introduced, followed by East Indians in 1861.

See Colonial Office, *Colonial Annual Reports.* (L. W. BE.)

ST. VINCENT, BATTLE OF, fought on the 14th of February 1797, between the British and Spanish fleets, the most famous and important of many encounters which have taken place at the same spot. The battle first revealed the full capacity of Nelson, which was well known in the navy, to all his countrymen. In 1796 the Spanish government had made the disastrous alliance with the French republic, which reduced its country to the level of a pawn in the game against England. The Spanish fleet, which was in a complete state of neglect, was forced to sea. It consisted of 27 sail of the line under the command of Don Jose de Córdoba—fine ships, but manned in haste by drafts of soldiers, and of landsmen forced on board by the press. Even the flagships had only about eighty sailors each in their crews. Cordoba was drifting about with his unmanageable ships in two confused divisions separated from one another, in light winds from the west and west-south-west, at a distance of from 25 to 30 m. S.W. of the Cape. While in this position he was sighted by Sir John Jervis, of whose nearness to himself he was ignorant, and who had sailed from Lisbon to attack him with only 15 sail of the line. Jervis did not hesitate to give battle. Six Spanish ships were to the south of him, separated by a long interval from the others which were to the south-west. The British squadron was formed into a single line ahead, and was steered to pass between the two divisions of the Spaniards. The six vessels were thus cut off. A feeble attempt was made by them to molest the British, but being now to leeward as Jervis passed to the west of them, and being unable to face the rapid and well directed fire to which they were exposed, they sheered off. One only ran down the British line, and passing to the stern of the last ship succeeded in joining the bulk of her fleet to windward. As the British line passed through the gap between the Spanish divisions ships were tacked in succession to meet the windward portion of the enemy. If this movement had been carried out fully, all the British ships would have gone through the gap and the Spaniards to windward would have been able to steer unimpeded to the north, and perhaps to avoid being brought to a close general action. Their chance of escape was baffled by the independence and promptitude of Nelson. His ship. 'the "Captain" (74), was the third from the end of the British line. Without waiting for orders he made a sweep to the west and threw himself across the bows of the Spaniards His movement was seen and approved by Jervis, who then ordered the other ships in his rear to follow Nelson's example. The British force was thrown bodily on the enemy. As the Spanish crews were too utterly unpractised to handle their ships, and could not carry out the orders of their officers which they did not understand, their ships were soon driven into a herd, and fell on board of one another. Their incompetence as gunners enabled the "Captain" to assail their flagship, the huge "Santissima Trinidad" (130), with comparative impunity. The "San Josef" (112), and the "San Nicolas" (80), which fell aboard of one another, were both carried by boarding by the "Captain." Four Spanish ships, the "Salvador del Mundo" and "San Josef" (112), the "San Nicolas" (80), and the "San Isidro" (74), were taken. The "Santissima Trinidad" is said to have struck, but she was not taken possession of. By about half-past three the Spaniards were fairly beaten. More prizes might have been taken, but Sir John Jervis put a stop to the action to secure the four which had surrendered. The Spaniards were allowed to retreat to Cadiz. Sir John Jervis was made Earl St. Vincent (*q.v.*) for his victory. The battle, which revealed the worthlessness of the Spanish navy, relieved the British government from a load of anxiety, and may be said to have marked the complete predominance of its fleet on the sea. (D. H.)

AUTHORITIES.—A very interesting account of the battle of Cape St. Vincent, *A Narrative* of *the Proceedings of the British Fleet, etc.* (London, 1797), illustrated by plans, was published immediately afterwards by Colonel Drinkwater Bethune, author of the History *of the Siege of Gibraltar,* who was an eyewitness from the "Lively" frigate. *See* also James's *Naval History* (London, 1837); Captain Mahan, *The Influence of Sea Power on the French Revolution and Empire* (London, *1892*); Professor Goeffrey Callender, *The Naval Side of British History* (1924).

ST. VITUS' DANCE (CHOREA MINOR; SYDENHAM'S CHOREA) is a name commonly applied to the neurological manifestations of rheumatic infection. The disease is characterized by irregular, involuntary and purposeless movements of muscle groups. These movements are most obvious in the extremities and face, but are present in the trunk and may involve muscles of phonation and swallowing. While the names are derived from descriptive terms applied to epidemics of dancing mania in the 14th, 15th and 16th centuries, common usage of the term chorea condones its rerention.

The name of St. Vitus' dance originated in the fact that sufferers from the mania were wont to resort to the chapels of St. Vitus (more than one in Swabia, Ger.), the saint being believed to possess the power of cure.

Chorea is chiefly a disease of childhood. occurring most frequently between the ages of 5 and 15 years and much more frequently in females. It may occur in young adults and is an infrequent complication of pregnancy. when it is especially severe. Chorea has a close association with rheumatic fever and may be considered a peculiar manifestation of this disease Episodes of choiea commonly occur in children who have had rheumatic fever. Patients with chorea who have evidence of systemic infection as indicated by fever, increase of white blood cells or of the sedimentation rate of red blood cells, have rheumatic heart disease as frequently as do those who have rheumatic fever. However, if these indications of systemic infection are absent, heart disease is uncommon, and if it does occur it is especially apt to be gradual stenosis of the mitral valve. Some effort has been made to separate rheumatic chorea from chorea of psychogenic origin on the basis of laboratory findings, but this differentiation is difficult to substantiate.

While emotional crises and anxiety may appear to be intimately related to the onset of chorea they are a manifestation of the disease and do not precipitate it. Facial grimaces tics and habit spasms are frequently confused with chorea, but these repetitive movements are quite different from the inco-ordinated Purposeless movements of the disease. These movements, which are typical and recognizable, are usually preceded by or appear with, evidence of irritability and emotional instability, chiefly episodes of crying initiated by trivial incidents.

The symptoms vary in severity. They may be mild or completely incapacitating. They are often first considered as awkwardness. Inability to hold objects or to write properly and difficulty in walking are frequent. Vague identification of deterioration in ability to perform customary tasks is soon replaced by recognition of gross twitching of muscle groups, most easily observed in the extremities. The movements are more marked on one side but are present on both.

While there is debate concerning the pathological changes in the central nervous system, there is considerable evidence that both the emotional manifestations and the typical movements are related to changes in the cerebral cortex.

Attacks of chorea tend to be self-limited although the duration is several weeks. Recurrence is frequent. Recovery is hastened by rest in bed in a pleasant sympathetic environment, and patients improve quickly in hospitals or convalescent sanitaria. Sedation with phenobarbitol is especially helpful, and administration of salicylates is often advisable. (D. E. C.)

SAINT-WANDRILLE, a village of northwestern France, in the *département* of Seine-Inférieure, 28 mi. west-northwest of Rouen by rail. Pop. (1954) 230.

Saint-Wandrille is celebrated for the ruins of its Benedictine abbey. The abbey was founded in the 7th century by St. Wandrille. In the 13th century it was burned down, and the rebuilding was not completed until the 16th century. Later it was practically destroyed by the Huguenots and was again restored. The demolition of the church was begun at the time of the Revolution. The abbey church belongs to the 13th and 14th centuries; portions of the nave walls supported by flying buttresses are standing, and the windows and vaulting of the side aisles are in fair preservation. There is a cloister, from which a Renaissance door opens into the refectory, containing a richly ornamented *lavabo*. The refectory has graceful windows.

SAIONJI, KIMMOCHI, PRINCE (1849–1940), Japanese statesman, was born in Oct. 1849, at Kyoto. When less than 20 years of age, he took part in the councils which led to the Restoration, and at 19 was commander in chief of an imperial army. In 1881 he commenced his official career, and in the following year accompanied Hirobumi Ito to Europe and the United States to investigate the parliamentary system. In 1885 Saionji was appointed minister to Austria; three years later he became vice-president of the house of peers and was raised to the privy council in 1894. In the same year he received the portfolio of education in the second Ito cabinet.

In July 1903 Saionji became the leader of the Seiyu-Kai and in 1906 prime minister; he was again premier from 1911 to 1912. In 1919 he represented Japan as chief envoy at the peace conference and in 1920 he was made prince. He was famous as Emperor Hirohito's chief adviser and as the last of Emperor Meiji's Genro (elder statesmen).

Saionji died Nov. 24, 1940.

SAIS (Egyptian *Sai*), an ancient city of the Egyptian Delta, lying westward of the Thermuthiac or Sebennytic branch of the Nile It was the capital of the 5th nome of Lower Egypt and must have been important from remote times. In the 8th century B.C. Sais held the hegemony of the Western Delta, while Bubastite families ruled in the east and the kings of Ethiopia in Upper Egypt At the time when invasions by the Assyrians drove out the Ethiopian Taracus again and again, the chief of the 20 princes to whom Esarhaddon and Assur-bani-pal successively entrusted the government was Niku, king of Sais and Memphis. His son Psarnmetichus (*q.v.*) was the founder of the 26th dynasty. Although the main seat of government was at Memphis, Sais remained the royal residence throughout this flourishing dynasty.

Neit, the goddess of Sais, was identified with Athena, and Osiris was worshipped there in a great festival.

The brick enclosure wall of the temple is still plainly visible near the little village of Sa-el-hagar (Sa of stone) on the east bank of the Rosetta branch; otherwise only crude brick ruins and rubbish heaps remain on the site, but a few relics conveyed to Alexandria and Europe in the Roman age have come down to our day, notably the inscribed statue of a priest of Neit who was high in favour with Psammetichus III, Cambyses and Darius. Bronze figures of deities are now the most interesting objects to be found at Sa-el-hagar.

SAISSET, BERNARD (d, *c.* 1314), French bishop, was abbot of Saint Antonin de Pamiers in 1268. Boniface VIII, detaching the city of Pamiers from the diocese of Toulouse in 1295, made it the seat of a new bishopric and appointed Saisset to the see. Of a headstrong temperament, Saisset as abbot brought to an end (1297) the struggle with the counts of Foix, begun two centuries before, for the lordship of the city of Pamiers, which had been shared between the counts and abbots by the feudal contract of *pariage*. As an ardent Languedocian he hated the French and opposed Philip IV. But when he tried to organize a general rising of the south, he was denounced to the king, perhaps by his old enemies the count of Foix and the bishop of Toulouse. Philip IV charged Richard Leneveu, archdeacon of Auge in the diocese of Lisieux, and Jean de Picquigni, vidame of Amiens, to make an investigation, which lasted several months

Saisset was on the point of escaping to Rome when the vidame of Amiens surprised him by night in his episcopal palace He was brought to Senlis and on Oct. 24, 1301 appeared before Philip and his court. He was charged with high treason. and Philip tried to obtain from the pope the canonical degradation of Saisset. Boniface VIII, who had supported Saisset against the count of Foix (when Saisset was a legate), ordered the king in Dec. 1301 to free the bishop in order that he might go to Rome to justify himself. At the same time disagreement between Boniface and Philip became more acute, and in the process Saisset was forgotten. He had been turned over in Feb. 1302 into the keeping of Jacques des Normands, the papal legate, and was ordered to leave the kingdom at once.

Saisset lived at Rome until after the incident at Anagni. In 1308 the king pardoned him and restored him to his see, He died, still bishop of Pamiers. about 1314.

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SAISSET, ÉMILE EDMOND (1814–1863), French philosopher, born at Montpellier, Fr.. on Sept. 16, 1814, studied philosophy in the school of Victor Cousin and carried on his eclectic tradition.

He was professor of philosophy at Caen, at the École Normale in Paris and later at the Sorbonne.

His works include *Discours de la philosophie de Leibnitz*

(1857); *Précurseurs* et disciples de Descartes (1862); and Critique *et histoire* de la *philosophie* (1865).

Saisset died in Paris on Dec. 17, 1863.

SAITAMA, a Japanese prefecture (Ken) north of Tokyo, with an area of 1,468 sq.mi. and a population (1960) of 2,430,871. Its level land areas are extensive and the ratio of cultivated area (38%) is the highest among the prefectures. Horticultural produce for consumption in Tokyo is the characteristic feature of agriculture. The Sayama area produces a choice green tea. The western section is devoted to sericulture. The chief products of manufacturing are textile goods and machinery. Cities in the south, including Urawa (*q.v.*), the prefectural capital, have become suburban residential centres for Tokyo commuters.

(R. B. H.)

SAIT FAIK ABASNANIK (1907–1954), Turkish author, who introduced a new form of short-story writing into Turkish literature. Born at Adapazari and educated in Istanbul and Bursa. he spent four years in France (1931–35), mainly in Grenoble. and on his return began to publish his short stories in *Varlik*, the leading avant-garde periodical. These were in a style new to Turkish literature: shapeless, without definite plot, but gripping, and conveying in a single episode a wide range of human experience.

In 1936 he published his first volume of short stories, *Semaver*. A dozen others followed, including *Lüzumsuz Adam* (1948), *Kumpanya* (1951), *Havuzbashi* (1952) and *Alem* Daginda aar *bir* Yilan (1953). He also experimented with a novel, ***Bir*** *Takim Insanlar* (1952), and published a volume of, verse. The subjects of his powerful sketches and stories are taken from the life of simple people in humble occupations;' his style, though realistic, has an element of poetry. He died in Istanbul. May 11. 1954. (F. I.)

SAITO, MAKOTO, VISCOUNT (1858–1936), Japanese naval officer and statesman. was born in Iwate prefecture, Dec. 2. 1858. Graduating from naval school in 1877, he rose to the rank of admiral in 1912. Being an unusually able administrator. he was appointed minister of the navy in 1906, a position which he held until 1914 in five successive cabinets. After the Korean uprising against Japanese rule in 1919, he was appointed governor-general of the colony, where he became noted for his liberal education policies. In 1927 he headed his country's delegation to the Geneva disarmament conference and from 1932 to 1934 served as the premier of Japan. As a moderate conservative he was strongly opposed by extremists in the government and army. In the military uprising of Feb. 1936. when Saito was serving as lord keeper of the privy seal and as imperial adviser, his political beliefs and influence led to his assassination (Feb. 26) by army fanatics. (HN. KN.)

SAKA (SHAKA), the name of various tribes which invaded India from central Asia. More accurately, it denotes the tribe which invaded India 140–130 B.C. They are the Sacae of classical authors and the Se of the Chinese, representing an original Sek or Sok. The Chinese state that they were a pastoral people in the neighbourhood of the modern Kashgar.

About 160 B.C. the Saka were driven southward by the advance of the Yue-Chi (*q.v.*) from the east. One portion appears to have settled in western Afghanistan, hence called Sakasthana, in modern Persian Seistan. The other section occupied the Punjab and possessed themselves of Sind, Gujarat and Malwa. The rulers of these provinces bore the title of satrap (*kshatrapa* or *chhatrapa*) and were apparently subordinate to a king who ruled over the valley of Kabul and the Punjab. In 57 B.C. the Sakas were attacked simultaneously by Parthians from the west and by the Malava clans from the east and their power was destroyed.

SAKAI, a city in Osaka urban prefecture, Japan. Pop. (1960) 339,863. Many large earthen tomb mounds around the city attest its antiquity; Emperor Nintoku's tomb (1,574 ft. long, 105 ft. high) is the largest in Japan. Sakai was celebrated in the 16th century as the leading eastern inland sea port and was noted for its rich merchants. A shift in the course of the Yamato river silted its harbour, and the city sank in obscurity with the rise of neighbourlng Osaka to commercial and industrial greatness. Sakai has revived as an Osaka industrial satellite since the opening of rail service between the two cities. Machinery, bicycle and automotive parts, fertilizer, tabi (cotton socks). dyestuffs and chemicals are among its chief products. The main industrial belt is located along the coast on reclaimed land. while residential areas spread inland on elevated sites. The port handles an active traffic in small native craft. (J. D. EE.)

SAKE, the national beverage of Japan, is a rice beer, often mistakenly called a wine because of its high alcoholic content, usually 17% to 18%. Brewing of sake dates back many centuries.

Production of sake begins with steamed rice or koji, which is mixed with *Aspergillus oryzae,* a specially cultured mold that converts the rice starch into fermentable sugars. Preparation of the koji takes place in warm, draft-free cellars. The next step is the mixing together of 36 litres of koji, 90 l. of fresh steamed rice and 108 l. of water. The, resulting mass is worked and kneaded by hand for two hours until a smooth, lump-free paste of even consistency is obtained. It is allowed to rest for 24 hours, after which it is put into a large vat containing more steamed rice and water. A wooden or enameled iron bucket 18 in. deep. with a diameter of 12 in. at the top and 8 in. at the bottom, filled with boiling water. is suspended and immersed in the mash, being moved about periodically to heat the mash evenly. A slow, free fermentation occurs over a period of four weeks. the result of which is *moto,* with an alcoholic content of 10½% to 11%. Additional quantities of koji, steamed rice and water are added to the *moto* in the fermenting vat and a new fermentation takes place. lasting seven days. In order to facilitate fermentation a culture of the yeast *Saccharomyces* sake is sometimes added to the fermentation mixture. Lactic acid also may be added, to prevent bacterial contamination. The fresh sake is rested for another week, after which it is filtered and bottled.

The drinking of sake is a delicate, even poetic ceremony. It is always served warm, in tiny porcelain bowls that hold little more than an ounce. It is sipped.

Though each drink of sake is small. consumption in Japan is an important economic factor. The average annual consumption of alcoholic beverages in Japan after World War II was about 350,000,000 U.S. gal., of which sake represented 40%.

(H. J. GN.)

SAKHALIN, an elongated, mountainous island, 29.344 sq.mi. in area. located off the Pacific coast of the C.S.S.R. Irregularly shaped. Sakhalin varies in width from 4 to 99 mi. (between 141° 49′ E. and 144" 45' E.) and extends over 589 mi. from Cape Yelizaveta in the south (45° 54' N.) to Cape Kril'on (Crillon) in the north (54° 25' N.). Between the island and the Asian mainland is the Tatar strait, an arm of the Sea of Japan. which in its narrowest section, called Nevelskogo strait (about 5 mi. wide), freezes in winter. The north and east coasts are washed by the cold waters of the Sea of Okhotsk. La Pérouse strait separates Sakhalin from Japanese Hokkaido, 25 mi. to the south.

Physical Features.— Mountains parallel much of the east and west coasts. The rugged, western Kamyshevy range, though rising scarcely above 4,000 ft., is the longest and most formidable of the island's ranges. In its southern extension. south of the 49th parallel, the range actually forms the spine of the island. Along the east coast! the mountains are more rounded and less extensive, terminating on the south in the Terpeniya peninsula; yet they contain the highest peaks on the island (Lopatina, 5,279 ft., and Nevelskogo, 4,587 ft.).

North of 51° N., the elevation of the island becomes lower and the uplands yield to unattractive lowlands. Enclosed by the coastal ranges is a central valley, from 3 to 19 mi. wide, drained northeastward to Okhotsk sea by the Tym river and southward to the Gulf of Terpeniya by the Poronai river. A narrow watershed separates the headwaters of the rivers, while sand bars and lagoons clutter the estuaries. Rapids impede the upper course of the Tym. but the Poronai, in which salmon and other fish abound, is navigable for small craft for about 30 mi. There are other shorter rivers on the island, including the Susunai in the extreme south, and numerous lakes.

Climate.—Sakhalin has a severe climate. Winter temperatures. lower than might be suggested by latitude (*i.e.,* from Odessa to Tula), result from the cold winds which sweep in from the

north over Okhotsk sea. The January mean ranges from 17° F. in the south to −10° F. in the north. The summers are cool, but thermally less varied than are the winters. Mean July temperatures of 60° F.–64° F. prevail throughout the Tym-Poronai valley. The relative warmth of the Kuro Shiwo current ameliorates the climate of the west coast, while the Okhotsk current chills the east. Dampness and fog are characteristic of the coasts. Off the north coast drift ice may appear as late as July The vegetation period varies from 97 days in the north to 167 in the extreme south. Much of the 20 in. (and more) annual precipitation occurs in summer and autumn, occasionally resulting in destructive floods. Snow falls from October to May, persisting on the mountain slopes until August.

Soils and Vegetation.—Basically, the soils of the island consist of infertile podsols, with barren tundra common throughout the northern lowland and on the higher uplands However, the alluvial soils of the valleys are fertile, support luxurious meadows and, in the southern half of the island where a more favourable climate prevails, permit the growing of foodstuffs. Taiga (coniferous) forest covers most of Sakhalin, with spruce and fir dominant. In the protected valleys may be found Manchurian deciduous species, while bamboo grows along the west coast. Fur-bearing animals are abundant in the forest and there are a great variety of birds.

History. — Although the island was first visited by Japanese, Russian and Dutch navigators (1630–49), it remained for the Japanese in 1805–08 to prove that Sakhalin was not a projection of the mainland but an island. Japanese fishing stations appeared along the southwest coast. but little settlement occurred. However, a growing interest in the island on the part of both the Japanese and Russian governments led, in 1855, to the establishment of a joint condominium. Twenty years of competition resulted in the treaty of St. Petersburg, 1875, in which Japan relinquished its claims to Sakhalin in exchange for the Kurile Islands to the east. Under complete Russian sovereignty, Sakhalin served for many years as a penal colony.

The treaty of Portsmouth, 1905, which ended the Russo-Japanese War. divided the island at the 50th parallel, establishing Japanese dominion over the southern half, called Karafuto. The Russian inhabitants withdrew northward, and their numbers declined from 40,000 to about 6,000 by World War I. As a result of rapid Japanese immigration, the population of Karafuto grew to more than 68,000 by 1917. Between 1920 and 1924, Japan occupied the Russian half of the island, but with the establishment of Soviet power in the far east it was forced to withdraw, retaining important mining concessions in the north.

Upon the collapse of Japan at the end of World War II, Soviet troops entered Karafuto and most of the 400,000 Japanese inhabitants were subsequently evacuated to Japan proper. In Jan. 1947, Sakhalin, together with the Kurile Islands, became a separate *oblast* of the U.S.S.R., with Yuzhno-Sakhalinsk (Toyohara) in the Susunai valley as the capital.

Population.—From a pre-World War II population of 120,000, the Russian population was estimated to have more than doubled by the mid-1950s. A small group of native peoples, numbering several thousand, still inhabited the island, divided primarily into two main ethnic groups: the Tungus-Manchurian, including the Tungus proper and the Goldi (Nanais) in the interior; and the Palaeo-Asiatics, including the Ainus in the south and the Gilyaks (Nivkhis) near the coasts.

Resources and Industry.—The wealth of the island lies in its minerals, fisheries and lumber and paper products. Petroleum, the existence of which was first officially reported in 1894, is the most important resource. Okha and Ekhabi, near the northeast coast, are the main fields. Contributing about 3% to the total Soviet oil production, they are the major source of supply for the entire Soviet far east. Refineries are located at Okha, as well as at Port Moskal'vo, a deep-water port on the Gulf of Sakhalin. A pipeline links the refineries to Nikolayevsk on the mainland near the mouth of the Amur river. Sakhalin's coal deposits, the reserves of which are reputed to be about 4,500,000,000 tons, are mainly lignite. Principal mining centres are located along the west coast near Aleksandrovsk and Uglegorsk.

The commercial fisheries are well-developed as the result of Japanese enterprise prior to World War II. Fishing, both maritime and inland, is a common occupation of the inhabitants, with fish a major item of diet. Small fishing villages, many of which possess canneries and other facilities for handling the catch. dot the south and west coasts. The lumber and paper industries are also concentrated in the south, primarily at Tomari, Kholmsk and Nevel'sk.

Agriculture, confined to the southern half of the island, is relatively unimportant. With a cultivated area of about 75,000 ac., the main crops are grains, vegetables, potatoes and sugar beets, etc. Livestock raising and dairying, based on the lush natural meadows in the valleys. have considerable potential.

Transportation.—Roads are virtually nonexistent and, save for a short line between Okha and Port Moskal'vo, the railroads are all in the southern half of the island, of prewar Japanese construction. Regular steamer connection exists between Aleksandrovsk and Nikolayevsk in the navigation season, from mid-May to Nov. 1.

See L. S. Berg, *Geographical Zones of the Soviet Union,* vol. ii, pp. 465–474 (1952); *Geographical Atlas for Teachers of Middle School,* pp. 134, 150 (1954). (D. JN.)

SAKI, the name of a group of tropical American monkeys. The sakis form the genus Pithecia, closely related to the uakaris (*q.v.*). They are characterized by their long, bushy and nonprehensile tails, distinct whiskers and beard and the elongated hair on the crown of the head, which may either radiate from a point in the centre or be divided by a median parting. They are very delicate animals and normally silent.

See PRIMATES.

SAKJEGÖZÜ, a village in a piedmont valley of the Anti-Taurus near Zincirli Hüyük in the Gaziantep vilayet of southern Turkey Sakjegözü first attracted the attention of archaeologists as the source of a Late Hittite slab relief depicting a royal lion hunt. which had been taken from the walls of the village chief's house and placed in the Berlin museum. There it was noticed by the British archaeologist, J. Garstang, who traced its original source to a small mound called Jobba Hüyük, adjacent to the village Excavations undertaken on this mound between 1907 and 1911 revealed a Late Hittite palace of moderate dimensions at its summit, fortified with a practically rectangular enclosure measuring 400 × 300 ft. The gateway of the enclosure was on the lower side of the mound, while the palace occupied the opposite higher section of the walled precinct. The walls, which were nearly 12 ft. thick and rested on massive foundations, were strengthened by projecting external buttresses and, at the corners, by turrets.

The palace itself was approached through a portico containing an outstanding series of sculptures. Notable among these are the two life-size gate lions flanking the entrance to the palace and forming its cornerstones. The representations comprise sphinxes and other fabulous creatures in the Assyrian manner; likenesses of human beings, and symbolic scenes, such as the "fertilizing of the sacred tree," reflect equally thoroughgoing Assyrian influence

Since no inscriptional material was found at Sakjegözü, neither the ancient name nor the precise date of the palace settlement could be determined. To provide a stratigraphic substitute for more immediate chronological evidence, a deep sounding mas made underneath the palace foundations down to virgin soil. The whole mound was found to be made up of the stratified debris of successive habitation layers, reaching back to Neolithic times; *i.e*, the 5th and early 4th millennia B.C. Flint and obsidian implements and burnished monochrome pottery (mostly rather simple black, grey or brown bowls) characterize the early Neolithic phase. During the latter half of the period a new style of pottery using coloured paint makes its appearance.

See J. Garstang, *The Hittite Empire,* pp. 262–278 (1929); S. Lloyd, *Early Anatolia* (1956). (J. PL.)

SAKONNAKHON is a province (changwat) in northeastern Thailand. Area 3,683 sq.mi., pop. (1960) 414,832. It

is comparatively level in the northeast and covered with sandy loams. Sandstone hills cover the southwestern part. The area is chiefly forest and grazing land. Cultivated land, settlements and population are concentrated in the few large valleys. Glutinous rice and livestock are the chief products. Sakonnakhon (pop. [1960] 16,457), the provincial capital, 85 mi. E. of Udon (Udon Thani), is on an all-weather highway net connecting the main towns of northeast Thailand. (T. F. B.)

SAKTISM. The worship of Sakti or female energy, is believed to be derived from lower cults prevalent in northeast Bengal and Assam. The principal Sakti shrine is situated at Kamakshya (? the fulfillment of lust) on the summit of a hill two miles west of Gauhati. In Indian speculation the male principle is often regarded as quiescent, while the female principle is active and creative, a view which it may be noted is found in the physiological ideas of the Ba Ila, who hold that the male element is an inert creature but upon the female depend all the generative functions (Ila-speaking Peoples, 1920, vol. i, p. 227). A close connection exists with Tantrism. the ritual for which includes the *pancamakara,* the five elements (wine, meat, fish, parched grain, copulation). Apart from this, caste restrictions are minimized, girl widows may remarry, women are honoured.

SAL (Shorea robusta), a valuable timber tree the wood of which resembles teak. Large forests of sal occur in India, where the tree is widely planted and officially protected. The genus Shorea (family Dipterocarpaceae) contains about 90 species found in India, Ceylon and thence eastward to the Philippines.

SALAD, a preparation of fresh or cooked vegetables or other ingredients, eaten cold, and served with a dressing of which oil, vinegar and salt are essential ingredients. The word comes from Med. Lat. *salata,* salted, pickled, salare, to sprinkle with salt.

Salads are prepared from raw green leaves and stems such as lettuces, watercress and endive, but many varieties are also made from fresh fruits and cold cooked vegetables. Cold fish, poultry, game, meat and eggs, may likewise be included.

SALADIN (Arab. *Salah ud-Din,* "Honour of the Faith") (1138–1193), first Ayyubite sultan of Egypt. was born at Tekrit in 1138. The brilliance of his career was made possible only by the condition of the east in the 12th century. Such authority as remained to the orthodox caliph of Baghdad (see CALIPHATE) or to the heretical Fatimites (*q.v.*) of Cairo was exercised by their viziers. The Seljuk empire had, after 1104, been divided and subdivided among Turkish atabegs. The Latin kingdom of Jerusalem had existed since 1098 only because it was a united force in the midst of disintegration. Gradually. however, Christian enthusiasm had aroused a counter enthusiasm among the Moslems. Zengi, atabeg of Mosul, had inaugurated the sacred war by his campaigns in Syria (1135–46). Nureddin, his son, had continued his work by further conquests in Syria and Damascus. by the organization of his conquered lands and by "publishing everywhere the Holy War."

The opportunity of Saladin lay therefore in the fact that his lifetime covers the period when there was a conscious demand for political union in the defense of the Mohammedan faith. By race Saladin was a Kurd of Armenia. His father, Ayyub (Job), and his uncle Shirguh, sons of a certain Shadhy of Ajdanakan near Dawin, were both generals in Zengi's army. In 1139 Ayyub received Baalbek from Zengi. in 1146 he moved, on Zengi's death, to the court of Damascus. In 1154 his influence secured Damascus to Xureddin and he was made governor. Saladin mas therefore educated in the most famous centre of Moslem learning, and represented the best traditions of bloslem culture.

His career falls into three parts: the conquest of Egypt, 1164–74, the annexation of Syria and Mesopotamia, 1174–86; and lastly the destruction of the Latin kingdom and subsequent campaigns against the Christians. 1187–92. The conquest of Egypt was essential to Nureddin. It was a menace to his empire on the south, the occasional ally of the Franks and the home of the unorthodox caliphs. His pretext was the plea of an exiled vizier, and Shirguh was ordered to Egypt in 1164, taking Saladin as his lieutenant. The Christians under King Amalric I of Jerusalem immediately intervened; and the four expeditions which ensued in 1164, 1167, 1168 and 1169 mere duels between Christians and Saracens. They resulted in heavy Christian losses. the death of Shirguh and the appointment of Saladin as vizier with the title of al-Malik al-Nasir. His relations toward the Fatimite caliph were marked by extraordinary tact, and on his death in 1171 Saladin was powerful enough to substitute the name of the orthodox caliph in all Egyptian mosques. The Mohammedan religion was thus united against Christianity. To Nureddin he was invariably submissive, but from the vigour nhich he employed in adding to the fortifications of Cairo and the haste with nhich he retreated from an attack on Montréal (1171) and Krak (Kerak, 1173) it is clear that he feared his lord's jealousy.

In 1174 Nureddin died, and the period of Saladin's conquests in Syria began. Nureddin's vassals rebelled against his youthful heir, as-Salih, and Saladin came north, nominally to his assistance. In 1174 he entered Damascus, Emesa and Hamah; in 1175 Baalbek and the towns round Aleppo.

The next step was political independence. Me suppressed the name of as-Salih in prayers and on the coinage and was formally recognized by the caliph in 1175. In 1176 he defeated an invasion by Saif ud-Din of Mosul and reached an agreement with as-Salih and also with the Assassins In 1177 he returned by Damascus to Cairo, which he enriched with colleges, a citadel and an aqueduct. From 1177 to 1180 he made war on the Christians from Egypt, and in 1180 he imposed terms of peace on the sultan of Konia. From 1181 to 1183 he was chiefly occupied in Syria. In 1183 he induced the atabeg Imad ud-Din to exchange Aleppo for the insignificant Sinjar and in 1186 he received the homage of the atabeg of Mosul. The last independent vassal was thus subdued and the Latin kingdom enclosed on every side by a hostile empire.

In 1187 a four years' truce was broken by the brilliant brigand Raynald of Chbtillon, and thus began Saladin's third period of conquest. In May a small body of Templars and Hospitallers was cut to pieces at Tiberias. and on July 4 Saladin inflicted a crushing defeat upon the united Christian army at Hittin. He then overran Palestine on Sept. 20 besieged Jerusalem and on Oct. 2. after chivalrous clemency to the Christian inhabitants. crowned his victories by entering and purifying the Holy City. In the kingdom only Tyre was left to the Christians. Probably Saladin made his worst strategical error in neglecting to conquer it before winter. The Christians had thus a stronghold whence their remnant marched to attack Acre in June 1189. Saladin immediately surrounded the Christian army and began the famous siege.

Saladin's lack of a fleet enabled the Christians to receive reinforcements and thus to recover from defeat by land. On June 8. 1191, Richard of England arrived, and on July 12 Acre capitulated without Saladin's permission. Richard followed up his victory by an admirably ordered march down the coast to Jaffa and a great victory at Arsuf (*q.v.*).

During 1191 and 1192 there were four small campaigns in southern Palestine when Richard circled round Beitnuba and Ascalon with Jerusalem as objective. In Jan. 1192 he acknowledged his impotence by renouncing Jerusalem to fortify Ascalon. Negotiations for peace accompanied these demonstrations, which showed that Saladin was master of the situation. Though in July Richard secured two brilliant victories at Jaffa, the treaty made on Sept. 2 was a triumph for Saladin. Only the coast line was left to the Latin kingdom, with a free passage to Jerusalem; and Ascalon was demolished The union of the Mohammedan east had beyond question dealt the death blow to the Latin kingdom. Richard returned to Europe, and Saladin returned to Damascus, where on March 4, 1193, after a few days' illness, he died. He was buried in Damascus and mourned by the whole east. (See CRUSADES)

The character of Saladin and of his work is singularly vivid. In many ways he was a typical Mohammedan, fiercely hostile toward the unbelievers who had occupied Syria, though tolerant to his own Christian subjects. intensely devout and regular in prayers and fasting. He shoued the pride of race in the declaration that "God reserved this triumph for the Ayyubites before all others." His generosity and hospitality were proved in his gifts to Richard and his treatment of captives. He had the oriental's power of endurance, alternating with violent and emotional courage. Other vir-

tues were all his own, his extreme gentleness, his love for children, his flawless honesty, his invariable kindliness. his chivalry to women and the weak. Above all he typifies the hlohammedan's utter self-surrender to a sacred cause. His achievements were the inevitable expression of his character. He was not a statesman, for he left no constitution or code to the east; his empire was divided among his relatives on his death. As a strategist, though of great ability, he cannot be compared to Richard. As a general, he never organized an army. "My troops will do nothing." he confessed, "save when I ride at their head and review them." He is famous in eastern history as the conqueror who stemmed the tide of western conquest on the east and turned it definitely from east to west, as the hero who momentarily united the unruly east and as the saint who realized in his personality the highest virtues and ideals of Mohammedanism.

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(W. F. K.; X.)

SALAMAN, REDCLIFFE NATHAN (1874–1955), English botanist, noted for his work on potatoes, was born in London on Sept. 12. 1874. He was educated at St. Paul's school and Trinity hall, Cambridge, took a medical degree and became director of the Pathological institute. London hospital. In 1904 he developed tuberculosis and in 1906 left London for Barley, near Royston, Hertfordshire. where he made a beautiful country home. There he became interested in William Bateson's genetic investigations, and in his garden he studied the potato intensively, particularly its resistance to blight. Later he studied its virus diseases with such success that a special research institute was set up at Cambridge to extend the work and he was appointed head. He initiated the building up of virus-free stocks of seed potatoes now carried on by the National Institute of Agricultural Botany at Cambridge.

Salaman was a man of wide culture and extensive interests and an active governor of the Hebrew university, Jerusalem. He died on June 12. 1955, at Royston.

His books include: *Potato Varieties* (1926) and *The History* and *Social Influence of the Potato* (1949). (E. J. R.)

SALAMANCA, a frontier province of western Spain, formed in 1833 out of the southern part of the ancient kingdom of León, and bounded north by Zamora and Valladolid, east by Ávila. south by Cáceres and west by Portugal. Pop. (1960 est.) 443,476; area, 3,763 sq.mi. Salamanca belongs almost entirely to the basin of the Duero (Portuguese *Douro, q.v.*), its principal rivers being the Tormes, which after a course of 135 mi. flows into the Duero; the Yeltes and the Agueda, also tributaries of the Duero: and the Alagon, an affluent of the Tagus. The southern border is partly defined along the crests of the Gredos and Gata ranges, but the highest point is La Alberca (5,653 ft.) in the Sierra de Peña de Francia, a little farther north. Forests of oak, pine, beech and chestnut cover a wide area in the south and southwest. Of the 50 Spanish provinces only Badajoz, Cáceres and Teruel have a larger number of livestock. Gold is found in the streams, and iron, lead, copper. zinc, coal and rock crystal in the hills, but the mines are only partially developed. The capital, Salamanca (*q.v.*), Ciudad Rodrigo (*q.v.*) and Béjar (15,511 [pop. 1950]) are the chief towns.

The railways from Zamora. Medina, Plasencia and Peñaranda converge upon the capital, whence two lines go westward into Portugal—one via Barca d'Alva to Oporto, the other via Villar Formoso to Guarda. The province was occupied by nationalist troops shortly after the outbreak of the civil war of 1936–39.

SALAMANCA (anc. SALMANTICA or ELMANTICA), the capital of the Spanish province of Salamanca on the right bank of the river Tormes, 2,648 ft. above sea level and 172 mi. by rail N.W. of Madrid. Pop. '(1960 est.) 89,085 (mun.).

The town was of importance as early as 222 B.C.. when it was captured by Hannibal from the Vettones; and it afterward became under the Romans the ninth station on the Via Lata from Merida to Saragossa. It passed successively under the rule of the Goths and the Moors. till the latter were finally driven out about 10jj. About 1100 many foreign settlers were induced by Alphonso VI to establish themselves in the district, and the city was enlarged by Count Raymond of Burgundy. The Fuero de Salamanca, a celebrated code of civil law, probably dates from about 1200. Thenceforward. until the second half of the 16th century. the prosperity of the university rendered the city one of the most important in Spain.

Salamanca is the centre of a network of railways which radiate north to Zamora. northeast to Medina. east to Pefiaranda, south to Plasencia. west-southwest to Guarda in Portugal and west to Oporto in Portugal. The river is here crossed by a bridge 500 ft. long built on 26 arches, 15 of which are of Roman origin, while the remainder date from the 16th century. The city is still much the same in outward appearance as when its tortuous streets were thronged with students. The university was naturally the chief source of wealth to the town, the population of which in the 16th century numbered 50,000, nearly 8 000 of whom were students. Its decay of course reacted on the townsfolk, but it fortunately also arrested the process of modernization. The ravages of war alone have wrought serious damage, for the French in their defensive operations in 1811–12 almost destroyed the western quarter. Salamanca was again the scene of bitter fighting between nationalist and loyalist troops during the civil war of 1936–39.

The magnificent Plaza Mayor, built by Andres Garcia de Quiñones at the beginning of the 18th century. and capable of holding 20,000 people to witness a bullfight, is one of the finest squares in Europe. It is surrounded by an arcade of 90 arches on Corinthian columns, one side of the square being occupied by the municipal buildings.

The University.—Salamanca is still rich in educational establishments. It still keeps up its university. with the separate faculties of letters, philosophy, sciences, law and medicine; its university and provincial public library, with many thousand volumes and manuscripts; its Irish college, provincial institute. superior normal school. ecclesiastical seminary (founded in 1778), economic and other learned societies. and very many charitable foundations. The city still has its 25 parishes, 25 colleges. and as many more or less ruined convents, and 10 yet flourishing religious houses.

The university, the oldest in the peninsula. was founded about 1230 by Alphonso IX of Leon, and refounded in 1242 by St. Ferdinand of Castile. Under the patronage of the learned Alphonso X its wealth and reputation greatly increased (1252–82), and its schools of canon law and civil law attracted students even from Paris and Bologna. In the 15th and 16th centuries it was renowned throughout Europe. Here Christopher Columbus lectured on his discoveries, and here the Copernican system was taught long before it had won general acceptance. But soon after 1550 a period of decline set in.

Principal Buildings. — The old cathedral is a cruciform building of the 12th century, begun by Bishop Jeronimo, the confessor of the Cid (*q.v.*). Its style of architecture is that late Romanesque which prevailed in the south of France, but the builder showed much originality in the construction of the dome, which covers the crossing of the nave and transepts. The inner dome is made to spring, not from immediately above the arches, but from a higher stage of a double arcade pierced with windows. The thrust of the vaulting is borne by four massive pinnacles, and over the inner dome is an outer pointed one covered with tiles.

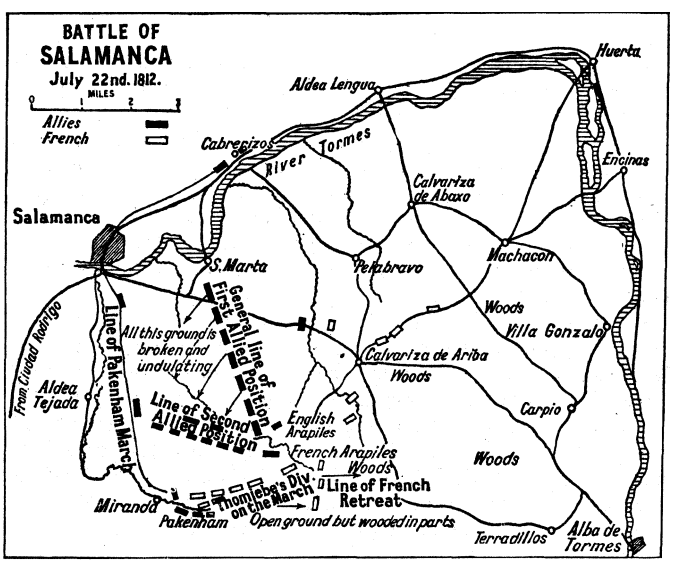
The Capilla de Talavera is used as a chapel for service according to the Mozarabic rite. which is celebrated there six times a year. On the north of and adjoining the old church stands the new cathedral, built from designs by Juan Gil de Ontaiion. Though begun in 1509 the work of construction made little progress until 1513. when it was entrusted to Ontaiion under Bishop Francisco de Bobadilla; though not finished till 1734, it is a notable example of the late Gothic and Plateresque styles. Its length is 340 ft. and its breadth 160 ft. The treasury is very rich, and among other articles possesses a custodia which is a masterpiece of goldsmith's work, and a bronze crucifix of undoubted authenticity, which was borne before the Cid in battle.

Of the university buildings the façade of the library is a peculiarly rich example of late 15th-century Gothic. The cloisters are light and elegant; the grand staircase ascending from them has a fine balustrade of foilage and figures. The Colegio de Nobles Irlandeses was built in 1521 from designs by Pedro de Ibarra. The double arcaded cloister is a fine piece of work of the best period of the Renaissance. The Jesuit college is an immense and ugly Renaissance building begun in 1614 by Juan Gomez de Mora. The Colegio Viejo, also called San Bartolome, was rebuilt in the 18th century, and serves as the governor's palace. The Dominican convent of San Esteban shows a mixture of styles from the 13th century onward. The church is Gothic with a Plateresque façade of great lightness and delicacy. The convent of the Augustinas Recoletas. begun by G. Fontana in 1616, is in better taste than any other Renaissance building in the city. The church is rich in marble fittings and contains several fine pictures of the Neapolitan school. especially the Conception by J. Ribera (1588–1656) over the altar. The convent of the Espiritu Santo has a good door by A. Berruguete (*c.* 1480–1561).

Many of the private houses are untouched examples of the domestic architecture of the times in which they were built.

See B. Dorado, *Compendio histdrico de la ciudad de Salantanca,* (1863); M. Villar y Macias, *Historia de Salamanca,* 3 vols. (1887); H. Rashdall, *Universities of Europe in the Middle Ages,* vol. ii, pt. 1 (1895); E. Esperabé, *Historia pragmática e interna de la Universidad de Salamanca,* 2 vols. (1914–17). (X.)

Battle of Salamanca, 1812. (For the operations which preceded this battle *see* PENINSULAR WAR.)—On July 22, 1812, the



allied army under Wellington (about 46,000 with 60 guns) was drawn up south of Salamanca, the left resting on the river Tormes, with a division under Pakenham on the north bank of Cabrerizos. Wellington's object was to cover Salamanca and guard his communications through Ciudad Rodrigo with Portugal.

The French under Marshal Marmont (about 42.000 with 70 guns) were collecting toward Wellington's right, stretching southward from Calvariza de Ariba. The country generally is undulating.

Until the morning of the battle it had been uncertain whether Marmont wished to reach Salamanca by the right or left bank of the Tormes, or to gain the Ciudad Rodrigo road, but Wellington now felt that the latter was his real objective. At daylight there was a rush by both armies for the two commanding hills of the Arapiles; the allies gained the northern (since termed the "English"). and the French the southern (since termed the "French") Arapiles. While Marmont was closing up his forces, a complete change of position was carried out by Wellington. Pakenham was directed to march through Salamanca, crossing the Tormes, and move under cover to a wood near Aldea Tejada. while Wellington took up a line under cover of a ridge between Arapiles and Aldea Tejada. By noon his old right had become his left, and he was nearer to the Ciudad Rodrigo road, flanking Marmont should he move toward it.

It was not Wellington's wish (*Despatches,* July 21, 1812) to fight a battle "unless under very advantageous circumstances." He knew that large reinforcements were nearing the French, and, having determined to fall back toward Portugal, he began to pass his baggage along the Ciudad Rodrigo road. Marmont, about 2 P.M. seeing the dust of his baggage column, ignorant of his true position, and anxious to intercept his retreat. ordered two divisions under Maucune to push westward, while he himself attacked Arapiles. Maucune moved off, flanked by some cavalry and 50 guns, leaving a gap between him and the rest of the French. Wellington instantly took advantage of this. Directing Pakenham to attack the head of the leading French division, and a Portuguese brigade (Pack) to occupy the enemy by assaulting the south (or French) Arapiles, he prepared to bear down in strength upon Maucune's right flank. The French attack upon Arapiles was after hard fighting repulsed; and, at about 5 P.M., Maucune's force, when in confusion from the fierce attack of Pakenham and Wellington in front and flank and suffering severely. was suddenly trampled down "with a terrible clamour and disturbance" (Napier) by an irresistible charge of cavalry under Sir Stapleton Cotton. This counterstroke decided the battle, Marmont's left wing was being completely broken. The French made a gallant but fruitless effort to retrieve the day, and repulsed Pack's attack upon the French Arapiles; but, as the light waned, Clausel. Marmont being wounded, drew off the French army toward Alba de Tormes and retired to Valladolid. Both armies lost heavily, the allies about 6,000, the French some 15,000 men, 12 guns, 2 eagles and several standards.

The rout would have been even more thorough had not the castle and ford at Alba de Tormes been evacuated by its Spanish garrison without Wellington's knowledge.

Salamanca was a brilliant victory, and followed by the capture of Madrid, it severely shook the French domination in Spain.

(C. W. Ro.)

SALAMANCA, a city of Cattaraugus county, in southwestern New York, U.S., about 55 mi. S.E. of Buffalo, is located on the Allegheny river.

Salamanca is on both sides of the river at an altitude of 1,390 ft., with wooded hills on the horizon. It lies in the Xllegany Indian reservation, and all land is held under a 99-year lease, authorized by congress in 1892. It is the northern gateway to Xllegany State park of 65,000 ac., which lies immediately south of the city.

Industries consist of railroad shops and terminals, furniture factories, tannery, plastic molding, worsted yarns, print rolls, last blocks and milk processing plants. Salamanca was first settled in 1855 and called Hemlock. It was later named after a Spanish banker who was a large stockholder in the first railroad built in the county in 1862.

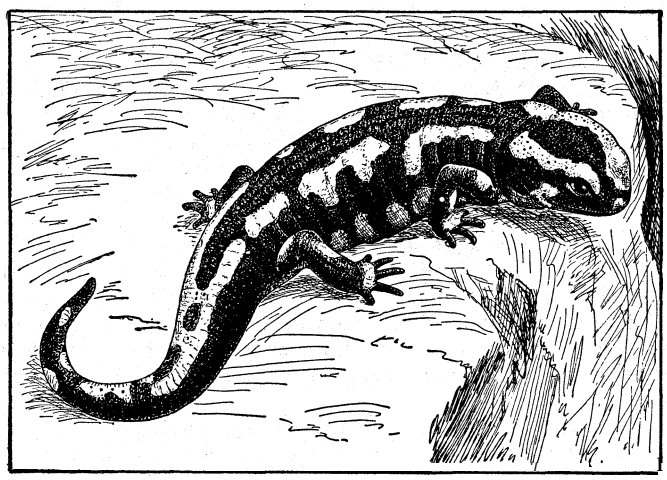
For comparative population figures *see* table in NEW YORK: *Population.*

SALAMANDER, properly the term for the tailed amphibians constituting the order Caudata. The group includes eight families of very diverse form, the majority of which are exclusively North American.

See AMPHIBIA.

In Europe the term may refer principally to the genus *Salamandra,* which is restricted to the western parts of the Palaearctic region. The fire salamander, *S. salamandra,* is the well-known

black and yellow creature inhabiting central Europe and northwest Africa, and southwest Asia; the black salamander, S. *atva,* is restricted to the Alps. These salamanders, far from being able to withstand the action of fire, as was believed by the ancients, are found only in damp places. They often emerge in great numbers in misty weather or after thunderstorms. Although harmless to man, the large glands on their smooth, shiny bodies secrete a milky poison, which protects them from many enemies. The bright coloration of S. *salanzandra* may therefore have a warning function.



THE EUROPEAN FIRE SALAMANDER, AFTER BREHM

The two well-known European species pair on land, the male clasping the female at the arms, and the impregnation is internal. Long after pairing the female gives birth to living young. *S. salamandra,* which lives at low altitudes (up to 3.000 ft), deposits her young, 10 to 50 in number, in the water, in springs or cool rivulets. These young at birth are similar to small newt larvae, and provided with external gills. *S. atra,* on the other hand, inhabits more hilly regions, up to 9,000 ft. Such altitudes not being, as a rule, suitable for larval life in the water, the young are retained in the uterus until after metamorphosis. Only two young, rarely three or four, are born, and may measure as much as 50 mm. at birth, the mother measuring only 120. The fertilized eggs are large and numerous, as in S. *salamandra,* but only one develops in each uterus, the embryo being nourished on the other eggs, the embryos of which break down into a soupy "vitelline mass." The embryo passes through three stages—(I) still enclosed within the egg membrane and living on its own yolk; (2) free, within the vitelline mass, which is swallowed by the mouth; (3) there is no more vitelline mass, but the embryo develops long external gills, which serve for a nutritive exchange through the maternal uterus, these gills functioning in the same way as the chorionic villi of the mammalian embryo's placenta. Embryos, in the second stage, if artificially released from the uterus, are able to live in water, but the uterine gills soon wither and are shed and are replaced by other gills similar to those in the larva of S. *salamandra.* In S. *salanzandra* without access to water, the development of the embryos becomes closely similar to that of *S. atra.*

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SALAMIS, an island of Greece in the Saronic Gulf of the Aegean Sea, extending along the coasts of Attica and Megaris, and enclosing the Bay of Eleusis between two narrow straits on the W. and S. Its area is 36 sq.mi., its greatest length in any direction 10 mi.; its extremely irregular shape gives rise to the modern popular name Κουλλοῦρι, *i.e.,* baker's crescent. In Homer Salamis was the home of the Aeginetan prince Telamon and his sons Ajax and Teucer, and this tradition is confirmed by the position of the ancient capital of the island opposite Aegina. It subsequently passed into the hands of the Megarians, but was wrested from them about 600 B.C. by the Athenians under Solon (*q.v.*) and definitely awarded to Athens by Sparta's arbitration. Though Attic tradition claimed Salamis as an ancient possession the island was not strictly Athenian territory; a 6th-century inscription shows that it was treated either as a cleruchy or as **a** privileged foreign dependency. The town of Salamis was removed to an inlet of the east coast opposite Attica. In 480 Salamis became the base of the allied Greek fleet after the retreat from Artemisium, while the Persians took their station along the Attic coast off Phalerum. Through the stratagem of the Athenian Themistocles the Greeks were enclosed in the straits by the enemy, who had wheeled by night across the entrance of the east channel and detached a squadron to block the west outlet. The Greeks had thus no resource but to fight, while the Persians could not utilize their superior numbers, and as they advanced into the narrow neck of the east strait were thrown into confusion. The allies, among whom the Athenians and Aeginetans were conspicuous, seized this opportunity to make a vigorous attack which probably broke the enemy's line. After waging a losing fight for several hours the Persians retreated with a loss of zoo sail and of an entire corps landed on the islet of Psyttaleia in the channel; the Greeks lost only 40 ships out of more than 300. During the Peloponnesian War Salamis served as **a** repository for the country stock of Attica. About 350 Salamis obtained the right of issuing copper coins. In 318 Cassander placed in it a Macedonian garrison which was finally withdrawn through the advocacy of the Achaean statesman Aratus (232). The Athenians thereupon supplanted the inhabitants by a cleruchy of their own citizens. By the end century A.D. the settlement had fallen into decay. In modern times Salamis, which is chiefly peopled by Albanians, has regained importance through the transference of the naval arsenal to Ambelaki near the site of the ancient capital. Excavations in this region have revealed large numbers of late Mycenaean tombs.

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SALAMIS, the principal city of ancient Cyprus, situated on the east coast north of the river Pedias (Pediaeus). It had a good harbour, well situated for commerce with Phoenicia, Egypt and Cilicia, which was replaced in mediaeval times by Famagusta (*q.v.*), and is wholly silted now. Its trade was mainly in corn, wine and oil from the midland plain, and in salt from the neighbouring lagoons. Traditionally, Salamis was founded after the Trojan War (c. 1180 B.C.) by Teucer from the island Salamis, **off** Attica, but there was a Mycenaean colony somewhat earlier.

A king Kisu of Silna (Salamis) is mentioned in a list of tributaries of Assur-banî-pal of Assyria in 668 B.C., and Assyrian influence is seen in terra-cotta figures from a shrine excavated in 1890–1891. Salamis seems to have been the principal Hellenic power in the island. The revolts against Persia in 500 B.C., 386–380 B.C. and 352 B.C. were led respectively by its kings Onesilas, Evagoras (*q.v.*) and Pnytagoras. In 306 B.C. Demetrius Poliorcetes won a great naval victory here over Ptolemy I. of Egypt. Under Egyptian and Roman administration Salamis flourished greatly, though the seat of government was at New Paphos (see PAPHOS). But it was greatly damaged in the Jewish revolt of A.D. 116–117; suffered repeatedly from earthquakes, and was wholly rebuilt by Constantius II. (A.D. 337–361) under the name Constantia. There was a large Jewish colony, and a Christian community was founded by Paul and Bamabas in A.D. 45–46. Barnabas was himself a Cypriote, and his reputed tomb, discovered in A.D. 477, is still shown near the monastery of Ail Barnába. St. Epiphanius was archbishop A.D. 367–402. The Greek city was destroyed by the Arabs under the Caliph Moawiya in 647; Christian survivors migrated to the neighbouring Ammochostos (see

FAMAGUSTA).

See W. *H.* Engel, *Kypros* (1841; classical allusions); J. A. R. Munro and H. A. Tubbs, *Journ. Hellenic Studies,* xii. 59 ff., 298 ff. (site and monuments); British Museum, *Excavations in Cyprus* (1899; Mycenacan tombs); G. F. Hill, *Brit. Mus. Cat. Coins of Cyprus* (1904; coins); J. L. Myres, *Archaeologia,* lxvi. 159–178 ("Prison of St. Catharine"); E. Oberhummer in Pauly-Wissowa, *Real Encyclopadie* der *classischen Altertumswissenschaft (s.v.).* (J. L. MY.)

SAL AMMONIAC (AMMONIUM CHLORIDE): *see* AMMONIA.

SALANDRA, ANTONIO (1853–1931). Italian statesman, was born of a wealthy family at Troia, Puglia, on Aug. 13. 1853. He was a barrister who also taught public administration in Rome university. Politically he was a conservative. An undersecretary in 1891, he became minister of agriculture in 1899 and then finance minister in 1906 and in 1909–10. When, in March 1914, Giolitti resigned. Salandra was called upon to form the new cabinet.

Salandra was premier on the outbreak of World War I, and it was his cabinet that took the momentous decision of proclaiming Italy's neutrality, in spite of the existence of the triple alliance, because Austria-Hungary had declared war on Serbia without a previous agreement with Italy.

After bargaining with both sides, in May 191 j Salandra assumed the still greater responsibility of bringing Italy into the war on the side of the Allies. This highhanded decision was taken during a parliamentary recess. Subsequently he had to resign office in June 1916, in consequence of the Austrian offensive in the Trentino. During the disturbed period from 1919 to 1922 Salandra upheld the principles of authoritarian conservatism. He succeeded T. Tittoni as Italian delegate on the League of Nations council and in its assembly, and represented the Italian thesis in the Italo-Greek conflict of Aug.–Sept. 1923 *(see* CORFU).

The Fascist movement was supported from the first by Salandra, but he did not join the Fascist party; and when he felt that Fascism was incompatible with the old Liberal tradition. especially after Mussolini's speech of Jan. 3, 1925, he modified his support. In 1928 on the proposal of Mussolini he was created a senator. He died on Dec. 9, 1931.

Salandra's war policy is covered in his two books *La Neutralità italiana, 1914: ricordi e pensieri,* published in 1928, and *L'Intervento, 1915* (1930). (D. M. SH.)

SALARIA, VIA, an ancient highroad of Italy which ran from Rome by Reate and Asculum to Castrum Truentinum (Porto d'Ascoli) on the Adriatic coast, a distance of 151 mi. Its first portion was the route by which the Sabines came to fetch salt from the marshes at the mouth of the Tiber. Considerable remains of its course through the Apennines survive.

SALAR JUNG, SIR (1829–1883), Indian statesman of Hyderabad. born in 1829, descendant of a family of officials under the Xdil Shahi kings of Bijapur, then under the Delhi emperors and lastly under the nizams. Sir Salar Jung's personal name was Mir Turab Ali. He succeeded his uncle Suraju 'l-Mulk as prime minister of Hyderabad in 1853. Salar Jung disciplined Arab mercenaries, the more valuable part of the nizam's army, and employed them against the rapacious nobles and bands of robbers who had annihilated the trade of the country. He then constituted courts of justice at Hyderabad, organized the police force, constructed and repaired irrigation works and established schools. On the outbreak of the mutiny he supported the British. and although unable to hinder an attack on the residency, he warned the British minister that it was in contemplation. The attack was repulsed; the Hyderabad contingent remained loyal and their loyalty served to ensure the tranquillity of the Deccan. Salar Jung took advantage of the preoccupation of the British government with the mutiny to push his reforms more boldly. and when the Calcutta authorities were again at liberty to consider the condition of affairs his work had been carried far toward completion. During the lifetime of the nizam Afzulu'd-dowla, Salar Jung was considerably hampered by his master's jealous supervision. When Mir hlahbub Ali. however, succeeded .his father in 1869. Salar Jung. at the instance of the British government, was associated in the regency with the principal noble of the state, the Shamsu 'l-Umara or Amir Kabir, and enjoyed an increased authority. In 1876 he visited England. unsuccessfully attempting to obtain the restoration of Berar.

Salar Jung died at Hyderabad on Feb. 8, 1883.

SALAYAR (Dutch SALAJAR), a group of islands between 5° 36′ and 7° 25′ S. and 119° 50′ and 121° 30′ E., Celebes, Indon., including Tambalongang. Pulasi and Bahuluwang. The main island, Salayar, is more than 50 mi. long and 8 mi. at its widest point; area, 248 sq.mi. The strata of the island are sedimentary rocks; except in the north and northwest it is covered by fertile soil. Pop, about 80.000, mainly a mixture of Macassars, Buginese and natives of Luvu and Buton, Salayar being one of the most thickly populated parts of the division of Celebes. Trepang, tortoise shell, copra, coconqt oil and salt are exported.

SALAZAR, ANTONIO DE OLIVEIRA (1889–), Portuguese statesman, was born on April 28. 1889, at Vimieiro, near Santa Comba Dão, province of Beira Alta, Port., the son of António de Oliveira and Maria do Resgate Salazar, modest small holders. From village school he passed in 1900 to the seminary at Viseu; after eight years he decided he had no vocation for the priesthood. He entered Coimbra university in 1910, took an economics degree in 1914 and joined the teaching staff. In 1918 he was appointed professor of economic sciences. Devoutly Catholic and much influenced by the papal encyclical *Rerum Novarum,* he became widely known for his writings and speeches on political economy. In Jan. 1921 he was one of three Catholic deputies elected to parliament. He appeared only once in the chamber.

When in May 1926 the parliamentary system was replaced by a dictatorship. Salazar was offered the portfolio of finance, which he accepted, only to resign five days later. However, on April 27, 1928, he left Coimbra to become finance minister under Gen. António Oscar de Fragoso Carmona on terms that gave him virtual control of the machinery of government. On July j. 1932, he became president of the council of ministers (prime minister).

The new constitution of 1933, which combined principles of an authoritarian state with *Rerum Novarum* ideas of social justice, was a distillation of theories and doctrines consistently expounded by Salazar from his earliest student days.

Salazar's first and most enduring impact on government was through budgetary reforms and controls, but he was, in fact, the all-pervading (though rarely seen) genius of Portugal's *Estndo Novo.* (F. *B.* H.)

SALCEDO, a province in northern Dominican Republic, is the smallest province in area (191 sq.mi.) and has the greatest density of population (1960 average. 359.5 per sq.mi.). Its many small farms produce a great quantity of cacao, coffee, corn and some tobacco. The province is crossed by the eastern section of the low Cordillera Septentrional. which divides the drainage northward to the Atlantic from the streams that flow southward to the fertile Vega Real.

Salcedo was created in 1952 from Espaillat province. The population of Salcedo province was 57,813 in 1950 and 68.656 in 1960.

The capital is Salcedo (pop. [1960] 6,175). (D. R. D.)

SALDANHA BAY, an inlet on the southwestern coast of South Africa, 63 mi. by sea north by west of Cape Town, forming a landlocked harbour. The northern part of the inlet is known as Hoetjes bay. From Kalabas Kraal on the Cape Town-Clanwilliam railway, a narrow gauge line was built via Hopefield to Hoetjes bay—126 mi. from Cape Town. It was used as a naval base during World War II. Saldanha bay was named after Antonio de Saldanha, captain in Albuquerque's fleet which visited south Africa in 1503.

SALDERN, FRIEDRICH CHRISTOPH VON (1719–1785), Prussian soldier and military writer, entered the army in 1735, and was transferred to the guards in 1739. As one of Frederick's aides-de-camp he was the first to discover the approach of Neipperg's Austrians at Mollwitz. He commanded a guard battalion at Leuthen, again distinguished himself at Hochkirch and was promoted major general. In 1760 at Liegnitz Frederick gave him four hours in which to collect, arrange and despatch the spoils of the battle. 6,000 prisoners, 100 wagons. 82 ,guns and 5,000 muskets. His complete success made him a marked man even in

Frederick's army. At Torgau, Saldern and Mollendorf with their brigades converted a lost battle into a great victory by their desperate assault on the Siptitz heights. In the following winter, however, being ordered by Frederick to sack Hubertusburg, Saldern refused on the ground of conscience. Nothing was left for him but to retire, but after the peace the general was at once made inspector of the troops at Magdeburg.

SALE, SIR ROBERT HENRY (1782–1845), British soldier, entered the 36th Foot in 1795, and went to India in 1798. He served in the operations against Tippoo Sahib, against the raja of Travancore (1808–09) and in the expedition to Mauritius (1810). In the Burmese War he rose to command a brigade. In 1838, on the outbreak of the Afghan War, Sale was assigned to the command of the 1st Bengal brigade.

Sale's column arrived at Kandahar in April 1839, and in May it occupied the Herat plain The Kandahar force next set out on its march to Kabul, and a month later Ghazni was stormed, Sale in person leading the storming column and distinguishing himself in single combat. The place was well provisioned, and on its supplies the army finished its march to Kabul easily. He was left. as second-in-command, with the army of occupation, and in the interval between the two wars conducted several small campaigns ending with the action of Parwan which led directly to the surrender of Dost Mohammed.

By this time the army had settled down to the quiet life of cantonments. and Lady Sale and her daughter came to Kabul. But the policy of the Indian government in stopping the subsidy to the frontier tribes roused them into hostility, and Sale's brigade received orders to clear the line of communication to Peshawar. After severe fighting Sale entered Jalalabad on Nov. 12. 1841. Ten days previously he had received news of the murder of Sir Alexander Burnes, along with orders to return with all speed to Kabul.

These orders Sale. for various reasons, decided to ignore; suppressing his personal desire to return to protect his wife and family, he gave orders to push on. and on occupying Jalalabad at once set about making the old and half-ruined fortress fit to stand a siege. There followed a close and severe investment. At last Pollock and the relieving army appeared, only to find that the garrison had on April 7, 1842, relieved itself by a brilliant and completely successful attack on Akbar's lines. Pollock and Sale after a time took the offensive, and after the victory of Haft Kotal, Sale's division encamped at Kabul again.

At the end of the war Sale received the thanks of parliament. In 1845, as quartermaster-general to Sir H. Gough's army, Sale again took the field. At Moodkee (Mudki) he was wounded and he died on Dec. 21. 1845.

SALE, a municipal borough in the Altrincham and Sale parliamentary division, Cheshire. Eng., 5 mi. S.W. of Manchester. Pop. (1961) 51.317. Area 5.7 sq.mi. In 1930 the urban districts of Sale and Ashton-upon-Mersey were amalgamated. The borough, created in 1935, is mainly residential but market gardening to supply Manchester is extensive. The Mersey river separates Sale from Manchester. Salford and Stretford. The Bridgewater canal passes through the town.

SALÉ (SLÄ), a seaport on the Atlantic coast of Morocco, on the north side of the Bu Ragreg, opposite Rabat (*q.v.*). Salé, inhabited by a native bourgeoisie, has many Moslem sanctuaries, mosques. *zaouïas, medersas* and tombs of saints. In the middle ages, it mas the most important merchant port and entrepôt of the west coast.

In the 17th century it became an independent republic, a great centre of corsairs. Various French and English expeditions tried. without much success, to put an end to it. Pop. (1960) 75,799.

SALE CITY, the first city to be proclaimed in Gippsland province in the county of Tanjil. Victoria, Austr.. on the Thomson river, 127½ mi. by rail E.S.E. of Melbourne. Pop. (1954) 6.537. It is an important administrative and educational centre situated in a rich agricultural (dairying and mixed farming) irrigation district. Sale City is the seat of the Anglican bishop of Gippsland and also of the Roman Catholic bishop of Sale. The climate is temperate; the average annual rainfall is 24 in.

SALEM, a city and district of Madras state, republic of India. The city is on both banks of the Tirumanimuttar river, 3 mi. from a station on the Southern railway, 206 mi. S.W. of Madras city. Pop. (1961) 249,084. There is a considerable weaving industry. Its situation in a green valley between the Shevaroy and Jarugumalai hills is picturesque.

The DISTRICT OF SALEM has an area of 7,063 sq.mi. Except toward the south it is hilly, with extensive plains lying between the several ranges. It consists of three distinct tracts, formerly known as the Talaghat, the Baramahal and the Balaghat. The Talaghat is situated below the Eastern Ghats on the level of the Carnatic generally; the Baramahal includes the whole face of the Ghats and a wide area of country at their base; and the Balaghat is situated above the Ghats on the tableland of Mysore.

The western part of the district is mountainous. Among the chief ranges are the Shevaroys, the Kalrayans, the Melagiris, the Kollimalais, the Pachamalais and the Yelagiris. The population in 1961 was 3.826.349. The principal crops are millets, rice, pulses, mangoes and oilseeds. Coffee is grown on the Shevaroy hills. The chief irrigation work is the Barur tapk system. The Southern railway runs through the district, with two narrow-gauge branches. The chief industry is cotton weaving, and magnesite and steatite are worked, and there are iron and steel works.

The district was acquired partly by the treaty of peace with Tippoo Sultan in 1792 and partly by the partition treaty of Mysore in 1799.

SALEM, one of New England's most historic cities, is an old seaport in Essex county, Mass.. U.S.. about 15 mi. N.E. of Boston. Its diversified industry includes a large parlor-game plant; electronic devices and leather goods are also important products. Its principal modern interest, however, is linked with its distinguished past. particularly its remarkable early maritime achievements, its witchcraft trials and executions, and its associations with Nathaniel Hawthorne (*q.v.*).

Salem was founded in 1626 by Roger Conant, six years after the settlement of the "Old Colony" at Plymouth. In 1628 Gov.

ROBERT FINKELSTEIN

JOHN TURNER HOUSE

Built in 1668 in Salem and made famous by Nathaniel Hawthorne in "The House of the Seven Gables"

John Endecott brought a band of settlers there as an advance guard of the Massachusetts Bay colony, which was established in force at Boston in 1630. In 1629 the first Congregational church in America was organized at Salem by Rev. Francis Higginson; Roger Williams was one of its early pastors. Several 17th-century homes are still standing, including the Pickering house (1660); the John Turner house (1668), immortalized by Hawthorne as "the house of the seven gables"; and the John Ward house (1684), preserved with 17th-century furnishings by the Essex institute. There is

also the "witch house," where Judge Jonathan Curtin held some of the preliminary examinations during the witchcraft hysteria of 1692, in which 19 persons, chiefly women, were condemned and executed for supposedly practising the occult arts.

Salem's chief distinction to historical fame comes from its achievements at sea during the 50 years following the outbreak of the American Revolution. It had a very mediocre harbour and a meagre hinterland but during the "golden age" of the American merchant marine its ships and mariners voyaged with great success to distant seas, particularly beyond the Cape of Good Hope. The boom came from privateering during the American Revolution, when Salem vessels made about 445 captures. With trade routes open in 1783 after British colonial regulations were removed, some of the larger Salem privateers, especially those of Elias Haskett Derby, opened up new contacts with the Baltic, the Mediterranean. India and what Samuel E. Morison in his *Maritime History of Massachusetts* has called the Salem East Indies, with pepper from Sumatra as a specialty. Particularly high profits were made by the Derbys, the Crowninshields and others by neutral traffic during the Anglo-French wars from 1793 until the end of 1807, when the Embargo act ended virtually all commerce with foreign nations. Salem still contains much atmosphere from the heyday of that trade, particularly in the high, square brick houses, with beautiful carved woodwork, designed by Samuel McIntire (*q.v.*). Of these, the Pingree house (1804), beautifully furnished, is opened to the public by the adjacent Essex institute. The atmosphere of the great age of Salem shipping has been ably preserved by the national park service's 9-ac. Salem Maritime National historic site, established in 1938. It includes the great Derby wharf, commenced around 1760, and the adjacent, shorter Central wharf; the Derby house (1762); the McIntire-designed Hawes house (1801); and the Salem Custom house (1819), nhere Hawthorne, as surveyor of the port from 1846 to 1849, wrote part of *The Scarlet Letter*. Salem's commerce never regained its former volume, although after the embargo was lifted there developed a lively trade with Zanzibar and a factory was started to produce cloth for that market. Eventually, as ships became larger, the harbour could not accommodate them and controlled and manned vessels operated out of Boston or New York.

Important custodians of the Salem tradition are the Essex institute, with its rich library and its quarterly *Historical Collections*, and the Peabody museum, housed in the old granite building of the East India Marine society and possessing maritime and ethnographic collections. In addition to Hawthorne, other distinguished Salem natives were Nathaniel Bowditch, pioneer in navigation; Timothy Pickering, early postmaster general and secretary of state; and William Hickling Prescott, the historian. Alexander Graham Bell did much of his significant telephone research while a resident of Salem.

For comparative population figures *see* table in MASSACHUSETTS: *Population.* (R. G. A.)

SALEM, a city of New Jersey, U.S., 38 mi. S.W. of Philadelphia, Pa.. is the oldest permanent English settlement in the Delaware valley and many of its houses, as well as its Quaker meeting house, have been preserved from colonial times. It was established in 1675 on Salem creek, 2 mi. from the Delaware, by John Fenwick, an English Quaker. Fenwick took the name Salem, meaning "land of peace," from the Old Testament. In 1682 Salem received royal permission to become a port of entry. In the decade before the American Revolution, however, the collector of customs reported that smuggling, especially of rum, sugar and molasses, was prevalent. During the American Revolution, the British occupied Salem in 1778, following Anthony Wayne's foraging expedition into the area for supplies for Washington's army at Valley Forge. It was during these years that the massacre of American militia at the William Hancock house, 4 mi. from Salem, occurred. The house is now a state museum.

The railroad reached the edge of Salem in 1863 but did not come into the town itself until 1882, when a bridge was built over Salem creek. The decade of the 1860s also witnessed the establishment of a glass works and an "oil cloth" factory to make floor coverings. By mid-20th century these two industries, along with canned foods, were the major sources of employment. Many inhabitants, however, commuted to work in nearby industries.

A point of historical interest is the Alexander Grant house (1721), home of the county historical society museum. The ancient oak tree under which Fenwick bartered with the Indians continues to attract visitors.

For comparative population figures *see* table in NEW JERSEY: *Population,* (H. F. *Wt.)*

SALEM, the capital of Oregon, U.S., and the seat of Marion county, is situated in the centre of the rich Willamette valley, equidistant from beach and mountain playgrounds, 50 mi. S. of Portland. The government buildings, built along an open mall and dominated by a modern neoclassical capitol completed in 1939, are in the heart of the city. Volcanic peaks of the Cascade mountains can be seen to the east and the forested Coast range to the west.

In 1834 a group of Methodist missionaries came to Oregon under the leadership of Jason Lee! a native of the Canadian border, of New England parentage and education. The first site chosen for the mission, 10 mi. N. of the present city of Salem, proved unhealthful, and in 1840 the mission was moved to a site known as Chemeketa, an Indian name, which meant "place of peace." This they translated to the biblical name of Salem and there erected a grist and sawmill and an Indian school.

In 1842 the missionaries decided to found a second school, for white children, called the Oregon institute, which they hoped would become a university; the first instruction was given in 1844. To provide funds for the institute, the missionaries decided in 1846 to lay out a town and sell lots. The Willamette valley was the focal point of the first migrations over the Oregon trail and as the population grew the mission townsite prospered. By a charter granted in 1853 the Oregon institute became Willamette university, the oldest institution of higher learning in the western United States. It is still related to the Methodist Church and offers liberal arts training and graduate work in law, music and education.

Salem became territorial capital of Oregon in 1851 and state capital in 1859, after having been chartered as a city in 1853. As the state grew, city and government grew, the city spreading from the flood plain by the river to surrounding hills. (For comparative population figures *see* table in OREGON: *Population.)* The city has had a council-manager form of government since 1947.

An eight-months growing season, an annual rainfall of 40 in. and a variety of soils produces a diversity of more than 100 crops in the area and Salem's canneries and frozen-food plants make it an important processing centre. Strawberries, beans, blackberries, sweet corn, onions! cherries and broccoli had the largest pack in 1960. As highways widen the market area, the city has become a major retail centre. Wood, paper products and metal fabrications are long standing and growing industries. The community used the Willamette river for transportation until 1933. It is served by north-south rail lines, an interstate highway and airlines.

The Salem Art museum in the Asahel Bush house (1878) is a city cultural centre. In the city or nearby are state schools for the blind and deaf, state hospitals, Fairview home for the mentally retarded and penal institutions.

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(U. C. D.)

SALE OF GOODS. The law of sale is usually treated as a branch of the law of contract, because sale is effected by contract. Thus Pothier entitles his classical treatise on the subject, *Traité* du *contrat de vente.* But a completed contract of sale is something more. It is a contract plus a transfer of property. By an agreement to sell a *ius in personam* is created; by a sale of *ius in rem* is transferred. The essence of sale is the transfer of property for a price. If there be no agreement for a price, express or implied, the transaction is of the nature of a gift. So, too, if commodity be exchanged for commodity, the transaction is called barter and not sale, and the rules relating to sales do not apply in their entirety. Again, a contract of sale must

contemplate an absolute transfer of the property in the thing sold or agreed to be sold. A mortgage may be in the form of a conditional sale, but English law regards the substance and not the form of the transaction. If in substance the object of the transaction is to secure the repayment of a debt, and not to transfer the absolute property in the thing sold, the law at once annexes to the transaction the complex consequences which attach to a mortgage. So, too, it is not always easy to distinguish a contract for the sale of an article from a contract for the supply of work and materials. If a man orders a set of false teeth from a dentist the contract is one of sale, but if he employs a dentist to stop one of his teeth with gold the contract is for the supply of work and materials. The distinction is of practical importance, because very different rules of law apply to the two classes of contract. The property which may be the subject of sale may be either movable or immovable, tangible or intangible. The present article relates only to the sale of goods—that is to say, tangible movable property.

The Code of 1893.—In 1847, when Justice Story wrote his work on the sale of personal property, the law of sale was still in process of development. Many rules were still unsettled, especially the rules relating to implied conditions and warranties. But for several years the main principles have been well settled. In 1891 the subject seemed ripe for codification, and Lord Herschell introduced a codifying bill which two years later passed into law as the Sale of Goods Act, 1893.

Sale is a consensual contract. The parties to the contract may supplement it with any stipulations or conditions they may see fit to agree to. The code in no wise seeks to fetter this discretion. It lays down a few positive rules—such, for instance, as that which reproduces the 17th section of the Statute of Frauds. But the main object of the act is to provide clear rules for those cases where the parties have either formed no intention or have failed to express it. When parties enter into a contract they contemplate its smooth performance, and they seldom provide for contingencies which may interrupt that performance—such as the insolvency of the buyer or the destruction of the thing sold before it is delivered. It is the province of the code to provide for these contingencies, leaving the parties free to modify by express stipulation the provisions imparted by law. When the code was in contemplation the case of Scotland gave rise to difficulty. Scottish law varies widely from English. To speak broadly, the Scottish law of sale differs from the English by adhering to the rules of Roman law, while the English common law has worked out rules of its own. The Codifying bill of 1891 applied only to England, but on the advice of Lord Watson it was extended to Scotland. As the English and Irish laws of sale were the same, the case of Ireland gave rise to no difficulty, and the act now applies to the whole of Great Britain. As regards England and Ireland, very little change in the law has been effected. As regards Scotland, the process of assimilation has been carried further, but this has not been completed. In a few cases the Scottish rule has been saved or re-enacted, in a few other cases it has been modified, while on other points, where the laws were dissimilar, the English rules have been adopted.

The act is divided into six parts, the first dealing with the formation of the contract. The 1st section, which may be regarded as the keystone of the act, is in the following terms: "A contract of sale of goods is a contract whereby the seller transfers or agrees to transfer the property in goods to the buyer for a money consideration called the price. A contract of sale may be absolute or conditional. When under a contract of sale the property in the goods is transferred from the seller to the buyer the contract is called a 'sale,' but when the transfer of the property in the goods is to take place at a future time or subject to some condition thereafter to be fulfilled the contract is called an 'agreement to sell.' An agreement to sell becomes a sale when the time elapses or the conditions are fulfilled subject to which the property in the goods is to be transferred." This section clearly enunciates the consensual nature of the contract, and this is confirmed by sec. 55, which provides that "where any right, duty or liability would arise under a contract of sale by implication of law," it may be negatived or varied by express agreement, or by the course of dealing between the parties, or by usage, if the usage be such as to bind both parties to the contract. The next question is who can sell and buy. The act is framed on the plan that if the law of contract were codified, this act would form a chapter in the code. The question of capacity is therefore referred to the general law, but a special provision is inserted (sec. 2) relating to the supply of necessaries to infants and other persons who are incompetent to contract. Though an infant cannot contract he must live, and he can only get goods by paying for them. The law, therefore, provides that he is liable to pay a reasonable price for necessaries supplied to him, and it defines necessaries as "goods suitable to the condition in life of such minor or other person, and to his actual requirements at the time of the sale and delivery."

The 4th section of the act reproduces the famous 17th section of the Statute of Frauds, which was an act "for the prevention of frauds and perjuries." The object of that statute was to prevent people from setting up bogus contracts of sale by requiring material evidence of the contract. The section provides that "a contract for the sale of any goods of the value of £10 or upwards shall not be enforceable by action unless the buyer shall accept part of the goods so sold, and actually receive the same, or give something in earnest to bind the contract, or in part payment, or unless some note or memorandum in writing of the contract be made and signed by the party to be charged, or his agent in that behalf." It is a much-disputed question whether this enactment has brought about good or harm. It has defeated many an honest claim, though it may have prevented many a dishonest one from being put forward. When judges and juries have been satisfied of the bona *fides* of a contract which does not appear to satisfy the statute, they have done their best to get round it. Every expression in the section has been the subject of numerous judicial decisions, which run into almost impossible refinements, and illustrate the maxim that hard cases make bad law. It is to be noted that Scotland is excluded from the operation of sec. 4. The Statute of Frauds has never been applied to Scotland, and Scotsmen appear never to have felt the want of it.

As regards the subject-matter of the contract, the act provides that it may consist either of existing goods or "future goods"—that is to say, goods to be manufactured or acquired by the seller after the making of the contract (sec. 5). Suppose that a man goes into a gunsmith's shop and says, "This gun suits me, and if you will make or get me another like it I will buy the pair." This is a good contract, and no question as to its validity would be likely to occur to the lay mind. But lawyers have seriously raised the question, Whether there could be a valid contract of sale when the subject-matter of the contract was not in existence at the time when the contract was made. The price is an essential element in a contract of sale. It may be either fixed by the contract itself, or left to be determined in some manner thereby agreed upon, *e.g.*, by the award of a third party. But there are many cases in which the parties intend to effect a sale, and yet say nothing about the price. Suppose that a man goes into an hotel and orders dinner without asking the price. How is it to be fixed? The law steps in and says that, in the absence of any agreement, a reasonable price must be paid (sec. 8). This prevents extortion on the part of the seller, and unreasonableness or fraud on the part of the buyer.

Warranty.—The next question dealt with is the difficult one of conditions and warranties (secs. 10 and 11). The parties may insert what stipulations they like in a contract of sale, but the law has to interpret them. The term "warranty" has a peculiar and technical meaning in the law of sale. It denotes a stipulation which the law regards as collateral to the main purpose of the contract. A breach, therefore, does not entitle the buyer to reject the goods, but only to claim damages. Suppose that a man buys a particular horse, which is warranted quiet to ride and drive. If the horse turns out to be vicious, the buyer's only remedy is to claim damages, unless he has expressly reserved a right to return it. But if, instead of buying a particular horse, a

man applies to a dealer to supply him with a quiet horse, and the dealer supplies him with a vicious one, the stipulation is a condition. The buyer can either return the horse, or keep it and claim damages. Of course the right of rejection must be exercised within a reasonable time. In Scotland no distinction has been drawn between conditions and warranties, and the act preserves the Scottish rule by providing that, in Scotland, "failure by the seller to perform any material part of a contract of sale" entitles the buyer either to reject the goods within a reasonable time after delivery, or to retain them and claim compensation (sec. 11 [2]). In England it is a very common trick for the buyer to keep the goods, and then set up in reduction of the price that they are of inferior quality to what was ordered. To discourage this practice in Scotland the act provides that, in that country, the court may require the buyer who alleges a breach of contract to bring the agreed price into court pending a decision of the case (sec. 59). It seems a pity that this sensible rule was not extended to England.

In early English law *caveat emptor* was the general rule, and it was one well suited to primitive times. Men either bought their goods in the open market-place, or from their neighbours, and buyer and seller contracted on a footing of equality. Now the complexity of modern commerce, the division of labour and the increase of technical skill, have altogether altered the state of affairs. The buyer is more and more driven to rely on the honesty, skill and judgment of the seller or manufacturer. Modern law has recognized this, and protects the buyer by implying various conditions and warranties in contracts of sale, which may be summarized as follows: First, there is an implied undertaking on the part of the seller that he has a right to sell the goods (sec. 12). Secondly, if goods be ordered by description, they must correspond with that description (sec. 13). Thirdly, there is the case of manufacturers or sellers who deal in particular classes of goods. They naturally have better means of judging of their merchandise than the outside public, and the buyer is entitled within limits to rely on their skill or judgment. A tea, merchant or grocer knows more about tea than his customers can, and so does a gunsmith about guns. In such cases, if the buyer makes known to the seller the particular purpose for which the goods are required, there is an implied condition that the goods are reasonably fit for it, and if no particular purpose be indicated there is an implied condition that the goods supplied are of merchantable quality (sec. 14). Fourthly, in the case of a sale by sample, there is "an implied condition that the bulk shall correspond with the sample in quality," and that the buyer shall have a reasonable opportunity of comparing the bulk with the sample (sec. 15).

Effects of Contract. — The main object of sale is the transfer of ownership from seller to buyer, and it is often both a difficult and an important matter to determine the precise moment at which the change of ownership is effected. According to Roman law, which is still the foundation of most European systems, the property in a thing sold did not pass until delivery to the buyer. English law has adopted the principle that the property passes at such time as the parties-intend it to pass. Express stipulations as to the time when the property is to pass are very rare. The intention of the parties has to be gathered from their conduct. A long train of judicial decisions has worked out a series of rules for determining the presumed intention of the parties, and these rules are embodied in secs. 16 to 20 of the act. The first rule is a negative one. In the case of unascertained goods, *i.e.,* goods defined by description only, and not specifically identified, "no property in the goods is transferred to the buyer unless and until the goods are ascertained." If a man orders ten tons of scrap iron from a dealer, it is obvious that the dealer can fulfil his contract by delivering any ten tons of scrap that he may select, and that until the ten tons have been set apart, no question of change of ownership can arise. But when a specific article is bought, or when goods ordered by description are appropriated to the contract, the passing of the property is a question of intention. Delivery to the buyer is strong evidence of intention to change the ownership, but it is not conclusive. Goods may be delivered to the buyer on approval, or for sale or return. Delivery to a carrier for the buyer operates in the main as a delivery to the buyer, but the seller may deliver to the carrier, and yet reserve to himself a right of disposal. On the other hand, when there is a sale of a specific article, which is in a fit state for delivery, the property in the article *prima facie* passes at once, even though delivery be delayed. When the contract is for the sale of unascertained goods, which are ordered by description, the property in the goods passes to the buyer, when, with the express or implied consent of the parties, goods of the required description are "unconditionally appropriated to the contract." It is perhaps to be regretted that the codifying act did not adopt the test of delivery, but it was thought better to adhere to the familiar phraseology of the cases. Section 20 deals with the transfer of risk from seller to buyer, and lays down the *prima facie* rule that "the goods remain at the seller's risk until the property therein is transferred to the buyer, but when the property therein is transferred to 'the buyer, the goods are at the buyer's risk whether delivery has been made or not." *Res perit domino* is therefore the maxim of English, as well as of Roman law.

Title. — In the vast majority of cases people only sell what they have a right to sell, but the law has to make provision for cases where a man sells goods which he is not entitled to sell. An agent may misconceive or exceed his authority. Stolen goods may be passed from buyer to buyer. Then comes the question, Which of two innocent parties is to suffer? Is the original owner to be permanently deprived of his property, or is the loss to fall on the innocent purchaser? Roman law threw the loss on the buyer, *Nemo plus iuris in alium transferre potest quam ipse habet.* French law, in deference to modern commerce, protects the innocent purchaser and throws the loss on the original owner. "En fait de meubles, possession vaut titre" *(Code civil,* art. 1,599). English law is a compromise between these opposing theories. It adopts the Roman rule as its guiding principle, but qualifies it with certain exceptions, which cover perhaps the majority of the actual cases which occur (secs. 21 to 26). In the first place, the provisions of the Factors Act, 1889 (extended to Scotland by 53 and 54 Vict. c. 40), are preserved. That act validates sales and other dispositions of goods by mercantile agents acting within the apparent scope of their authority, and also protects innocent purchasers who obtain goods from sellers left in possession, or from intending buyers who have got possession of the goods while negotiations are pending. In most cases a contract induced by fraud is voidable only, and not void, and the act provides, accordingly, that a voidable contract of sale shall not be voided to the prejudice of an innocent purchaser. The ancient privilege of market overt (*i.e.,* "open market") is preserved intact (sec. 22). The section does not apply to Scotland, nor to the law relating to the sale of horses which is contained in two old statutes, 2 and 3 Phil. and Mar. c. 7, and 31 Eliz. c. 12. The minute regulations of those statutes are never complied with, so their practical effect is to take horses out of the category of things which can be sold in market overt. The privilege of market overt applies only to markets by prescription, and does not attach to newly-created markets. The operation of the custom is therefore fitful and capricious. For example, every shop in the City of London is within the custom, but the custom does not extend to the greater London outside. If then a man buys a stolen watch in Fleet street, he may get a good title to it, but he cannot do so if he buys it a few doors off in the Strand. There is, however, a qualification of the rights acquired by purchase even in market overt. When goods-have been stolen and the thief is prosecuted to conviction, the property in the goods thereupon revests in the original owner, and he is entitled to get them back either by a summary order of the convicting court or by action. This rule dates back to the statute 21 Hen. VIII. c. 11. It was probably intended rather to encourage prosecutions in the interests of public justice than to protect people whose goods were stolen.

Having dealt with the effects of sale, first, as between seller and buyer, and, secondly, as between the buyer and third parties,

the act proceeds to determine what, in the absence of convention, are the reciprocal rights and duties of the parties in the performance of their contract (secs. 27 to 37). "It is the duty of the seller to deliver the goods and of the buyer to accept and pay for them in accordance with the terms of the contract of sale" (sec. 27). In ordinary cases the seller's duty to deliver the goods is satisfied if he puts them at the disposal of the buyer at the place of sale. The normal contract of sale is represented by a cash sale in a shop. The buyer pays the price and takes away the goods "Unless otherwise agreed, delivery of the goods and payment of the price are concurrent conditions" (sec. 27). But agreement, express or implied, may create infinite variations on the normal contract. It is to be noted that when goods are sent to the buyer which he is entitled to reject, and does reject, he is not bound to send them back to the seller. It is sufficientif he intimate to the seller his refusal to accept them (sec. 36).

Remedies of Buyer and Seller.—The ultimate sanction of a contract is the legal remedy for its breach. Seller and buyer have each their appropriate remedies. If the property in the goods has passed to the buyer, or if, under the contract, "the price is payable on a day certain irrespective of delivery," the seller's remedy for breach of the contract is an action for the price (sec. 49). In other cases his remedy is an action for damages for non-acceptance. In the case of ordinary goods of commerce the measure of damages is the difference between the contract price and the market or current price at the time when the goods ought to have been accepted. The convenient market-price rule is subordinate to the general principle that "the measure of damages is the estimated loss directly and naturally resulting in the ordinary course of events from the buyer's breach of contract" (sec. 56). Similar considerations apply to the buyer's right of action for non-delivery of the goods (sec. 51). In exceptional circumstances the remedy of specific performance is available to the buyer (sec. 52). Thus the court might order the specific delivery of an autograph letter of an otherwise unrecorded signatory of the Declaration of Independence. The seller's rights are further protected by the rules as to lien and stoppage in *transitu* (secs. 38 to 48).

The sixth and last part of the act is supplemental, and is mainly concerned with drafting explanations, but sec. 58 contains some rules for regulating sales by auction. The practice known as a "knock-out" has since been struck at by the Auctions (Bidding Agreements) Act, 1927, by which it is declared illegal and punishable.

The act of 1893 has been adopted in substance by very many of the colonial possessions, and has been followed in the main by the American Sales Act (U S.A.). (M. D. C.)

C.I.F. Contracts.— These are in a class by themselves. The law governing them is mostly of recent growth and, nearly all of it, case law. They are contracts for the sale of sea-borne goods where the price quoted covers cost, insurance and freight. Hence the name. But the distinguishing characteristic of these sales is this: Performance is effected by tender of the documents in place of the delivery of the actual goods. Indeed, in the business world they are often referred to as sales of documents. By their means the goods are often sold many times over while still afloat; even though the ship be sunk or the goods perish no loss need fall upon the buyer, because he is protected under the policy of insurance effected on the goods or the bill of lading under which they are carried.

The documents are naturally the focus of attention. The seller must tender to the buyer the invoice, the bill of lading and the policy of insurance. On this point the requirements of the English courts are strict. By bill of lading is meant a bill or document attesting that the goods have been loaded on board, not that a shipping company is under contract to carry the goods on a named or subsequent ship. In the United States the practice may be different and the courts there may recognize "received for shipment" bills of lading and similar documents which circulate freely enough in the commercial world. Similarly with the policy of insurance. English law requires the tender of a policy. In the United States certificates of insurance and even more informal records of the contract of insurance are in recognized use. In this respect perhaps English law lags a little behind commercial practice, for certainly these certificates are a great convenience and by special agreement can be regularly employed. But in criticizing the law as it stands it must not be forgotten that other interests besides those of buyer and seller are affected; the banker and underwriter have to be taken into account. The banker for his part has up till now resolutely set his face against the so-called "bill of lading" which gives no certain information as to the whereabouts of the goods.

When the documents are tendered the buyer must be ready and willing to pay the price. He is not entitled to withhold payment until he has had an opportunity of examining the goods. The term "net cash" in a c.i.f. contract means cash against documents. The property passes, if any one general rule can be laid down on the subject, when the documents are tendered. But on this as on other aspects of the sale there is a growing body of law to which it is very difficult to do justice in a general statement. Some of the topics are not altogether free from difficulty. Moreover, though it is a form of contract in use the world over, the law governing it is by no means as uniform as could be wished. Accordingly it has been suggested, though the suggestion has a greater measure of support on the Continent where it originated than in either England or the United States, that attempts should be made to secure uniformity along the lines of the York-Antwerp rules. More doubtless will be heard of the proposal as time goes on. (H. GOT.)

UNITED STATES

The English law, as stated above, gives even in its details a picture of the American law. There is, to be sure, no market overt in the United States; and the American Factors' Acts are not only less broad in scope than the English, but, even with their narrower scope, are found only in a handful of States. Their policy should be compared with that of the statutes requiring filing or recording of chattel mortgages (*see* BILL OF SALE) and of conditional sales (*see* INSTALLMENT CREDIT). Where found, they commonly permit a consignee of goods, whose business also includes selling on his own account, to make an effective pledge of his principal's goods to secure his own debt; but the American law extends such powers to the "intending purchaser" who has secured possession only in a few specific cases, such as (in many States) instalment purchase. It should also be noted that the rule that risk follows title has an exception where title is withheld—as in the instalment purchase—only for securing payment of the price.

The chief divergence of American sales law from that described above has to do with warranties; *i.e.*, the nature of the seller's obligation with reference to the kind and quality of goods sold. The facts which will place some obligation on the seller with reference to quality are substantially the same in both countries. But in the United States, if the seller has undertaken any obligation in this respect, the buyer will, in the majority of States, be entitled not only to damages (the English "warranty") but also (at his election) to return the goods and recover the price (the English "condition"). This rule as indicated, is not universal. The American common law was in some conflict and confusion on the point, and the Uniform Sales Act, incorporating the view just stated, has not been adopted as yet (1928) in 20 of the States.

The long controversy over the buyer's power to return defective goods indicates the extent to which the law of warranty has been a creature of mercantile law, designated to settle disputes about goods between merchants. Of recent years, however, the law of warranty has been put to another striking social use: that of allocating the risks incident, in a highly industrialized society, to the unavoidable use of goods manufactured by persons with whom the user has no direct contact, who may be a "corporation" located in a distant place, Whose methods the user has neither skill nor opportunity to know—but whose efficiency he is forced by the nature of the market to rely upon. Injury in those cases results from a tack or a piece of glass concealed in cake or a can of beans, from the explosion of an automatic water-heater, or from the breaking of an automobile wheel. In such cases return of the goods is not in

question, but only the allocation of the damage suffered. The device of an action for negligence has recently been extended for this purpose; but it seems to be limited to personal injury, as opposed to property damage; and it is obviously ineffective in the many States in which the burden rests on the injured plaintiff of proving the manufacturer negligent in regard to the particular defective article. There is some tendency to shift the burden to the manufacturer where the article is one, which, if negligently made, would be dangerous; *i.e.,* to make an injury due to defect raise a presumption of negligence in manufacture Under this rule the remedy "for negligence" is effective—so effective indeed, as apparently to have given rise to a considerable volume of fraudulent claims. The remedy in negligence, too, may well be extended to any injured purchaser.

But the remedy for the same injury by way of the law of warranty seems in almost all States to be limited to the specific purchaser against his specific seller; it has been held to extend neither to his wife, his child, his employee nor his guest. Nor, under most decisions, will it run against the manufacturer if the plaintiff bought the article not directly from him, but from an intervening dealer. On the other hand, wherever remedy, in warranty is available, it requires no proof of negligence at all: the seller is held to guarantee against dangerous defects in the article. It is clear the situation is one in which the courts are groping toward satisfying a definite social need, and yet one in which the traditional legal devices are only with delay and distortion capable of being made to fill the need.

Documents of Title.--One feature of American law in which wide changes have been worked in recent years requires mention. The old rule that no man might convey goods which he did not own imposes on buyers either a noticeable risk (of having any goods which have been improperly sold to them recovered by their true owners) or a degree of investigation incompatible with rapid turnover. Especially dangerous and impracticable is this in the case of bankers advancing money on the security of goods in warehouse or in transit; a banker's margin of profit is too low to make losses readily compensable, and enquiry into title is in general outside his competence. A practice therefore grew up, in the case of goods in warehouse, of accepting the warehouseman's receipt for the goods, if fair on its face, as full evidence of title to the goods, and of dealing with the receipt as with the goods themselves. The same practice has developed, even earlier, with reference to bills of lading, *i.e.,* carriers' receipts for goods entrusted to their care.

This mercantile custom has now received full warrant at law, in America, in all 28 States which have adopted the Uniform Sales Act (beginning in 1906); also, as to warehouse receipts, in the 48 States which have enacted the Cniform Warehouse Receipts Act (beginning in 1906); in more than half the States, as to bills of lading, and in all bills of lading arising out of interstate shipments, by the adoption of the Uniform Bills of Lading Act by Congress and many State legislatures (beginning in 1909). Sharp distinction is taken under these acts between straight or *non-negotiable* documents, which do not contain a promise to deliver to the *order* of named person, and which can transfer only such rights as the transferor possesses; and on the other hand, *order* or negotiable documents, which do carry a promise to deliver to the order of a named person, and which in general carry to a *bona fide* purchaser (or pledgee) for value all the rights apparent on their face, even though the transferor may have lacked such rights. The English law is to the same effect, and even expressly extends the same rules to policies of marine insurance drawn in proper form All the American uniform acts named above are the work of Prof. Samuel Williston, whose credit in this connection is as great as that of Chalmers in England, and whose text on sales (see *The Law of Sales,* 2nd ed , 1924) promises to remain for a generation the authoritative work on the subject.

(K. N. L.)

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SALEP, a drug extensively used in oriental countries as a nervine restorative and fattener, and also much prescribed in paralytic affections. It is not used in European medicine. It consists of the tuberous roots of various species of *Orchis* and *Eulophia,* which are decorticated, washed, heated until horny in appearance, and then dried. Its most important constituent is a mucilaginous substance which it yields with cold water to the extent of 48%

SALERNO (known in Roman and mediaeval times as Salernum), a small seaport, archiepiscopal see and capital of a province of the same name, about 30 mi. S.E. of Naples, Italy. finely situated at the foot of an amphitheatre of hills. Pop. (1957 est.) 102.614 (commune). The modern town is of little commercial importance, but during World War II it was the landing site for the invasion of Italy by Allied forces on Sept. 9, 1943.

The site was of some strategic significance under the Roman Republic and Empire, but the town was of only secondary importance until mediaeval times. It was dismantled by Charlemagne in the 9th century. Later it became the fortified capital of an independent principality and the rival of Benevento. During the 9th and 10th centuries it was frequently attacked by the Saracens. It was taken in 1076 by the Normans under Robert Guiscard. In 1194 it was sacked by Henry VI., and its develnpment ceased. Salerno revived somewhat in the early 13th century, under Frederick II. (1194–1250), but soon fell into decay. The historic interest of Salerno centres round its medical school, the foundation of which is ascribed to the legendary "four masters"—a Latin, a Greek, a Jew and a Saracen. The legend represents the syncretic cultural influences under which the school arose. In the 10th and 11th centuries the place was a health resort. Under Norman rule the medical element became organized and was profoundly influenced by the work of Constantine the African (d. 1087, *q.v.*), secretary to Robert Guiscard who translated medical works from Arabic into Latin. A contemporary who translated medical works from Greek was Alfanus, archbishop of Salerno. A Jewish element was early in evidence. Under Frederick II. lectures in Hebrew were given at Naples, and one of the most important Latin translators from the Arabic; the Jew, Faraj ben Salim (d. c. 1290), worked at Salerno. The decline of the school dates from 1224, when Frederick II. instituted a university at Naples. The very well known doggerel Latin verses on the preservation of health, known as the *Regimen Sanitatis Salerni,* have been translated into almost every European language. They are addressed to an apocryphal "King of England," usually supposed to be Robert of Normandy, but there is no doubt that the verses are mostly of the 14th century. They are probably, in the main, the work of Arnald of Villanova (1235–1313).

The school is regarded as the earliest university in Europe. It became, in the later middle ages, a place of bogus degrees but survived till 1811, when it was closed by Napoleon.

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SALESBURY or **SALISBURY, WILLIAM** (c. 1520–*c.* 1584), Welsh scholar, was a native of Denbighshire, being the son of Foulke Salesbury, who belonged to a family said to be descended from a certain Adam of Salzburg, a member of the ducal house of Bavaria. who came to England in the 12th century. Salesbury was educated at Oxford, where he accepted the Protestant faith, bat he passed most of his life at Llanrwst, working at his literary undertakings. The greatest Welsh scholar of his time, Salesbury was acquainted with nine languages, including Latin, Greek and Hebrew, and was learned in philology and botany. He died about 1584. About 1546 he edited a collection of Welsh proverbs (*Oll synwyr pen kembero)*, probably the first book printed in Welsh, and in 1547 his *Dictionary in Englyshe and Welshe* was published (facsimile edition, 1877). In 1563 the English parliament ordered the Welsh bishops to arrange for the translation of the Scriptures and the Book of Common Prayer into Welsh. The New Testament was assigned to Salesbury, who had previously translated parts of it. He received assistance from Richard Davies, bishop of St. Davids, and also from Thomas Huet, or Hewett (d. 1591), but he himself did the greater part of the work. The translation was made from the Greek, but Latin versions were consulted, and in Oct. 1567 the New Testament was published in Welsh for the first time. This translation never became very popular, but it served as the basis for the new one made by Bishop William Morgan (*c.* 1547–1604).

Salesbury and Davies continued to work together, translating various writings into Welsh, until about 1576 when the literary partnership was broken. After this event, Salesbury, although continuing his studies, produced nothing of importance.

SALESMANSHIP. Like other skills, salesmanship is based on a body of kno ledge that approaches a science; but a mere knowledge of the principles involved is not sufficient to make a person a good salesman. He must be able to apply these principles with an efficiency gained only by practice. Certain native abilities are helpful, but most of the needed skills can be acquired by any normal person willing to study and practise diligently.

The salesman is a concomitant of the industrial era wherein most goods are manufactured for exchange rather than for use by the maker. The maker himself employs salesmen to sell his product to the middleman, the middleman uses salesmen to sell to other middlemen or to consumers, while some manufacturers sell directly to the final buyers. The production of goods on a large scale usually involves the problem of finding buyers for those goods, because it is cheaper for the salesman to contact several buyers than for each of those buyers to contact several manufacturers. Thus the salesman performs an economic function, imparting to the product time utility, place utility or possession utility. The buyer is willing to pay for these utilities for the same reason that he pays for the form utility imparted by the manufacturers.

In addition the salesman often brings to his customer a fund of helpful suggestions relating to the use of his product or its resale at a profit, thereby still further meriting the payment he receives for his work. With this recognition of the importance of the salesman's work came a marked improvement in his economic and social status.

There are many types of selling and just as many types of salesmen, each of which should be fitted by endowment and training for his particular task. This need for varied abilities makes it possible for nearly anyone to find some sort of congenial sales work. At one extreme is the sales engineer who requires considerable academic training before he receives his specialized education from the company whose product and services he sells. This man must be intelligent and possess a better-than-average personality. At the other extreme may be classed the clerk in a chain store whose duties embrace little more than making change and wrapping parcels. Little education or product knowledge is demanded, and personality traits are not of so great importance.

Between these extremes are found salesmen and saleswomen whose jobs vary widely as to type of employer (manufacturer, wholesaler, retailer), type of product sold (tangible or intangible, specialty or staple), complexity (some jobs are simple while others involve the performance of many functions), personality preferred (some selling demands aggressiveness while other sales jobs are best handled by persons of the type termed by psychologists as "submissive"), repetitive or pioneering (some salesmen call on the same customers at frequent intervals while others are always calling on new prospective buyers), seeking out customers (retail store salesmen wait for customers to walk in while insurance salesmen must seek out their customers), physical vigour required (some selling work is light and easy while other jobs demand great strength and stamina), general difficulty (the greater the difficulties to be surmounted, the higher the rewards to the salesman who can surmount them).

Most salesmen work as part of an organization, not as individual entrepreneurs. This is true whether they work for a manufacturer, wholesaler, retailer or as a door-to-door salesman. An organization implies management of the individuals in that organization, and the head of the sales organization or department is usually called the sales manager.

In a large manufacturing establishment this department may embrace hundreds or even thousands of individuals, and it is divided and subdivided by geographical divisions, by products sold, by type of prospects called on, or by the functions performed by the salesmen. Over each division of the organization is placed a minor sales manager responsible for sales in his jurisdiction and responsible to the man immediately above him in the chain of command.

The management of a sales organization is subject to the same principles that govern management anywhere. Management is management, but the methods used by the sales manager will vary with the manager himself and with the type of salesmen under him. Here are the same extremes as those seen in the political world—the extreme of dictatorship on the one hand and, on the other, a considerable degree of democracy marked by a two-way flow of ideas between the sales manager and salesmen and by a large amount of self-management exercised by the salesmen. The higher the type of salesman involved, the greater the degree of self-government granted him; the lower type of salesman requires more detailed supervision.

The sales manager gives careful attention to such problems as analysis of the market, estimating potential sales, fixing quotas for each territory and salesman, analysis of the product sold, determination of marketing policies, selection of salesmen, their training, assignment to proper duties, their supervision in the field, analysis of their jobs, methods of compensation, stimulation to optimum effort, adequate reports from salesmen, conferences with individual salesmen or with groups varying in size up to a general convention, pensions and retirement programs, and dealings with unions in which his salesmen may hold membership.

In selecting new salesmen the sales manager employs personal interviews, credentials and references, and various psychological tests to determine aptitudes, attitudes and pertinent personality traits. Such tests may forecast with accuracy the testee's probable success, but they have not supplanted the judgment of the manager, based on personal appraisal of the applicant.

After the new salesman is hired, he is usually put through a course of training that may vary from a few days to a couple of years in length, depending on the complexity of the product or service to be sold and on the difficulties in selling it. This training may be accomplished through classroom instruction; trips through or actual work in the factory; accompanying experienced salesmen and watching them operate; coaching in the field by persons trained for such work; or correspondence courses in which the young salesman must study printed lessons and pass examinations on them. Careful training greatly increases the productiveness of salesmen.

Assignment of salesmen to various duties is based on an analysis of the jobs to determine precisely each salesman's duties. A proper job analysis enables the sales manager to choose for each job a man who, as nearly as possible, will fit that job. The result is happier, more efficient salesmen, and a lower rate of turnover

in the sales force.

Most salesmen, like other workers, require some supervision. This may be done in large organizations by men whose status is similar to that of factory foremen, each of whom supervises the work of a group of salesmen. In retail stores the department head or proprietor does this.

Salesmen are paid in a wide variety of ways ranging from a straight time wage or salary to a straight commission on volume of sales. In choosing or devising a method of compensation the sales manager seeks one that will accomplish these objectives: attract the type of salesman he wants, keep him working happily, pay him for doing what the sales manager wants him to do, offer him an incentive to put forth his best efforts, and not be too complicated to understand or too costly to operate. The time wage gives the sales manager the greatest degree of control; the commission offers the strongest selling incentive to the salesman. A combination is often worked out to afford the salesman some feeling of security based on a fixed salary or drawing account on which he can depend even when his sales fall below normal. To this may be added payments or bonuses based on volume of sales, number of new customers, collections made by salesmen, opening of new accounts, etc. Some companies have tried profit-sharing plans for paying their salesmen. but these are hard to compute and the salesman is likely to feel that profits depend too much on others' efforts. Above all, any system of compensation must appeal to the salesman as being equitable.

To stimulate salesmen to greater effort, resort may be had to contests, with attractive prizes for the winning salesmen. Bulletins and house organs are also used to develop and maintain enthusiasm. Salesmen are usually expected to make daily reports on their activities, these reports being used by the sales manager as a basis for determining policies and helping the salesmen who need help.

Unions among salesmen are relatively rare in the United States,. although in some fields the movement had made progress by mid-20th century. Pensions likewise gained in popularity, although many salesmen feel quite competent to make their own provisions against old age.

In learning to be a salesman, a person must master three areas of knowledge. He must learn all he can about the product or service he is to sell; he must study himself and strive to develop a good selling personality; and he must study prospective buyers or prospects so that he may learn what objectives each is seeking and what desires each is trying to satisfy. Only when he has learned this can the salesman intelligently and helpfully demonstrate how his proposition will meet those needs.

The salesman thus becomes a practical psychologist, specializing in motivation. He learns to recognize such buying motives as greed, the urge to feel important, love of family, physical comfort or pleasure, knowledge, imitation, romance, health, caution, love of beauty, and the desire for security. He adapts his presentation to the individual prospect, making it appeal to whichever buying motives dominate that prospect at that time.

To make a sale, the salesman must carry the prospect through five mental stages, viz., attention to the salesman and his proposition, interest in that proposition, desire to possess it, confidence that it will be as represented by the salesman, and finally, action or the decision to buy.

To accomplish this, the salesman himself must often take certain definite steps. The first may be to locate his prospect, a task of vital importance to many specialty salesmen, although one seldom performed by the store salesman. To discover logical prospects the salesman functions as a detective, utilizing many sources of information.

His next step is termed the preapproach or the gathering of information about the prospect — information pertinent to his task. This will include, among other items, the question of which buying motives are most likely to appeal to the prospect; but it embraces also such matters as ability to buy, actual need for the proposition, hobbies, preferences and prejudices in many lines. The preapproach continues even after the salesman and prospect face each other.

Perhaps the next step is the winning of the interview or a chance to tell his story — sometimes a challenging sales project in itself.

Then comes the actual demonstration of his proposition, which is a dual task — to awaken in the prospect's mind a feeling of need and to show how the salesman's proposition meets that need. He utilizes logical reasoning and emotional appeals, usually relying more heavily on the latter; he listens attentively at proper times and displays tact in other ways; he avoids argument; he speaks the prospect's language; he dramatizes his points; he follows a more or less standardized sales talk to insure its completeness and effectiveness; he treats competition firmly but fairly; he meets a variety of objections and questions raised by the prospect, being careful to give them due weight and to avoid becoming involved in a debate; he takes the prospect through the successive mental stages of buying, making certain that he has taken each step before urging him to take the next one.

Finally, the salesman attempts to gain the buying decision or to close the sale. If he is a skilled salesman he has injected into his canvass a number of intimations that the prospect has decided to buy, such suggestions being known as "trial closes." The prospect's reaction informs the salesman as to whether he can safely proceed with the real closing effort. Also, he watches the prospect closely to detect signs of rising interest.

In closing, most salesmen use such proved techniques as obtaining a series of affirmative replies to various questions that lead or add up to the final decision; getting a decision on a minor point as size of order, date of delivery, terms, or colour desired; summarizing the talking points previousiy made; simply asking for the order. He strives to avoid creating an atmosphere of tension. Rather, he seeks to convey the impression that consummating a sale is nothing out of the ordinary for either buyer or salesman. He makes the final decision seem like merely one more in a series of decisions.

After he obtains the order, the salesman strives to take his departure with dignity and poise, leaving the door open for future sales. And finally, he will follow through on the sale to assure himself that the buyer is thoroughly pleased with his purchase. The truly professional salesman always remembers that his ultimate success depends upon the service he renders the buyer.

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SALES TAXES. Sales, excise and commodity taxes refer to taxes levied upon sellers of designated goods and services. When the classes of commodities are defined in tax legislation by broad classes and the tax base is the money value of the things sold, the tax is called a sales tax.

Usually sales taxes are levied upon manufacturers, wholesalers or retailers. When sales taxes are levied upon the services sold by workers, they are very close to income taxes restricted to wages and salaries.

Commodity taxes in one form or another are found in every country, and their use dates back to antiquity. Many small countries employ import duties in place of internal sales taxes because of the administrative convenience of the concentration of goods at ports-of-entry. These duties play much the same role as do internal sales taxes in larger countries. Manufacture sales taxes are limited to countries with important fabricating industries. Canada first imposed such a tax in 1920 and continued it with many modifications.

The federal government of the United States has never levied a tax officially described as a sales tax, but it has levied an assortment of commodity taxes both at the manufacture and the retail levels. Retail sales taxes. widely used by American states, were introduced during the 1930s under the pressure of dwindling revenues from other sources, and they became a main revenue source

for many states. This type of taxation spread to local governments also. In California, all major cities and many minor ones have retail sales taxes.

Great Britain introduced the misnamed "purchase tax" in 1940 as a war measure with differential and high rates, exceeding 100% in some instances. The purpose was to curtail the production of luxury items, permitting an increase in the output of utility items. This wholesale sales tax was continued into the postwar era with a downward modification of rates.

Sales taxes are commonly believed to fall upon consumers by raising the prices paid for taxed items. Sellers who are legally responsible for the tax are, according to this view. simply collectors of the tax from consumers. It is this belief that provides the basis for the claim that sales taxes are regressive, when the burden of the tax is compared with income size. Other explanations have been suggested.

According to some authorities, sales taxes are only partly shifted to buyers; a portion of the taxes rests upon sellers by reducing their money incomes. The degree of shifting to buyers depends upon the character of the market. whether competitive or monopolistic, the nature of the demand for each commodity, and the cost conditions surrounding its production.

Some experts regard sales taxes as falling upon sellers and their suppliers by reducing their money incomes. Such taxes are looked upon as similar to nonsystematic income taxes without exemptions. Buyers pay higher prices for taxed items but pay less for other commodities. suggesting that as a group they do not bear sales or coinmodity taxes. The legislative assumption that consumers pay such taxes in their entirety receives only modest support among economists.

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SALFORD, a city and a municipal, county and parliamentary borough. Lancashire, Eng.. 2 mi. W. of Manchester. Pop. (1961) 154.963. Area 8.1 sq.mi. The parliamentary borough returns two members, for Salford East and Salford West. Salford is a quarter sessions borough.

The borough, composed of three townships identical with the ancient manors of Salford, Pendleton and Broughton, is for the most part separated from Rlanchester by the river Irwell. The main railway station is Exchange station which is connected with Victoria station. Manchester, by one of the longest railway platforms in the world. Salford town hall was built in 1825 and Pendleton town hall in 1866. St. John's Roman Catholic cathedral was opened in 1848. Peel park. formerly Lark hill but renamed after Sir Robert Peel, contains the art gallery and museum and the Royal Technical college (1896). In Ruile Hill park is the natural history 'museum.

The only old building remaining in Salford is Ordsall hall, the ancient seat of the Radcliffe family, which dates from 1350. Kersall cell, the site of a 12th-century Cluniac monastery, was the birthplace of John Byrom (1692–1763). James Joule, the physicist, (1818–89) was born in Salford.

The Flemish weavers settled first in Salford in about 1360, and from that date it has been one of the foremost cotton towns. To the opening of the Manchester ship canal (*q.v.*) in 1894 is due its great commercial importance, for it contains the largest docks on this canal. Ram cotton is imported and among many exports are manufactured cotton and woollen goods. machinery and locomotives. Salford is an important centre for importing timber and also a great distributing centre. It has more than 1,000 factories which include cotton spinning, bleaching and dyeing, brewing, the making of rubber goods and waterproofed fabrics, paper mills and engineering.

Neolithic implements. British urns and Roman coins have been found within the borough. Domesday Book mentions the Great Hundred of Salford (of which Manchester formed a part) as held by Edward the Confessor and covering some 400 sq.mi. At the Conquest it was part of the domain granted to Roger le Poitevin. In 1228 Henry III granted the town an annual fair and market and a weekly market; in 1825 George IV granted two annual fairs and a weekly market. When the corporation bought the market rights they built a new market, on the site of the old cattle market, which was opened in 1939.

In 1230 Ranulf de Blundeville, earl of Chester, granted a charter constituting Salford a free borough and it was administered according to this charter until 1791. In 1267 Salford was granted by Henry III. with all the crown demesne, to his son Emund, earl of Lancaster.

When the house of Lancaster succeeded to the throne their Lancashire possessions were kept separate and Salford remained part of the duchy of Lancaster thereafter. The borough was incorporated as a municipal borough in 1844; Broughton and Pendleton were amalgamated with it in 1853; in 1888 it became a county borough. It was raised to the status of a city in 1926.

SALICACEAE, a family of dioecious trees or shrubs consisting of two genera, the flowers borne in characteristic catkins. The family is essentially characteristic of the north temperate zone of both hemispheres, but *Salix* also extends into the arctic and tropical regions.

Populus, known as poplar (*q.v.*), conservatively estimated to have about 18 species in 1900, had more than 100 additional species proposed in the succeeding half century. *Salix,* known as willow (*q.v.*), has in excess of 1,000 described species, but many of these are probably only forms or varieties and others are hybrids. (*See* also OSIER.) (E. D. ML.)

SALICETI, ANTOINE CHRISTOPHE (1757–1809), French revolutionary, was born at Saliceto, Corsica, on Aug. 26, 1757.

After studying law in Tuscany. he became an *avocat* at the upper council of Bastia and was elected deputy of the third estate to the French states-general in 1789. Later he was elected as deputy to the Convention and voted for the death of Louis XVI. He was sent to Corsica on a mission to oppose counterrevolutionary intrigues. but the success of his adversaries compelled him to withdraw to Provence, where he took part in repressing revolts at Marseilles and Toulon. On that mission he met and helped his compatriot Napoleon Bonaparte.

His friendship with Robespierre led to his denunciation on 9 Thermidor year II, but he was saved by the amnesty of Brumaire year IV.

Saliceti subsequently organized the army of Italy and the two departments into which Corsica had been divided, was deputy to the Council of the Five Hundred and accepted various offices under the consulate and the empire, being minister of police and of war at Naples under Joseph Bonaparte (1806–09).

He died at Naples on Dec. 23, 1809.

SALICIN (SALICINUM), the bitter principle of willow bark, $C_{13}H_{18}O_7$, found in most species of *Salix* and *Populus.*

Salicin is prepared from a decoction of the bark by first precipitating the tannin by milk of lime, then evaporating the filtrate to a soft extract and dissolving out the salicin by alcohol. As met with in commerce it is usually in the form of glossy white scales or needles.

Salicin is neutral, bitter, odourless, unaltered by exposure to the air, soluble in about 30 parts of water and So parts of alcohol at the ordinary temperature, and in 0.7 of boiling water or in 2 parts of boiling alcohol, and more freely in alkaline liquids. It is also soluble in acetic acid without alteration, but is insoluble in chloroform and benzol.

Salicin is used in medicine for the same purposes as salicylic acid (*q.v.*), but is much less effective.

SALIC LAW and other Frankish laws. The Salic law is one of those early mediaeval Frankish laws which, with other early Germanic laws, are known collectively as *leges germanorum.* It originated with the Salian Franks. The Salic law has come down in numerous manuscripts. The most ancient form, represented by Latin manuscript no. 4404 in the Bibliothèque Nationale, consists of 6j chapters. The second form has the same 65 chapters, but contains interpolated provisions. The third text consists of 99 chapters. The fourth version, as amended by Charlemagne, consists of 70 chapters with the Latinity corrected

and without the glosses. The last version, published by B. J. Herold at Easel in 1557 is founded on the second recension.

The law is a compilation, the various chapters were composed at different periods, and we do not possess the original form of the compilation. Even the most ancient text, that in 65 chapters, contains passages which a comparison with the later texts shows to be interpolations. The scale of judicial fines is given in the *denarius* ("which makes so many *solidi"),* and it is known that the monetary system of the *solidus* did not appear until the Merovingian period. Even in its earliest form the law contains no trace of paganism—a significant fact when we consider how closely law and religion are related in their origins. The Romans are clearly indicated in the law as subjects, but as not yet forming part of the army, which consists solely of the *antrustions, i.e.,* Frankish warriors of the king's bodyguard. As yet the law is not impregnated with the Christian spirit; this absence of both Christian and Pagan elements is due to the fact that many of the Franks were still heathens, although their king had bee6 converted to Christianity. (For contrary opinion *see* Franz Beyerle in the *Zeitschrift der Savigny-Stiftung,* xliv, 216 *seq.)* Christian enactments were introduced gradually into the later versions. Finally, we find capitularies of the kings immediately following Clovis being gradually incorporated in the text of the law—*e.g.,* the *Pactum pro tenore pacis* of Childebert *I* and Clotaire I (511–558), and the *Edictum Chilperici* (561–584), chapter iii of which cites and emends the Salic law.

The law as originally compiled underwent modifications of varying importance before it took the form known to us in Latin ms. No. 4404, to which the edict of Childebert I and Clotaire I is already appended. Finally, Charlemagne, who took a keen interest in the ancient documents, had the law emended, the operation consisting in eliminating the Malberg glosses, which were no longer intelligible, correcting the Latinity of the ancient text, omitting a certain number of interpolated chapters, and adding others which had obtained general sanction.

The Salic law is not a political law; it is in no way concerned with the succession to the throne of France, and it is absolutely false to suppose that it was the Salic law that was invoked in 1316 and 1322 to exclude the daughters of Louis X and Philip V from the succession to the throne. The Salic law is pre-eminently a penal code, which shows the amount of fines for various offenses and crimes, and contains, besides, some civil law enactments, such as the famous chapter on succession to private property (de alode), which declares that daughters cannot inherit land.

Of the numerous editions of the Salic law only the principal ones can he mentioned: J. M. Pardessus, *Loi salique* (Paris, 1843), 8 texts; *A.* Holder, *Lex Salica* (1879 *seq.),* reproductions of all the mss. with all the abbreviations; H. Geffcken, *Lex Salica* (Leipzig, 1898), the text in 65 chapters, with commentary paragraph by paragraph, and appendix of *additamenta:* and the edition undertaken by Bruno Krusch for the *Mon. Germ. hist.* For further information *see* E. Mayer-Homberg, *Die fränkischen Volksrechte und das Reichsrecht* (1912); Cl. v. Schwerin, in the *Neues Archiv,* xl, 581 *seq.;* Bruno Krusch, in the *Neues Archiv,* xl, 497 *seq.,* and in the *Nachrichten der Gesellschaft der Wissenschaften zu Gottingen* (1916), 683 *seq.;* E. Heymann and others, in the *Neues Archiv,* xli, 375 *seq.,* 419 *seq.;* Franz Beyerle, in the *Zeitschrift der Savigny-Stiftung,* xliv, 216 *seq.*

The *Lex Ripuaria* was the law of the Ripuarian Franks, whose centre was Cologne. We have no ancient mss. of the law of the Ripuarians; the 35 mss. we possess, as well as those now lost which served as the basis of the old editions, do not go back beyond the time of Charlemagne.

On analysis, the law of the Ripuarians, which contains 89 chapters, falls into three heterogeneous divisions. Chapters i–xxviii consist of a scale of compositions; but, although the fines are calculated, not on the unit of 15 *solidi,* as in the Salic law, but on that of 18 *solidi,* it is clear that this part is already influenced by the Salic law. Chapters xxix–lxiv are taken directly from the Salic law; the provisions follow the same arrangement; the unit of the compositions is 15 *solidi:* but capitularies are interpolated relating to the affranchisement and sale of immovable property. Chapters lxv–lxxxix consist of provisions of various kinds, some taken irom lost capitularies and from the Salic law, and others of unknown origin.

There is an edition of the text of the Ripuarian law in *Mon. Ger. hist. Leges* (1883), v. 185 *seq.* by R. Sohm, who also brought out a separate edition in 1885 for the use of schools. For further information *see* the preiaces to Sohm's editions; H. Brunner, *Deutsche Rechtsgeschichte* (2nd ed., Leipzig, 1906), I, 442; Bruno Krusch, *Die Lex Bajuvariorum, mit zwei Anhängen: Lex Alamannorum und Lex Ribuaria* (1924) 333 *seq.* and *Neue Forschungen über die drei oberdeutschen Leges: Bajuvariorum, Alamannorum, Ribuariorum* (1927) 142 *seq.;* Franz Beyerle, in the *Zeitschrift der Savigny-Stiftung,* xlviii, 264 *seq.*

Lastly, we possess a judicial text in 48 paragraphs, which bears the title of *Notitia vel commemoratio de illa ema (law), quae se ad Amorem habet.* This was in use in the district along the Yssel formerly called Hamalant. The name Hamalant is unquestionably derived from the Frankish tribe of the Chamavi, and the document is often called *Lex Francorum Chamavorum.*

There is an edition of this text by R. Sohm in *Mon. Germ. hist. Leges,* v. 269, and another appended to the same writer's school edition of the *Les Ribuaria. See* also Fustel de Coulanges, *Nouvelles Recherclzes sur quelques problèmes d'histoire* (1891).

(C. PF.; K. A. ECK.)

SALICYLIC ACID, a white, crystalline solid, is used, with its derivatives, in medicines and flavouring agents and in the manufacture of dyes. The largest single use is in the preparation of aspirin (*q.v.*).

Salicylic acid occurs naturally in small amounts in the roots, leaves, blossoms and fruits of many plants. particularly in the oils from various species of *Spiraea.* The methyl ester is widely distributed in nature in the roots, bark and leaves of plants and is the principal constituent of oil of wintergreen from the wintergreen shrub, *Gaultheria procumbens.*

Chemically, salicylic acid is orthohydroxybenzoic acid, HO.C_6H_4.COOH. It crystallizes from hot water in the form of white needles which melt at 159° C., and sublimes without decomposition at temperatures up to 155° C. It is very soluble in alcohol and ether, but soluble in water to the extent of only 1.8 g. per litre at 20° C. and 20.5 g. per litre at 80° C.

Preparation. — Salicylic acid was first prepared by R. Piria in 1838 by treating salicylaldehyde with potassium hydroxide. Until 1874 the only commercial source was the hydrolysis of the methyl salicylate obtained from the bark of sweet birch (*Betula lenta*) or the leaves of the wintergreen shrub.

The general method of large-scale manufacture in the late 1950s was based on the celebrated synthesis discovered in 1859 by H. Kolbe in which phenol (*q.v.*) was treated with carbon dioxide in the presence of metallic sodium. In 1874 the method was modified to the treatment of dry sodium phenate with carbon dioxide at elevated temperature and pressure.

Commercial Preparation.—Phenol and a hot concentrated solution of sodium hydroxide in water are mixed in an autoclave and the solution heated to about 130° C. The resulting sodium phenate is dried by heating and stirring in the autoclave, initially at atmospheric pressure and then under reduced pressure. The dry pulverized sodium phenate is cooled to about 100° C., and continuously stirred while carbon dioxide is admitted to the autoclave under a pressure of approximately 100 lbs. per square inch. After the desired amount of carbon dioxide has been absorbed. the autoclave is heated at about 150° C. for several hours and then cooled. The resulting sodium salicylate is dissolved in water and the solution acidified with mineral acid to precipitate crude salicylic acid, which is recovered by centrifuging and drying.

The crude acid thus obtained is purified by recrystallization and sublimation.

Salicylic acid decomposes at about 200° C. into phenol and carbon dioxide. It develops a violet colour in aqueous solution with ferric chloride.

In its chemical behaviour it undergoes the typical reactions of an aromatic carboxylic acid as well as a phenol. Salts, esters, ethers and acyl derivatives are readily prepared.

Uses of Salicylic **Acid** and Derivatives. — Salicylic acid finds some use as a preservative in nonfood products, but its use in food is objectionable and is unlawful in many countries. Lotions, ointments and powders containing from 2% to 10% of the acid are used in the treatment of skin diseases.

Salicylic acid applied to unbroken skin causes a softening of the horny layer of the epidermis and hence is used as a wart, corn and callus remover.

Large quantities of crude salicylic acid are used in the manufacture of dyes such as monoazo mordant dyes, direct diazo and triazo dyes and mordant-type dyes of the triphenylmethane series.

The sodium salt of salicylic acid, sodium salicylate, is used medicinally as an antipyretic (an agent that relieves fever) and as an analgesic (an agent that alleviates pain), particularly in the treatment of rheumatic fever.

The largest use of salicylic acid is in the preparation of its acetyl derivative, aspirin. which is made by treating the acid with acetic anhydride. Aspirin is widely used both as an analgesic in the treatment of headache, neuralgia. etc., and as an antipyretic in the treatment of colds, flu, etc. The annual world-wide production of acetylsalicylic acid is in the many millions of pounds.

The second largest use of salicylic acid is in the preparation of its methyl ester (synthetic oil of wintergreen). It is made by esterifying the acid with methyl alcohol, sulfuric acid being used as a catalyst. Methyl salicylate is widely used as a flavouring agent in confectionery, beverages, dentifrices, etc. Medicinally it is used externally as a counterirritant in ointments and lotions

Phenyl salicylate. since it absorbs ultraviolet light, has been used in antisunburn creams. It is also used for enteric-coated (protected from absorption until reaching the intestine) pills. Salicylanilide is a fungicide and finds use as a mildewproofing agent for cotton articles.

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SALIENTIA, the scientific term for the amphibian superorder that includes living frogs and toads (order Anura) and ancestral types (order Proanura). Some zoologists relegate Salientia to the rank of order, placing all forms in this group. In such a scheme Salientia becomes practically synonymous with Anura. *See* AMPHIBIA.

SALIERI, ANTONIO (1750–1825), Italian composer, was born at Legnano on Aug. 19, 1750. In 1766 he was taken to Vienna, Aus.. by F. L. Gassmann, who introduced him to the emperor Joseph, His first opera. *Le Donne letterate,* was produced at the Burg-Theater in 1770. Others followed in rapid succession, and his *Armida* (1771) was a triumphant success. On Gassmann's death in 1774. he became *Kapellmeister* and, on the death of Bonno in 1788. *Hofkapellmeister.* He held his offices for 50 years, though he made frequent visits to Italy and Paris, and composed music for many European theatres. His chef-d'oeuvre was *Tarare,* later called *Axur, re d'Ormus* (1787), a work which was preferred by the Viennese public to Wolfgang Mozart's *Don Giovanni.* His last opera was *Die Neger,* produced in 1804. After this he devoted himself to the composition of church music, for which he had a very decided talent. Salieri lived on friendly terms with F. J. Haydn, but was a bitter enemy to Mozart, though the wild suggestion that he actually poisoned him (albeit made the basis of Nicolas Rimsky-Korsakov's *Mozart and Salieri)* has long been scouted.

Salieri retired from office on his full salary in 1824, and died at Vienna on May 7, 1825.

Salieri gave lessons in composition to M. Cherubini and to Ludwig van Beethoven, who dedicated to him his three sonatas for pianoforte and violin, op. 12.

SALII ("dancers"). An ancient priesthood at Rome, consisting of two colleges, each of 12 members! the Salii Palatini and the Salii Collini or Agonenses, connected respectively with the worship of Mars on the Palatine and the Quirinus on the *collis Quirinalis.* They wore armour of an ancient pattern, probably the old war dress of the Italians, and in particular, carried shields called *ancilia,* shaped somewhat like the figure 8. These they carried in procession on certain days of the year, in March (Mars's month) and October (end of the campaigning season under early conditions), singing a very ancient hymn or hymns *(axanzenta,* in honour of all the gods, and separate hymns to single deities, called by their names). They were assisted by women similarly dressed and called *saliae virgines;* these were hired for the occasion in historical times. The whole performance was accompanied with dancing.

All this suggests a war dance, and can easily be paralleled from the customs of uncivilized peoples. But the matter is complicated by a statement of Johannes Lydus, a late and untrustworthy author, that on March 15 a man clad in goatskins and called Mamurius was driven out with rods. This person Lydus identifies with Mamurius Veturius. said to have been the smith who made the *ancilia* after a pattern fallen from heaven. *(See* Joannes Lydus, *De Mensibus,* p. 105. 19 Wünsch.) But the name may mean "old Mars," hence it has been plausibly conjectured that the ritual is at least in part connected with vegetation. the "old Mars" or worn-out spirit of fertility being yearly driven away. As, however; we have no proof that the Salii were connected with this ceremony, it is open to us to suppose, with Georg Wissowa, that it is a mere coincidence of date, and that the name of the skin-clad figure was a popular one only, made up from the unintelligible words *mamuri veturi* in the Saliar hymn.

The balance of evidence certainly is in favour of supposing the ritual of the Salii to have been purely war magic, in its origin at least.

There were also Salii at Tibur, of whom nothing is known (Servius on *Aen,* viii. 285).

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SALINA, a city of central Kansas; U.S., 75 mi. N.W. of Wichita is located on the Smoky Hill river near its confluence with the Saline; the seat of Saline county. Salina is a distribution and trade centre for the great central Kansas wheat-growing area; grain milling is the chief industry and there are extensive facilities for the storage and processing of wheat. The city was founded in 1858 by Col. William A. Phillips; much of its early trade was with Indians and settlers and with soldiers from nearby Ft. Riley. By 1862, however: only about 12 families lived there; the first real growth of the community came with the arrival of the Kansas Pacific (part of the Union Pacific) railway in 1867. The city was chartered in 1870. If has a council-manager form of government, in effect since 1921. Kansas Wesleyan university (Methodist, established 1885), Marymount college (Roman Catholic. founded 1922) and St. John's Military school (Episcopal. established 1887) are among the educational institutions in Salina. Schilling air force base (formerly Smoky Hill air base) is near the city. For comparative population figures *see* table in KANSAS: *Population.* (D. P. G.)

SALINA CRUZ, southernmost port of Mexico on the Pacific coast in the state of Oaxaca at the southern terminus of the transisthmian railway across Tehuantepec. The population in 1950 was 8.243. In the northwestern part of the bay. Salina Cruz lies at the mouth of the Tehuantepec river, and is divided into a free port and a fiscal port. Lying in a hot, semiarid area. Salina Cruz is chiefly a transshipment point for petroleum products from Minatitlan on the north to supply the western parts of Mexico. It also exports coffee. (HD. C.)

SALINAS, a city in western California, U.S., the seat of Monterey county, is situated near the Pacific ocean, about 10 mi. from Monterey bay and less than 100 mi. S. of San Francisco. The city lies on a broad plain which is just above sea level and which extends southward for 50 mi. along the Salinas river, so named because of the salt pools along its lower course. This area is protected by the Coast range and the Gabilans on the east and the Santa Lucias on the west. The original site of Salinas and its growth were determined by the route of the Southern Pacific railroad. Settlement on El Camino Real, now a U.S. highway, began in the 1850s and the town was incorporated in 1874. It adopted the city-manager form of government in 1936. The economy is mostly agricultural, the valley being under irrigation except for the foothills which are used for grazing and dry-land farming. Salinas is the shipping centre for vegetables, including beets, lettuce, celery, broccoli, cauliflower, spinach, artichokes, peas and onions. Some fruits are grown, especially strawberries. The production of sugar beets, once the primary crop, centres around the

largest sugar beet factory in the United States. Many beets are still grown in the valley and tons are also shipped in from adjacent and remote valleys, thereby keeping the factory at high-level production for several months each year. Salinas is the centre of a bulb and seed industry, with experimentation and production possible all year because of the excellent climate and fertility of the soil. It is the home of Hartnell college (1920), a state-supported institution. Salinas is widely known as the home of the annual California rodeo. For comparative population figures *see* table in CALIFORNIA: *Population.* (B. L. B.)

SALISBURY, JAMES EDWARD HUBERT GASCOYNE-CECIL, 4TH MARQUESS OF (1861–1947), British politician, eldest son of the 3rd marquis *(see* SALISBURY, ROBERT A. T. G.-C.), was educated at Eton and University college, Oxford. He entered parliament in 1885 and succeeded to the peerage in 1903. He served in the South African War, and on his return entered the ministry, joining the cabinet in 1903. In the crisis over the Parliament bill he threw in his lot with the "Die-hards." He did not join either coalition government during World War I, but was critical of both, taking an independent line. He gradually came to assume the informal leadership of the conservative opposition first in the house of lords, and afterward in the party generally. In a speech on Oct. 16, 1922, he categorically demanded the freedom of the party. Three days later the policy was accepted at the Carlton Club meeting. He was lord president in the council in Bonar Law's cabinet and in Stanley Baldwin's first cabinet. In Baldwin's second cabinet he was lord privy seal, and from Curzon's death in 1925 until 1929 was leader of the house of lords. He was created K.G. in 1917. He died on April 4, 1947.

SALISBURY, ROBERT ARTHUR TALBOT GASCOYNE-CECIL, 3RD MARQUIS OF (1830–1903), British statesman, second son of James, 2nd marquis, by his first wife, Frances Mary Gascoyne, was born at Hatfield on Feb. 3, 1830. Lord Robert Cecil, as he then was, was educated at Eton and Christ Church, Oxford. His health was delicate and after leaving Oxford, he spent nearly two years at sea on a voyage round the world, visiting Cape Colony, Australia, Tasmania and New Zealand. On his return home he stood for parliament and on Aug. 22, 1853, was returned unopposed as member for the borough of Stamford in Lincolnshire. In the same year he was elected to a fellowship of All Souls.

He married in July 1857, the eldest daughter of Sir Edward Hall Alderson, Baron of the Court of Exchequer, a man of notable parts who at Cambridge had earned the rare distinction of being both Senior Wrangler, Senior Classic and Smith's Prizeman. His daughter inherited his abilities but there was very little money, and to add to his income Lord Robert joined the staff of the *Saturday Review* which had been lately founded by his brother-in-law, Mr. Alexander Beresford-Hope, this being, so far as is known, his only contribution to pure journalism. Most of his writing was done for the *Quarterly Reziew,* whose articles were then exclusively anonymous. The literary quality and vigorous lucidity of his style secured him a welcome in its pages, and of the 24 numbers which appeared between the years 1860 and 1866 there were only three which did not contain an article from his pen. Six of these have since been republished in volume form — three of them biographical essays on Pitt and Castlereagh and three dealing with foreign questions. These were uncompromisingly denunciatory of Lord John Russell's policy and to the study required for an effective presentation of his case may probably be traced his first knowledge of and interest in foreign affairs.

In the House of Commons. — Speeches on the same subjects, and notably one or two in 1864 on the abandonment of Denmark at the time of Germany's annexation of Schleswig-Holstein, placed him for the first time by general consent in the front rank of parliamentary debaters. When Lord Russell's Government was defeated over Mr. Gladstone's Reform bill in 1866, it was a foregone conclusion that he should be among those invited to join Lord Derby's cabinet. His eldest brother had died in 1865 and it was as Lord Cranborne that, in July 1866, he took office as secretary of State for India.

He only held it for seven months. The story of that ministry is well known. In the summer of 1866 the Tory party, assisted by a secession of anti-democratic Liberals. defeated Mr. Gladstone's Reform bill as tending dangerously in the direction of household suffrage. In the summer of 1867 the same party passed a Reform bill which established household suffrage. Lord Cranborne, with two other members of the Cabinet, Lord Carnarvon and General Peel, resigned on Feb. 9, two days before the bill's introduction. The breach was embittered by the tactics which the two leaders employed towards their junior colleagues. They kept them in the dark till within a week or two of the bill's production; offered reassurance in the shape of counter-checks and limitations which were changed with every meeting of the cabinet — and were in fact all abandoned in the course of the bill's passage through parliament — and allowed 'them no opportunity for considered argument. Their belief that there had been a deliberate attempt to hustle them into a consent which it was known that they would not have given freely, estranged them personally from Disraeli for many years afterwards. When the parliamentary fight was over Lord Cranborne accepted the constitutional change as an accomplished fact which it behoved every good citizen to make the best of, and it was the offence against public morality of which he held his party and its leaders to have been guilty that became the theme of an article called "The Conservative Surrender" which appeared that October in the *Quarterly Review.* Its quality and its easily divined authorship procured it a sensational reception. Seven editions of the number which contained it had to be issued in order to meet the demand for it.

On April 12, 1868, his father died and his House of Commons career came to an end. During the six years which followed (1868–1874), Lord Salisbury joined actively from below the gangway in the warfare which his late colleagues waged against Mr. Gladstone's legislation. In 1870 he was chosen chancellor of Oxford university in succession to Lord Derby, — an indication of the reputation which his attitude in '67 had won for him among the more serious representatives of the party outside Parliament. It was a distinction which he always peculiarly prized. When, after the defeat of the Liberals in 1874, Disraeli undertook the formation of his second ministry, almost his first step was to invite the return of this alienated colleague. Under actual conditions there could be no risk of a repetition of his earlier experience, and after a few days of painful hesitation, he accepted. On Feb. 17 he resumed control of the Government of India where a disastrous famine claimed all his energies. By a curious chance a similar visitation had synchronised with his previous brief tenure of office and he had left behind him a high reputation for success in dealing with it.

The first two years of this ministry were uneventful — except in connection with an ecclesiastical measure — the Public Worship Act, introduced in 1874 by Archbishop Tait. Lord Salisbury and his chief took opposite sides upon it. and the momentary clashing of their swords in debate excited some quite unfounded anticipations of ministerial rupture. But in 1876 a crisis arose in the southeast of Europe, one of whose incidental results was to fix permanently Lord Salisbury's destiny in public life.

The Eastern Question. — Two or three of the European provinces of the Turkish Empire had revolted against its misgovernment; there had been a voluminous interchange of notes and protocols among the signatory Powers of the Treaty of Paris; the already autonomous principality of Serbia had taken up arms in support of its co-religionists, and finally the Russian tsar had mobilised his army and declared that, if the rest of Europe did not act, he would. A conference of the Great Powers had thereupon been called to meet at Constantinople in December, to draw up a scheme of reforms and, by securing the Porte's acceptance of it. avert the threatened war.

The repercussion of these events in England had been peculiarly characterized. The insurrection in Bulgaria had been suppressed by Turkish irregular troops with incidents of great savagery. Misled by the optimism of the British embassy at Constantinople, the prime minister — now become Lord Beaconsfield — had poured scorn upon the first newspaper reports of these outrages, and in the impassioned agitation which Gladstone initiated on the

subject throughout the country, the Tory Government became an object for almost equal denunciation with the Turkish sultan.. Salisbury resented the agitation, but was himself admittedly sympathetic with the cause of the insurgent Christians and had privately urged his colleagues to dissociate England once and for all from the incriminated cause of Turkish ineptitude. His views were known or divined and when Beaconsfield invited him to serve as plenipotentiary to the Constantinople Conference, the appointment helped to quiet the prevailing excitement and was received with general acclamation. At first all went smoothly at the Conference; there was no difficulty in obtaining unanimous agreement among the Christian Powers as to the reforms to be recommended. But there success stopped. The Turkish envoys rejected all proposals, and were deaf to every argument. Salisbury would have tried that of force, but his colleagues refused, and on Jan. 20, 1877, the conference broke up and Russia was left to carry out her originally proclaimed purpose.

She declared war on April 24. Throughout the remainder of that year counsels in the British cabinet were divided. The prime minister and Cairns advocated present intervention; Salisbury and Carnarvon opposed a resolute veto to any action which the Turks could construe into acquiescence in their defiance of Europe; and Derby, the foreign secretary, supported them with impartial loyalty. Agreement between the warring groups was obtained for a declaration of neutrality, balanced by a warning addressed to Russia that no attempt on Constantinople itself would be tolerated.

The change of issues foreshadowed in this document materialised in the new year and with it a change in cabinet grouping. The Turkish defence, at first resolute and successful, suddenly collapsed and when the Russian troops in rapid advance appeared upon the threshold of the forbidden city Lord Salisbury was foremost in urging that men-of-war should be sent up to the Bosphorus for its protection. On this decision being taken (Jan. 23), Derby and Carnarvon resigned, though the former was subsequently persuaded to withdraw his resignation.

An armistice was agreed upon and a treaty of peace, negotiated between the two belligerents, was signed at San Stefano on March 3. It provided for a huge Slav State under Russian protection stretching right across the Balkans and completely isolating Constantinople. Russia announced that at the approaching conference of the Signatory Powers required under treaty law to legalize the settlement she would admit discussion on those parts only of the new treaty which were "of European interest." The other Powers hesitated to enforce their rights but England declared that unless the treaty were submitted in its entirety she must decline to participate in the congress; Russia again refused, the summoning of the congress was indefinitely postponed, and when the British cabinet met on March 27 it was to face an imminent probability of war. They called out the Reserves and telegraphed orders for a contingent of Indian troops to be at once embarked for the Mediterranean. Lord Derby resigned the same evening and Lord Salisbury, who had taken a leading part in these decisions, was appointed foreign secretary the following day.

He signalized his accession to control by a despatch whose contents were telegraphed on April 1 to every capital and which became famous as the Salisbury Circular. Its object was to show that the Treaty of San Stefano, by reducing the Turkish Empire to vassalage, would constitute a greater menace to the interests of other Powers than would have arisen from its frank dismemberment in Russia's favour. It was by the treaty as a whole that this result would be achieved and it was as a whole therefore that it must be submitted to the judgment of Europe. This document, by the lucidity of its style and argument, the impression of resolution which it conveyed and the subtly indirect appeals which it contained to the interests or sentiments of the different neutral nations, effected an immediate revolution in the international position. Hesitation disappeared; the rest of Europe ranged itself on the side of the British contention and Russia could do no other than submit.

But danger was not over with the removal of obstacles to the meeting of the Powers. In present conditions a failure of agreement at the Congress itself must precipitate a general war and Salisbury refused to risk that possibility. He entered into private communication with Russia and satisfied himself that the provisions which either side regarded as vital were capable of adjustment. On May 31st a secret agreement was signed between him and the Russian ambassador binding both Powers not to push dispute on these provisions to the point of rupture at the Congress. Russia's price for this adjustment was her retention of her Asiatic conquests, and to counteract the effect of these Salisbury co-incidentally arranged a convention with Turkey. Under this, in consideration of her ceding Cyprus to England and entering into an engagement of administrative reform in Asia Minor, England guaranteed her Asiatic frontier against further aggression.

These preparations having been effected, the Congress, summoned by Prince Bismarck, met at Berlin on June 13. Lord Beaconsfield and Lord Salisbury attended it, and a month later a treaty was signed there by the seven great Powers. It secured all the objects for which England had contended, and when the two plenipotentiaries returned to London Beaconsfield was able to announce that they had brought back "Peace with Honour."

In Opposition.—At the generai election of 1880, the Conservative party was heavily defeated. Lord Beaconsfield died the following spring, and Lord Salisbury succeeded him as leader in the House of Lords, sharing with Sir Stafford Northcote in the leadership of the party as a whole. During this period of opposition and in the election campaign which closed it, he spoke continually on public platforms and developed gifts for attracting and holding mass meetings of working men which hitherto had had little opportunity for display.

In home affairs his attitude was distinguished alike from that of the Tory Democrats of that day and that of the more old-fashioned Toryism. He made no attempt, like the former, to clothe his views in radical or democratic phraseology, but on the other hand he was disdainful of privilege and frankly indifferent to tradition. That the confidence begotten of economic stability and respect for individual rights was of supreme importance to the class whose welfare depends on full and well-paid employment; that theorists and phrasemakers are the enemy, always and everywhere; above all, that unity and mutual trust are the indispensable foundation for all moral and all material welfare in a nation,—mere the recurrent texts from which he spoke. But he demurred to the title of Conservative: "There is much . . . which it is highly undesirable to conserve." He identified himself strongly with the movement for housing reform and in speaking to a bill promoted by a Royal Commission of which he had been a member, he shocked the rigid individualists of his own and the opposite party by his warm advocacy of State expenditure in dealing with the evils of overcrowding.

In 1884 Gladstone introduced a bill for enfranchising two million agricultural voters and divorced it from the large rearrangement of seats which such an unequally distributed addition to the electorate would require. Salisbury saw in this procedure an intention of manipulating the constituencies in a party sense and invited the House of Lords to compel an appeal to the country on the question by refusing to pass one bill without the other. They did so and a tempestuous campaign of protest against their action followed. It was responded to by a similar campaign in their favour, in which Salisbury took a prominent part. The recurrent climax of his speeches was a challenge to the Government to dissolve parliament and so obtain the verdict of the electors on the issue. Through the Queen's mediation the controversy was closed by Gladstone's giving the required guarantee of impartiality in the Redistribution bill by inviting Salisbury and Sir Stafford Northcote to assist in drawing it up.

On June 8, 1885, the Liberals, disorganized by Sudanese disaster, allowed their Government to be defeated on a Budget vote and Mr. Gladstone resigned. The passage of the Franchise Act had made a dissolution impossible until the new registers were completed in November, and there were patent reasons why Salisbury, whom the Queen summoned, should refuse to take office. It would lose for his party all the advantage of attack in the

approaching elections, and it would place on it the invidious responsibility of governing Ireland without the Crimes act, whose necessity it had urged and which was due to expire ihat summer. But the state of affairs abroad which the Queen revealed to him decided Salisbury upon acceptance. England was at that moment without friends or authority in Europe; perennial antagonists—Russia and Austria—France and Germany—had been negotiating reconciliation at her expense; if present conditions were suffered to continue it seemed to him that any catastrophe was possible. He kissed hands as prime minister and foreign secretary on June 24.

First Ministry.—His tenure of office this time was too short for the testing of any policy, but he achieved one sensational success. That September, the southern Bulgarians, who had been left under Turkish rule by the Treaty of Berlin, revolted and proclaimed union with their northern brethren. These and their Prince, Alexander of Battenberg, had in the intervening seven years quarrelled hopelessly with their Russian patron and Russia was now foremost in vindication of the treaty and insistence upon an immediate reversal of the achieved union. A conference of the Powers was called and the rest of the Continent rallied to the Russian demand. Salisbury alone refused. Now that the union had become an accomplished fact, he declared, the Bulgarians would never willingly surrender it and to force surrender, as the Imperial Governments proposed, by means of a Turkish military "execution," was unthinkable. For weeks he was argued with, pressed, objurgated for stultifying the united authority of Europe. He refused to give in and on Nov. 25 the conference broke up. Meanwhile Serbia, outraged at the accretion of territory illicitly secured by her neighbour, had invaded Bulgaria. Her unexpected and crushing defeat by Prince Alexander converted the great Powers to a depressed recognition of the facts upon which Salisbury had insisted. In December he was appealed to for help in discovering some face-saving compromise and the sultan was induced to come to a direct agreement with Prince Alexander, in which the union was recognized. The Treaty Powers had only to acquiesce, while the continental press turned round and congratulated the British minister upon the prescience and firmness which had saved Europe from a disastrous blunder.

Before this settlement was finally consummated Salisbury had left office. The general election in November had resulted in giving the Irish party the casting vote in the House of Commons. In December Gladstone had announced his adhesion to Home Rule and Salisbury's ministry was defeated on an amendment to the address on Jan. 26, 1886. Gladstone introduced his Home Rule bill which, with the assistance of 90 dissident Liberals, was rejected, on June 8. Parliament was dissolved; the Unionists gained a decisive victory though not one giving a majority to the Conservatives independently of their allies. On July 20, the Queen sent for Salisbury who, with her leave, pressed Hartington to take the premiership in his stead. But the Liberal-Unionist chief refused, promising independent support, and Lord Salisbury formed his second Government which remained in power for six years,—1886–92.

Government of 1886–92.—The worst difficulty which it had to encounter was at starting. Lord Randolph Churchill, who was the second man in the ministry and leader in the House of Commons, found himself unable to work with his colleagues, and resigned at the end of the year. The most popular platform speaker in the party, he was at that time without a rival on his own front bench, and the break up of the Government was anticipated. Salisbury again offered to widen its support by retiring in Hartington's favour, and Hartington again refused. But he advised his lieutenant, Goschen, to join the cabinet, which in the end suffered no permanent injury by Lord Randolph's defection. Salisbury, who at the outset had surrendered the foreign office to Lord Iddesleigh, now resumed its direction (Jan. 1887).

England was no longer in the position of dangerous isolation which she had occupied when he took office in 1885. The initiatory approaches which he had then made to the German chancellor had re-established friendly relations between them, and his successful obstinacy about Bulgaria had presented England to Europe as a power that had to be reckoned with. In '86, circumstances all combined to draw her towards the grouping of Central European Powers,—Germany, Austria and Italy as against the Russo-French combination. Russia had been alienated by her resistance to the coercion of Bulgaria, while across the Channel France's growing resentment at her continued presence in Egypt had operated in the same direction. But in 1887 there was an interval of hesitation. Salisbury was repelled by the German chancellor's methods. Throughout the preceding autumn and winter he had been ceaselessly resisting the chancellor's efforts to induce an Anglo-Russian war and so shift the Bulgarian quarrel from Austrian to English shoulders. The menacing pressure with which the chancellor visited any crossing of his wishes by a friendly Power had been a constant source of irritation. Salisbury's wish for a wider choice in friendships expressed itself that spring in a new departure in Egyptian policy. He offered to Turkey—as the suzerain power—an engagement to evacuate Egypt in three years if the conditions for her security permitted and with a right of re-entry reserved. After prolonged negotiation the sultan agreed to sign a convention to that effect (May 22, 1887). But France rejected the proffered compromise with indignation, and under threats of violence from her and Russia the sultan withdrew his consent, and refused ratification. The attempt, though it failed in its main object in a reconciliation with France, was not fruitless. It freed England from further solicitations and intrigues on the score of Egypt. She had made her offer and it had been rejected. Thenceforward, as Lord Salisbury soon made abundantly clear, she would consult only her own judgment as to the period of her occupation.

But France's inveteracy was decisive in determining England's continental friendships for the next ten years. Lord Salisbury declined to give them the character of alliances. In response to insistent requests from the Austrian and Italian Governments, backed by a private letter of strong appeal from the German chancellor (Nov. 22), he that autumn signed an engagement (the Tripartite Agreement, Dec. 10, 1887), to join with them in resisting any future coercion of Turkey on the part of Russia. The chancellor's letter hinted at a more general and binding adhesion to the Triple Alliance and it was followed by other suggestions to the same effect. These were ignored or evaded and more definite proposals met with more definite refusals. In the spring of 1887, Italy had asked for a defensive alliance specifically directed against France and in Jan. 1889 Germany invited a similar compact. Salisbury's answer on both occasions was that an undertaking to fight on an unarrived issue was contrary to the traditions of English policy and was impossible for a Constitutional Government.

To maintain this refusal of the only thing that constituted an alliance in Continental eyes without falling into the pit of national isolation was a difficult problem for diplomacy. Salisbury's large success in solving it during the period of his ministry was due in the main to his avoidance of exaggerated claims and his readiness not only to acquiesce in but actively to assist those of other countries wherever they were in any way admissible. Thus the detachment which must otherwise have become a source of jealousy and suspicion was, time and again, presented in a guise attractive to the needs of other nations. England never occupied a position of greater authority in Europe than during this time, and after Bismarck's retirement in 1890 Salisbury's became the dominating figure among European statesmen.

The white invasion of Africa which signalized that decade afforded opportunity for a marked display of his capacity for international co-operation. It was a movement unique in history for the rapidity, and, it may be added, the human benefit of its achievement. But behind the inrush of explorers, missionaries and traders of all nations, had now come their Governments, whose claims—undefined and illimitable—were, by the end of the eighties, advancing to inevitable conflict. England, whether by earlier occupation or the present activity of her adventurers, was a competitor in every region, north, south, east and west, and Lord Salisbury accepted the initiative to bring order out of chaos which was thus marked out for him. He engaged in negotiations, delimitations, arbitrations, and struck the best bargains he could

for his own clients compatible with an instructed sympathy with their rivals' requirements. With an eye for a future still eight years distant he averted encroachment upon the Nile valley up to the river's source, though no Englishman had as yet set foot south of Wady Halfa, and placated French enmity beforehand by a large complaisance in the west and north-west of the continent. He reasoned suavely with Italy's aspirations and sharply with Portugal's baseless obstruction to the northward advance of Cecil Rhodes' South Africans; and when England's and Germany's irreducible requirements proved incompatible, threw Heligoland into the scales in security of a peaceful settlement (June 1890). When he left office the main outlines of actual occupation and prospective "spheres of influence" had been drawn without the serious chilling of a single international relationship.

The elections of 1892 resulted in a victory for the Liberal party though with a small and unharmonious majority. Gladstone passed a bill for Home Rule and one for Welsh Disestablishment through the House of Commons in successive sessions, but the evident want, of enthusiasm in the country for either measure encouraged Salisbury, in accordance with the principle on which he acted in this connection, to invite their rejection by the House of Lords. The place of the Lords in the Constitution was to secure an appeal to the electorate but they could only wisely assert it against the House of Commons when there were sound reasons to believe that the electorate agreed with them. On this occasion his judgment proved amply justified. Parliament was dissolved in '95 and the verdict of the constituencies ratified the Lords' action by a substantial majority. Lord Salisbury again became prime minister and foreign secretary while the Liberal Unionist leaders established the fusion of the two sections of the party by joining his cabinet.

Third Ministry.—This was in many ways the least satisfactory of Lord Salisbury's four tenures of the foreign office. Since he was last in office the German emperor had quarrelled with England over Far East politics, and never afterwards paid more than lip service to the old friendship. The breach with France was not yet healed, and, though Lord Salisbury's personal authority remained and the influence of his initiative, England was isolated in European sympathy throughout this period. He found diplomacy once more absorbed in the Near East problem as the result of a peculiarly atrocious outbreak of Turkish cruelty and misgovernment in Armenia. After failing in a private proposal to Germany to join in some drastic enterprise—its details are not known—for the dismemberment or subjugation of Turkey, he appealed in 1896 to the Christian Powers as a whole to take combined action for enforcing reform on the Porte. They agreed and accepted his initiative. The "Concert of Europe" succeeded both in this matter and in a subsequent crisis in Crete, in averting the ever-present danger of a breach in the "armed truce" on the continent. But as regarded the lot of the unhappy Armenians it proved a sore disappointment to its author—Russia, who, in the strange whirligig of time, had become the champion of Turkish independences, vetoing, with German support, any form of coercion at Constantinople.

In the summer of 1895 a long-drawn-out frontier dispute between British Guiana and Venezuela achieved sudden importance through the action of the American Government which, with a view to hastening a conclusion, addressed a singularly discourteous despatch to that of England, claiming rights of dictation rather than intervention. Lord Salisbury, after some delay, replied with a reasoned demurrer to such a development of the Monroe doctrine. President Cleveland responded in a fierce speech, foreshadowing ultimatums, and was applauded by his public in a wild outbreak of anglo-phobic jingoism. Lord Salisbury declined the quarrel and some months later, when feelings had cooled, tacitly conceded America's claim to intervene and agreed to defer the whole question to neutral arbitration, whose verdict substantially conceded the British case. (Oct. 1899.)

In the winter of '97–98 a stir of anger was roused in England by Russia's illegal seizure from China of two ports—Port Arthur and Talienwan—which were supposed to secure domination over Pekin, and Lord Salisbury was much censured for passing the aggression by with no more than a diplomatic protest. Events elsewhere called urgently for complaisance. The culminating crisis of the long quarrel with France over Egypt was imminent and Lord Salisbury held that its peaceful issue would depend on her finding no militant encouragement from sympathetic outsiders when the moment came. Colonel Marchand had been for more than three years making his way through the forests of Central Africa with instructions to assert a French claim upon the upper waters of the Nile before England had established an effective occupation there. He succeeded in fact in arriving that July at Fashoda a few weeks before General Kitchener reached it., steaming hurriedly up the river from the battle of Omdurman. Rut the news of the planting of the French flag and that of its removal reached Paris concurrently and with it a telegram from Lord Salisbury announcing the British occupation of the post and warning the French Government and people in the clearest terms that no compromise on England's claim upon the Nile valley was possible. Popular passion, dangerously excited for a few days, was thus compelled in the first moment of its ebullition to face the gravity of the decision to be taken and in the end it suffered its Government, discouragingly advised thereto by its Russian ally, to follow counsels of peace. The episode thus safely passed through proved, in spite of the resentment which it aroused at the time, the close of the quarrel that had so long kept the two nations apart. The resentment was artificially prolonged by the general unpopularity in which England was submerged through the South African war the following year, but when in 1901 that had passed by, the way was left open for the automatic operation of the forces which three years later resulted in the Entente.

The successful conduct of this crisis was Lord Salisbury's last diplomatic achievement of any note. He surrendered the foreign office in Nov. 1900, and the prime ministership in July 1902—only deferring this final retirement to avoid the embarrassment of a change before peace had been concluded in South Africa. He died a year later on Aug. 22. 1903.

Science was his main interest outside his profession and he was also widely read in history and theology. He was a strong churchman and a devout Christian, his religious faith constituting. the fundamental inspiration of his life. (G. Ce.)

See *Speeches of the Marquis of Salisbury,* ed. *H.* W. Lucy, with short biography (188;) and Lord Salisbury's *Essays,* 2 vol. (1905); also F. S. Pulling, *Life and Speeches of the Marquis of Salisbury* (1885); S. H. Jeyes, *Life and Times* of *the Marquis of Salisbury,* 4 vol. (1895–96); G. G. Cecil, *Life of Robert, Marquis oj Salisbury* (1921).

SALISBURY, ROBERT CECIL, 1ST EARL OF SALISBURY (1563–1612), English secretary of state and lord high treasurer, was born on June 1, 1563, the only surviving son of Lord Burghley by his second wife, Mildred, daughter of Sir Anthony Cooke, tutor to Edward VI, and sister to Sir Francis Bacon's mother. (See BACON: FRANCIS.) Robert Cecil was educated at home, probably by his learned mother. and at St. John's college. Cambridge, for an unknown period around 1581. He was given his M.A. in 1605, although he had been lord steward of the university from 1591 and lord chancellor from 1600 until his death. He was admitted to Gray's Inn in 1580, but how long he studied law is not recorded. Probably to broaden his education he visited France in 1584, and accompanied Lord Derby to the Spanish Ketherlands in 1588. He was married on Aug. 31. 1589, to Elizabeth Brooke. daughter of Lord Cobham. After Sir Francis Walsingham's death in 1590, Cecil gradually took over the work of the secretaryship of state; although not formally appointed to that office until July j, 1596. He had been knighted and sworn of the privy council in 1591. He was elected to parliament for Westminster in 1584 and 1586, and for Hertfordshire in 1588, 1592, 1597 and 1601, and was the official exponent of government policy in the house of commons from 1593 until 1603. when he was created Baron Cecil of Essendine, and then in the upper house. Early in 1 j98 he headed a mission to Henry IV of France to try to prevent the inclusion of anything prejudicial to the English or Dutch in the treaty of Vervins between France and Spain. After his father's death in 1598 he became and remained the chief minister of the crown until his own death. His chief rival for the

favour of Elizabeth I was the earl of Essex. When in *1601* Essex was on trial for rebellion he alleged that Cecil had once said that only the Spanish infanta had any claim to succeed Elizabeth. Cecil's denial was supported by the witness Essex named. The incident had an important bearing upon his future because he could now disprove the false rumours which had reached James VI of Scotland that the secretary was hostile to his claims to the English throne. Cecil entered into a secret correspondence with the king and gave him the excellent advice not to plague Elizabeth formally to recognize him as her successor, but to be careful to cultivate her good will. As Cecil expected, James succeeded Elizabeth unopposed and retained her secretary of state as his chief minister.

Cecil was one of the chief examiners of the conspirators in the Gunpowder plot to blow up the two houses of parliament, but the suggestion that he fabricated it in order to enhance his position has been decisively refuted. He was a persecutor of those Catholics who upheld the papal claims'to depose heretical monarchs and release subjects from their allegiance. The test of loyalty for Catholics in the oath of *1606* was willingness or refusal to denounce those claims. His tract entitled *An Answere to Certain Scandalous Papers* (1606), denied that he intended to exterminate all English Catholics. A Calvinist in doctrine but not in church organization he felt that the "turbulent humours" of the Puritans necessitated their coercion. He was not, like his master. an enthusiastic advocate of the union of England and Scotland, but he supported the plantation of Ulster and accepted the barony of Clogher in Tyrone, Ireland, of *12,500* ac. He did not actively participate in the formation of the Virginia company.

In *1604* Cecil was created Viscount Cranborne and the next year earl of Salisbury. In *1608* he became lord treasurer, and found that the king was *£1,000,000* in debt. By new impositions on merchandise and other measures he reduced the debt to *£300,-*000 but could not balance expenditures and revenue. He failed, however, to persuade parliament to accept the Great Contract of *1610.* by which the revenue would have been increased by *£200.000* minus about *£100,000* received from various feudal dues which would be abandoned. He was equally unsuccessful in curbing James's extravagances. In foreign affairs he negotiated peace with Spain in *1604,* but sympathized with the Dutch in their war of independence. When the *12* years' truce was arranged in *1609,* England joined France in guaranteeing the Dutch against any infringement of it by Spain. He did not agree with the king's dreams of preventing wars by marriage alliances between the Catholic and Protestant powers. One of his last services was the betrothal of the Princess Elizabeth to Frederick of the Palatinate.

Salisbury died on May *24, 1612.* (G. Ds.)

SALISBURY, ROLLIN D. (1858–1922), U.S. geologist, was born at Spring Prairie, Wis., Aug. *17, 1858,* graduated from Beloit college in *1881,* and later spent a year in graduate study at the University of Heidelberg, Ger. He taught successively at Beloit college: at the University of Wisconsin and, from *1892,* at the new University of Chicago. From *1899* until his death Aug. 15, *1922,* he was dean of Chicago's Ogden graduate school of science. Salisbury's chief researches were in glacial geology. His early studies made famous the "driftless area" of the upper Mississippi valley. In *1895,* as a member of the Peary Relief expedition, he studied glaciers in Greenland. His most systematic field work was on the Pleistocene formations of New Jersey. In *1904–06* appeared the three volumes of *Geology,* written jointly with T. C. Chamberlin. (*R.* T. Cn.)

SALISBURY, THOMAS DE MONTACUTE, 4TH *EARL* OF (1388–1428), was son of John, the 3rd earl, who was executed in *1400* as a supporter of Richard II. Thomas was granted part of his father's estates and summoned to parliament in *1409,* though not fully restored until *1421.* He was present throughout the campaign of Agincourt in *1415,* and at the naval engagement before Harfleur in *1416* and in 1417–18. During the spring of *1419* he held an independent command, captured Fécamp, Honfleur and other towns, was appointed lieutenant general of Normandy and created earl of Perche. In *1420* he was in chief command in Maine and defeated Maréchal de Rieux near Le Mans. When Henry V went home *(1421)* Salisbury remained in France as the chief lieutenant of Thomas, duke of Clarence. The duke. through his own rashness, was defeated at Baugé on March *21. 1421.* Salisbury came up with the archers too late to retrieve the day, but recovered the bodies of the dead, and by a skillful retreat averted further disaster. He gathered a fresh force, and in June was able to report to the king "this part of your land stood in good plight never so well as now." *(Foedera,* x, *131.)* Salisbury's success in Maine marked him out as John of Bedford's chief lieutenant in the war after Henry's death. In *1423* he was appointed governor of Champagne, and by his dash and vigour secured one of the chief victories of the war at Crevant on July *30.* Subsequent operations completed the conquest of Champagne and left Salisbury free to join Bedford at Verneuil. There his "judgment and valour" won the day.

During the next three years Salisbury was employed on the Norman border and in Maine. After a year's visit to England he returned to the chief command in the field in July *1428.* Against the judgment of Bedford he determined to make Orleans his principal objective, and began the siege on Oct. *12.* While surveying the city from a window in Tourelles he was wounded by a cannon shot and died on Nov. *3, 1428.* Salisbury was the most skillful soldier on the English side after the death of Henry V.

(C. L. K.)

SALISBURY, WILLIAM LONGSWORD (or LONGESPÉE), 3RD *EARL OF* (d. 1226), was an illegitimate son of Henry II. who granted him the estates of Appleby, Lincolnshire *(1188).* In *1198* he received from Richard I the hand of Isabella or Ela (d. 1261), daughter and heiress of William, earl of Salisbury! and was granted this title with the lands of the earldom. He was received with favour by Ring John. who appointed him sheriff of Wiltshire in 1200, and subsequently gave him many important military and diplomatic posts, thus retaining his allegiance during the period of excommunication. In *1213* Salisbury was sent in command of a fleet to attack Philip of France. By his successful action at Damme, he foiled the projected invasion of England, but in the following year he was captured by the French and only exchanged after prolonged negotiations.

On his return to England he supported John in opposition to the baronial party, but feeling that the king's cause was hopeless, he surrendered to Louis on his arrival in England.

After the death of John! Salisbury deserted the French side in *1217,* supported Herbert de Burgh and the young king Henry III and was appointed sheriff of Lincoln. It is asserted by Matthew Parker that he took part in the siege of Damietta (1219), but the evidence in support of this is scanty. It is known, however, that he supported the excommunication of William of Aumble in *1221*; that he assisted in the war on the Welsh marches *(1224)*; and that in *1225* he accompanied the expedition to Gascony. On the return voyage he was wrecked on the isle of *RC;* the hardships which he suffered probably hastened his death, which occurred March 7, *1226,* at Salisbury.

SALISBURY, a city and municipal borough, the chief town of Wiltshire, Eng., *23* mi. W. of Winchester and *83* mi. W.S.W. of London by road. Pop. *(1961) 35,471*; area *4.4* sq.mi. The city lies in the valley at the junction of the Avon, Wylye, Nadder and Bourne. The cathedral stands out above the city, which is partly laid out in squares called the Chequers. To the north rises the bare upland of Salisbury plain. The neighbourhood of Salisbury was one of the most important areas in prehistoric England and was a meeting place of early cultures: *e.g.,* the Beaker peoples and the megalith builders; *6* mi. N. is Stonehenge (*q.v.*). The Salisbury: South Wilts and Blackmore museum in the city has exhibits of almost every age from the neighbourhood.

Old Sarum.—Most intimately associated with the origins of Salisbury is the great prehistoric fortress of Old Sarum, about 2 mi. N. of the centre of the city. The great mound has a fosse and earthwork; the summit is hollowed out like a crater and its rim surmounted by a rampart. The outer earthworks probably date from the Iron Age. It was an important site in Romano-British times and especially in the period immediately preceding the arrival of the Romans. It was known to the Romans as Sorviodunum. In 552 it was taken by Cenric, who named it Searobyrg, and it became the home of the kings of Wessex.

About 1075 Old Sarum became the seat of a bishopric, transferred there irom Sherborne. Osmund, the second bishop, compiled a missal which iorms the groundwork of the celebrated "Sarum Use." The "Sarum Breviary" was printed at Venice in 1483, and upon this, the prayer books of Edward VI were mainly based. Osmund also built a cathedral, in the form oi a plain cross (1078–92). The garrison and priests were perpetually feuding, and in 1217 the dean and chapter complained to Pope Honorius III, who granted a licence enabling the priests to move to the Avon valley. In 1220, under Bishop Richard Poore, work on the new cathedral was begun. With the building of New Sarum in the 13th century and the transference to it of the see, Old Sarum lapsed to the crown. By the end of the 15th century it was abandoned and in 1608 the town walls were demolished.

New Sarum.—The new city, New Sarum (New Saresbury, Salisbury), immediately began to spring up around the cathedral. A charter oi Henry III created it a free city in 1227. In 1611 the city obtained a charter under the title of "mayor and commonalty" of the city of New Sarum.

The Cathedral.— The cathedral church of St. Mary is a beautiiul example of Early English architecture, begun and completed! save its spire and a few details, within one briei period (1220–1265). It was consecrated in 1258. There is a tradition that Elias de Derham, canon of the cathedral (d. 1245), was the principal architect. The spire, the highest in England, measures 404 it. The building is 473 it. long (the nave being about 228 it. and the choir 220 it.). (For plan, see GOTHIC ARCHITECTURE.) The cathedral consists of a nave of ten bays, with aisles and a lofty north porch, main transepts with eastern aisles, choir with aisles, lesser transepts, and presbytery. The Lady chapel is the earliest part of the original building. The two upper stories of the tower and the spire above are early Decorated. The west front bears in its rich ornamentation signs of the transition to the Decorated style. The irequent use of Purbeck marble ior shafts contrasts with the delicate gray ireestone, the principal building material. An unhappy restoration (1782–91) destroyed many magnificent stained-glass windows which had escaped the Reformation, and also removed two Perpendicular chapels and the detached belfry which stood to the northn-est. The cloisters were built directly aiter its completion. The fine octagonal chapter house is of the time of Edward I with a series of contemporary sculptures. The library contains valuable manuscripts including a copy of *Magna Carta*. The diocese covers most of Dorset and Wiltshire, and a number oi parishes in Hampshire, Berkshire, Somerset and Devon.

The City.—There are three ancient parish churches: St. hlartin's, with square tower and spire, and possessing a Norman font and Early English portions in the choir; St. Thomas' (oi Canterbury), iounded in 1240 as a cathedral chapel, and rebuilt in the 15th century; and St. Edmund's, iounded as the collegiate church of secular canons in 1268, hut later rebuilt in the Perpendicular period. St. John's chapel, founded by Bishop Robert Bingham in the 13th century, is occupied by a dwelling house. There is a chapel attached to the St. Nicholas hospital. The poultry cross, or high cross, an open hexagon with six arches and a central pillar, was erected by Lord Montacute before 1335.

SALISBURY, the capital city of the Federation of Rhodesia and Nyasaland and of Southern Rhodesia. is situated in the north-eastern part of Southern Rhodesia: at an altitude of 4,865 ft. above sea level. The climate is'temperate, the average mean annual temperature being 65° F., and the average annual rainiall 31.92 in. Greater Salisbury comprises the city and numerous adjoining satellite towns. The population of Salisbury in 1956 was 225,750 (including 61.930 Europeans, 2,043 coloured, 1,777 Asians and an estimated 160,000 Africans).

Salisbury was iounded on Sept. 12, 1890, and named aiter the British prime minister, Lord Salisbury. Chartered in 1935, it is well laid out. with tree-lined avenues and, in the business and governmental centre, many multistoried buildings. Pearl .Assurance house and Robinson house, standing 205 it. and 163 ft. high respectively, are the tallest. The main streets run irom north to south and irom east to west. Notable buildings include the Anglican and Roman Catholic cathedrals, the Dutch Reiormed church, the Queen Victoria Memorial library and the town house. Adequate educational, medical, recreational and cultural facilities have been established. The Central African archives: the multiracial University of Rhodesia and Nyasaland, opened in 1957, and the National Art galleries are in the city. The Salisbury gardens and Cecil square are the chiei parks. Salisbury is on the main rail, road and air routes of Africa. The international airport is situated at Kentucky, close to the city. The city is the centre ior the agricultural industry of Southern Rhodesia, of which Virginia tobacco is the main crop. A gold-mining area also surrounds it. Secondary industries range irom clothing iactories to steel foundries. (F. J. LT.)

SALISBURY, a city of North Carolina, U.S., the seat of Rowan county, is located 120 mi. W.S.W. of Raleigh in the rolling countryside of the industrial piedmont section midway between Charlotte and Greensboro. The town's tree-lined streets dotted with ante-bellum homes are reminiscent of colonial times when Salisbury was one of the six largest boroughs in the colony. Settled by Scotch-Irish and Germans in the mid-18th century and named for Salisbury, Eng., it was laid out in 1753 as the county seat. It was incorporated in 1755, chartered in 1770 and has been city-manager governed since 1927.

Daniel Boone lived with his parents nearby from 1755 until 1767, and Andrew Jackson received his licence to practise law there in 1787 after studying for a year under Judge Spruce Macay. The British general Cornwallis pursued Gen. Nathanael Greene through Salisbury in Feb. 1781, just prior to the battle of Guilford Courthouse, and a small action occurred at Trading Ford 6 mi. E. During the American Civil War a large Confederate prison was established in an old cotton mill which housed, in the latter months of the war, 10,000 Federal prisoners of which about 6,000 died of starvation and disease. A national cemetery now marks the place where these unknown soldiers were buried in several long trenches.

Salisbury has been sustained historically by the textile industry and. during the first half of the 20th century, by major repair shops of the Southern Railway, since abandoned. There has been marked diversification in small industries, and remarkable growth of livestock, small grain farming, and dairying activity in the immediate area A 1.000-bed veterans hospital was completed there in 1953 Catawba college (1851) and Livingstone college (founded as Zion Wesley Institute in 1879) bulwark the town's cultural life. For comparative population figures see table in NORTH CAROLINA: *Population.* (JA. S. B.)

SALISH (FLATHEAD), a linguistic group of Indians, all speaking cognate dialects, in British Columbia and northwestern United States. The coast Salish had patrilineal clans practised potlatch festivals. accumulated wealth, held slaves and lived in plank houses like the other coastal tribes of the area. The arts and customs of the inland Salish were simpler. The principal groups or tribes are: (1) interior Salish. comprising the Shuswap. Lillooet. Thompson or Ntlakyapamuk, Okanagan in British Columbia, and the Flathead or Salish proper, Kalispel, Coeur d'Alêne, Spokane, Methow in the United States; (2) coast Salish, in order from north to south: Bellacoola of Dean's inlet. Comox, Cowichan of Vancouver Island. Nanaimo. Squawmish, Lummi, Snohomish, Snoqualmie (Seattle), Puyallup, Nisquallie, Conlitz, Skokomish, Songish. Clallam of Strait of Juan de Fuca. Quinault. Chehalis, and, south of Columbia river, Tillamook (called also Nehalim). In 1950 there were about 23,000 Salish. See also INDIANS, NORTHWEST COAST.

SALIVAN, a little-known South American Indian linguistic family, sometimes called Macuan and possibly related to Piaroan. The Salivan-speaking tribes lived along the Orinoco river in Venezuela. They had a hunting-fishing type of economy supplemented by the cultivation of root crops such as manioc. Like other tropical forest tribes, they were expert at extracting the poison from bitter manioc to make it edible. In the latter part of the 17th century they suffered from the depredations of the Carib Indians.

See also SOUTH AMERICA: *Ethnology: The* Tropicul Forest Tribes; SOUTH AMERICAN LANGUAGES.

SALIVARY GLANDS are certain glands, located in the mouth, that secrete saliva, a substance whose chief functions are to moisten and soften food and to keep the mouth moist. Saliva also contains a digestive enzyme and thus takes part in the chemical as well as the mechanical digestion of food. Numerous glands in the walls of the oral cavity pour their secretions into the mouth (*q.v.*); they are lodged in the submucosal tissue of the lips. cheeks, gums, tongue and palate. They are numerous in the lips. less so in the cheeks; the lingual glands are richly distributed at the base and lateral margin of the tongue and on the undersurface on each side of the frenulum. The glands of the roof of the mouth make up a large portion of the palatal mucosa and submucosa.

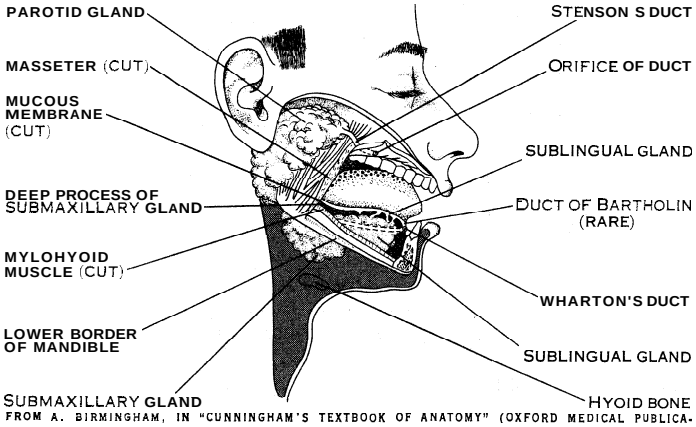
In addition to the above-described glands. which are intrinsic to the mouth cavity, there are three larger pairs: the salivary glands proper. They are the parotid, the submaxillary and the sublingual.

Anatomy.— Parotid.— Theparotid gland is the largest of the salivary glands and is situated between the ear and the ascending branch of the lower jaw. In cross section it is roughly triangular. The parotid is molded into the shape of a prism or wedge by the structures that bound the pit in nhich it is lodged. In front. the

gland embraces the ascending branch of the lower jaw; behind, it is delimited by the external opening of the ear, the styloid process of the temporal bone and the sternocleidomastoid muscle; on the deep (internal) aspect it approaches the wall of the pharynx; on the superficial (external) aspect it is covered by fascia prolonged upward from the platysma muscle of the neck. The gland is disposed in two partly overlapping leaves that are continuous behind at a so-called isthmus. The branches of the facial nerves course forward between these leaves, as do also branches of the external maxillary artery and tributaries of the external jugular vein. Accessory glandular masses are fairly common. They are likely to be situated above the parotid duct,-sometimes partly overlapping it. The parotid duct terminates in a minute orifice. opposite the second molar tooth of the upper jaw. The parotid duct (Stensen's duct) crosses the upper part of the masseter muscle and then pierces the buccinator muscle on its way to the mouth; it is about two inches long.

Submaxillary.—The submaxillary gland lies deep to the posterior half of the body of the lower jam; it is about the size of a walnut. The facial artery is embedded in the upper part of the gland. The submaxillary duct (Wharton's duct) runs forward to the sub. lingual papilla.

Sublingual.—The sublingual gland is placed farther forward



FROM A. BIRMINGHAM, IN "CUNNINGHAM'S TEXTBOOK OF ANATOMY" (OXFORD MEDICAL PUBLICATIONS)

THE SALIVARY GLANDS AND THEIR DUCTS. WITH THE GREATER PORTION OF THE BODY OF THE MANDIBLE REMOVED TO SHOW THE SUBLINGUAL AND THE DEEPER PARTS OF THE SUBMAXILLARY GLANDS

than the submaxillary; it is like an almond in shape though larger; its outer flattened surface rests against the lower jaw; its ducts are small and numerous.

Embryology.— Thesubmaxillary and sublingual salivary glands develop embryologically as solid outgrowths of the buccal epithelium that are canalized later, while the parotid appears first as a groove. The parotid is ectodermal in origin, all the others entodermal.

Diseases.—Among the diseases of the salivary glands is xerostomia. This rare condition, the result of arrested or diminished secretion of saliva (aptyalism), is of nervous origin. It probably is allied to the deficient secretion of saliva actuated by fear in ancient trials by ordeal. Dryness of the mouth in fever and in belladonna poisoning. though equally due to deficient secretion of saliva, is not included under the term.

Excessive salivation results from the action of certain poisons (*e.g.*, mercury, potassium iodide) and accompanies many diseased conditions of the mouth. In cancer of the tongue, floor of mouth, cheek or gingival border, salivation is one of the most distressing symptoms. Mercurial salivation disappeared largely after modern methods of treating syphilis were introduced, and at present is mainly the result of industrial conditions.

For the functions of saliva in digestion, see DIGESTION. See also ENZYMES; MOUTH.

See J. B. Erich, "Diseases of the Mouth, Salivary Glands and Pharynx," in R. L. Cecil and R. F. Loeb (eds.), Textbook *of* **Medicine,** 9th ed (1955). **(W. S. L.-B.; B. J. A.)**

SALIX, the genus name for the trees and shrubs comprising the willows and osiers (*qq.v.*).

SALK VACCINE: see INFANTILE PARALYSIS.

SALLÉ, MARIE (1707–1756), French dancer of extraordinary grace, elegance and dramatic power. was the first woman choreographer. She was also first to unify music. costumes and dance style with the theme of a ballet (Pygmalion, produced in London, 1734).

After childhood appearances in England, Sallé studied under Françoise Prévost, who sponsored her Paris opera debut in 1721. Never a virtuoso, Sallé was noted for her sensitive acting ability. As early as 1729, she had her partner discard the mask traditionally used by male dancers (and only formally abolished about 1770) to permit interplay of facial expression when they appeared together in the duet Les Caractbves de la Danse.

Sallé's greatest success was achieved in London, where she danced in Handel's operas and created, besides *Pygmalion,* the brilliant solo Les Cavactbves de *L'Amour* and a ballet. *Bacchus and Ariadne,* which revealed her power as a tragic actress.

Returning to Paris, she danced the rose in J. P. Rameau's Les *Indes* Galantes, and attained great distinction as Hébé in Castor et *Pollux.* In 1740 Sallé retired from the opera, but continued to appear at French court performances until 1752. She was painted by Nicolas Lancret.

See Émile Dacier, *Mlle. Sallé* (1909). (LN. ME.)

SALLUST (GAIUS SALLUSTIUS CRISPUS) (86–C. 34 B.C.), Roman historian and one of the great Roman literary stylists. He came of a plebeian family from the Sabine town of Amiternum. After a gay youth in Roman society he took up public life to obtain the quaestorship and enter the senate. His intellectual energy and personal ambition brought him into conflict with Pompey and the nobles. As tribune of the people (52) he was among those who bitterly attacked Cicero during the trial of the political agitator Milo. A freedman of Pompey, Lenaeus. satirized him for his criticism of the great man. It was doubtless for political reasons as well as on grounds of vice that in 50 he was removed from the senate. Caesar made him quaestor again in 49 so that he regained senatorial standing. In the Civil War he commanded a legion in 48. without distinction, and failed to control mutinous troops in Campania in 47, but as praetor in 46 he rendered Caesar valuable service in Africa and fought at Thapsus. For this he was renarded with the aroconsular governorship of Africa Nova. His administration of the province laid him under prosecution for extortion. Although he escaped conviction, he had become wealthy enough to build a magnificent mansion and gardens in Rome—the horti *Sallustiani*—and to retire from public life and devote himself to history.

The Cattltnae *Coniuratio* (or *Bellum* Catilinae), a study of Catiline's attempt at revolution (63). appeared in 44, and was followed by the *Bellum Iugurthinum,* which treated the war with Jugurtha in 111–106; both monographs survive complete. Then the *Historiae* in five books took up the events of 78–67, as a sequel to the work of L. Cornelius Sisenna; but only fragments (including speeches) remain. Sallust conceived the history of his age in terms of political degeneracy. which set in after the destruction of Carthage in 146. The war with Jugurtha. in his view, revealed the corruptness of the nobles, successfully challenged by popular leadership under Marius, despite his faults; Sulla intensified the troubles of the state, and after him both the nobles and Pompey proved unworthy to govern; the subsequent moral chaos threw up Catiline. His judgment involved an ideal of public morality, which declined through ambition, avarice and luxury, and this he expounds in his prefaces. Some critics have considered him a mere party propagandist who chose to arite about Catiline in order to create an opportunity to exonerate Caesar from charges of complicity in the plot and who chose his ground in the other works so as to attack the senatorial regime; but his real scope is wider. and he castigates not only the nobles but their rivals. His prefaces are not merely platitudinous; they provide the key to his selection of material. His conception, in fact, represents the political issue between the nobles, who regarded birth as the qualification for leadership, and the popular leaders, who—as Marius states in the *Jugurtha*—held that ability estab-

lished the right to rule. He applies this test of "Roman virtue" against the nobles, stressing it by his very praise of Cato, but equally against their unscrupulous rivals, apart from Q. Sertorius and Caesar. His analysis is too penetrating to be merely partisan —whatever secondary motives he had—but it is historically rigid. Rome was more unsettled before 146, less venal in 111, than he admits. His setting of Catiline's conspiracy may exaggerate its significance. just as it reduces the part of Cicero. His pattern of generalization led to chronological errors in detail.

As a stylist and in his generalizations about events Sallust shows the influence of Thucydides — with a Roman interest in typical personalities. What he grasps politically, he depicts dramatically, with an eye for a historical scene. In applying traditional standards he had recourse to the elder Cato. whose robust archaic style he consciously imitated. But he has a mordant, aggressive power of expression, which is his own. His style is an artificial creation —he took professional advice over it—and he fuses archaism with rhetoric, common speech with conventional vocabulary, under the pressure of a syntactical technique that used asymmetry and antithesis to point his distinctive anaiysis. The form of his language represents the character of his thought, as he conceived his theme. Occasional obscurity is the price for a powerful severity: his reward was to inspire Tacitus.

Doubtful Attributions. — Certain anonymous pieces in Sallust's historical style, which appear alongside his work in the manuscripts, have been dubiously attributed to him. An attack on Cicero (*Invectiva* in *Ciceronem*) in terms of the year 54 seems certainly spurious. Of two letters addressed to Caesar (*Epistulae ad Caesarem senem de re publica*) the first reflects conditions in 46. the second those in 49 (if not in 51 or 50). Both appear well-informed, but standard histories could have provided the material; and the second letter contains anachronisms that mark it as a later work. Stylistic comparisons may be deceptive. because Sallust was a likely object for imitation. In an age of literary conventions he would hardly have composed an "open letter" in his archaic historical style. In any event he had probably not evolved it before 45, and so even the first letter falls under suspicion.

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SALMASIUS, CLAUDIUS, Latinized name of CLAUDE SAUMAISE (1588–1653), French classical scholar, born at Semuren-Xuxois in Burgundy on April 15, 1588. He was educated at Paris and Heidelberg, where he went over to Protestantism. In 1609 he brought out an edition of Florus. He then returned to Burgundy. In 1620 he published Casaubon's notes on the *Augustan History,* with copious additions of his own. In 1629 Salmasius produced his magnum opus as a critic, his commentary on Solinus' *Polyhistor,* or rather on Pliny, to whom Solinus is indebted for the most important part of his work. Salmasius learned Arabic to qualify himself for the botanical part of his task. In 1631 he went as professor to Leiden, where he composed for Frederick of Nassau his *De Re Militari Romanorum,* not published until 1657. He was persistently attacked by a clique led by Daniel Heinsius. His *De primatu Papae* (1645) excited a warm controversy in France.

In Nov. 1649 appeared his *Defensio regia pro Carolo I.* It is not known who influenced him to write it but Charles II defrayed the expense of printing and presented the author with £100. The first edition mas anonymous, but the author was universally known. This celebrated work, in modern times principally famous for the reply it provoked from Milton (1651). even in its own time added little to the reputation of the author. His reply to Milton, which he left unfinished at his death and which was published by his son in 1660, is insipid as well as abusive. Salmasius died on Sept. 3, 1653.

SALMERÓN, NICOLÁS (1838–1908). Spanish statesman, born at Alhama la Seca. Almeria. April 10. 1838. Professor of literature and philosophy at Madrid. he co-operated with Castelar on *La Democracia* and in 1865 was a member of the directing committee of the Republican party. Imprisoned as a suspect in 1867. he was elected to the *Cortes* in 1871 and on the resignation of Xmadeo (Feb. 11. 1873) was naturally marked out to be the leader of the party which sought to establish a republic in Spain. He succeeded Pi y Margall in the presidency of the republic on July 18. 1873, but resigned (Sept. 7), when he found that the generals insisted on executing rebels taken in arms. His successor, Castelar. was compelled to restore order by drastic means. Salmerón took part in the attack made on him in the *Cortes* on Jan. 3, 1874, and went into exile until recalled by Sagasta in 1881. In 1886 he was elected to the *Corfes* as Progressive deputy for Madrid He died at Pau. Sept. 21, 1908.

SALMON, THOMAS WILLIAM (1876–1927), U.S. physician and psychiatrist. was born in Lansingsburg. N.Y.. on Jan. 6, 1876. In 1899 he took his degree in medicine at the Albany Medical college and then entered private practice for a short time. Two years later he was appointed to the Willard (N.Y.) State hospital nhere he made one of the earliest studies of the role of human beings as disease carriers. In 1903 he was commissioned in the U.S. marine hospital service (now U S. public health service) and in 1905 undertook an assignment in conjunction with the immigration office' at Ellis Island. New York state authorities had become alarmed at the prevalence of foreign born among patients admitted to state hospitals. and under Salmon's direction, a psychiatric service mas incorporated into the regular medical department at Ellis Island. When the federal immigration lam was in process of revision, his aid was requested at congressional hearings, and much of his advice was incorporated into the new law. In 1915 Salmon became medical director of the newly formed National Committee for Mental Hygiene. in which capacity he gave practical guidance toward the extension of hygiene knowledge and the applications of psychiatry to public welfare. The second most outstanding achievement of his career was his role in establishing neuropsychiatric services for the armed forces during World War I. After the war, he provided plans for model hospitals to care for mentally disabled veterans. In 1921 he became professor of psychiatry at Columbia university, where he virtually established that field of study on an independent basis. He died on Aug, 13. 1927.

SALMON AND SALMONIDAE. The family Salmonidae, as understood in modern ichthyology, consists of three principal groups of fishes. which will be referred to here as the salmon. the trouts and the chars (*qq.v.*). Formerly the lake herrings or ciscoes and the whitefishes, also. were included. However, the last mentioned groups. having larger scales and a skull that differs in structure. now are generally assigned to a separate family called Coregonidae.

The Salmonidae have robust, somewhat-rounded, muscular bodies. The skeleton is bony. and the fins have soft rays only. The lower pair of fins, the ventrals. are attached to the abdomen, far behind the upper pair, the pectoral fins. A fleshy fin, without rays, is situated on the back behind the larger dorsal fin. and the caudal fin usually is more or less concave or forked. The entire body, exclusive of the head, is covered with small smooth-edged scales, of which more than a hundred are present along the middle of the side.

These fishes are more or less midway in zoological classification between the sharks with their primitive cartilaginous skeleton and the higher fishes such as the basses and cods with a complex tony frame. In colour the Salmonidae are greatly specialized, however. since many of them rival the most brilliant productions

of the tropical seas.

Nearly all the members of the family live in the northern part of the northern hemisphere and are largely restricted to coastwise waters, neighbouring islands and the inland waters of North America. Europe and Asia. Only a few have spread naturally beyond this range. as in the Atlas mountains of northern Africa. However, several species have been widely distributed and have become well established far beyond their natural range by the help of man.

Virtually all Salmonidae make some sort of migration to spawn. Those that live habitually in fresh water may ascend the stream they occupy only a short distance; inhabitants of lakes migrate somewhat farther as they ascend the streams; while those species that live chiefly in the sea make long migrations, to and in fresh-water rivers. some of which are exceedingly great as shown subsequently. Salmonidae are carnivorous, and normally feed on live bait. Fish, crustaceans and many insects are included in the diet.

The Salmon. — The name, salmon, when used herein as a group name is restricted to the several species of the Pacific belonging to the genus *Oncorhynchus.* This is done, notwithstanding that the name salmon was used for the anadromous species of the genus *Salmo* long before it came into use for the members of the genus *Oncorhynchus.* No other common English name is available for *Oncorhynchus,* whereas most of the species of the genus *Snlmo* have long been known as trout. Therefore, the common Atlantic salmon (*Salmo salar*), and its relatives, will be discussed in this article under the general group name) see *The Trouts* below.

The salmon, as defined in the preceding paragraph, differ externally from the trouts and chars in the size of the anal fin. In the salmon this fin is longer than it is high and has 13 or more developed rays. whereas in the trouts and chars it is higher than it is long and has fewer than 12 developed rays.

Five commercially important species of salmon of the genus *Oncorhynchus* occur on the Pacific coast of North America and northern Asia, with a few more. restricted to Japan and vicinity. These fishes are the source of the large annual pack of canned salmon shipped to virtually all parts of the world, and constituting a familiar article of diet to many millions of people. The catch for the United States and Canada totaled approximately 437,000,000 lb. in the mid-1950s. Of this amount the United States contributed about 324,000,000 lb. and Canada contributed about 113,000,000 lb. Alaska, the leading state in salmon catch contributed about 80% of the U.S. total.

The five important species of salmon are the Chinook or king salmon (*O. tschawytscha*), the largest, occasionally attaining a weight of 70 to 100 lb., though the average probably does not exceed 20 lb.; the chum or dog salmon (*O. keta*). generally weighing 7 to 10 Ib.; the silver salmon (*O. kisutch*) and the sockeye or blueblack (*O. nerka*), both weighing about 5 to 8 lb.; and the pink or humpback salmon (*O. gorbuscha*) averaging about 3 to 5 lb. in weight. The smallest of the five species exceeds every other species in the percentage of the total catch, and the largest supplied the least.

Even though the greater part of the catch of salmon came from Alaska, as has been the case for many years, the total catch has declined gradually but impressively over the years.

The salmon as well as some of the trouts, are anadromous. That is, they migrate from the sea to fresh-water streams to spawn. Some of the species ascend streams to their headwaters, whereas others spawn in the lower stretches of rivers. The king salmon goes to the headwaters. It has been found in the upper Yukon river, 3,000 mi. or so from the sea. The pink salmon, on the other hand, commonly spawns only a few miles above salt water.

The fish come in from the sea in fine condition. Upon entering fresh water they cease feeding. and sometimes they wear themselves out completely trying to reach proper places to deposit their eggs. They will ascend rapids and falls, often jumping vertically several times their onn length in passing difficult places. By the time they have spawned they often are terribly emaciated, and have broken and ragged fins However, whether worn out or still in fair condition the Pacific salmon die after spawning. It is not known nhether these fish have lived to spawn more than once.

When the fish reach the spawning ground — believed to be more or less the selfsame spot where these mature males and females themselves were hatched — the female with body, tail and fins prepares a trough-shaped depression in gravel or sand. The eggs are deposited in this "nest" and are fertilized at the same time by the male. Cpon completion of this process the female covers the eggs nith the excavated or other material, which is the final act in the life cycle. She, as well as the male. now appear to have lost interest in life. They drift downstream more or less nith the current, and as already indicated they soon die.

The relatively large eggs, one-fourth of an inch or more in diameter. may hatch in 60 days, though the incubation period may be prolonged several days by a drop in the temperature of a degree or two and shortened several days by a similar increase in temperature.

The newly hatched fish with their tremendously large yolk sac are quite helpless. They remain hidden among pebbles on the spawning ground until the yolk is absorbed. At that stage in life the young fish begin to swim about and to seek food. After remaining in fresh water from a few months to perhaps a year or more they descend the streams and enter salt uater. When once in salt water the fish grow rapidly.

Sometime between the ages of two to seven years the fish have matured. Sexual products have developed. and the urge to spawn causes them to re-enter the fresh-nater streams to fulfill their final mission in life. in the same vicinity uhere their ancestors completed their life cycle.

The **Trouts.**—The trouts (genus *Salmo*) are among the most difficult fishes to classify. Indeed, scarcely two ichthyologists agree as to the number of species that should be recognized. The reasons for the confusion are the irregularities in the anatomical structures. the great variation in colour and the confusing irregularities in habits. However, some generally accepted species exist, but a reasonable and logical interpretation of the group as a whole is missing.

The Atlantic salmon *(Salmo salar),* is one of the well-known and generally recognized species of the genus. It occurs on both sides of the North Atlantic and ranges well within the Arctic circle. In Europe it occurs as far south as the Bay of Biscay, and in North America to Cape Cod and formerly to the Hudson river. It has many near relatives that live habitually in fresh-water lakes and streams.

Salmo salar has been greatly reduced in abundance in some parts of its range. In New England it may be listed among the "vanishing animals." This depletion is in part the result of overfishing, but the construction of dams across rivers without providing "fish ladders," and the pollution of streams have constituted a far greater menace. Whether the streams formerly occupied can again be made suitable and the fish restored is an unsolved problem. Neither is it known whether the fish can be brought back in commercial numbers in those rivers that are still frequented to a limited extent.

The life history of *Salmo salar* is better known than that of any other species of the family, and therefore is described herein in some detail. In general. it is similar to that of the Pacific salmon. It also ascends rivers to spawn, but unlike the Pacific salmon it does not habitually die after spawning) but may live to spawn three or four times. The migration upstream starts in the autumn and occurs from October to February. *Salmo salar,* like the Pacific salmon, does not feed while in fresh water en route to its spawning ground. In the meantime the sexual products are developed at the expense of the other tissues. This causes the flesh. which was red and fat when the fish left the sea, to become pale and watery. In the breeding male the jaws become prolonged during migration; the lower one becomes curved upward. or even acquires a hook, and the teeth grow large. The silvery colour becomes replaced by a dull gray in the female, while the male acquires irregular dark and reddish spots on the body.

The eggs, as in the Pacific salmon, are deposited in shallow excavations made in sand or gravel by the female and covered by her after spawning is finished. The eggs are fully one-fourth of

an inch in diameter, and incubation extends over a period of about five months.

The newly hatched fish, about three-fourths of an inch long, is quite helpless at first and lies hidden among the pebbles until the big yolk sac it retains at hatching is absorbed. At this time the fish is an inch or more long and swims actively beginning its search for food. The little fish. known as à parr, soon becomes brilliant in colour, and has 10 or 11 dark crossbars, alternating with bright red spots.

The parr live in fresh water a variable length of time, according to the locality and factors not well understood. Most of the fish migrate to the sea principally in the spring and early summer, at the age of two years. when they have attained a length of about six inches. However, some linger in fresh water, especially in northern localities, three. four, five or even six years.

When the young fish approach tidewater they lose the bars and spots. and become silvery for their sojourn in the sea. These fish, known as smolts. stay in or near the mouths of rivers and in estuaries for some time: although by fall they have disappeared. Little is known of their movements during the first winter in the sea. It is certain, however. that they grow rapidly on the abundant diet in the ocean, for when they reappear on the coast the following spring they are 16 in. and more in length. and weigh 1½–7 lb. or, rarely. more. The fish, known as grilse, are distinguishable from older fish by the slenderer body. smaller head. more deeply forked caudal fin and by the more numerous spots on the body, which at this stage in life are bluish rather than black.

A few individuals, especially males. may spawn during the grilse stage, but the great majority remain in the sea. Many fish spawn after living in the ocean two years. while others do not make a return migration for three. four or even five years.

A tremendously large size for a trout is attained by the Atlantic salmon. An individual weighing 83 lb. has been reported from England. None even approaching such a weight has been found in America where a 50-lb. fish is a rarity. Large trout are not necessarily old, as they probably are fish that remained on rich feeding grounds in the sea without spawning. It is improbable that any Atlantic salmon lives more than eight or nine years. In general, the ones that begin spawning early in life and spawn every year do not grow large, whereas those that spawn for the first time late in life. and perhaps spawn only once. reach a large size.

Landlocked Salmon.—The Atlantic salmon has many near relatives that habitually live in fresh water; the nearest of all are the landlocked forms. The lake dwellers received this name from the belief long held that their ancestors. *Salmo salar,* in some way became shut off from the sea and were obliged to remain in fresh water. It seems more probable in the light of present knowledge that some young *Salmo salar* found certain lakes. which they reached while migrating toward the sea. a sufficiently agreeable substitute ior the ocean to remain there voluntarily and permanently. Thus, landlocked salmon seems to be a misnomer, and lake salmon has been suggested as a substitute.

Under the influence of the new environment in the lakes the progeny in the course of time diverged sufficiently from the parent stock. *Salmo salar,* to become recognized a.; distinct species. In fact, several species have been named. but in this case as in others general agreement as to their validity is lacking. Therefore, no attempt to list the species herein has been made.

Colonies of landlocked salmon exist in New England. eastern Canada and in Europe. While these fish spend most of their lives in lakes, they retain the migratory instinct of their ancestors and ascend rivers to spawn. In geuerai, landlocked salmon run smaller than the Atlantic salmon. though some weighing 20 lb. arid more have been reported. They are protected and reserved for sport, only, in the United States.

Sumerous other species of *Salmo* occur in the fresh waters of North America. and of Europe, and a few are found in the mountains of northern Africa. The fresh-water trouts are especially difficult to classify. Among ihem are the brown trout. *S. trutta,* and the Loch Eaven trout. *S. levensis,* of Europe. which have long been subjects of fish culture and have been widely distributed artificially.

In western North America there are numerous closely related species of *Salmo,* which J. O. Snyder regarded as belonging to two main groups which he called rainbon series and the cutthroat series. He has claimed that the steelhead trout, long held to be a distinct species somewhat intermediate of the rainbow and cutthroat trouts, is not entitled to specific rank because it is a sea migrant of a particular stream species. This is another illustration of the extreme difficulties met in classifying trouts. It is also an illustration of the diversity of habits, since some rainbow and cutthroat trouts retain the migratory instinct of distant ancestors and continue to migrate to the sea, whereas others remain in fresh water throughout life.

The rainbow and cutthroat trouts are extensively cultivated in America, where they also are protected and reserved for sport. There are many records of rainbow and cutthroat trouts weighing 20 lb. and more, but the average size is much smaller.

Chars.—Many species of char (genus *Salvelinus*) occur in Europe and the cold regions of the north the range extending far into the Arctic circle. Some of the species continue to live in salt water. like all the ancestors of the living species no doubt did However. others have become chiefly or nholly restricted to fresh nater. Certain species that live in fresh water in the southern part of their range throughout life will enter salt water if they inhabit streams adjacent to cold seas. *Salvelinus fontinalis,* known in the Cnited States as the eastern brook trout. for example, ranges southward into Georgia, but it enters the sea only from Cape Cod northward. Even there only a part of the population of any one river "run down" to the sea. The ones that enter salt water are called sea trout. These fish are not to be confused, however, with the sea trout of the southern shores of the C.S. which are not Salmonidae. but are members of the croaker family. Sciaenidae.

The chars, that is. the species of the genus *Salvelinus,* generally are distinguishable from the trouts of the genus *Salmo* by the smaller scales, which are so minute as to be hardly visible in some species, and usually they may also be distinguished by the colour, since the chars have reddish spots, whereas the trouts have dark ones. However, for certain identification it is necessary to examine the teeth on the roof of the mouth. In *Salvelinus* the teeth are present in a group on the anterior part of the vomer only. whereas in *Salmo* the teeth extend back on the vomer in a double zigzag series.

The chars generally are valued as food and game fishes. Thus, the eastern brook trout in America is extensively cultivated, and has been distributed by man far beyond its natural range. and is protected as a game fish. However, there is a disliked member: the Dolly Varden trout (*Salvelinus malma*), which occurs in the Pacific coast regions of North America. Kamchatka, U.S.S.R., and Japan. The Dolly Varden is highly predatory, destructive of salmon eggs and young salmon and is not regarded as a good game fish.

Chars generally do not run large in size, often attaining a length of only about 10–12 in.. though some individuals of those species that run down to the sea may attain a length of about 24 in.

The Great Lakes Trout (*Cristivomer namaycush*).—This fish, as its name indicates, lives in the Great Lakes of North America, and in other deep lakes northward and beyond to the Arctic circle. It does not belong to one of the major groups of Salmonidae named at the beginning of this article, though its relationship is with the trouts, genus *Salmo.* It is readily distinguished. however, as it lacks bright colours. and has pale yellow or grayish spots rather than dark ones. Further, its tail is more deeply forked. Although it does not belong to one of the major groups of Salmonidae, it is important enough to require at least brief mention. It is among the largest of the entire family. A maximum weight of roo lb. has been reported. Certainly a weight of 50 to 80 lb. is occasionally attained, though the average weight of the fish that reach the markets is less than ro lb. While the Great Lakes trout is chiefly a commercial fish, it is also a game fish of importance. The annual catch for the Great Lakes is around 2,400,000 lb. (S. F. Ha.; X.)

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SALMONBERRY (*Rubus spectabilis*), a vigorous North American shrub of the raspberry genus, native from California to Alaska and eastward to Idaho, bearing rose-coloured flowers and large salmon-coloured edible berries.

The name is applied also to the thimbleberry (R. *parviflorus*), of similar range but extending farther eastward, with white flowers and red scarcely edible fruit.

SALMONEUS, in Greek mythology, son of Aeolus (king of Magnesia, in Thessaly,' looked upon as the mythic ancestor of the Aeolian race), grandson of Hellen and brother of Sisyphus. He removed to Elis, where he built the town of Salmone, and became ruler of the country. His subjects were ordered to worship him under the name of Zeus; he built a bridge of bronze, over which he drove at full speed in his chariot to imitate thunder, the effect being heightened by dried skins and cauldrons trailing behind; while torches were thrown into the air to represent lightning. At last Zeus smote him with his thunderbolt, and destroyed the town (Xpollodorus i. 89; Hyginus, Fabularum Liber, 60, 61; Strabo, viii, p. 356; Manilius, Asfronomica, 5, 91; Virgil, *Aeneid,* vi. 58j). This is a confused recollection of some old rite of weather magic.

At Crannon in Thessaly there was a bronze chariot, which in time of drought was shaken and prayers offered for rain (Antigonus of Carystus, Historiae mirabiles, 15).

Frazer, *Golden Bough, see* index s.v.; another interpretation in S. Reinach, *Cultes, Mythes et Religions,* II, 160.

SALOME, the name of one of the women present at the crucifixion of Jesus (Mark xv, 40) and at the sepulchre (xvi, 1). The name is derived from Heb. shalom, "peace." Comparison with Matt. xxvii, 56, suggests that she was the wife of Zebedee. The name was borne by some of the Herod family also, notably by the daughter of Herodias by her first husband, the disinherited Herod Philip.

She is probably the "damsel" (whose name is not given) mentioned in connection with the death of John the Baptist (Matt, xiv, 3–6; Mark vi, 17–22). She afterward married her uncle, Herod Philip the Tetrarch.

The reading in Mark vi, 22 adopted by Hort, however, assumes that the girl dancer was Herod Antipas' o n daughter, also called Herodias.

See Josephus, *Jewish Antiquities,* vol. xviii, 4; *Jewish War,* I, xxx, 7; Justin, *Dial.* 49; Schurer, *The Jewish People in the Time of Jesus Christ.*

SALOMON, ALICE (1872–1948), German social worker and founder of one of the earliest schools of social work, was born April 19. 1872, in Berlin. She was one of the first women granted a Ph.D. from the University of Berlin (1906), where her doctoral thesis concerned the inequality of pay between men and women doing equivalent work.

Convinced of the need for special training for social workers, in 1899 Miss Salomon organized regular training courses which soon evolved into the first German social work school, of which she was president until 1928 and which was named the Alice Salomon school in her honour in 1932. As president also of the federation of German schools of social work, her ideas and influence spread throughout that nation and to other countries. Miss Salomon was active in international feminist work and wrote on problems of public health and on the position of women and children in industry. In 1937, exiled from Nazi Germany, Miss Salomon went to the United States where she continued her work as a lecturer on social work administration. She died Aug. 30, 1948, in New York city. (M. C. E.)

SALOMON, HAYM (1740–1785), early American financier and patriot of Jewish-Portuguese origin, was born in Lissa, Pol. in 1740. He went to America following some revolutionary activities in defense of Polish liberty.

When he arrived in New York, he established himself as a commission merchant. and his personality and keen discernment soon made him a successful financier. During the American Revolutionary War, Salomon was with the patriotic party known as "Sons of Liberty." Within a short time he was made financial agent of the French government, for which services he accepted no commission. His ability and patriotic activities brought him to the attention of Robert Morris, who assigned him to the office of the superintendent of finance, where he handled all the bills of exchange.

Among his many other contributions to the colonies, Salomon subscribed heavily to government loans, endorsed notes, gave generously to soldiers and statesmen, and equipped several military units with his own money. He was made interpreter during the war, and was permitted to go into the British lines, but on two occasions was thrown into prison. He escaped, but suffered ill-health from exposure, which later led to his death.

While living in Philadelphia (1778–85), Salomon initiated a measure in behalf of Jewry in the state of Pennsylvania which later resulted in more liberal conditions of employment for them. At that time, persons seeking to qualify for civic employment in Pennsylvania were required to take an oath affirming their belief in the New as well as the Old Testaments. Salomon presented a petition to the Council of Censors on Dec. 23, 1783, in which he requested the removal of this condition, so that public service might not be closed to orthodox Jews. Later, the constitution of the state was so amended.

Salomon died in Philadelphia, Pa., on Jan. 6, 1785.

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SALON (-de-Provence), a town of southeastern France, in the department of Bouches-du-Rhône, 40 mi. N.N.W. of Marseilles by rail. Pop. (1954) 11,111. Salon is situated on the eastern border of the plain of Crau and on the irrigation canal of Craponne. The church of St. Laurent is 14th century, and the church of St. Michel (12th century) has a fine Romanesque portal. The central part of the town preserves a gateway of the 13th century and the remains of fortifications. There are remains of Roman walls near Salon, and in the *hôtel* de ville (17th century) there is a milestone of the 4th century.

SALONIKA or THESSALONIKE, as the name was officially fixed in Aug. 1937, the capital of Greek Macedonia, and one of the principal seaports of southeastern Europe. Pop. (1928, last census before World War II) 236,524, including some 50,000 Sephardic Jews. whose ancestors fled thither in the 16th century from Spain and Portugal: their language is a corrupt form of Spanish, called Ladino (*i.e.*, Latin). Pop. (1961) 377.026.

Salonika lies on the west side of the Chalcidic peninsula, at the head of the Gulf of Salonika (Simus *Thermaicus*), on a fine bay whose southern edge is formed by the Kalamara heights, while its northern and western side is the broad alluvial plain produced by the Vardar and Vistritza rivers.

Antiquities. — The Via Egnatia of the Romans (Grand Rue du Vardar) traverses the city from east to west, between the Vardar gate and the Kalamara gate. Excavations there have revealed the Hellenistic agora near the present prefecture. Two Roman triumphal arches used to span the Via Egnatia. The arch near the Vardar gate—a massive stone structure probably erected towards the end of the 1st century A.D., was destroyed in 1867 to furnish material for repairing the city walls; an imperfect inscription from it is preserved in the British museum. The other arch, assigned to the reign of Galerius (A.D. 305–311), is built of brick and partly faced with sculptured marble.

The ecclesiastical architecture of Salonika was once remarkable for its specimens of early Christian (Byzantine) origin and style, with well-preserved mural decorations. St. Sophia (Aya Sofia), formerly the cathedral, probably erected in the 6th century by Justinian's architect Anthemius, was converted into a mosque in 1589. The nave, forming a Greek cross, is surmounted by a

hemispherical dome covered with a rich mosaic representing the Ascension. St. Demetrius, which was probably older than the time of Justinian, consisted of a long nave and two side aisles, each terminating eastward in an atrium the full height of the nave, in a style not known to occur in any other church. This church was destroyed by the great fire of 1917. It is partly repaired but mainly ruinous. St. George's, conjecturally assigned to the reign of Constantine (d. 337), is circular in plan, measuring internally 80 ft. in diameter. The external wall is *18* ft. thick, and at the angles of an inscribed octagon are chapels formed in the thickness of the wall, and roofed with wagon-headed vaults visible on the exterior; the eastern chapel, however, is enlarged and developed into a bema and apse projecting beyond the circle, and the western and southern chapels constitute the two entrances of the building. The dome is covered throughout its entire surface of 800 sq. yd. with what is the largest work in ancient mosaic still extant, representing a series of fourteen saints standing in the act of adoration in front of temples and colonnades. The Eski Juma, or Old Mosque, is another interesting basilica, evidently later than Constantine, with side aisles and an apse without side chapels.

Salonika is the see of an Orthodox Greek archbishop. Each religious community has its own schools and places of worship, among the most important being the Jewish high-school, the Jesuit college, a high-school founded in *1860* and supported by the Jewish Mission of the Established Church of Scotland, a German school, dating from *1887*, and a college for boys and a secondary school for girls, both managed by the French *Mission Laïque* and subsidized after 1905 by the French government.

Railways, Harbour and Commerce.—Salonika is the principal Aegean seaport of the Balkan Peninsula, the centre of the import trade of all Macedonia, and the natural port of shipment for the products of an even larger area. It is the terminus of four railways. One line goes north to Nish in Serbia, where it meets the main line (Paris–Vienna–Constantinople) of the Oriental railways; another, after following the same route as far as Usküb in Macedonia, branches off to Mitrovitza in Albania. A third line extends westward from Salonika to Monastir. A fourth, the Constantinople junct+ railway to Constantinople, was partly dismantled and put out of use in *1921*, but re-organized later. It now runs via Séres and Kavalla and joins the main line at Kuleli Burgas.

The new harbour, which was opened to navigation in Dec. *1901*, allows the direct transhipment of all merchandise whatever may be the direction of the wind, which was previously apt to render shipping operations difficult. The harbour works consist of a breakwater 1,83*j* ft. long, with 28 ft. of water on its landward side for a width of 492 ft. Opposite the breakwater is a quay 1,47*j* ft. long, which was widened in 1903–07 to a breadth of 306 ft ; at each end of the quay a pier 656 ft. long projects into the sea. Between the extremities of these two piers and those of the breakwater are the two entrances to the harbour. Salonika exports grain, flour, bran, silk cocoons, chrome, manganese, iron, hides and skins, cattle and sheep, wool, eggs, opium, tobacco and fennel. Other industries are cotton-spinning, brewing, tanning, iron-founding, and the manufacture of bricks, tiles, soap, flour, ironmongery and ice. The spirit called mastic or raki is largely produced.

Province of Macedonia, of which Salonika is the capital, is rich in minerals, including chrome, manganese, zinc, antimony, iron, argentiferous lead, arsenic and lignite, but some of these are unworked. The chief agricultural products are grain, rice, beans, cotton, opium and poppy seed, sesame, fennel, red pepper; there is also some trade in timber, live stock, skins, furs, wool and silk cocoons. Apart from the industries carried on in the capital, there are manufactures of wine, liqueurs, sesame oil, cloth, macaroni and soap. The principal towns, Séres, Vodena and Kavalla, are described in separate articles; Tikvesh is the centre of an agricultural region, Karaferia a manufacturing town, and Drama one of the centres of tobacco cultivation. The total population of Macedonia is in the neighbourhood of 1,500,000. This total includes the large number of refugees who were settled here after *1922*. The Greeks form about 90% of the population; there are no Muslims except those of Albanian origin. Bulgarians number about 77,000, being about 5% of the total.

History — Thessalonica was built on the site of the older Greek city of Therma, so called in allusion to the hot-springs of the neighbourhood. It was founded in 315 B.C. by Cassander, who gave it the name of his wife, a sister of Alexander the Great. It was a military and commercial station on a main line of communication between Rome and the East, and had reached its zenith before the seat of empire was transferred to Constantinople. It became famous in connection with the early history of Christianity through the two epistles addressed by St. Paul to the community which he founded here; and in the later defence of the ancient civilization against the barbarian inroads it played a considerable part. In A.D. 390, 7,000 citizens who had been guilty of insurrection were massacred in the hippodrome by command of Theodosius. Constantine repaired the port, and probably enriched the town with some of its buildings. During the iconoclastic reigns of terror it stood on the defensive, and succeeded in saving the artistic treasures of its churches: in the 9th century Joseph, one of its bishops, died in chains for his defence of image-worship. In the 7th century the Macedonian Slavs strove, but failed, to capture the city. It was the attempt made to transfer the whole Bulgarian trade to Thessalonica that in the close of the 9th century caused the invasion of the empire by Simeon of Bulgaria. In 904 the Saracens from the Cyrenaica took the place by storm, and the inhabitants to the number of 22,000 were sold as slaves throughout the countries of the Mediterranean. In 1185 the Normans of Sicily took Thessalonica after a ten days' siege, and perpetrated endless barbarities, of which Eustathius, then bishop of the see, has left an account. In 1204 Baldwin, conqueror of Constantinople, conferred the kingdom of Thessalonica on Boniface, marquis of Montferrat; but in *1222* Theodore, despot of Epirus, one of the natural enemies of the new kingdom, took the city and had himself crowned there by the patriarch of Macedonian Bulgaria. On the death of Demetrius, who had been supported in his endeavour to recover his father's throne by Pope Honorius III., the empty title of king of Salonika was adopted by several claimants. In *1266* the house of Burgundy received a grant of the titular kingdom from Baldwin II when he was titular emperor, and it was sold by Eudes IV to Philip of Tarentum, titular emperor of Romania, in 1320. The Venetians to whom the city was transferred by one of the Palaeologi, were in power when Murad II appeared and on May 1st, 1430, in spite of the desperate resistance of the inhabitants, took the city, which had thrice previously been in the hands of the Turks. They cut to pieces the body of St. Demetrius, the patron saint of Salonika, who had been the Roman proconsul of Greece under Maximian and was martyred in A.D. *306*. In *1876* the French and German consuls at Salonika were murdered by the Turkish populace. On Sept. 4, 1890, more than 2,000 houses were destroyed by fire in the south-eastern quarters of the city. During the early years of the 20th century Salonika was the headquarters of the Committee of Union and Progress. the central organization of the Young Turkey Party, which carried out the constitutional revolution of 1908. Before this event the weakness of Turkey had encouraged the belief that Salonika would ultimately pass under the control of Austria-Hungary or one of the Balkan States, and this belief gave rise to many political intrigues which helped to delay the solution of the Macedonian Question.

When the first Balkan War broke out in *1912*, Salonika surrendered to the Greeks on the festival of its patron, St. Demetrios, Nov. 8, after 482 years of Turkish occupation. King George I. proceeded to what was now the second largest city of his kingdom, but was assassinated there on March *18*, 1913, by *a* Greek, named Schinasi.

The Treaty of London of May *30, 1913*, assigned Salonika *to* Greece, and the battle of Kilkis in the second Balkan War of that year prevented the Bulgarians from approaching it. Salonika was becoming more and more Hellenized when World War I brought it into prominence as the base of the Allied

operations in the Near East. (See SALONIKA CAMPAIGNS 1915–18.)

In 1916 a Venizelist revolution against King Constantine broke out there, and on Oct. 9 E. Venizelos arrived and formed a provisional government, which the Allies recognized, and to uhich Lord Granville was accredited as British representative. This government declared war on Nov. 23 against Bulgaria and Germany. On Aug. 18. 1917, a great fire destroyed a large part of the city, including the church of St. Demetrius. After the war an arrangement was made by which Yugoslavia should have a "Serbian Zone" in the harbour. After the proclamation of the Greek republic, Salonika often had a decisive voice in politics, and the large immigration of Greek refugees from Asia Minor further Hellenized the country round it. Salonika again figured prominently in World War II.

German forces driving southward from Bulgaria captured the city April 9, 1941, only three days after their initial assault on Greece. By so doing they cut off all Thrace from the rest of Greece and split Macedonia in two.

See General Sarrail, *Mon Commandement en Orient, 1916–18* (1920); P. Risal, La *Ville Convoitée, Salonique* (1914); *Greek Refugee Settlement* (League of Nations, Geneva, 1926).

SALONIKA CAMPAIGNS 1915–18. Gnder the heading SERBIAN CAMPAIGNS the collapse and subjugation of Serbia in 191 j is related in this work. The present article describes the campaigns in Salonika which formed the sequel to this Allied disaster.

I. OBJECTS OF THE EXPEDITION

Although undertaken for political objects—to bring relief to a hard-pressed ally and to check the influence of Germany in the Balkans—the Salonika campaigns were ultimately crowned by the first decisive military success of the World War. For on the Macedonian front the continent-wide trench barriers of the Central Powers were first breached beyond repair, and there too was knocked away the first national prop—Bulgaria—of the Germanic alliance. To disentangle cause from effect is difficult where moral, military and economic threads are so closely interwoven as in the years 1914–18, yet the fact at least stands out that the overthrow of Bulgaria began the series of national capitulations which ended with that of Germany on Nov. 11, 1918.

If Salonika was for several years an unproductive field of military effort, an infringement of the law of economy of force, which in some measure justified the German gibe that it was their largest concentration camp—"an enemy army, prisoner of itself"—the historian, when weighing his verdict, must throw the counterpoise of 1918 into the scales. And not this only, for it must be remembered that the Allied occupation of the Salonika front made possible the rebuilding of the Serbian army—from the ragged and disorganized survivors of the 1915 winter retreat throngh Albania to the well-equipped and irresistible force which broke through the Vardar front in Sept. 1918. On the credit side also must be set the fact that the Salonika expedition prevented the danger that Greece might become a submarine base for the Central Powers, one which would have lain in deadly proximity to the British artery of communication with the East via the Suez Canal. And again, that the Allied force contained the bulk of the Bulgarian army—although it is perhaps doubtful whether these would have placed their services at Germany's disposal for any front more remote from their homeland.

Although the Salonika expedition was the immediate outcome of the Serbian débâcle of Sept.–Oct. 1915, the idea had an earlier origin. For Salonika was not only the one feasible channel of Allied communication with and supply to Serbia, but that front offered a possible strategic flank for attack once the trench line on the western front had been welded into a seemingly impenetrable barrier. As far back as 1914, British and French naval missions, with guns, had been sent to support the Serbians, and they had also been supplied with munitions by the Salonika route. The question, too, had been mooted of a larger employment of military force in that theatre, but British commitments at Gallipoli led to this project being shelved—until the Bulgarian mobilization for war on the side of the Central Powers.

Throughout the summer of 1915 the two warring coalitions had been bidding for intervention on the part of the Bulgarians, and in this diplomatic bargaining the Entente suffered a moral and a material handicap—the first, their obvious failure at the Dardanelles; the second, Serbia's reluctance to concede any part of Bulgarian Macedonia, which she had seized as her share of the spoils of the second Balkan war of 1913. As this was the one prize on which the Bulgarians had set their heart, and as Austria had nothing to deter her from offering territory that belonged to her enemy—Serbia—the Entente offers failed to attract Bulgaria. Her intervention on the opposite side meant that free communication could be easily established between Germany and Turkey, and as a consequence that the Entente forces on the Gallipoli peninsula were imminently menaced.

II. THE RETREAT TO SALONIKA

Faced with this critical situation, the French and British Governments decided, albeit tardily, to succour Serbia with an expeditionary force.

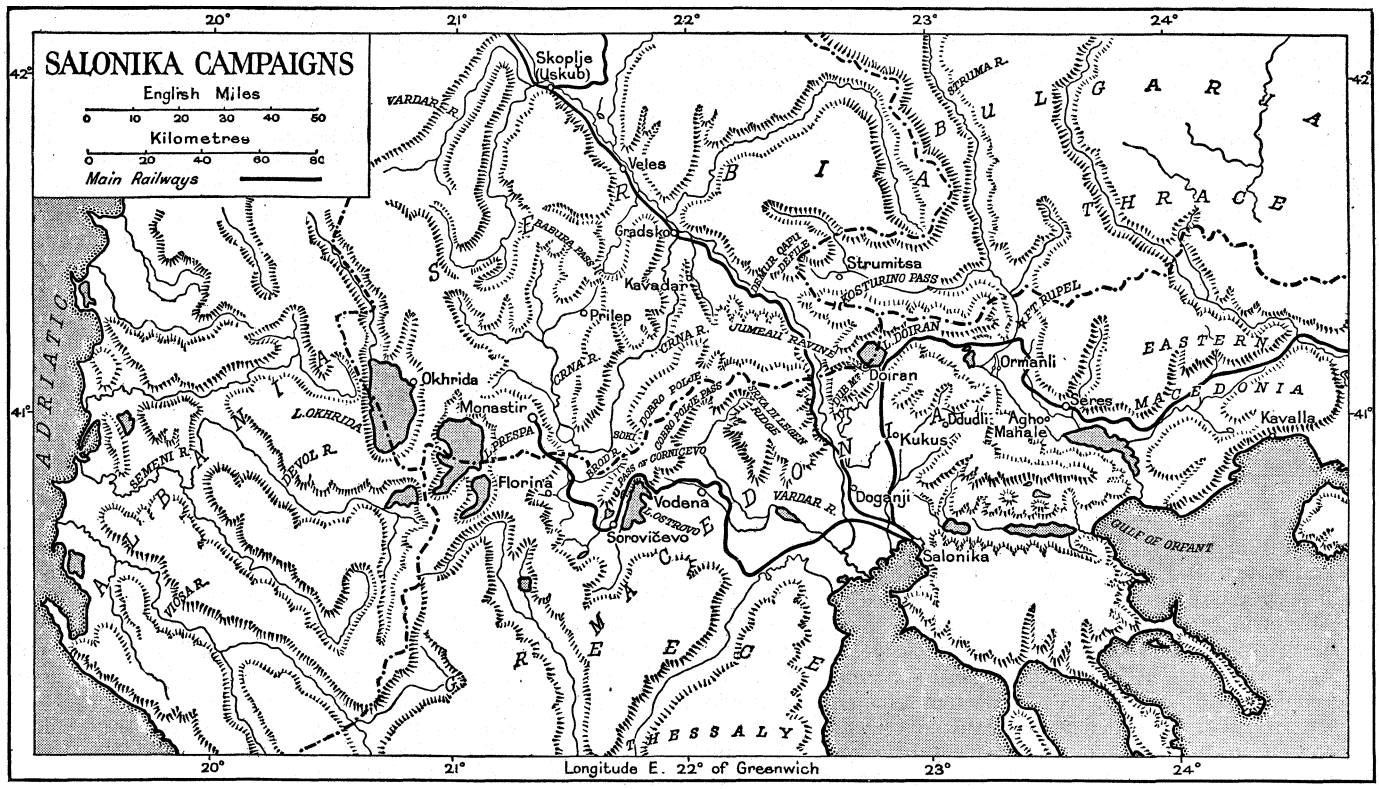
In this the French Government took the lead and nominated as commander Gen. Sarrail, the former chief of the III. Army in the Verdun sector. Sarrail's political activities had earned him the distrust of the military authorities; but the same factor, through his influence with the parties of the Left, made it difficult to ignore him completely. His removal by Joffre from the III. Army command placed the Government in a temporary dilemma, and they eagerly seized the opportunity of placating Sarrail and his political supporters by appointing him to a conveniently distant theatre of war.

While the constitution of Sarrail's force was still under discussion, the Bulgarian mobilization on Sept. 22 forced the hands of the Entente Governments. A hurried order was sent for the dispatch to Salonika of contingents from Gallipoli, preliminary to the arrival of reinforcements from France. Preceded by staff officers, the British 10th and French 156th Divs. began to disembark at Salonika on Oct. 5, and they were followed by the French 57th Division. On the same day, however, the Greek promise of aid to Serbia, made by M. Venizelos, was repudiated by King Constantine, and the Venizelist Government fell—to be replaced by that of M. Zaimis, which took neutrality as its keynote. This reacted at once not only on the Franco-British plan but on their operations. The Greek officials, civil and military, at Salonika did their best, or worst, to obstruct the disembarkation of the Allied contingents.

To increase the confusion, the intended concentration point was several times changed by successive orders from Paris until, on Sarrail's arrival on Oct. 12, he decided, in view of his slender resources and the doubtful attitude of the Greek army in his rear, to concentrate no further forward than the Demir Qapu (Demir Kapija) defile. The limited object was to protect the railway and to ease the pressure on the Serbian forces to the north by repelling a Bulgarian advance from Strumitsa (Strumica)—which would sever that line and so the Serbian line of retreat. Meanwhile, the British troops under Gen. Mahon began moving up to Doiran, in echelon behind the right of the French.

On Oct. 14 the vanguard of the French troops came into action at Strumitsa station (in Serbia), driving back a Bulgarian reconnaissance, and on Oct. 17, in response to Serbian urgings, a brigade was sent forward beyond the Demir Qapu defile as far as Krivolak. Reinforced by the arrival of the French 122nd Div. Sarrail began, on Nov. 3, an offensive northward to facilitate the Serbian retreat. But the seizure of the Babuna pass by the Bulgarians closed the channel of southward retreat for the main Serbian army, and finally shattered the hope that the Serbians might fall back on the relieving force, as was the advice of their allies.

Sarrail was thus faced with a difficult problem. On the one hand the gallant French efforts to break through toward the Babuna had failed and they were forced on the defensive, and, on the other, he received news of the Serbian decision to retreat westward through Albania toward the Adriatic. With his small force thus isolated he took the only possible decision—to fall



MAP SHOWING THE TERRAIN OF THE SALONIKA CAMPAIGNS IN 1915–1918. NATIONAL BOUNDARIES ARE INDICATED BY THE BROKEN LINE

back towards Salonika. This decision raised further problems. Were they to hold on there, or evacuate Greek soil altogether? With the disappearance of Serbia beneath the enemy flood, the Entente Powers could no longer claim that they were at Salonika merely to use a line of communication to which Serbia was by treaty entitled. The other justification, that they had come at the request of the Greek Government was now nullified by the downfall of Venizelos. Considerations of prestige and their desire to use Salonika as a base for diplomatic operations in the Balkans led the Entente Governments to remain, but without any clear policy as to the future.

Even with the decision to retreat taken, the Franco-British forces were not "out of the wood." The withdrawal had to be made down a single-track railway, through a country without roads—converted by the autumn rains into a swamp—and in face of a pursuing enemy. The retreat was made by echelons, in four stages, and only by a narrow margin did the French frustrate Bulgarian efforts to outflank and cut their retreat, first at the Demir Qapu defile, and again at Strumitsa station. The British, too, on the right were heavily attacked, and any weakening of their line at this critical juncture might have been fatal to the extrication of the Allied forces from the noose into which they had been pushed.

Fortunately, once the Greek frontier was regained the pursuit halted—mainly because the Germans were reluctant to undertake further commitments in the Balkans to the detriment of their strength in other theatres. Falkenhayn held that the Macedonian operations should be left to the Bulgarians, but this policy overlooked the fact that the Greeks. however friendly to the Germans, would have resented any invasion of their territory by the Bulgarians. Thus by Dec. 12 the retreating forces were safely out of reach of their pursuers, facing them across the frontier. After pausing for a few days on a line stretching roughly from Sorovičevo to Lake Doiran, the withdrawal was resumed, and by Dec. 18 the forces of Sarrail and Mahon were back in the vicinity of Salonika. Covering this base an entrenched line was constructed, on an 80m. arc stretching from the mouth of the Vardar through Doganji to the Gulf of Orfano, and occupied early in the new year.

Allied Reinforcements.—The delay in the expected enemy offensive enabled the Entente force to receive reinforcements, not only French and British but Serbian, for the remnant of their army, after resting and being re-equipped at Corfu, was brought round to Salonika. From April onwards the stream steadily swelled until by July their strength on the Salonika front reached a total of 152,000, divided into three armies of two divisions each. The French had four divisions. The British had been raised to five divisions (10th, 22nd, 26th, 27th, 28th), and later a sixth (60th), organized in two army corps; in May Lieut.-Gen. G. F. (later Sir George) Milne took over command as general officer commanding the British Salonika Force. The total allied force was thus a little over 300,000 men. Opposing it early in 1916 were the Bulgarian I. and II. Armies and the German XI. Army—a total of some 280,000 men—aligned on a front from Lake Okhrida on the west to the point where the Struma enters Bulgaria on the east. But from March onwards the drain on the German forces at Verdun led Falkenhayn to withdraw the German troops, all but one division; by 1918 the XI. Army, though German in name and in staff, contained only one complete German battalion.

On the Entente side the reaction of Verdun took the form of orders from Joffre to Sarrail to pin down the enemy on his front, in order if possible to prevent Falkenhayn drawing upon the forces there. Accordingly the French moved out west of the Vardar towards Vodena and the British advanced north to Rukus. This advance, although it lengthened the front to be defended and the lines of communication, was of essential value for the security of the Allied force, for the entrenched position at Salonika itself was dominated from the mountains east of the town, and might become untenable if these heights were occupied by the enemy. But in how small degree the Allied advance fixed the Germans can be gauged from the previous paragraph, and Sarrail, who had been placed under Joffre's supreme command in Dec., received instructions not only to operate with greatly increased vigor on the Salonika front but also to prepare and organize a definite offensive to be launched simultaneously with the anticipated entry of Rumania into the war.

Meantime the situation was complicated by a Greek incident; until 1918 politics were to play a larger part in the Salonika theatre than war. The neutral Greek forces, five corps, were

distributed throughout the region, in theory to guard the frontier; and such a situation, while Gilbertian in its absurdity to the distant observer, was a source of serious anxiety to the Franco-British forces on the spot. Feeling that they would be safer without such dubious protection, they brought diplomatic pressure to bear on the Greek Government for the withdrawal of the Greek forces from Macedonia and their demobilization. Reluctantly the Greeks complied, but while the Allies occupied certain of their forts the Bulgarians seized the opportunity to cross the frontier, and appeared before Fort Rupel, which commanded the Struma gate into the Macedonian plain. The Greek commander thereupon handed over the fort to them (May 26).

This unfriendly act bared the eastern flank of the Entente army, and gave the whole of Eastern Macedonia into the hands of the enemy. To meet the danger the British occupied the Struma line in force. Further, the Entente Governments instituted an economic blockade of the Greek coast, sent a brigade to Athens, and by the ultimatum of June 21 enforced the demobilization of the Greek army and the resignation of the Government. As it proved, however, the seizure of Rupel and Eastern Macedonia did not develop into a general offensive by the German-Bulgarian forces.

Handicaps of **the** Allies' Army.—While these external troubles with Greece beset the Entente Powers, they were far from the sum of the handicaps which hindered effective action by the Salonika force. The idea of an offensive was constantly discussed between the French and British Governments, as also between Joffre and Sarrail; but, apart from reluctance to provide adequate forces, it depended on too many contingencies, in particular the uncertain and often postponed intervention of Rumania. Furthermore the internal troubles of the Salonika force were notorious. Sarrail had the title of "Commander-in-chief of the Allied Armies in the Orient," and with him Cordonnier commanded the French forces; but his status was a nebulous one. Not only was the British commander to all intents independent, but also the Italian—a detachment arrived from Italy in Aug. 1916.

Apart from the defect that Sarrail's orders were issued from French headquarters without consultation with the other Allied Powers, Sarrail's own personality was not such as to weld this loose understanding into an effective co-operation. In a heterogeneous force, composed of French, British, Italians, Serbians and Russians, it was hardly a recommendation that the chief commander should be known not to have the confidence of his own supreme command, and that even the suspicion should exist that he was conducting operations with one eye on the political game at home. The British, by polite but firm insistence on their independence, maintained tranquil relations; wrangles and disputes between the other Allied commands were continual, and the majority were unfortunately attributable to the policy or tactlessness of Sarrail.

While the Allied leaders were debating ways and means, the opposing armies moved, on Aug. 17, to forestall and dislocate the Allied offensive, which they judged would synchronize with Rumania's intervention. The Bulgarians made their effort on the two wings. The eastern wing from Rupel drove back the French cavalry on the east of the Struma and pressed down towards its mouth. But they dissipated their force by detaching part to seize the coastal strip of Kavalla, and the stout resistance of the British prevented them forcing the river line. On the western wing the position was more critical, for the Bulgarian advance from the Monastir area drove the Serbs out of Florina and reached Lake Ostrovo before they were ultimately held.

III. THE FIRST AND SECOND ALLIED OFFENSIVES

These reverses caused a further change in Sarrail's plan for the Allied offensive; the forces east of the Vardar were merely to contain the enemy, while those west of the Vardar carried out the offensive. Thus to all intents it became no more than a counter-offensive to restore the impaired situation in this sector. To release additional French troops the British extended their line west from Doiran to the Vardar; Sarrail was thus enabled to form an offensive group (of 2½ French divisions, one Serbian division and a Russian brigade) under Cordonnier, in addition to the Serbian striking force of four divisions.

On Sept. 10 various British detachments crossed the river Struma in raids at six points in order to divert the enemy's attention, and on Sept. 11 the real attack developed west of the Vardar. The Serbs, skilled mountain fighters and inspired by the closeness of their native soil, made good progress, and on Sept. 14 gained the pass of Gorničevo, breaking through the hostile front. But the Cordonnier group was slower, partly because of transport difficulties and Cordonnier's own inclination for the secure methodical advances he had practised successively in France. As a result, however, the Bulgarians, broken by the Serbs at Gorničevo, were able to fall back across Cordonnier's front and re-establish their lines on the Brod. Sarrail, incensed, ordered fresh attacks by both groups, which were repulsed with heavy loss—as Cordonnier, protesting, had prophesied.

Between Sept. 30 and Oct. 8 the British XVI. Corps (Briggs) advanced its front to the line Agho Mahale-Ormanli, as a fixing move, coincidently with a fresh attack on the main front by the French and Serbs from Kaimakčalan westward. The pressure of the Serbs turned the Bulgar left and forced a further slight withdrawal, but a Franco-Russian attack on Oct. 6 failed. Cordonnier urged the idea of a wider turning manoeuvre, but Sarrail, in the mistaken belief that a Bulgarian collapse was imminent, ordered a fresh blow on Oct. 14. This was a costly failure and led to a violent scene between Sarrail and his subordinate. Cordonnier left for home a few days later. This internal friction caused a temporary breakdown of action, and the Serbs were left to fight unsupported, until Sarrail took the step of putting the whole attacking force under the Serbian Gen. Michich—a man of real military genius and with the knack of inspiring not only Serbian but other national forces.

Michich attacked in the Crna bend on Nov. 12 while, to aid this offensive, Milne's troops made local attacks and raids as a diversion on the Struma. Despite rain and snow the Serbs pressed on, turning successive positions, with the French, Russians and an Italian brigade on their left. Monastir was outflanked and on Nov. 19 was found evacuated—the first important Serbian town to be regained. For a moment there was a real opportunity of exploitation, as the Bulgarians were in full retreat towards Prilep; but the immediate attacking forces were tired and hungry, and Sarrail suspended the advance—to the annoyance of the Serbs, who, in default of receiving fresh reserves, tried to press on unsupported until exhaustion stopped them.

By this time the Rumanian collapse, under pressure of the convergent German and Bulgarian attacks, was clear, and on Dec. 11 Sarrail received instructions to consolidate a defensive line embracing as much of the regained territory as possible. This line stretched from Lake Prespa—just north of Monastir—north slopes of Kaimakčalan—to the Vardar, and thence by Doiran to the Struma and down to the sea. Its worst feature was that the commanding heights were held almost everywhere by the enemy. This front was to remain practically unchanged until Sept. 1918.

Reorganization.—Apart from the incident of a threatening Greek concentration in Thessaly—settled by a fresh ultimatum—the winter months of 1916–17 passed quickly, and the opportunity was taken to reorganize and regroup the forces. From the Gulf of Orfani to the Vardar the front was held solidly by the British, owing to Milne's insistence, but on the rest of the front Sarrail followed his usual plan of interspersing detachments of the various nationalities—presumably on the principle *"divide et impera."* Whatever its personal advantages it was hardly conducive to prompt and effective action. Reinforcements had now brought the French up to a strength of eight divisions, while there were six Serbian and 1½ Italian divisions—making with the British 21½ divisions, plus two Russian brigades. The total Allied strength was approximately 600,000, while the Greek National Defence, or Venizelist army, was in process of formation. This concentration afforded adequate reserves for a resolute offensive in the spring.

Confronting the Allies were still the nominal German XI.

Army, and Bulgarian I. and II. Armies, comprising the equivalent of one German and 13 Bulgarian divisions,[1] of which practically half faced the British. Apart from the II. Army, these forces were under a German Commander-in-chief, Gen. Von Scholtz. On their side no large move was considered, partly because the Bulgarians had already achieved their principal territorial aims, and merely desired to hold tight, while the Germans were satisfied with immobilizing so large an Allied force at no expenditure to themselves.

For the 1917 campaign Sarrail's scheme was for a preliminary flanking move on the extreme west, between Lakes Okhrida and Prespa, to shake the enemy's hold in the Monastir area; following this was to be the main fixing attack by the British on the Doiran front; then the French, Russians and Italians in the south-west of the Crna bend were to advance; and finally the Serbs were to strike the decisive blow to the west again.

The preliminary move began on March 12 and was soon suspended, achieving little apart from a creditable French local success on a spur west of Monastir. Then came the British turn —to attack the key position formed by the Dub and lesser ridges which commanded the passage between Lake Doiran and the Vardar. Milne had rejected an alternative proposal of Sarrail's that he should attack to gain Seres, which while attractive as a political advertisement had no military value, and being dominated by the hills behind would have been difficult to hold. After a two days' artillery preparation, in vile weather, the British infantry advanced to the assault, on a two-division front (22nd and 26th), at 9.45 P.M. on April 24, the late hour being to gain surprise and protection. On the left the enemy's first position was gained and held, but in the centre and right the difficulties of the Jumeaux ravine and the strength of the resistance foiled the attackers.

Worst of all, their sacrifice was in vain and their "fixing" rôle rendered abortive because the attack west of the Vardar was postponed by Sarrail, ostensibly for climatic reasons. Not until May g did the other attacks develop. Sarrail had rejected the Italian proposal for a flanking manoeuvre, in preference for a frontal blow, and this, made by the French and Italians, was a costly failure. The Serbian attack was even less effectual, in fact hardly developed, partly owing to internal political troubles then rife and partly to their want of confidence in the higher direction and in the genuineness of its intention to support their efforts. Once more the British, on the night of May 8, had deiivered a fixing attack, and once more their heavy sacrifice had been purposeless. The offensive was definitely closed down by Sarrail on May 24.

The Bulgarians, content with the prestige of this successful repulse, attempted no counter-stroke, and as the Allied forces were neither in the mood nor the condition for further efforts, the front relapsed into stagnation for the rest of the year. The only minor incidents were a successful local advance in Sept. by the French on the extreme left, west of Lake Okhrida, and Milne's withdrawal of his right from the marshy valley to the foot-hills west of the Struma, a precaution to lessen the danger of malaria and dysentery. The focus of interest again became political—common action was taken to settle the simmering menace and intrigues of Greece. In June, Allied troops invaded Thessaly, but the abdication of King Constantine was forced without fighting, and the Venizelist Government returned to power. The consequent reinforcement of the Allies by the Greek army came as a prospective counterpoise to the contemplated withdrawal of two British divisions in Sept. for the projected offensive in Palestine.

Sarrail Superseded.—At the end of 1917 the new Clemenceau ministry recalled Sarrail, in response to the renewed requests of the British and Italian Governments, which were supported by Foch. His successor was Gen. Guillaumat, who had distinguished himself as an army commander on the Verdun front. His first aim was to restore confidence and cohesion in the Allied forces at Salonika, while hastening the reorganization and training of the Greek army. His second, to think out and prepare the plan for a fresh offensive, adopting in its main outlines one which Gen. Michich had suggested in 1916. But to obtain the sanction of the Allied Governments was more difficult, obsessed as they were with the threatened German offensive in France, and in any case dubious of the effectiveness of any major operation in Macedonia. While biding his time, however, Guillaumat seized the opportunity to "blood" his new Greek troops in an ably planned coup de *main* against the Srka di Legen ridge. Supported by a powerful concentration of French artillery it was completely successful, and Guillaumat withdrew the attackers into reserve before any possible counterstroke might dilute the moral tonic. On the main front there were no other incidents of note between Jan. and Sept. 1918; but away on the Adriatic coast, in Albania, Ferrero's Italian XVI. Corps, aided by a French division, advanced in July from the Viosa to the line of the Semeni and Devol rivers; an Austrian counter-offensive late in Aug. regained most of the lost ground.

In July also, Gen. Guillaumat, his task of reorganization completed, was summoned back to France, to be entrusted with the defence of the capital in view of the critical situation caused by the German offensives. A man who put first not his own interests, nor even those of France, but his duty to the Allied forces as a whole, his military ability had won the respect, as his character had won .the esteem, of the multifarious contingents. He was succeeded by Gen. Franchet d'Esperey, who, if perhaps not possessing the exceptional tact and supra-national outlook of Guillaumat, was yet an able strategist, and well able to maintain allied co-operation. He adopted and put the finishing touches to Guillaumat's offensive plan, while the latter utilized his position at the centre of policy to gain sanction for its execution. Winning over M. Clemenceau, he then went to London and Rome on the same mission, and at last on Sept. 11 Franchet d'Esperey was authorized to attack—if there was still little confidence in its success.

IV. THE DEFEAT OF BULGARIA

The military situation on the eve of the offensive was numerically little changed. The Bulgarians had a ration strength of some 700,000 and a rifle strength of 200,000—divided into the same three armies. The Allies had a ration strength of about 574,000 and a rifle strength of 157,000, although against the inferiority of numbers they could put a slight preponderance in artillery and a heavy one in aircraft. But the real defect on the enemy's side was the first underlying war-weariness of the Bulgarians and their dissatisfaction with their German directors; and secondly the divided command by which the so-called German XI. Army and the Bulgarian I. Army—from Doiran westwards—were under Von Scholtz, while the Bulgarian II. Army and the coastal detachments were under the Bulgarian commander-in-chief, Gen. Gekoff.

For the new offensive Franchet d'Esperey's plan was first to strike a concentrated blow with a Franco-Serb group under Michich on a narrow front of seven miles along the Sokol-Dobro Polje range, aiming at a tactical break-through and a subsequent expansion of the breach to gain and clear the triangle formed by the Crna and the Vardar. This would menace the enemy's communications on both flanks, and the offensive would then be taken up in turn by the other forces along the front. The initial objectives were relatively modest, for the possibility of a strategic break-through, ending in the overthrow of the enemy armies, was no more than an idea in the commander's mind.

The immense difficulties of the terrain and the scantiness of reserves made even this limited aim far from certain of success. But Franchet d'Esperey's plan, made possible by the wholehearted co-operation of the other Allied commanders, was an admirable fulfilment of the principle of concentration. On the vital sector six Serbian and two French divisions with 600 guns—more than a third of the total artillery strength in Macedonia—were concentrated against one Bulgarian division, and to do this the other sectors were almost stripped of their artillery.

The offensive began on Sept. 1, as the British 27th Div. made

[1] A Bulgarian division had almost twice the infantry strength of a French or German division.

a feint attack in the Vardar valley to divert the enemy's attention, and on the night of Sept. 14 a heavy bombardment was begun on the real front of attack. Next morning at 5:30 A.M. the French divisions assaulted and after hard fighting gained the Dobro Polje ridge, the Sokol also falling by the evening — opening a path for the Serbian divisions of the I Army, hitherto in reserve, to be pushed through. At the same time the Serbian II Army advanced to the attack. By nightfall on Sept. 16 a penetration of 5 mi, had been made.

The Serbian troops now wonderfully inspired by success and the sight of their homeland swept forward with such *élan* that by the night of Sept. 17 they were 20 mi. forward, and the breach had been expanded to 25 mi. by Greek and French divisions on the flank. After the initial clash resistance was feeble, partly because the mountains hampered the lateral movement of reserves. By Sept. 19 the left wing of the attackers had reached across the Crna, while the right wing was rolling up the front eastward toward the Vardar, and between the two wings the Serbian cavalry had penetrated to Kavadarci in the apex of the Crna-Vardar triangle. Meanwhile on Sept. 18 Milne's troops attacked on the whole front from the Vardar to Lake Doiran in order to prevent the Bulgarians withdrawing troops to dam the breach west of the Vardar. Facing the British were the pick of the Bulgarian troops and also the strongest fortified positions, so that although they penetrated the enemy's lines along most of the front. it was little wonder that lack of reserves and artiliery compelled them to yield up the larger part'of their gains. But they had fulfilled their mission of pinning down the enemy including the reserves during these critical days, Sept. 18 and 19, and. by Sept. 21 the whole of the enemy's front west of the Vardar had collapsed under the convergent pressure of the exploiting Serbs and of the French on their flanks.

By the afternoon of the same day the collapse had extended to the Doiran-Vardar front, and the British aeroplanes spread considerable havoc among the troops of the Bulgarian VI Army falling back through the narrow Kosturino pass. Similarly, on the extreme west, facing Prilep, the Italians joined in the advance. From now on the advance became a strategic pursuit, now fast, now slow, in which successive rear-guard resistances of the enemy were outflanked. On Sept. 23 the Serbian spearhead reached Gradsko, and Veles three days later. Seizing their opportunity, a French cavalry brigade under Gen. Jouinot-Gambetta made a dash for Skoplje (Usküb), and seized this vital centre of communications, the key to the whole front, on Sept. 29. This definitely separated the XI Army from the remainder of the Bulgarian forces, forcing them on divergent lines of retreat. To the southeast the British had already invaded Bulgaria itself, taking Strumica on Sept. 26. That night a Bulgarian staff officer arrived at British headquarters to ask for an armistice, and three days later the Bulgarians capitulated, accepting the Allied terms unreservedly. The first national prop of the Central Alliance had fallen. While the reoccupation of Serbia proceeded rapidly, a mixed striking force was rapidly organized under Milne's command to advance through Thrace on Constantinople, and had pressed as far as the Maritsa, seizing the bridgeheads, when Turkey — its force in Syria already annihilated by Allenby — surrendered on Oct. 30. *(See* WORLD WAR *I: Bibliography.)*

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SALSETTE (or SASHTI; *i.e.*, "sixty-six villages"). a large island north of Bombay city. Its area (246 sq.mi.) was distributed in April.1950 between Greater Bombay and Thana district (within which the whole island formerly lay). It is connected with Bombay Island and also with the mainland by bridge and causeway. In various parts of the island are ruins of Portuguese churches. convents and villas. and at Kanheri are 109 Buddhist cave shrines dating from the end of the 2nd century A.D. Salsette is crossed by the Central and Western railways, and the island is encircled by a motor road. The island was taken from the Portuguese by the Marathas in 1739 and from them by the British in 1774; it was formally annexed by the East India company in 1782. There is another Salsette in the Portuguese settlement of Goa.

SALSIFY or SALSAFY, *Tragopogon porrifolius*, sometimes called oyster plant or vegetable oyster: a hardy biennial with long, cylindrical, fleshy, esculent roots, which. when properly cooked, are extremely delicate and wholesome; it occurs in meadows and pastures in the Mediterranean region and in Britain is confined to the south of England, but is not native. The leaves are linear-lanceolate. The second season a handsome purplish flower is borne atop a stalk 2–4 ft. high; the mature seed head appears much like that of an enlarged dandelion. Salsify requires a free, rich. deep soil, which should be trenched in autumn, the manure used being placed at two spades' depth from the surface. The first crop should be sown in March and the main crop in April, in rows a foot from each other. the plants being afterward thinned to 8 in. apart. In November the whitish roots should be taken up and stored in sand for immediate use, others being secured in a similar way during intervals of mild weather. Salsify is widely naturalized as a wayside weed in the United States and Canada. In the United States. salsify is widely grown in home gardens but is of little importance as a market vegetable. It is sown about the average date of last frost in the spring. in rows about 1½ ft. apart and thinned to 3–4 in. apart. It requires the entire growing season to develop. Roots may be harvested and stored in a moist cellar or dug as needed through the winter. The roots are not damaged by freezing of the soil but must not be allowed to freeze after harvest. (V. R. B.)

SALSOMAGGIORE, a town of Emilia-Romagna, Italy, in the province of Parma, 6 mi. southwest of Fidentia by steam tramway. Pop. (1951) 8,476. It is a popular watering place. The water is strongly saline and is also used for inhalation. The wells are, some of them, over 2,000 ft. deep and yield illuminating gas and oil as well as water.

SALT, SIR TITUS, BART., 1869 (1803–1876), English manufacturer, was born on Sept. 20, 1803, at Morley, Yorkshire. His success in introducing the coarse Russian wool (*donskoi*) into English worsted manuiacture, due to special machinery of his own devising. gave his firm a great impetus. In 1836 he solved the difficulties of working alpaca (*q.v.*) wool, created an enormous industry in the production of the staple goods for which that name was retained and became one of the richest manufacturers in Bradford. In 1853 he opened, a few miles out of the city on the Aire, the extensive works and model manufacturing town of Saltaire. He died on Sept. 20, 1876.

SALT. In chemistry the term salt is applied generically to any compound formed by substituting the hydrogen of an acid by a metal or a group of elements acting as a metal. *(See* ACIDS AND BASES.) Common salt, or, simply. salt, is the name given to the varied natural and industrial forms of sodium chloride, NaCl.

Uses.—The best-known use of sodium chloride is as table salt. For this service, a fine-grained salt of high purity is used. To ensure that it will remain free-flowing when exposed to the atmosphere, small quantities of sodium carbonate or trisodium phosphate sufficient to combine with such hygroscopic impurities as calcium and magnesium chlorides are added. Usually potassium iodide is added in small quantity to overcome any possible iodine deficiency of the consumer. Common salt used for various manufacturing purposes may be coarser in grain than table salt. Salt is used universally as a condiment and preservative. It is employed in meat packing and fish curing, in the dairy and pickle industries, for salting cattle and curing hides and as a brine for refrigeration. It is indispensable to the manufacture of sodium carbonate (washing soda), sodium bicarbonate (baking soda). sodium hydroxide (caustic soda), hydrochloric acid. bleaching powder. chlorine and many other heavy and fine chemicals. The glass and soap industries are dependent upon it and it is used also in the glaze and enamel trades. As a flux, it enters into metallurgical processes and has been used in the manufacture of cement to aid in the recovery of potash as a by-product.

In the late 1950s the pattern of salt consumption in the U.S. was approximately as follows: chlorine, bleaches, etc. 36%; soda

ash 30%; other manufacturing uses 11%; food industries 5%; agricultural uses 5%; highway, railroads 6%; household use 3%; miscellaneous 4%. Total U.S. consumption was about 25,000,000 tons per year.

The production of salt is one of the world's most widely distributed mineral industries. Outputs of salt vary with the population and industrial activity of the country in question. Heavily populated countries like India and China require the major part of their production for food uses only; the Cnited States on the other hand requires several times as much salt for industrial purposes as is consumed in food. Many countries contribute to the total world production of salt. Within the last half of the 20th century some of the leading salt-producing countries were: the United States, United Kingdom, C.S.S.R., China, India. France, west Germany and Italy with a total annual production of about 50,000,000 tons.

Historical Background. — Salt must have been quite unattainable to primitive man in many parts of the world. Thus the Odyssey speaks of inlanders who did not know the sea and used no salt with their food. In some parts of America, and even of India (among the Todas), salt was first introduced by Europeans; and there are still parts of central Africa where its use is a luxury confined to the rich. Indeed, where men live mainly on milk and flesh, consuming the latter raw or roasted, so that its salts are not lost, it is not necessary to add sodium chloride, and thus it can be understood how the Numidian nomads in the time of Sallust and the Bedouins of Hadhramaut at the present day never eat salt with their food. On the other hand, a cereal or vegetable diet calls for a supplement of salt, and so does boiled meat.

The habitual use of salt is intimately connected with the advance from nomadic to agricultural life; *i.e.*, with precisely that step in civilization which had most influence on the cults of almost all ancient nations. The gods were worshiped as the givers of the kindly fruits of the earth, and, as all over the world "bread and salt" go together in common use and common phrase, salt was habitually associated with offerings, at least with all offerings which consisted in whole or in part of cereal elements. This practice was prevalent among the Greeks and Romans and among the Semitic peoples (Lev. ii, 13).

As covenants were ordinarily made over a sacrificial meal: in which salt was a necessary element. the expression "a covenant of salt" (Num. xviii, 19) is easily understood; it is probable, moreover. that the preservative qualities of salt made it a peculiarly fitting symbol of an enduring compact, and influenced the choice of this particular element of the covenant meal as that which sealed an obligation to fidelity. Hence the Greek phrase "Trespass not against the salt and the board," the Arab phrase "there is salt between us." the expression "to eat the salt of the palace" (Ezra iv, 14, Revised Version) and the modern Persian phrase *namak haram*, "untrue to salt" (*i.e.*, disloyal or ungratefulj and many others.

Salt and incense were economic and religious necessities of the ancient world and contribute greatly to knowledge of the ancient highways of commerce. Thus one of the oldest roads in Italy is the Via Lalaria, by which the produce of the salt pans of Ostia was carried into the Sabine country. Herodotus' account of the caravan route uniting the salt oases of the Libyan desert makes it plain that this was mainly a salt road, and to the present day the caravan trade of the Sahara is largely in salt. The salt of Palmyra was an important element in the vast trade between the Syrian ports and the Persian gulf (see PALMYRA), and long after the glory of the great merchant city was past "the salt of Tadmor" retained its reputation. In like manner the ancient trade between the Aegean and the coasts of southern Russia was largely dependent on the salt pans at the mouth of the Dnieper and on the salt fish brought from this district. The vast salt mines of northern India mere worked before the time of Alexander. The economic importance of salt is further indicated by the prevalence down to the present day of salt taxes or of government monopolies, In oriental systems of taxation high imposts on salt are seldom lacking and are often carried out oppressively with the result that the article is apt to reach the consumer in an impure state largely mixed with earth. "The salt which has Iost its savour" (Matt. v, 13) is simply the earthy residuum of such an impure salt after the sodium chloride has been washed out.

Cakes of salt have been used as money; *e.g.*, in Abyssinia and elsewhere in Africa, and in Tibet and adjoining parts. (See the testimony of Marco Polo and Sir Henry Yule's note on analogous customs down to our own time, in his translation of Polo ii, 48· et seq. The same work gives interesting details as to the importance of salt in the financial system of the Mongol emperors, ii, 200 et *seq.*)

In the Roman army an allowance of salt was made to officers and men, from which in imperial times this *salarium* was converted into an allowance of money for salt.

Salt in Sea **Water.**—Assuming that each gallon of sea water contains 0.2547 lb. of salt, and allowing an average density of 2.24 for rock salt, it has been computed that if dried up the entire ocean would yield no less than 4,500,000 cu.mi. of rock salt or about 14½ times the bulk of the entire continent of Europe above high-water mark.

Sea water contains on the average about 3.33% of solids, but the concentration of salts varies from about 2.9% in the polar seas to 3.55% and upward at the equator. Enclosed seas such as the Mediterranean and Red seas contain a higher proportion of salt than the open ocean at the same latitude. (See OCEAN AND OCEANOGRAPHY.) From C. R. Dittmar's analyses of sea water taken during the "Challenger" expedition (18; 2-76) the average composition of the solids in sea water may be considered to be: sodium chloride 2.60%, magnesium chloride 0.31%, magnesium sulfate 0.22%, calcium sulfate 0.12%, potassium chloride 0.07% and magnesium bromide 0.007%. The mixed salt obtained by evaporation of sea water has, however, the following composition irrespective of the source of the sea water: sodium chloride 77.82%, magnesium chloride 9.44%, magnesium sulfate 6.57%, calcium sulfate 3.44%, potassium chloride 2.11%, magnesium bromide 0.22% and some calcium carbonate.

Natural **Brines.**—Natural brines of commercial importance are found in Austria; France; Germany; Kharaghoda and Kuda, India; Michigan, New Tork state. Ohio; Pennsylvania, \Vest Virginia and the salt lakes of Utah in the United States; and in the Dead sea. In Great Britain there are salt brines in Cheshire, Worcestershire, Lancaster and Torkshire and in deep wells in Derbyshire, Staffordshire and Midlothian. Salt in brines is nearly always accompanied by chlorides and sulfates of potassium. calcium and magnesium; in many cases carbonates and the valuable element bromine are present.

The Dead sea. which covers an area of 394 sq.mi., contains approximately 11,600,000,000 tons of salt, and the river Jordan. which contains only 3; parts of salt per 100,000 of water, adds each year 850,000 tons of salt to this total. The composition of Dead sea water is given in Table I (although the salts exist as ions in solution and are so analyzed; it is customary to express the analvses in terms of compounds):

TABLE I.— Composition of Dead Sea Water

Item	Surface water	Deep water (250 ft.)
Specific gravity	1.1651	1.2356
Sodium chloride	6.11%	7.20%
Potassium chloride	0.85%	1.25%
Magnesium bromide	0.38%	0.61%
Magnesium chloride	9.46%	13.73%
Calcium chloride	2.63%	3.82%
Calcium sulfate	0.11%	0.05%
Total solids.	19.54%	26.66%

The concentration of salts in the Dead sea increases to a depth of about 250 ft., after which it remains practically constant. At this depth and below it is a concentrated solution, which, indeed, is supersaturated when pumped up. for a slight deposition of salt takes place owing to diminished pressure. Noteworthy features of Dead sea water are its relative freedom from sulfates and the high proportions of potassium and bromine. These facts, coupled with the circumstance that atmospheric conditions in Palestine are favourable to solar evaporation for about eight months of the year,

indicate that the production of salt, potassium and even bromine is feasible in the Dead sea area. the process as regards salt and potash being similar to that described below under *Manufacture*. The brines at Kharaghoda resemble sea water in the character of their dissolved salts, but are much more concentrated and in some cases practically saturated.

TABLE 11.—*Composition of Some Concentrated Natural Brines*

Item	Droitwich	Winsford	Syracuse, N.Y.	St. Charles, Mich.	Artern, Saxony	Friedrichshall, Württemberg
	%	%	%	%	%	%
Sodium chloride	24.97	25.46	21.71	22.84	25.27	25.49
Sodium sulfate	0.26	..	..	..		..
Potassium chloride	..	..	..	..	0.12	..
Potassium sulfate	..	..	..	..	0.29	..
Magnesium bromide	..	..	..	0.26	..	..
Magnesium chloride	0.05	0.21	0.14	4.03	0.42	0.01
Calcium sulfate	0.37	0.45	0.50	0.20	0.40	0.44
Calcium chloride	..	..	0.19	0.77		..
Total solids	25.65	26.12	22.54	28.10	26.50	25.94

Table II gives the composition of some concentrated natural brines used for the production of salt in various countries.

Certain natural brines occurring in England and the United States are of interest. not only from the economic point of view, but also because they contain salts not usually found in brines, such as the chlorides of barium and strontium; when salt is produced from such brines special methods of manufacture are adopted.

In Great Britain these brines were found at great depth in boreholes in Derbyshire. Staffordshire and Midlothian during the search for petroleum wells. In the U.S. they occur in the Ohio valley district of West Virginia and in Ohio, at depths ranging from 1,100 ft. to 1,600 ft.

TABLE III.—*Natural Brines Containing Unusual Salts*

Item	Renishaw, Derbyshire	West Calder, Scotland	Pomeroy, Ohio	Malden, W. Virginia
Depth (feet)	3,198	3,910	..	..
Specific gravity	1.127	1.063	1.075	1.063
Sodium chloride	10.28%	6.26%	7.92%	6.01%
Potassium chloride	0.03%	0.04%	0.04%	0.06%
Magnesium bromide	0.11%	0.07%	..	..
Magnesium chloride	0.84%	0.55%	0.57%	0.50%
Calcium chloride	4.23%	1.34%	1.36%	1.49%
Strontium chloride	0.12%	0.16%	0.03%	0.02%
Barium chloride	0.14%	0.07%	0.04%	0.07%
Total solids	15.75%	8.49%	9.96%	8.15%

It has been suggested that those brines which are characterized by the absence of carbonates and sulfates have been produced by a natural process akin to the ion exchange (*q.v.*) process for softening water. (J. J. F.; A. G. F.; R. H. RN)

Rock Salt.—Rock salt is crystalline halite (sodium chloride) occurring in the form of rock masses and beds. It has a wide geographic distribution and occurs abundantly in rocks of all ages. Because of its great solubility in water it occurs under extremely thick cover in humid regions, but lies close to the surface in arid regions.

All important rock-salt deposits originated from the evaporation of sea water at some time during the geologic past. Some 77% of the mineral matter in normal sea water is sodium chloride. Upon evaporation of about nine-tenths of the volume of sea water, rock salt is precipitated. The precipitation of rock salt overlaps the precipitation of calcium sulfate (gypsum and anhydrite) on the one hand and potassium and magnesium salts on the other. Thus these compounds commonly occur uith rock salt. Deposits are found in beds from a few feet to many hundreds of feet thick. In age these beds are distributed through much of geologic time from the Cambrian through the Mesozoic.

Since it is necessary to evaporate a large quantity of sea water to deposit a small amount of salt, it is thought that many extremely thick rock-salt beds were deposited in partly enclosed arrns of the seas in which evaporation was greater than inflow of fresher water. The supply of aater was continually renewed by inflowing currents while a barrier on the sea floor at the entrance to the basin prevented the outflow of the concentrated saline water so that the salts were deposited in thick beds on the basin floor.

Such bedded salt deposits occur in the Lower Cambrian of the Punjab Salt range in Pakistan and in Iran, but are little exploited. The Silurian and Devonian rocks of the northeastern Cnited States and Ontario in Canada contain important rock-salt deposits which are extensively worked for industrial and domestic use. The Carboniferous of Nova Scotia contains extensive rock-salt deposits which are utilized in eastern Canada and northeastern United States. The Pennsylvanian (Carboniferous) of Colorado and Utah contains large amounts of rock salt.

The rocks of Permian age contain some of the largest rock-salt deposits in the world. The most important are the Zechstein deposits of Germany, long exploited not only for their common salt but for their potassium content. The salt deposits of the sub-Carpathian region extending from Poland through Hungary and Rumania may be of this age. In the Donetz basin and the Volga region of European U.S.S.R. are extremely important deposits of Permian rock salt. In the United States enormous thicknesses of rock salt underlie much of the Permian basin extending from Kansas to western Texas.

The Triassic of England contains important rock-salt deposits which have been worked for many years. In the Tyrol the Triassic strata also contain important salt deposits. In the province of Szechwan, China, rock salt occurs in beds of Triassic Age and has been exploited through salt wells for more than 2,000 years.

Another type of rock-salt deposit which is economically important is the salt dome. This deposit has been forced up by earth pressure from great depths in the form of plugs of roughly circular shape a few yards to a mile across. The domes appear to be a development of folding, in which the salt is forced up through other rocks, because of its great plasticity under high pressure, from depths as great as 20,000 ft. Such salt domes are abundant along the Gulf coast of southern United States and extend into the east Texas basin and northern Louisiana. Many domes occur at shallow depths and are extensively mined to supply the southern United States. Similar domes in the sub-Carpathian region of Europe have been worked since ancient times. The north German plain has many domes, extensively worked, which are thought to have originated below 6,000 feet. (See SALT DOME.)

Rock salt may be expioited by usual mining methods. Another method of exploitation is by drilling wells into the salt strata, pumping water down them to dissolve the salt and treating the returning brine in a manner similar to the treatment of natural brines. It is difficult to arrive at any estimate of the relative importance of rock-salt production as compared with production of other types of salt since most available statistics make no distinction between natural and artificial brines. The United States and Europe are leaders in exploitation of rock-salt deposits. However, South American countries are developing their deposits rapidly with Brazil the largest producer. (J. M. Hs.: R. H. RN.)

Manufacture.—At one time almost all of the salt used in commerce was produced from the evaporation of sea water. and sea salt still is a staple commodity in many maritime countries, especially where the climate is dry and the summer of long duration. Commercial salt is manufactured (1) from rock salt and (2) from sea water and other natural and artificial brines. Most of the artificial brines are obtained by pumping water into wells drilled into underground salt beds and pumping up the solution which results when this water dissolves salt from the deposit. In addition to the ordinary uses of crystalline salts, much is used directly in the form of brine in industrial countries.

Manufacture From Rock Salt.—The beds of rock salt are mined or quarried by the usual excavation methods, depending upon the depths and thicknesses of the deposits and upon local conditions. In some cases the mined rock salt is dissolved and salt manufactured by treatment of the brine as described below. This treatment affords opportunities for purification of the salt. Where the rock salt is of high degree of purity, as in the United States and in Galicia, the salt is ground, sieved and marketed with no further treatment. The mined salt in large lumps is first crushed. then

more finely ground and screened to separate the various size grades; the oversize material going back to the mill and the acceptable sizes being packed for market, usually by bagging. A disadvantage of such salt is the tendency to revert to hard masses in storage. In Germany rock salt is treated in similar fashion, except that the larger fragments of impurities such as anhydrite and gypsum are hand picked from the coarsely crushed rock salt. Less pure German rock salt is purified by fusion, either alone or with sodium carbonate and silica or with chalk and saltpetre (sodium nitrate). In some cases, the fused mass is "blown" with air to burn away carbonaceous material, leaving a clear melt which crystallizes on cooling. After separation from the slag by concussion, the salt is ground and sieved. Alternately, an impure salt is leached with a saturated solution of pure salt in dilute hydrochloric acid whereby impurities such as gypsum, magnesium salts and iron oxide are dissolved. The treated salt is filtered, washed with a saturated solution of pure salt, dried, ground and graded for market.

Manufacture From Sea Water and Brines.—When an aqueous solution of several salts is evaporated, the salts separate, each as it reaches its point of saturation in the solution. The solubilities of the salts in the complex solution will, in general, be similar to but not the same as the solubilities for the same salts in water. In the case of sea water and many brines the order of deposition is calcium carbonate, calcium sulfate, sodium chloride, magnesium sulfate, carnallite (potassium magnesium chloride) and magnesium chloride. These salts are not, however, deposited within sharply defined limits of concentration. As each salt reaches its own point of saturation it deposits along with all the other salts which have reached their own saturation points. Therefore each salt deposited is contaminated by some of the other salts and by the residual brine. Further, the relative solubilities are altered by temperature and hence in solar evaporation the difference in temperature between day and night and also the seasonal temperature changes affect the character of the salt deposited. The art of the saltmaker is to produce grades of salt suitable for the particular use to which it is to be put.

Salt is produced by solar evaporation from sea water in France, Portugal. Spain, Italy, India, the U.S.S.R. and the United States—in fact, in nearly all maritime countries. The processes generally adopted are similar in principle, although details of evaporating pans and of manufacturing plants vary with local conditions. A preliminary concentration is usually carried out by allowing the brine to flow through a series of channels to concentration ponds constructed of wood, puddled clay or concrete. The areas of the ponds vary from 280 sq. ft. to 50 ac. in different countries. The solution is concentrated first to a specific gravity of about 1.21. At this stage, suspended impurities (sand and clay) and the less soluble salts (calcium carbonate or chalk and calcium sulfate) are removed. The clear concentrated brine is then run successively into a series of crystallizing pans, usually three, where the salt is deposited. The total area of the crystallizing pans is approximately one-tenth of that of the evaporating pans. In the first crystallizing pan the brine is concentrated to a specific gravity of 1.25 and here the best grade of salt is produced. The specific gravity of the mother liquor increases slowly during crystallization of the salt because of the increasing concentration of the other salts. The mother liquor reaches a specific gravity of 1.26 in the second pan where a second grade of salt is obtained. In the third pan a specific gravity of 1.275 is obtained and here the lowest grade of salt is deposited. The final mother liquor, termed bitterns, is used in some countries (*e.g.,* France, India and the United States) for the manufacture of potash, bromine, Epsom salts (magnesium sulfate) and magnesium chloride.

The salt in each crystallizing pan is raked into rows and allowed to drain for several days, is then collected into heaps, drained again, lifted from the pans and finally dried. As a tax is levied on salt (by weight) in most European countries, it is obviously an advantage to trade in the dried material. The salt from the first pan is frequently used locally as table salt, that from the second pan may go into the chemical industry and that from the third pan is used for pickling fish, refrigeration and other purposes. Typical compositions of the salts thus produced are given in Table IV.

In Palestine, solar evaporation of the Dead sea water is aided by dye added to the water. The dye permits complete absorption

TABLE IV.—*Typical Compositions of* Salts from Evaporation Pans

Item	Grade I	Grade II	Grade III
	%	%	%
Sodium chloride	96.0	95.0	91.0
Calciumsulfate	1.0	0.9	0.4
Magnesium sulfate	0.2	0.5	1.0
Magnesium chloride	0.2	0.5	1.2
Insolublematter	..	trace	0.2
Water (moisture)	2.6	3.1	6.2
	100.0	100.0	100.0

of sunlight in thinner layers of water so that shallow ponds may be used and absorption of brine by the ground is reduced.

In England, Germany, most of the eastern part of the United States and other places where it is impractical to manufacture salt by means of solar heat, the brines are concentrated and evaporated by artificial heat. Formerly the brine was concentrated in open pans over fire. More recently steam-jacketed vessels were used, but now the largest part of the salt produced in the colder countries is manufactured in multiple-effect vacuum evaporators and an important quantity is made in open crystallizers or grainers which produce a type of crystal preferred for use in some of the food industries. The brine, natural or artificial, is first pumped into settling tanks, where calcium and magnesium compounds may be removed by chemical treatment, usually lime and sodium hydroxide are used. After settling and filtration, the brine is delivered to the grainer, which is a long open trough with steam coils. The brine is fed into the grainer at approximately the same rate as that at which evaporation is taking place and at a temperature only slightly below that of the brine in the grainer. The residue of brine or bitterns, may be removed daily or less often or may be withdrawn continuously. The evaporation occurs at the surface of the liquid and the crystals originate there. They remain at the surface, held up by the surface tension of the brine. The crystal grows at the top edges, becoming a small inverted hollow pyramid or hopper. Eventually the hopper sinks and ceases to grow. When the crystals are recovered the salt is largely in the form of flakes, whence the name "flake salt." When multiple-effect evaporators are used, the vacuum in each vessel is adjusted so that the vapour from the first vessel is sufficiently hot to boil the brine in the second; the vapour from the second supplying the heat to operate the third vessel or effect. The brine is usually sent through the stages or effects in succession, although in the case of salt manufacture, fresh brine may be fed to each stage if desired. In a triple-effect system, vacuums of 15 in., 25 in. and 27 in. of mercury have been found efficient. With open pans, one ton of coal will produce about two to two and one-half tons of salt whereas it will yield five to six tons of salt with an efficient triple-effect plant.

After crystallization, with either closed or open equipment, the brine is separated from the salt by draining or by centrifugal separation. The moist salt is then dried by a current of hot air, usually in rotary driers; however, a "fluid bed" type of drier may be used.

In the late 1950s, the proportions of salt produced in the United States by various processes were approximately: open-pan evaporation 2%, vacuum evaporation 10%, solar evaporation 5%, rock salt 20%, used in brine 59%.

Properties of Salt.—Pure sodium chloride may be made by passing dry hydrogen chloride gas into a saturated solution of the salt whereupon the purified salt is deposited as a colourless crystalline powder. It crystallizes in the cubic system, usually as cubes (see above under Rock Salt). The melting point is 800° C., which is a bright red heat. Vaporization begins near this temperature. It dissolves easily in cold water and a little more readily in hot water; 100 parts by weight of water dissolve 35.8 parts of salt at 20° C., 39.2 parts at 100° C. and 39.6 parts at 108.7° C., the boiling point of the saturated solution. If a saturated solution in water be cooled below 0° C. a crystalline hydrate, $NaCl.2H_2O$, separates. (See HYDRATE.)

Solution of salt in water is accompanied by reduction of tem-

perature: 36 parts of salt in dissolving in 100 parts of water at 12.6° C. will lower the temperature to 10.1° C. If the same proportion of salt and snow be intimately mixed the temperature falls to −21.3° C.

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SALTA, a northwestern province of Argentina. An official decree of Sept. 23, 1943, awarded to Salta the departments of San Antonio de los Cobres and Pastos Grandes, both in the former territory of Los Andes. The province is bounded on the west by Chile. Area, after these boundary changes, 59.759 sq.mi.; pop. (1947) 290,826, (1960) 412,652. In terms of its present boundaries the western part of the province lies in the Andean highlands and is characterized by lofty chains of mountains (sierras) and high, intermont basins or salares.

The sandy and rock-strewn volcanic soils support a sparse cover of stunted plants and hard grasses. The climate is arid and cold, although extreme diurnal variations in temperature are quite common.

Streams are numerous but small, and nearly all drain into the salares, where their waters are rapidly evaporated. In the valleys of the central and eastern parts of the province the vegetation is exuberant, with thick forests of valuable woods. The eastern plain is well watered and hot, with precipitation and temperatures decreasing westward with increasing altitudes. The capital of the province is Salta (*q.v.*).

The chief rail communications of the province are provided by the Belgrano railway, with connections to all of the principal parts of Argentina and to Bolivia, and across the Andes to Antofagasta, Chile. The excellent natural forage in the province has long made livestock raising a lucrative enterprise. Since colonial times Salta has supplied the markets of northern Chile with cattle, formerly driven on the hoof across the Andes, and when prices are sufficiently high to offset transportation costs, the animals are in demand in the markets of the east coast. Sheep raising is also important.

Although a great variety of crops is planted, tobacco (considered the best in the country) and sugar cane lead in commercial importance. The province also produces appreciable quantities of timber and minerals, and ordinarily ranks third among the Argentine states in the production of petroleum. Other minerals include gold, silver, copper, marble and lead.

(R. W. RD.; X.)

SALTA, a city of Argentina and capital of a province of the same name. in the picturesque and historic valley of Lerma, 1,007 mi. by rail N.N.W. of Buenos Aires. Population (1960) 121,491. Salta was founded in 1582 (under the name of San Felipe de Lerma) by Hernando de Lerma, governor of Tucuman. In 1813, during the War of Independence, the Spanish forces under Gen. Pio Tristán, after suffering a decisive defeat at Salta, were obliged to capitulate to Gen. Manuel Belgrano. Salta, 3.895 ft. above sea level. is the centre of a rich mineral and timber region. Mean monthly temperatures range from 53° F. in June to 72° F. in January; average annual rainfall is 28 in., with a distinct dry season from May to October.

A colonial city that has preserved and perpetuated colonial architecture and traditions, Salta holds many attractions for tourists and offers exceptional hotel accommodations and travel facilities.

SALTASH, a municipal borough in the Bodmin parliamentary division of Cornwall, Eng., 4 mi. W.N.W. of Plymouth by road and ferry. Pop. (1961) 7,420. Area 8.3 sq.mi. It is on the wooded west shore of the Tamar estuary, on the opposite side of which lies Plymouth. Communications are maintained by two floating ferry bridges. At Saltash the Royal Albert bridge (1848–59), built by I. K. Brunel, carries the railway across the estuary. The church of St. Nicholas and St. Faith has an early Norman tower and that of St. Stephen retains its ornate Norman font. Saltash (Aysh, 1284; Saltesh, 1337), the oldest borough in Cornwall, belonged to the manor of Trematon, and at the Domesday survey was held by Reginald de Valletort. A charter was granted sometime at the end of the 12th century. Roger de Valletort gave the borough to the earl of Cornwall, and thenceforth the earls, and subsequently the dukes of Cornwall were lords of Saltash. The privilege of parliamentary representation was conferred by Edward VI.

In 1584 Elizabeth I granted the town a charter of incorporation which was superseded by another in 1683, and the modern charter was adopted in 1886. In 1832 Saltash was deprived of its two members of parliament. Saltash is in part a fishing town. One mi. S W. is Trematon castle, associated with the Black Prince.

SALTBUSH, the name given especially in Australia to plants of the genus *Atriplex* (family Chenopodiaceae). which inhabit arid saline soils, notably to A. halimoides and *A. nummularia*, which are cultivated for forage. *A.* semibaccata, also native to Australia, is grown as a forage plant in California, where it is known as Australian saltbush.

See GREASEWOOD.

SALT DOME. Geologic structures in which salt is a controlling factor may be steep folds in which salt flowage modifies the geologic deformation or structures in which the flow and uplift of the salt itself is the primary geologic movement. It is this latter type of geologic phenomenon which is commonly meant by salt dome. Such structures commonly are roughly circular in plan although some may be greatly elongated. Usually the vertical dimensions are of the same order or greater than the horizontal dimensions. A typical dome may consist of a more or less cylindrical vertical salt column about two miles across and with a vertical dimension of three to six miles. However, the size of individual domes in the same area may vary greatly.

Salt domes always occur in areas underlain by thick layers of salt which is primarily sodium chloride. Domes are not found in all areas of thick salt deposits but only where such deposits have been buried to great depth by subsequent deposition. It appears that a minimum overburden of the order of 10,000 ft. is required for salt domes to form and domes are known where the depth to the salt is estimated to be as great as 30,000 to 40,000 ft.

Origin and Mode of Formation.— There has been considerable controversy and speculation in geological literature on the mechanics of the formation of domes. European geologists. from studies of the German and Rumanian salt structures, recognized that the domes were formed from bedded salt which had flowed under pressure. In some areas the salt flowage resulted from recognized tectonic forces. In other cases, however, such as in the Gulf coast of the United States, there is no recognized tectonic pattern. The intrusive uplift of the domes now is generally attributed to buoyancy resulting from the fact that the density of the salt is less than that of the surrounding sedimentary rocks. The existence of a density difference is shown by the negative gravity anomalies of practically all of the simple, round intrusive salt domes of the Gulf coast and many other areas. as determined by geophysical prospecting (*q.v.*) methods

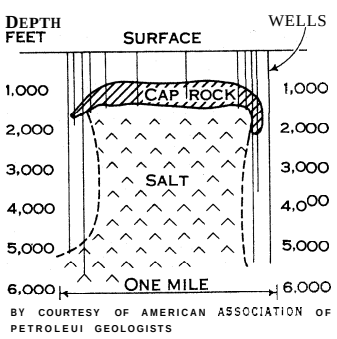
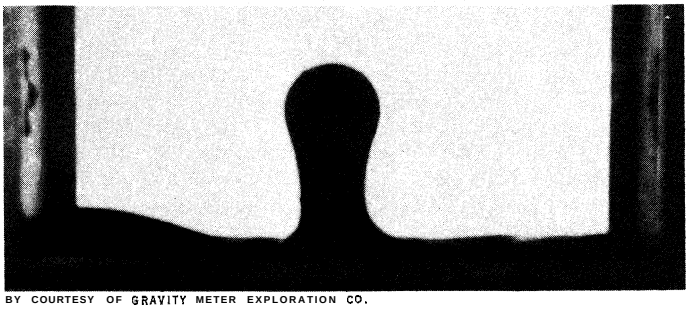


FIG 1.—CROSS SECTION OF A GULF COAST SALT DOME, ALLEN DOME, BRAZORIA COUNTY. TEX.

This theory. which appears to account for many of the major features of salt domes. may be likened to the flow of fluids. One can compare the layer of low density salt under heavier sediments with a low density fluid under a heavier one. and models based on this principle produce

forms which are rather strikingly similar to the forms which salt domes have in nature. Figure 1 shows a cross section of a salt dome and fig. 2 a fluid model consisting of a layer of asphalt with a density of 1.0 beneath heavy sirup with a density of 1.4. After the flow is localized by an initial disturbance. the asphalt rises up through the sirup because of its lower density and takes a form very similar to that which many of the Gulf coast domes are known to have from drilling and from analysis of geophysical surveys.



BY COURTESY OF GRAVITY METER EXPLORATION CO.

FIG. 2.— FLUID MODEL TO SIMULATE SALT DOME FORMATION. BLACK PART IS LOWER DENSITY ASPHALT FLOWING UPWARD IN HIGHER DENSITY SIRUP. ONE-FOURTH NATURAL SIZE

Moreover, the ratios between the mechanical properties of the model and those of its prototype in nature are such that the dimensional relations are approximately correct for dynamic similitude. Thus, it appears quite clear that a major factor in the uplift of intrusive salt domes is simple isostatic flowage of the salt because it is of lower density than the sediments.

Cap Rock.—Many of the salt domes, especially in the Gulf coast of the United States and in Germany, have a so-called cap rock. In the Gulf coast, this usually consists of an upper layer of limestone (calcium carbonate) and a lower layer of anhydrite (anhydrous calcium sulfate). In some shallow domes, the limestone may be missing and part or all of the anhydrite changed to gypsum. apparently by contact with surface waters. When present, the cap rock usually covers the top of the dome completely and may extend down the flanks forming a cap or thimble over the salt. It may vary in thickness from a few feet to over 1,000 ft.

The mechanism and chemistry of the formation of cap rock is not clearly understood. It has been suggested that the cap rock is a disk of overlying evaporite deposit which was punched out and pushed up by the intrusive salt, but this theory has been largely discarded

The more generally accepted theory is that the cap rock is formed from minerals originally disseminated through the salt which become concentrated as the salt is dissolved a ay by circulating waters near the surface.

Distribution **of** Domes.—The simple piercement salt domes resulting from isostatic flowage of salt are best known in the southeastern United States because of the intensive drilling around them on account of their economic importance. The Gulf coast belt of domes extends 50 to 100 mi. northward from the coast and reaches from the Mississippi river westward across Louisiana and Texas to midway between Houston and Corpus Christi. The same belt extends offshore for many miles, as shown by geophysical surveys and drilling in the waters of the continental shelf. There are now some 1 jo proven domes in this belt. **A** separate small group of five domes lies between Corpus Christi and Laredo, in southern Texas. The "interior" domes include about 20 in the Tyler basin of northeast Texas and about 70 in a belt extending southeastnard from Shreveport. La., across northern Louisiana and southern Mississippi to southwestern Alabama.

In addition to these domes proven by drilling into salt. there are a great many probable, and deeper domes indicated by geophysical work.

Outside of the southeastern states, the only salt structures known in North America are in the Paradox basin of western Colorado and eastern Utah. but these structures are long folds controlled by tectonic movement and not simple piercement domes. Salt occurrences. possibly in domes, are found in Nova Scotia.

Domes controlled primarily from flowage of salt. but in some cases with modification by tectonic forces, occur in northern Germany. Denmark. Poland. Rumania. northern Spain the Isthmus of Tehuantepec in Mexico, in small areas in Colombia, Peru, and Argentina. in southern Iran along the northeasterly shore of the Persian gulf and in the Persian gulf itself, in western U.S S.R. with the largest area being north of the Caspian sea, and on the west coast of French Equatorial Africa.

Economic Importance.— Salt domes are of great economic importance because of oil. sulfur. and the salt itself.

In areas where the salt domes have intruded or uplifted petroliferous-bearing sedimentary rocks, the deformation nhich localizes oil accumulation is commonly over or around a dome (see PETROLEUM).

A very large fraction of the oil production of the gulf coast of Texas and Louisiana is taken from salt dome structures Since the discovery of the first salt dome oil field in the gulf coast in 1901 some 350 proven or probable salt domes have been located (a large number by geophysical surveys) and many have oil fields over them or around their flanks.

The most productive salt dome area is the Texas-Louisiana coastal belt. where oil production averages about 300,000,000 barrels per year. Oil is also found in salt dome structures in Germany, Rumania. U.S.S.R. and in West Africa.

A relatively small number of the shallow domes with thick cap rock are very prolific sources of sulfur, which occurs in the porous limestone in the upper part of the cap rock. It is mined by the Frasch process in which the sulfur is melted by superheated water and pumped, by compressed air, as a liquid. Of the approximately 240 domes in Texas. Louisiana and Mississippi, approximately 60 are shallow and have thick cap rock but of these only about 18 all in the coastal belt. have sulfur in sufficient quantity and purity to be mined economically. Sulfur is also mined from a small number of domes in the Isthmus of Tehuantepec in Mexico. Salt dome sulfur production has averaged approximately 5,000,000 long tons per year.

In a small number of domes, the salt itself is mined, either by shafts into the dome and normal mining operations or by solution of the salt by circulating water. Production of salt is approximately 5,000,000 short tons per year.

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SALTILLO, capital city of the Mexican state of Coahuila, is at the northern edge of the great central plateau of Mexico. Founded in 1586, Saltillo is chiefly significant as an active commercial and manufacturing centre and communications hub. It has an annual fair of importance and manufactures cotton and woollen fabrics, knitted goods and flour. Its blankets or serapes have for centuries been considered among Mexico's finest and many are collector's items. Coal seams near by are exploited on a small scale, though the chief reserves lie in the Sabinas basin. Pop. (1960) 95.066. (HD. C.)

SALT LAKE CITY, the capital of Utah, U.S., and seat of Salt Lake county. is the largest city between Denver and the Pacific coast. World capital of the Latter-day Saints (Mormons). it is also the seat of Roman Catholic and Episcopal dioceses and a regional metropolis influencing the economic. social. cultural, educational and political life of people in an area of about 185,000 sq.mi., embracing not only Utah but southern Idaho, eastern Nevada and southwestern Wyoming.

Salt Lake valley, in which the city is situated, is the southernmost of the numerous valleys which together compose the valley of the Great Salt Lake and is almost central in the longer chain of fertile irrigable valleys lying at the west base of the Wasatch mountains. Salt Lake City lies at an approximate elevation of 4.200 ft. under magnificent peaks that rise in places more than 7,000 ft. above the valley floor; its wide. generally rectangular, tree-lined streets are laid out on a series of terraces lifting gently east and north from the Jordan river. This river, which connects Utah lake with the Great Salt lake (*q.v.*), flows nearly north

through the valley, bordered on the west by poorly drained, alkaline and generally infertile plains. The principal incorporated area of Salt Lake City occupies the northern part of Salt Lake valley, east of the Jordan; in the central and southern reaches are various suburban communities. including South Salt Lake, Murray, Midvale, Sandy City and Draper.

On its founding, the centre of Salt Lake City was placed close under the northern benchlands, so the city developed asymmetrically to the east, south and southeast. Major expansion westward came only during and after World War II. That same period made the whole of Salt Lake valley a residential appendage of the city, as also Davis county to the north; this growth was directly related to the development of an adequate metropolitan water supply in the late 1930s and early 1940s. The metropolitan area of Salt Lake City reaches toward that of Ogden (*q.v.*), 35 mi. N., with which it has a twin-city relationship, but because of historical priority, general economic dominance and Salt Lake City's status as a federal and state government centre, the influence of the capital city is overriding.

History.— Salt Lake City (until 1868 Great Salt Lake City) was founded in 1847 as the central city of Mormon settlement in the west, and its history since has been inextricable from that of the church (see LATTER-DAY SAINTS, CHURCH OF JESUS CHRIST OF) and of the state (see UTAH: History). A planned community from the outset, Salt Lake City was laid out by Brigham Young (*q.v.*) in accordance with a plat for the city of Zion drawn by Joseph Smith in 1833. Streets 8 rods wide were made to run with the cardinal directions and to cross at right angles, dividing the land into square blocks of 10 ac. each, originally divided into 1¼ ac. lots, with provision for public squares, of which one was set aside as the Temple block. Streets were numbered outward from the central Temple block, those on the south being named South Temple, 1st South, 2nd South, etc., those on the west, West Temple, 1st West, and so on. However, East Temple eventually was renamed Main street, and 1st East became State street. Later, as the city grew, "courts" and "places" were cut into many of the large central blocks, and new subdivisions were cut up into smaller areas, especially on the steep North Bench and south of 9th South street. The old rectangular street pattern continued dominant until World War II, and curving streets are found chiefly in modern subdivisions, west of the Jordan or high on the eastern benchlands.

Those who wintered in Salt Lake valley in 1847–48, numbering about 1,700, lived in a log and adobe fort centring upon the present Pioneer park. Permanent allocation of the land began when Young made his final return from the Missouri river in Sept. 1848, and most of the settlers began building on their lots the following spring. At that time the city was divided into 19 ecclesiastical wards of nine square blocks each, the bishop of each ward acting as magistrate.

Previously, reflecting the theocratic character of Mormon society, the city had been ruled by a high council, administering an ecclesiastical jurisdiction called a stake of Zion, coextensive with the city. It was the high council that enacted the first municipal ordinances, ratified in public meeting Jan. 1, 1848. Out of this original localized theocratic government evolved the broader State of Deseret, organized by the Mormons in 1849 to embrace a vast area between the Sierra Nevada and the Rocky mountains. By that time, the treaty of Guadalupe Hidalgo having been ratified, the site of Salt Lake City with the rest of Utah had passed from Mexican to U.S. sovereignty. The provisional State of Deseret was not recognized by congress, which instead created the Territory of Utah in Sept. 1850, but before its dissolution, the Deseret legislature in Jan. 1851, incorporated Great Salt Lake City. The city charter almost exactly duplicated that once granted the Mormon city of Nauvoo by the Illinois legislature, which made the city virtually an autonomous political unit, empowered to pass any law not in conflict with the state or federal constitutions and to maintain its own militia and city court. Until its repeal the Nauvoo charter was a storm centre of Illinois politics; in a different environment, the Salt Lake City charter occasioned no trouble.

Organized Mormon immigration, gathering the faithful initially from the midwest and later from the eastern states and Europe, quickly made Salt Lake City famous as "the New Jerusalem," "the City of the Saints." The unexpected discovery of gold in California in 1848 contributed greatly to its early growth, as a flood of gold seekers en route to California poured in upon the city in 1849, trading clothing, tools and manufactured goods for fresh livestock and crops. Overland emigration continued as a stimulus through the 1850s, not nithout friction between Mormon settlers and non-Mormon travelers. The city continued as a staging point for arriving Mormon converts, who were sent from Salt lake to open or strengthen new communities down the entire length of Utah. This planned system of colonization thus tended to drain off population that might otherwise have stimulated the early growth of the church headquarters city. but at the same time gave it deep roots in the entire mountain-desert west. Public works projects. instituted by the church in the early 1850s to furnish employment for the needy, contributed to the building up of the city, including a wall erected around the Temple block and a never-completed wall around the city itself, supposedly to protect it from the Indians but chiefly useful as an object-lesson to smaller and more exposed Mormon towns.

In 1858. during the so-called Utah war of 1857–58, when anti-Mormon agitation led to the federal government's declaring "a state of substantial rebellion" in Utah, Gen. Albert Sidney Johnston's army marched through the city en route to establish a military post, Camp Floyd. west of Utah lake. There followed a considerable influx of non-Mormons, giving Salt Lake City a rowdier character but also renewing economic vitality. These federal troops were withdrawn from Utah after the American Civil War broke out, but were replaced in 1862 by a regiment of California-Nevada volunteers commanded by Patrick Edward Connor, who established Camp (later Fort) Douglas on the benchland above the city, the better to keep the doubtfully regarded Mormons under military scrutiny. Prospecting by these soldiers soon opened up Utah's mining economy and gave non-Mormon merchants a better foothold in Salt Lake City, but their position continued precarious until the completion in 1869 of the Union Pacific railroad (which by-passed the city itself) put the mining industry on a sound basis.

The Mormon-built Utah Central railroad, completed Jan. 1, 1870, connected Salt Lake City with the Union Pacific at Ogden, and during the next decade other roads were built from Salt Lake City in all directions to now-booming mining regions. Violent political strife came for the first time with this new order of things, the non-Mormon Liberal party contending with the Mormon People's party for local supremacy, while the federal government intervened massively with legislation, ostensibly directed against the Mormon practice of polygamy but basically designed to force a separation of church and state. In 1690 the Mormon church surrendered on the polygamy issue, and though intermittent conflicts between Rformon and non-Mormon elements continued as late as 1905–07, when the American party captured the city government, the old social antagonisms gradually disappeared. Since World War I the history of the city has been primarily economic and cultural, as in the case of most other large U.S. cities.

Except between 1851 and 1856, when Fillmore was the legal capital, Salt Lake City since its founding has been capital of Utah in name as well as fact. The graceful capitol building at the head of State street overlooking the city was erected in 1912–15. Other familiar landmarks include Temple square, with the many-spired gray granite temple and the turtle-domed tabernacle; and on the adjacent block to the east, two of Brigham Young's residences, the Beehive house and the gabled Lion house. On what was once Emigration square the City and County building with its lofty sandstone clock tower was built in 1897. High office buildings and hotels along Main street were principally completed between 1909 and 1924. Along the East Bench sprawls the broad campus of the University of Utah, and above it old Ft. Douglas, established in 1862. Farther south, near the mouth of Emigration canyon, is a state park centred upon the This is the Place Monument, which commemorates the Mormon entrance into Utah in 1817.

Population.— By the 1960 census Salt Lake City's population

was 189.454. The population of the standard metropolitan statistical area (Salt Lake county) in 1960 was 383,035, an increase of 3.0% over 1950. The nonwhite percentage was less than 2% of the total population of the city and consisted principally of Japanese, Negroes, Chinese and Filipinos. Many of the early settlers in Salt Lake City came from Europe, particularly England and the Scandinavian countries, as the result of Mormon missionary work. After the Civil War the number of non-Mormons in the city steadily increased and by 1960 comprised an estimated 40% of the population.

Government.— Salt Lake City is governed by a mayor and board of five commissioners, elected in nonpartisan elections. Revenue comes mostly from taxation of real property but also from franchise and other taxes, from fees and licences, and from the municipally owned waterworks and airport.

Commerce, Industry and Transportation.— Principal industries include food processing, printing and publishing, oil refining, coking, copper refining, smelting of silver, lead and copper, manufacture of iron, steel and clay products and of radio equipment, electronics and textiles. The copper mines at Bingham and a Geneva steel plant in Utah valley have greatly contributed to the growth of metal fabricating industries since the early 1900s. The city serves a major wholesaling function in its region, aided by transportation facilities which include service by several railroads, highways and airlines. The city is the seat of a branch of the Federal Reserve Bank of San Francisco.

Education and Cultural Activities.— Public education is administered by a board made up of two members elected from each of the six municipal wards and by a superintendent appointed for a minimum term of two years. Institutions of higher learning in the city include the University of Utah (see UTAH: Education) and Westminster college (Presbyterian, established in 1875). Hospitals are operated by religious denominations and a fraternal organization as well as by Salt Lake county and the Veterans administration. The Utah Symphony orchestra, Salt Lake opera, Tabernacle choir and organ recitals and University of Utah music festival are among the best known of the state's musical activities. Art collections are displayed in the state capitol, the State Historical society mansion, the University museum and the Art Barn. Besides many specialized museums at the university and displays at the capitol, pioneer collections are shown in museums of the Mormon church at Temple square and the Daughters of Utah Pioneers, and in the Pioneer Village of the Sons of Utah Pioneers. Principal libraries are those at the university, Salt Lake City Free Public library, Utah State library, and Utah State Historical society, as well as the private Historian's Office of the Mormon church.

Parks and Recreation.— The 100-ac. landscaped Liberty park, once the Brigham Young farm, is the principal municipal park. Memory grove, below the capitol. is a war memorial. Other parks and playgrounds are scattered about the city, and some are maintained in nearby canyons, a contrast to beach resorts and a yacht. harbour on Great Salt lake, west of the city. Golf courses, a zoo, tennis courts and other recreational facilities are easily accessible. (D. L. M.)

SALTO, a rich department in northwest Uruguay. on the Uruguay river. Pop. (1954 est.) 123,003. Area 5,546 sq.mi. The rolling rocky soil is well suited for pasture and there are considerable numbers of both cattle and sheep on the ranches of Salto. Orange and tangerine production is also important; citrus groves stretch for about 20 mi. around the departmental capital, Salto (*q.v.*). The department's vineyards are considered the best in Uruguay. Salto also grows corn, cereals, sunflower seeds, flax, forage crops, tomatoes and strawberries. (M. I. V.)

SALTO, capital of the department of Salto in Uruguay, a river port on the Uruguay river, rivals Paysandú, farther south, for position as Uruguay's second city. Pop. (1954 est.) 44.900. North of Salto the Uruguay river is too shallow even for river boats so the port supplies northwest Uruguay and parts of the Brazilian state of Rio Grande do Sul. Salto has air and road connections with Montevideo and other points. Wine production and orange-drink bottling, both from locally grown fruits, are outstanding among Salto's industries. Pueblo Nuevo, a new suburb north of the city, has important shipyards. Salto probably was founded as a depot where hides could be assembled for shipment downriver, either in 1756 or 1817. (M. I. V.)

SALTPETRE: see NITRIC ACID AND NITRATES.

SALT RANGE, a hill system in the West Pakistan, deriving its name from its extensive deposits of rock salt. The range commences in Jhelum district, in the lofty hill of Chel (3,701 ft.), on the right bank of the Jhelum river, traverses Shahpur district, crosses the Indus in Mianwali district, thence a southern branch forms the boundary between Bannu and Dera Ismail Khan until it finally merges in the Waziristan system of mountains. The highest point (4,992 ft.) is at Sakesar resort.

SALTYKOV, MICHAEL EVGRAFOVICH (1826–1889), Russian satirist who wrote under the pseudonym of Nicolay Evgrafovich Stchedrin, was born in the province of Tula, Jan. 15 (27), 1826. In 1848 he published *Zaputennoye Dyelo* ("A Complicated Affair"), which led to his banishment to Vyatka, where he spent eight years as a minor government official. The clever picture of Russian provincial officials in his *Gubernskie* Otcherki ("Provincial Sketches") resulted from this experience. After an interval given to writing he was appointed deputy governor, first of Ryazan and then of Tver. On his return to St. Petersburg in 1864 he was appointed president of the local boards of taxation successively at Penza, Tula and Ryazan. In 1868 he finally left the civil service. His principal works are: Poshekhonskaya *Starina* ("The Old Times of Poshekhona"), *Istoria* odnavo Goroda ("The History of a Town"); a satirical history of Russia; Messieurs et *Mesdames* Pompadours; and Messieurs *Golovloff*. He died in St. Petersburg on April 30 (May 12), 1889.

SALUS, an ancient Roman goddess of safety and welfare, later identified with the Greek Hygieia (*q.v.*) who was exclusively a personification of health. Although essentially a deified abstraction, Salus was nevertheless worshiped quite early both at Rome and throughout Italy. Her temple on the Quirinal was dedicated in 302 B.C. and was the scene of an annual sacrifice on Aug. 5. Its walls were decorated with frescoes painted by C. Fabius, consul in 269 B.C. As a result he was called Pictor, "the Painter," a name which he handed down to his descendants—among them Fabius Pictor the annalist.

The *augurium* salutis, not involving a personification and possibly antedating the deification of Salus, was an annual performance; it was an inquiring to ascertain whether it was acceptable to the gods to hear prayers for the public salus. Since it had to be performed on a day of peace, the constant warfare of the late republic caused its interruption, but it was revived by Augustus. In the empire the goddess appears both as Salus publica and Salus Augusti.

In 180 B.C. on the occasion of a severe pestilence a *supplicatio* was held in honour of Apollo, Aesculapius (*qq.v.*) and Salus, revealing that the identification with Hygieia was made this early and Salus was regarded as a deity of public health. Indeed, on coins she appears regularly as Hygieia, with patera and sacred snake, although at times with ears of grain, symbolic of general prosperity.

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SALUTATIONS (GREETINGS), the customary forms of kindly or respectful address, especially on meeting or parting or on occasions of ceremonious approach. Etymologically salutation (Lat. *salutatio,* "wishing health") refers only to words spoken.

Embraces.— Forms of salutation frequent in preliterate societies may persist almost unchanged in civilized custom. The habit of affectionate clasping or embracing is seen at the meetings of the Andaman islanders and Australian aborigines, or where the Fuegians in friendly salute hug "like the grip of a bear." This natural gesture appears in old Semitic and Aryan custom.

Rubbing Noses.—The salute by smelling or sniffing (often called by travelers "rubbing noses") belongs to Polynesians, Malays, Burmese and other Indochinese, Mongols, etc., extending thence eastward to the Eskimo and westward to Lapland.

Kissing.--The kiss, the salute by tasting, appears constantly

in Semitic and Aryan antiquity. Herodotus describes the Persians of his time as kissing one another—if equals on the mouth, if one was somewhat inferior on the cheek. In Greece. in the classic period. it became customary to kiss the hand, breast or knee of a superior. In Rome the kisses of inferiors became a burdensome civility. The early Christians made it the sign of fellowship: "greet all the brethren with an holy kiss." Of more ceremonial form is the kiss of peace given to the newly baptized and in the celebration of the Eucharist. which is retained by the Greek church. After a time, by ecclesiastical regulations, men were only allowed to kiss men. and women women, and eventually in the Roman Catholic Church the ceremonial kiss at the communion was only exchanged by the ministers, a relic or cross called an *osculatorium* or *pax* being carried to the people to be kissed. While the kiss has thus been adopted as a religious rite, its original social use has continued. Among men, however, it has become less effusive. Court ceremonial keeps up the kiss on the cheek between sovereigns and the kissing of the hand by subjects. When these osculations cease to be performed they are still talked to by way of politeness: Austrians say, *Küss d' Hand!* and Spaniards, *Beso* a *Vd. las manos!* ("I kiss your hand!") Strokings, pattings and other caresses have been turned to use as salutations.

Weeping.— Weeping for joy is sometimes affected as a salutation. Highly ceremonious meeping is performed by several primitive peoples when, meeting after absence, they renew the lamentations over friends who have died in the meantime. Among the Australian aborigines, the male nearest of kin presses his breast to the newcomer's, and the nearest female relative, with piteous lamentations, embraces his knees with one arm. while with the other she scratches her face till the blood drops. Obviously this is mourning. So, too, the New Zealand *tangi* is performed at the reception of a distinguished visitor, whether he has really dead friends to mourn or not. Weeping, as A. R. Brown has shown, is for the Andamanese a rite for the revival of sentiments that have lain dormant, the renewal of interrupted social relations and for the recognition of a change in personal relations.

Cowering.— Cowering or crouching is a natural gesture of fear or inability to resist. Its extreme form is lying prostrate, face to the ground. In barbaric society, as soon as distinctions are marked between master and slave. chief and commoner. these tokens of submission become salutations. The sculptures of Egypt and Assyria show the lowly prostrations of the ancient east, while in Dahomey or Thailand subjects crawl before the king. A later stage is to suggest, but not actually perform, the prostration, as the Arab bends his hand to the ground and puts it to his lips or forehead, or the Tongan would touch the sole of a chief's foot, thus symbolically placing himself under his feet.

Kneeling.— Kneeling prevails in the middle stages of culture. as in the ceremonial of China; Hebrew custom sets it rather apart as an act of homage to a deity; medieval Europe distinguished between kneeling in worship on both knees and on one knee only in homage.

Bowing.— Bowing, as a salute of reverence, appears in its extreme in oriental custom, as among the ancient Israelites: "bowed himself to the ground seven times." The Chinese according to the degree of respect implied bow kneeling or standing. The bowing salutation, varying in Europe from something less than the eastern salaam down to the slightest inclination of the head, is given mutually. Cncovering is a common mode of salutation. originally a sign of disarming or defenselessness or destitution in the presence of a superior. Taking off the hat by men has for ages been the accepted mode in the western world. Some eastern nations are apt to see disrespect in baring the head. hut insist on the feet being uncovered. Europeans have been called on to conform to custom by taking off their shoes to enter the royal presence. In Burma it is respectful to squat in the presence of a superior; elsewhere the inferior should stand.

Handshaking.— Grasping hands appears in antiquity as a legal act symbolic of the parties joining in compact. peace or friendship. In marriage, the hand grasp was part of the ancient Hindu ceremony, as was the *dextrarum iunctio* (joining of right hands) in Rome. which passed on into the Christian rite and became a mere salutation.

Words of Greeting.— As to words of salutation. even among primitive peoples certain ordinary phrases have passed into formal greetings. Many formulas express difference of rank and consequent respect. as where the Basuto salute their chiefs with *Tama sevata!* (*i.e.*, "Greeting. wild beast!"). Congo Negroes returning from a journey salute their wives with an affectionate *Okowe!* but they, meekly kneeling round him, may not repeat the word, but must say *Ka! kn!* Among civilized peoples salutations are apt to be expressions of peace and good will. There are numerous biblical examples; *e.g.*, "Peace be to you and peace he to your house" (I Sam. xxv, 6). Such formulas run on from age to age and may be traced on to the Moslem greeting *Salam 'alaikum!* ("The peace be on you"). to which the reply is *Wa-'alaikum as-salam!* ("And on you be the peace [of God]!"). This greeting is a password among fellow believers, for it may not be used by or to an infidel. The Babylonian form. "O king, live for ever!" (Dan. iii, 9), represents a series of phrases which continue still in the *Vivat rex!* ("Long live the king!"). The Greeks said, "Be joyful!" both at meeting and at parting. The Romans applied *Salve!* ("Be in health!",) especially at meeting, and *Vale!* ("Be well!") at parting. In the modern civilized world. everywhere, the old inquiry after health appears. the "How do you do?" becoming so formal as often to be said on hoth sides. without either waiting for an answer. Hardly less wide in range is the set of phrases "Good day!" "Good night!" etc.. varying according to the hour and translated into every European language. Among other European phrases. some correspond to the English "Welcome!" and "Farewell!" ("God be with you!") and French *Adieu!* ("To God!"). Such half meaningless forms of salutation serve the purpose of keeping up social relations. (E. B. T.: X.)

SALUTE, a friendly greeting or gesture of respect. Although the salute has existed in one form or another. both civilian and military. for many centuries. the modern connotation of the word is primarily military and naval. In this sense salutes are usually performed by prescribed movements of the hand. flag, rifle, sword or sabre, or by firing guns or playing music. Cheering and manning the yards of naval ships are forms of saluting that have become obsolete. It is not possible to determine the exact origin of the various forms of salute practised today, but they all have in common the symbolism of showing defenselessness or obeisance in the presence of a superior or friend. It is assumed that the hand salute, for example. originated in prehistoric times as a means of showing one's weapon hand raised and empty. Uncovering one's head—removing or simply tipping the hat—later became a universal form of salute or obeisance. During the age of chivalry an armoured knight removed his helmet or raised the visor to reveal his identity and also to indicate defenselessness in the presence of superiors or friends. Boning and kneeling had the same connotation.

When the wearing of uniforms became common in military forces around the mid-17th century. soldiers saluted, as did civilians of the period. by removing the hat. It was soon noted, however. that this practice soiled the hat and shortened its life. A regimental order of the Coldstream Guards in 1745 recorded: "The men ordered not to pull off their hats when they pass an officer. . . . but only to clap up their hands to their hats. and bow as they pass by." But this custom was not generally adopted hy other units until the advent of more cumbersome headgear such as the busby and bearskin made doffing the hat impracticable. At one time it was proper to salute with either the left or right hand, the rule being that one used the hand opposite the person being saluted.

Raising the right hand to the cap visor is now a universal military and naval salute. The junior initiates a hand salute when approaching or leaving a superior. when addressing or being addressed by a superior except when in ranks and on other prescribed occasions. The salute is a gesture of mutual recognition and respect among fighting men and the superior normally returns it or at least acknowledges it.

In the U.S. army. navy and, air force the hand salute is executed with the palm down. The British navy salutes the same way. but the British army and Royal Air Force salute with the palm turned forward. In several other European countries there are slightly different variations of the hand salute within the armed forces.

The rifle salute has various forms. When troops are in formation it consists of the movement in unison of "present arms." At this command. soldiers move their weapons to a vertical position with triggers forward. This ceremony has been traced to the restoration of Charles II in 1660. Monk's regiment (now the Coldstream Guards). wishing to come over to the king's service. was formed for his inspection in a field. On the king's approach they were given the command "Present your weapons for service under His Majesty." On this order each man held his musket or pike forward. With an eye for the dramatic. Charles prescribed that this ceremony he standardized for the entire army. When not in formation a soldier renders the rifle salute by touching his weapon in a variation of the normal hand salute.

The sword or sabre salute is executed by raising the hilt opposite the chin and then lowering the point of the weapon to one side. The first motion is believed to go hack to the crusaders' custom of kissing the cross (symbolized by the hilt) before battle; the second motion symbolizes lowering one's guard. Some old military prints show the sword salute being rendered with one hand and the hand salute with the other.

Gun or cannon salutes, now used to honour distinguished persons or to mark special occasions, originate from the practice of firing all guns of a battery, fort or ship as a token of disarming them, for early guns could not be speedily reloaded. Modern gun salutes are tired with blank cartridges or charges. The number of shots is prescribed by international custom and agreement, and is determined by the rank of the person being honoured. A 21-gun salute, for example, is fired for chiefs of state. heads of government. members of a reigning royal family and others of comparable rank; it is commonly referred to as a royal salute. Nineteen guns are fired for ambassadors, cabinet members. state governors (in the U.S.) and officers above the rank of admiral or general; salutes of 17. 15. 13, 11, 7 and 5 guns are fired for persons oi lesser ranks. In some cases it is prescribed that guns be fired on the person's departure as well as on arrival. The convention of firing an odd number of shots is believed to stem from an ancient naval superstition that an even number of shots is unlucky.

In the United States the national salute of 21 guns is fired on Feb. 22 (Washington's birthday) and May 30 (Memorial day): the salute to the union, fired July 4 (Independence day), is one gun for each state.

(For saluting the flag of the United States, *see* FLAG: *Flags of the United States.*)

Musical honours consist of a prescribed number of drum ruffles and bugle or trumpet flourishes followed by a march or by the national anthem of the person honoured. They are rendered in conjunction with gun salutes to an individual.

Saluting with the colours (flags carried by troops) consists of dipping them to the ground. Although it is a fundamental rule that the U.S. national flag is never dipped. an exception is made in the interest of international courtesy: U.S. vessels dip the national ensign in return for such a compliment from a passing ship of a country formally recognized by the U.S. In this case. dipping consists of lowering the flag a short distance and then running it back to the top of the mast. The U.S. navy dips the national ensign only in return for such a compliment. and answers dip for dip. The origin of the flag salute has been traced by some authorities to the naval custom of lowering sails as a token of respect.

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SALUZZO, a city and episcopal see of Piemonte. It.. in the province of Cuneo. 12 mi. S. of Turin. Pop. (1951) 11.028. The old castle of the marquises of Saluzzo (1142–1548) now serves as a prison. Besides the Gothic cathedral (1480–1511). the churches of San Giovanni (formerly San Dornenico) and San Bernardo are noteworthy. Henry IV restored the marquisate to Charles Emmanuel I of Savoy at the peace of Lyons in 1601.

SALVADOR, EL, the smallest and most densely populated republic of Central America and probably the most intensively cultivated country in all of Latin America. Its capital city is San Salvador. The country is bounded on the north and east by Honduras, on the south by the Pacific ocean and on the west and northwest by Guatemala. It is the only republic of Central America that has no Atlantic seaboard. El Salvador is 140 mi. long from east to west and 60 mi. wide.

Physical Geography.—*Geology.*—The three principal physiographic-geologic features of El Salvador are: (1) mountain ranges in the north and south; (2) broad plateaulike areas between the mountain ranges cut by the upper Lempa and San Miguel rivers; and (3) the coastal and lower Lempa and San Miguel plains bordering the Pacific. The northern mountain range consists of lax-as. andesitic rocks and ashes of the Tertiary period, except for small areas of older Cretaceous sandstones, shales and conglomerates in the vest. Older rocks in the southern mountain range are covered deeply with Pliocene and Pleistocene eruptives — basaltic and andesitic lavas, pumice and ashes — forming over 20 volcanoes. These volcanoes are clustered in five groups that stretch across the country. The westernmost are Izalco (active since 1770. 6.181 ft.), San Marcelino, Santa Ana (highest mountain in the country. 7,818 ft.), Xaranjos, Aguila, San Juan de Dios, Apaneca, Tamajaso and Lagunita. Next in order come San Salvador (6.398 ft.) and Cojutepeque; San Vicente and Siguatepeque; Tecapa, Taburete, Buenapa, Usulutan, Chinameca and San Miguel (6,985 ft.); and. farthest east, Conchagua (4.101 ft.) and smaller ones nearby. Several of these volcanoes are still active. The coastal plain. 5 to 15 mi. wide, consists mostly of Pleistocene marine sediments and recent alluvium.

Relief *and Drainage.*—The northern and southern mountain ranges are high and rugged. Plateaulike areas between them. deeply carved by the upper Lempa and San Miguel rivers and tributaries, consist mostly of rolling to rough land between 700 and 3,500 ft. altitude. The Lempa river rises in Guatemala, crosses a corner of Honduras, cuts across the northern range. flows eastward for more than 80 mi. then south for 65 mi. across the southern range to the Pacific. The San Miguel system drains eastern El Salvador. The sloping coastal plain is mostly well drained by these two rivers and many other short ones.

Climate.—The temperature of various regions varies according to their altitude. The Pacific lowlands and low areas in the middle Lempa valley have mean monthly temperatures between 78° F. and 85° F. At San Salvador (2.156 ft.) the maximum monthly mean temperature is 95° F. in March and the lowest monthly mean is 58° F. in January. At 4,800 ft. mean monthly temperatures vary between 63° F. and 72° F. El Salvador has two seasons, the wet or summer season from Nov. to April and the dry or winter season from May to Nov. Annual precipitations on the Pacific lowlands averages about 68 in.; on the southern (volcanic) and northern mountain ranges between 2,000 and 3.500 ft. between 70 and 97 in.; higher mountains receive a little more. Annual precipitation in the deep valleys and plateaulike areas is between 45 and 60 in.

Vegetation.—The northern mountains have temperate grasslands and remnants of deciduous oak and pine forests. The southern volcanic mountains have temperate grasses, and below these are remnants of pine and deciduous broadleaf forests, including oak and many other species. Between these two mountain ranges the natural vegetation of the plateaulike areas and deep valleys, with 45 to 60 in. of rainfall annually concentrated during six rainy months, consists of small deciduous trees, or bushes, and of subtropical grasslands. On the Pacific plains and lower southern mountain slopes are savannas and deciduous broadleaf forests. Among the many species is balsam, the trunk of which yields excellent lumber and resin, the latter used in antiseptics and medicinal gums. In 1950, 46% of the land of El Salvador was in pastures (35% in natural pasturesj, 35% was cultivated and 14%

was in forest and woodland. There are many varieties of tropical fruit and many medicinal plants.

Animal Life.—The fauna of El Salvador is less rich and varied than that of other Central American countries because of the scanty rainfall and forest cover. However, it includes many species of land birds and water fowl, rodents, reptiles, insects (butterflies, beetles, bees, wasps, spiders, ants: flies and mosquitoes), and fresh-water and salt-water fish. Although many fish inhabit streams and lakes, most of the animal catch of nearly 750,000 lb. comes from offshore waters and coastal lagoons, and consists chiefly of mullets, grunts, snappers, jacks, groupers, sharks and anchovies.

Geographical Regions.—El Salvador may be divided into four major geographical regions: (1) northern mountains; (2) southern volcanic mountains; (3) between these two mountain ranges, the plateaus and deep valleys region; and (4) Pacific lowlands and coastal hills.

The northern mountains: comprising about 15% of El Salvador, are high and rugged. They have 6% of the national population, widely dispersed in many deep valleys; the region has no towns with more than 5,000 people. Although these mountain dwellers are engaged chiefly in subsistence farming and grazing, the region has several small coffee and lumbering districts, for the high rainy areas still have considerable stands of oak and pine forests.

As noted above, the southern volcanic mountains consist of about 20 steep cone-shaped volcanoes between 4,000 and 7,800 ft. and areas of gently sloping land between 1.000 and 4.000 ft. altitude. This region comprises 30% of El Salvador. It has 63% of the country's population. including most areas of dense rural settlement and all cities (except. two) with more than 10,000 people. Its soils, derived from lava and volcanic ashes, are the country's most productive. Its temperatures range from tropical to temperate. 'Three-fourths of its precipitation (between 70 in, and nearly 100 in.) falls during the period from May to Nov. This region produces 90% of El Salvador's coffee, tobacco and manufactured goods; two-thirds of its corn, beans, fruits, vegetables and sugar; and half the nation's cotton, rice and animal and forest products.

The region of plateaus and deep valleys comprises 45% of El Salvador's area and has 25% of its population. The people live in rural areas and in many towns of less than 10,000 population. Lying between 700 and 3.500 ft. altitude. its temperatu.es are tropical to subtropical. With only 45 to 60 in. of precipitation during the rainy months from May to November, it is the driest region of El Salvador. Its soils, derived largely from old volcanic materials, are generally shallow and stony. The region has much more pasture land than cropland. It is significant in supplying animal products, corn, beans, vegetabies, henequen and simple manufactures.

The Pacific lowlands and coastal hills comprise 10% of El Salvador's area and have 6% of its population. This region is hot all year around and rainy for six months. It has much more land in either pasture or forest than in crops. It is significant in the production of beef, forest products, cotton, sesame, rice, sugar, corn and fish. (C. F. J.)

The People.—Over four-fifths of the people of El Salvador are of mixed Spanish-Indian descent (mestizo). The remainder are pure Indians. whites and a few Negroes. When the Spaniards arrived the land was inhabited mainly by the Pipil Indians, whose civilization resembled that of the Aztecs in Mexico. The majority of the tribes were farmers; the others were potters, carpenters, masons, weavers, etc. The Indians were great builders, left numerous ruins and had advanced to the stage oi developing hieroglyphic writing. Of the several large towns which they established, two which have continued to remain in existence are the present cities of Sonsonate and Ahuachapán.

Few Spanish settlers arrived to colonize the erea but intermarriage of these few Spaniards and the Pipil Indians resulted in a racially homogeneous people. Only a few pure Indians remain today, notably the Izalco Indians, and the Panchos from the village of Panchimalco near the capital. Their bright costumes and traditional ceremonies lend much colour to the land. The language of El Salvador is Spanish, although a few of the Indians still speak their native tongue. The majority of the people are of Roman Catholic faith.

The Salvadoreans show a well-developed interest in art. They are also sports loving and have been hosts to numerous national and international sports events Many festivals are held throughout the country, such as the day of *El* Salvador *del Mundo* ("the Saviour of the World"), held from July 24 to Aug 6, and the Día del Indio ("Day of the Indian") held on Dec. 12.

(P. H. AR.)

History.—El Salvador was in early times the home of Indian groups nho were advanced in civilization but whose identities are unknown The Pipil most significant of the three groups nho inhabited the land in the 15th century, had their capital at Cuscatlán, a name still sometimes used as that of the country. The first Europeans to enter El Salvador were Spaniards commanded by Pedro de Alvarado (*q.v*), who came from Guatemala in 1524. Though Cuscatlán mas briefly occupied at that time, and nearby San Salvador founded in 1525, it was not until 1527 that the Pipil were subdued by Alvarado's lieutenants. San Salvador was a part of the province of Guatemala, as was San Miguel, founded east of the Lempa river in 1530 to discourage the territorial ambitions of Pedrarias Dávila in Nicaragua. The port of Acajutla was used by Alvarado in preparations for his illegal expedition to Ecuador in 1534. Western El Salvador became valuable to the Spaniards economically nhen Acajutla after a few decades became the funnel through which passed a lively export trade in cacao. Nearby Sonsonate was founded in 1552 to handle this trade.

Sonsonate and San Salvador developed as separate provinces, ruled by *alcaldes mayores*, each subject to the jurisdiction of the Spanish *Audiencia* de Guatemala. Sonsonate was the smaller of the two but remained the wealthier for about a century until the cacao trade declined under competition from Ecuador. San Salvador gren more slonly, nith dependence upon stock raising, general agriculture and the manufacture oi indigo, but eventually became more important The city of San Miguel was included in its territory. The Spanish town of San Vicente, founded in 1635 to remove Spaniards, Negroes and persons of mixed blood from nearby Indian viilages, was also included in El Salvador as was Cihuatehuacán (Santa Ana), an Indian centre which grew second in size to the city of San Salvador but went unrecognized as a Spanish town until 1812. The province of San Salvador was raised in 1786 to the rank of an intendancy, along with León (Nicaragua), Comayagua (Honduras), and Ciudad Real (Chiapns, Mexico), each continuing to be subordinate to the government in Guatemala. Both Sonsonate and San Salvador had by this time a large mestizo population, with some mixture of Negro blood as well Most of the important "Indian" villages, including Ahuachapán, Chalchuapa, Zacatecoluca, Cojutepeque, Suchitoto, and Usulután, were becoming progressively non-Indian in their customs.

Independence Movement.—In the rapid evolution of Central American affairs from 1811 to 1840, San Salvador played a most active role. The first Central American defiance of Spain occurred there in Nov. 1811, inspired by the deeds of Miguel Hidalgo y Costilla (*q.v.*) in Mexico, and led by another priest, José Matías Delgado (who aspired to become San Salvador's first bishop) and his nephew, Manuel José Arce. Both this attempt and another in 1814 failed. When the government in Guatemala declared independence from Spain, Sept. 15, 1821, subject to the approval of a Central American congress, the authorities in San Salvador went one step further (Sept. 22) and declared absolute independence. Battles were fought in 1822 and 1823 to resist annexation to the Mexican empire. Arce even traveled to Washington, D.C., to eek the protection of the United States. Sonsonate was annexed by force in 1823, but Delgado and Arce now played prominent roles in the provisional government of the United Provinces of Central America (1823–1825), and Arce mas chosen first president of the federation (1825–1829). Although San Salvador, now a state in the union: tried unsuccessfully to secede in 1832 and 1533, the federal ccpital was transferred there in 1834. The union ended in 1839; Francisco Morazan, its second and last

president, was forced to leave San Salvador in 1840.

The republic of El Salvador ("The Saviour") was first so named on Jan. 30, 1841, but only provisionally so until 1856. It now ran through 45 years of checkered history, in which Conservatives (heirs of the opposition to Francisco Morazán) battled with Liberals (the Morazán party, generally the more interested in a renewal of the Central American union) for control of the country. Both groups found support from and lent assistance to similar parties in the neighbouring states. In the midst of the turmoil, El Salvador organized its first university and was finally established as a bishopric. Agitation quieted somewhat during the longer administrations of Francisco Dueñas (1863–1871), who was backed by Conservative elements in Guatemala, and Rafael Zaldivar (1876–1885), a protégé of Dueiias who nevertheless maintained friendly relations for some time with Liberal administrations in all the bordering republics. Coffee, introduced as a crop in 1840, was exported in sizable quantities by the 1870s. Zaldivar successfully opposed the move of Pres. Justo Rufino Barrios of Guatemala to reunify Central America by force (1885), but was himself pushed out of office soon after Barrios was killed in battle.

Coffee became all-important to the country's economy in the period from 1885 to 1931, while international conflicts became less frequent and the presidential succession more regular. Violence upset only one of the eight four-year terms which followed each other starting in 1899. Relative absence from turmoil did not bring democracy. Each president's successor was a friend or close relative and all power remained in the hands of the wealthy. But the coffee plantations flourished; companies from Britain and the United States built a national network of railroads; the port of La Unión was developed; the population more than doubled (passing the million mark); and El Salvador enjoyed some of the blessings of peace.

Military Dictatorships.—A step toward democracy in 1931 led to a military dictatorship instead. Pio Romero Bosque, president from 1927 to 1931, decided not to control the election of his successor. When no candidate won a majority of the popular vote, Arturo Araujo was chosen by congress, but he was overthrown by force before the year was out. Gen. Maximiliano Hernandez Martinez then came to power but was not recognized by the other Central American states or by the United States because he had been involved in the coup *d'état*. Hernández Martinez retained power only by a ruthless policy which involved mass executions.

Hernandez Martinez maintained his authoritarian rule from 1931 to 1944. Re-elected to the position in 1935, he was chosen to continue in 1939 by an assembly which he had picked to write a new constitution. Recognition of his government by neighbouring republics came in 1934. Energetic measures of the early years of this regime included the establishment of a new coinage system, the organization of a national bank, the pushing of the Inter-American highway across the country, and the extension of state control over the coffee industry. Hernbndez Martinez gained international attention by early recognition of the Japanese puppet regime in Manchukuo (1934) and of the regime of Francisco Franco in Spain (1936). He was generally accounted to have warm relations with Nazi Germany and Fascist Italy, and German business interests had considerableholdings in El Salvador in the late 1930s. Nevertheless, El Salvador after Pearl Harbor quickly joined the side of the United States against the Axis, and Hernandez Martinez received the same material benefits from co-operation with Washington through the war as did his isthmian neighbours.

Post-World War *II* Era.—The end of the Hernández Martinez regime was not the end of government by military officers. Hernandéz Martinez' resignation came after a fierce revolt (which brought bombings and fire to the capital) and a general strike, prompted by a decision of the assembly to extend his term five more years. Gen. Andrés Menéndez, vice-president, held office from May to Oct. 1944, when a new coup brought in Col. Osmin Aguirre y Salinas. Salvador Castaneda Castro, who took office March 1, 1945, after elections, lasted until Dec. 14, 1948, when a military junta took control. Maj. Oscar Osorio, important in this junta, was the popular choice in new elections of March 1950. His political group, the new Partido Revolucionario de Unificación Democrática (P.R.U.D.), came to dominate the political life of the country.

Osorio remained in the presidential chair for a full six-year term, starting Sept. 14, 1950. Material progress during this period was considerable. To coffee exports, which continued as valuable to the country as ever, were added significant sales of cotton. The new emphasis on growing cotton even caused temporary problems due to shortages of corn and beans. Low standards of living continued to prevail for the masses of underpaid workers, but various measures, including government construction of low-cost homes, held some hope for their future. Of particular importance were the hydroelectric power project on the Lempa river, the asphalting of the Inter-American highway nearly from border to border, the development of a new east-west highway closer to the Pacific, the construction of a few industrial plants and plans for modern port facilities at Acajutla.

When a new beginning was made in the 1950s on the project of Central American union, El Salvador qualified as a ready participant. The Charter of San Salvador, written in the city Oct. 8–14, 1951, and ratified by the five Central American governments, provided for meetings at regular intervals of the chief officials of the republics, with the purpose of constituting an economic and cultural unity on the isthmus which might eventually express itself through a political federation. After further delay caused by renewed isthmian dissension, a meeting of the foreign ministers held in Antigua, Guatemala (Aug. 1955) chose José Guillermo Trabanino of El Salvador as first secretary general of the Organización de Estados Centroamericanos (O.D.E.C.A.). Serving in this capacity from Oct. 14 of the same year, Trabanino was able to conciliate ruffled feelings between the nations on more than one occasion, even when his own country was involved.

The candidate of P.R.U.D. for the presidential election in March 1956, was Lieut. Col. José Maria Lemus. Other parties withdrew from the race shortly before the balloting, and Lemus was inaugurated Sept. 14. In his first years, Lemus continued the policies of his predecessor as to public works and undertook a variety of measures to buoy sagging price levels for coffee. A controversy with Nicaragua in Jan. 1957, concerning El Salvador's lack of apprehension of persons allegedly involved in the murder of Pres. Anastasio Somoza, was quieted through the efforts of Trabanino. A treaty with Guatemala in April of the same year dealing with the use of the waters of international Lake Guija for mutual hydroelectric developments indicated a hoped-for new era in Central American relations.

New unrest broke out in El Salvador in 1960. A six-man junta led by Col. César Yánez Urias ousted President Lemus on Oct. 26. The junta promised a democratic regime. Political parties rapidly organized in preparation for elections. However, another coup (Jan. 25, 1961) brought into power a new five-man junta of distinctly rightist orientation. Elections were still envisaged, but with restricted participation. (F. D. P.)

Population.—El Salvador had a population of 1,855,917 in 1950 and an estimated 2,475,665 in 1958, with an area of 8,260

Population and Area of El Salvador by Department

Departments	Area (sq.mi.)	Population*	Capital	Population*
Ahuachapán	472	124,399	Ahuachapán	12,629
Cabaiias	423	103,765	Sensuntepeque	4,920
Chalatenango	817	139,157	Chalatenango	5,374
Cuscatlán	283	115,121	Cojutepeque.	12,832
La Libertad	642	190,186	Nueva San Salvador (Santa Tecla)	24,539
La Paz	464	130,843	Zacatecoluca	11,388
La Unión	770	153,386	La Unión	10,580
Morazán	666	128,564	San Francisco Gotera	3,743
San Miguel	837	228,763	San Miguel	33,063
San Salvador	336	402,863	San Salvador	221,708
Santa Ana	768	269,242	Santa Ana	70,769
San Vicente	466	115,175	San Vicente	13,618
Sonsonate	459	156,658	Sonsonate	22,088
Usulután	762	213,390	Usulután	12,276
Total	8.165†	2,475,665‡		

*1958 estimate. †Land area only. Total area is 8,260 sq.mi.
‡Total includes 4,153 registered migrants not distributed by departments.

sq.mi. there were 299.7 inhabitants per square mile. Three-fourths of the people are concentrated in the area around the department of San Salvador, which has a population density four times the national average. The least heavily populated department is Chalatenango in northern El Salvador, with 170.3 inhabitants per square mile in 1958.

Administration and Social Conditions. — The constitution adopted in 1950 provides for a representative form of government with three branches — legislative, executive and judicial. All Salvadoreans, male and female, who have attained the age of 18 are permitted to vote. Executive power is exercised by the president, his cabinet ministers and undersecretaries of state. The president is elected by direct, popular vote for a term of six years anu is ineligible to succeed himself. Legislative power is vested in a unicameral national legislative assembly (*asamblea nacional legislativa*), which meets in regular session on the first of June and the first of December of each year. The number of deputies is determined by apportionment. They are elected by popular vote for two-yzar terms, with no bar to re-election. The judicial branch is composed of a supreme court of justice, whose members are selected by the national assembly, and of other tribunals as established by statute. The supreme court consists of nine magistrates, one of whom serves as president.

The territory of El Salvador is divided into fourteen departments (see Populatiort, above.). Each department has a governor and a substitute governor, appointed by the executive power. For purposes of local government the departments are divided into municipalities, which are governed by popularly elected municipal councils (*consejos* municipales), consisting oi a mayor (alcalde), a syndic (*síndico*), and two or more aldermen (*regidores*), the number of whom are in proportion to the population. Independent in their local functions, the municipalities are limited to economic and administrative activities.

With the exception of Costa Rica, El Salvador has the highest per capita income in Central America. Its per capita income is estimated to he increasing at a rate of about 2% or 3% each year. This income is not evenly distributed, but the government has taken active steps to insure a more equitable distribution by emphasizing workers' education, sponsoring projects in literacy and training workers for union activity and community life. Union orgarization was given government support in 1950 and soon over half a hundred unions were in existence. In 1950 the Urban Housing and Rural Colonization institutes were created to help overcome the lack of low-cost housing and to insure adequate housing iacilities ior future population increases. The Social Security institute was inaugurated in 1949 as an autonomous organization to provide health, accident, unemployment, old age and life insurance. Its benefits are financed by contributions from workers, employers and the government.

All public and private institutions of learning are under the jurisdiction of the ministry of culture. The school system is composed of preschool, primary, secondary and university categories. Primary education is free and compulsory but the illiteracy rate is high. The National University of El Salvador has schools of law and social sciences, medicine, engineering, chemistry and pharmacy, architecture, dentistry, economics and humanities. The Institute of Fine Arts fosters the talents of novelists, poets and essayists. The Institute has a literary department, a department of plastic arts and music, and a department of theatre and dancing. There is also a National Agricultural institute and the:: are schools of public administration, social service, and nursing and various other vocational schools.

Military service ior at least one year is compulsory for all Salvadorean males from 18 to 30 years oi age. The strength of the army is fixed annually by the national assembly; in no case not less than 3,000 men.

Economy. — The foundation of El Salvador's economy in modern times has continued to be agriculture. Coffee accounts for about 85% of the country's total foreign exchange resources derived from exports making the country vulnerable to world price changes. During the second quarter oi the 20th century, however, the government took steps to stimulate diversification of the economy with the result that there was a steadily increasing investment in industry and other fields. The inauguration of the "5 de Noviembre" hydroelectric plant on the Lempa river in 1954 gnve a great deal oi impetus to the industrial expansion program by providing much needed electric power.

Cotton ranks next to coffee in El Salvador's agricultural production. Then come sesame and balsam, a healing drug produced only in El Salvador. Corn, sorghum, beans and rice are grown for domestic consumption. As the wooded area oi the country is small, there is little forestry. Mining activities are limited and the production of gold and silver declined during the 1950s. The fishing industry, or the other hand was greatly expanded during the 1950s. Of the country's local industries, textiles were the most important; by 1960 El Salvador had the largest number of cotton mills in Central America. Other industries includrd the processing of foods and beverages, and the production of cement, bricks, simple chemicals (soap, candles, matches and iertilizers), leather, cigarettes, footwear, hats and cardboard. There were also woodworking shops, printing establishments and machinery and metal-repair shops.

The value of exports from El Salvador increased from $25,000,000 in 1946 to $138,000,000 in 1957. Of this amount coffee accounted for 79% and cotton 11%. The value of imports during 1957 amounted to $115,000,000, chiefly manufactured products, foodstuffs and raw materials from the United States, Germany and Japan.

The monetary unit of El Salvador is the colón, which is divided into 100 centavos. The colon has been stabilized in world market quotations at 2½ to the U.S. dollar. Central banking functions are performed by the Central Reserve Bank of El Salvador, created in 1934.

El Salvador's transportation facilities are well developed. There are two foreign-owned railroad companies (one U.S. and one British), operating 383 mi. of public service lines. A highway network stems irom the Inter-American highway, which crosses the country from border to border and is completely paved. The total highway mileage in El Salvador in 1960 was 5,561, of which 610 mi. were paved.

See also Index references under "Salvador, El" in the Index volume.

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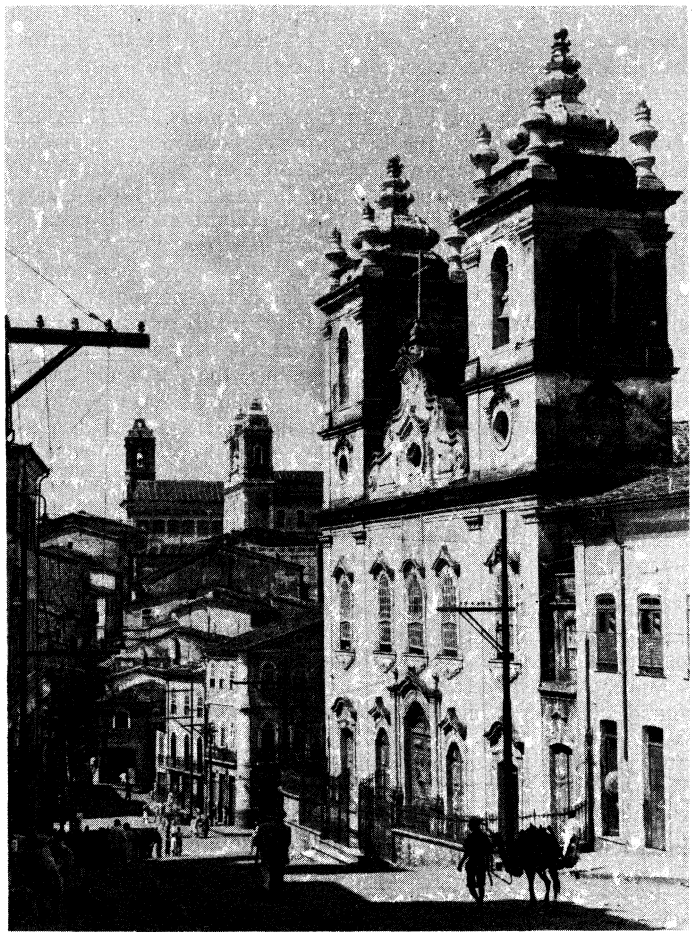
SALVADOR, known as SÃO SALVADOR and BAHIA, the oldest city and first capital of Brazil. now the major port and capital of the state of Bahia. Pop. (1950) 589,422. Salvador is located at the southern tip of a picturesque and bluff-formed peninsula that separates All Saints bay (Bahia de Todos os Santos), a deep natural harbour 28 mi. wide and 22 mi. long, from the Atlantic. The mean temperature is 78° F. and the annual rainfall is 52 in. The terrain on which the city is built is sharply broken by a series of short, narrow valleys and steep hills that range in elevation from slightly above sea level to about 250 ft. Residences and public buildings for the most part are situated on the slopes (*ladeiras*) and ridges. The valleys and other open places in the city are characterized by lush, tropical vegetation.

A distinctive feature of Salvador is its division into two separate sections, the lower city *(cidade baixa)* and the upper city *(cidade altaj.* The port. commercial district and adjoining residential zones are located at the foot of a cliff on a low shelf of land facing west onto the bay only a few feet above the water level. The principal shopping districts, state and municipal government offices and the leading residential areas are on the upper level. This section extends northward for several miles and eastward to the Atlantic shore. The two sections of the city are connected by a few graded, winding roads, a funicular railway and several elzvators. Of these, the Lacerda elevator, the outstanding landmark of Salvador, is the chief link joining the separate streetcar systems that operate on the upper and lower levels of the city.

Salvador was a major centre of the African slave trade in the colonial period and still has one of the largest concentrations of Negro and mulatto population in Brazil. These two racial groups, which constitute the great bulk of the inhabitants of the city, have contributed many of the folkways, costumes and distinctive foods for which Salvador is noted. After 1940 the city experienced continuous and rapid population growth, increasing at the rate of about 40% per decade. During this growth the racial composition of the population remained fairly constant.

Significant economic expansion accompanied the population growth. It was reflected in extensive public works and private construction — notably in the form of new residential suburbs in the upper city and improvements in port facilities and the erection of numerous modern office buildings in the lower city. The port of Salvador is one of the finest and more important of Brazil. It is protected by two long breakwaters and is dredged to permit ocean-going vessels to tie up at the docks. There are many large warehouses, and mechanical energy has largely replaced physical labour in handling cargo. Imports consist chiefly of manufactured goods, while exports include cacao, tobacco, sugar, hides, castor beans, diamonds, hardwoods and petroleum from the nearby Candeias oil field. The number of industrial plants in Salvador rose at a slow and steady rate during the middle part of the 20th century. Food and tobacco processing, textile manufacturing,



PHOTOGRAPH E . HESS

THE CHURCH OF NOSSA SENHORA DO ROSARIO DOS PRETOS. SALVADOR. BRAZIL

metallurgy. wood- and leatherworking and shipbuilding and repair are the chief industries. The Brazilian government. maintains a naval base and dockyard in the port area. Abundant electric power is available from the Paulo Xfonso hydroelectric project on the São Francisco river 250 mi. N. of the city.

In the second part of the 20th century Salvador was becoming a fairly important tourist attraction. It is served by domestic and foreign steamship lines and by domestic airlines. There are regular rail and bus connections with central and southern Brazil. Salvador is famed throughout Brazil for the number and beauty of its baroque colonial churches, the most striking of which is the church of the convent of the Third Order of St. Francis. Among other leading attractions of Salvador are examples of colonial lay architecture. the Barra lighthouse at the Atlantic tip of the peninsula and the numerous 17th-century fortresses which dot the bay shore and harbour. The city's educational facilitiei include a university with schools of medicine, law and engineering; normal. commercial and trade schools; and schools of fine arts and arts and crafts.

Salvador was founded in 1549 by Tomé de Sousa, first governor general of Brazil, as capital of the Portuguese colony. It was named, and is still known officially as, São Salvador da Bahia de Todos os Santos. As the seat of the colonial government and entrepôt of the thriving sugar trade that developed in the Recôncavo area along the shores of All Saints bay. Salvador soon became a tempting prize for pirates and enemies of Portugal. Chief of these were the Dutch, who attempted to wrest northeastern Brazil from Portuguese control between 1624 and 1654. Salvador was captured by Dutch forces in 1624 but was retaken the following year. It remained under the control of Portugal until 1823. when the last Portuguese troops were expelled in the war for Brazilian independence. With the transfer of the capital to Rio de Janeiro in 1763, Salvador lost political pre-eminence in Brazil and entered a long period of economic decline from nhich it did not emerge until after 1900 (R E. P.)

SALVAGE, a term used in maritime law to designate either the act of rescuing life or property from peril on nater or the reward to which the rescuers, known as salvors, are entitled. In common English usage the term is used generally to describe rescue operations of various sorts (in commercial and banking circles, for example, the refloating of a corporation that has run on financial reefs is often referred to as a salvage operation) but it has no legal significance outside the field of maritime law. The present article is devoted exclusively to the legal aspects; for salvage engineering see SALVAGE, MARINE.

Rescue Efforts and the Law. — In Anglo-American law (apart from the law of the sea) there is, as laymen and beginning law students are usually shocked to discover, neither a duty to go to the aid of another person when he or his property is in peril nor a right to a reward if aid is furnished and life or property preserved. If a man happens to see someone drowning or if. walking past a house he observes that it is on fire. he may in either case enjoy the spectacle with a clear legal conscience. If, on the other hand, he thrusts himself forward and rescues someone from drowning or a house from destruction by fire he has no right, enforceable in a court. to compensation for services or even to reimbursement for injuries he may have suffered or for damage to his own property in saving others' In the eyes of the common lan the volunteer rescuer is an officious intermeddler.

In maritime law a quite different set of rules developed. At sea there is both a duty to gibe aid and assistance and where property is saved a right to a reward, which is not looktd on merely as a compensation for services rendered but is. it has often been said. to be generously computed in order to furnish an inducement to mariners and shipowners to risk their lives and property. The generosity with which salvage awards are computed may also serve. as one judge has realistically reminded us, "to withdraw from the salvors as far as possible every motive to depredate upon the property of the unfortunate owner" (Clifford, J. in *The Clara* and *The Clarita,* 90 U.S. [23 Wall.] 1, 17 [1874]).

The salvage rules are a branch of property law rather than of moral law; this proposition may be illustrated by the fact that under general maritime law salvors of life at sea hsd no right to a reward. Life salvage was formally recognized in the Salvage convention of 1912, which was adopted by the principal maritime countries of the world. The U.S. version of the life salvage provision is that: "Salvors of human life, who have taken part in the services rendered on the occasion of the accident giving rise to salvage, are entitled to a fair share of the remuneration awarded to the salvors of the vessel, her cargo and accessories.!! It will be noted that this provision does not purport to reward "pure" life salvage. If only life is saved, the situation remains as it was before the convention. If both life and property are saved on the same "occasion," the life salvors get a "fair share" of the award to the property salvors and there is nothing in the quoted language to suggest that the total amount of the award is to be increased over what it would have been if only property had been saved. Neither does it appear that one whose life is saved in such a combined operation himself becomes liable to the salvors for any fraction of the award, which continues to be assessed exclusively against the property. As will be seen. the courts in computing salvage awards have traditionally, and without regard to the life salvage provision of the Salvage convention! taken into account the moral aspects of the salvors' behaviour. Daring rescues of survivors inure to the benefit of good salvors when the award is computed and the greedy salvors who let the survivors drown while they save the property find themselves appropriately punished. The only situation in which the Salvage convention appears to justify an award that would not otherwise be made is one in which. following the same accident. two sets of salvors appear and, acting independently of each other, one set saves only life and the other set saves only property. There have been a few such cases (*e.g., The Shreveport,* 42 F. 2d 524 [E.D S C. 1930]) and the judges have taken the life salvage provision to mean that a portion, typically a small portion, of the

award made for saving the property should be taken from the property salvors and given to the life salvors.

Salvage Defined.—The classical statement of the components of an act of salvage is: the rescue of maritime property (a ship or her cargo) on navigable waters within the jurisdiction of the admiralty from a peril which, except for the salvor's assistance, would have led to the loss or destruction of the property. Except for salvage performed under contract, a salvor must act voluntarily without being under any legal duty to do so, apart from the general duty, which has been reinforced by statute, to give assistance to those in peril at sea or to stand by after a collision. Since the salvage award is computed on the value of the property saved, it is evident that only successful salvage attempts will be rewarded. An abandoned ship or derelict is fair game for anyone who comes across it, but, so long as the owner or his agent remains on the ship, unwanted offers of salvage may be refused. It was not merely romantic heroism that in Dec. 1951 prompted Capt. H. K. Carlsen to remain aboard the "Flying Enterprise" until the contract salvors arrived but a commendable desire to protect his owners from a judicially computed salvage award.

There appears to be a fairly widespread belief, which might be described as folk lam, that a salvor becomes the owner of the property that he rescues, at least if the property had been abandoned by the owner or was derelict. There is no foundation for this belief. The owner may always reclaim his property from the salvor on paying salvage money. The salvor has a maritime lien on the salved property and the salvage lien outranks all other maritime liens except the lien for seamen's wages. As lienor, the salvor need not return the property to the owner until his claim is satisfied and may file a libel in *rem* against the property, in which case the admiralty court will take possession of the property unless the owner posts a bond to secure its release. An owner may elect not to reclaim his property but to abandon it; if he does so, he cannot be made liable for a salvage award. The only basis for the popular belief about the salvage of derelict property is that awards for salvage of such property may run somewhat higher than for other property, but the reason for the additional award is that salvage under such circumstances. will usually be a more dangerous operation for the salvors than when the ship in peril is still manned by her own crew.

Any act that in fact contributes to the preservation of property in peril may rank as a salvage service. At the bottom of the scale is the situation in which one ship merely tows another into port, without danger, difficulty or delay. The owner of the towed ship, now safe in port, will naturally take the position that the towage was convenient but not necessary, that his ship could have made port under her own power, and will offer to pay for the service at the customary towage rates. The owner (and crew) of the towing ship will claim salvage on the ground that, except for the assistance rendered, the other ship would have been unable to make port and might well have come ultimately into peril even though no immediate disaster threatened. If the court finds that the danger was real, it will decree salvage and make an award that will be substantially in excess of the towage rates. Typical acts of salvage include releasing ships that have run aground or on reefs, raising sunken ships (or their cargo), putting out fires and so on. In centuries more colourful than the 20th, one of the most liberally rewarded acts of salvage was the recapture of a ship taken by pirates or taken as prize in time of war; following the Russian Revolution of 1917 an English court had occasion to make such an award to an impromptu crew of Allied soldiers who sailed a ship out of Murmansk harbour under gunfire after collapse of the Allied intervention (The Lomonosoff [1921] P. 97). The salvage act need not be some kind of physical assistance directly rendered to the ships in peril. Standing by ready to give aid if necessary, summoning assistance that is given by others and even giving information as to the channel to follow in dangerous waters have all been regarded as salvage acts.

Objects of Salvage.—It is often said that the only objects of salvage are a ship, her accessories and her cargo, and that the rescue of other types of property, looked on as nonmaritime, from peril at sea will go unrewarded. The U.S. author G. H. Robinson has suggested, in a hypothetical example, that there would, under this theory, be no right to salvage for raising a freight car that had fallen into the sea from a railroad trestle. The strict "maritime property" theory is principally based on two 19th-century cases, one English, one U.S. In Cope v. Valette Dry-Dock Co. (119 U.S. 625 [1887]) the U.S. supreme court decided that no salvage could be claimed with respect to a dry dock that, having been moored in a fixed position for 20 years, had broken loose from its moorings. A few years later the house of lords came to the same conclusion in The Gas-Float *Whitton* No. 2 ([1895] P. 301) with respect to a navigation beacon. There seems to have been neither much reason nor much authority behind these decisions of the two highest courts. A leading U.S. admiralty judge of the period had commented, in awarding salvage on rafts of timber found floating in Boston harbour, that it would be no defense to a salvage claim "that the goods had been washed out to sea from the shore by a gale or a flood, or had been dropped from a balloon" (Lowell. J. in 50,000 Feet of Timber, 9 Fed. Cas. 47 [D. Mass. 18711). In the 20th century the invention of the airplane raised in a novel context the problem of whether "nonmaritime property" found in peril at sea is a proper object of salvage. After some initial hesitation while the courts wrestled with the distinguished authorities, the answer has been given, in England by statute and in the United States by the course of judicial decision, that salvage can be claimed for aircraft rescue on navigable waters. Recent U.S. cases in particular have shown a tendency to award salvage with respect to any kind of property found afloat—even money recovered from a dead body in New York harbour (Broere v. $2,133, 72 F. Supp. 115 [E.D N.Y. 19471). Since the supreme court has not reversed itself and since the house of lords is said not to be able to reverse itself. the Cope case and The Gas-Float *Whitton* are still technically good law but, it may be, only as to dry docks and navigation beacons, respectively.

Legal **Duty** as a **Bar** to Claims.—The requirement that a salvor act as a volunteer and the rule that a legal duty to give aid defeats his salvage claim has analogies in other areas of law. It is. for example, a principle of the law of contracts that doing or promising to do something which the promisor already has a legal duty to do is not sufficient consideration to make a return promise enforceable. Thus a law officer who is under a duty to arrest criminals cannot claim rewards offered for their apprehension, at least if he makes the arrest in the course of performing his regular duties. In a commercial context the pre-existing legal duty rule has led courts to conclude that a creditor who has given his debtor a full release upon a part payment of a liquidated debt can. despite the release, sue to collect the balance of the debt. In making the part payment the debtor was merely performing his existing duty so that the creditor's promise to forgive the balance nas not binding. The rule that salvage services must be voluntarily performed is not a peculiarity of maritime law but an integral part of our general legal theory of obligations.

There are several classes of salvage claimants against whom the legal duty rule is regularly employed to defeat the claim. One class consists of public officials and employees; municipal firemen and licensed pilots may be taken as examples. The rule is also applied to salvage claims by the crew of the salved ship. Since the crew is under a duty to save the ship at all costs, no feats of heroism, however extraordinary, will be rewarded as salvage. When the ship was recaptured from pirates or enemies, the traditional rules did allow for a liberal award to the crew; the modern formulation of the piracy cases is that salvage can be claimed by crew members who voluntarily return to the ship after the master has abandoned it. The rule against crew salvage has been, somewhat illogically, extended to passengers, although extraordinary contributions by passengers have occasionally been rewarded. A somewhat different application of the legal duty rule appears in the cases where a tug claims salvage against a vessel she is towing under contract. Under the contract of towage the tug is said to be under a duty to come to the tow's assistance and the salvage claim is denied. In most of the cases mentioned, with the possible exception of that of the crew when the master has not

abandoned ship. the legal duty rule appears not to be an absolute bar. Rescue efforts that are above and beyond the call of duty may be rewarded as salvage.

In 19th-century salvage law the legal duty rule seems to have led to the odd conclusion that there could be no salvage claims when both the salving and the salved ship were held in common ownership. Obviously the owner of the two ships had no interest in claiming salvage from himself; the effect of the rule was to deny salvage to the crew of the salving ship, presumably on the ground that the crew was under a duty to preserve the onner's property. The Salvage convention of 1912 provided that common ownership of salving and salved vessels should not affect salvage claims and in the United States a statute was passed to implement the rule of the convention. In England the house of lords seems to have rejected the 19th-century doctrine in *The Kafiristan* ([1937] *P.* 63).

There appears to be no reason why a government cannot claim salvage for rescue operations performed by its naval or merchant fleets. A U.S. judge commented: "While I can see that a sovereign would and perhaps should consider it beneath his dignity to ask for compensation for saving property at sea, I can imagine no legal reason to prevent him from doing so" *(The Impoco,* 287 Fed. 400 [S.D.N.Y. 19221). In several cases decided during and after World War II both the British and the United Statei governments made salvage claims, sometimes apparently for the benefit of the government, sometimes for the benefit of the crew of the salving ship. Naval personnel would presumably be unable to bring forward such a claim without governmental sponsorship, but the crews of government-owned merchant ships have been allowed to claim salvage as freely as the crews of privately owned ships.

Computation of Awards.— The judicial computation of salvage awards is far from being an exact science. A classical statement of a method of computing awards was formulated by Justice Nathan Clifford in *The Blackwall* (77 U.S. [10 Wall.] 1 [1869]) in the following often quoted language:

> Courts of admiralty usually consider the following circumstances as the main ingredients in determining the amount of the award to he decreed for a salvage service:
> (1) The labor expended by the salvors in rendering the salvage service.
> (2) The promptitude, skill and energy displayed in rendering the service and saving the property.
> (3) The value of the property employed by the salvors in rendering the service, and the danger to which such property was exposed.
> (4) The risk incurred by the salvors in securing the property from the impending peril.
> (5) The value of the property saved.
> (6) The degree of danger from which the property was rescued.

It was noted earlier that salvage is a doctrine of property lam and not of morals. but it is clear from Justice Clifford's list that the moral element intrudes to the extent of making it impossible for anyone successfully to contest the trial judge's computation. Since he is entitled to take into account such imponderables as "skill." "risk " "energy" and "danger," and to increase or decrease his award accordingly it will be impossible to say that any award he may choose to make is "wrong." Consequently each salvage case is a law unto itself and precedents are valueless except to indicate in a general way the maximum and minimum amounts which judges have, at various periods, in fact awarded.

The converse of the rule that good behaviour—extraordinary skill. daring, heroism or ingenuity—increases the award is that bad behaviour—negligence or incompetence or vandalism or theft—decreases the award or, in extrenie cases, forfeits it entirely. It is a natural and obvious stratagem for owners to put forward such allegations, and a reading of the defense testimony in a random sample of salvage cases will leave the impression that the typical salvor is a blackhearted villain lineally descended from Captain Ridd. The admiralty courts. which sit nithout juries, are inclined to treat such testimony with deserved skepticism. Self-serving allegations of negligence or worse brought by owners against salvors will therefore be disregarded unless the proof is compelling Doctrinally, however, the salvor may forieit his award, in whole or in part, for bad behaviour and is also liable to the owner for any unnecessary damage that an incompetently performed salvage service may have caused to the property.

An extension of the fault principle is that a ship that has been solely or jointly at fault in a collision cannot claim salvage for services thereafter rendered to the other ship. This point is confidently stated in the leading British treatise on salvage as well as by most U.S. commentators. There are in fact almost no cases except a few of relatively ancient vintage. It is also customarily stated, with one dissent in a 20th-century U.S. treatise, that the fault of a ship is, in this context, "imputed" to its crew, so that even the personally innocent crew members would be barred from salvage claims for post-collision services.

The key item in a salvage award is the valuation of the property saved. (It is also customary, as the quotation from *The Blackwall* indicates. to value the salvor's property in order to determine how much he had put at risk. The valuation of the salvor's property appears to have no direct relationship to the amount of the award and is typically undertaken in a lighthearted fashion. There is disagreement between British and U.S. commentators on whether cargo carried in the salving ship may be added to the value of the ship and her freight to increase the total value of the property at risk and thus, hopefully, the amount of the award.) The importance of the valuation of the salved property is that the award will be in all cases calculated as a fraction of that value. In any case of salvage that involves a large ship, this phase of the proceedings will typically be protracted, bitter and hard fought.

In arriving at the valuation the items taken into account are the value of the ship: the value of the cargo and the amount of freight that would, except for the salvage, have been lost. In valuing the ship, the customary method is to take its sound value before the salvage less the cost of repairs for damage suffered in the peril from which the ship was rescued. The owner is not, of course. entitled to deduct from sound value the cost of repairs that would put his ship in a better state than it was in before the accident or the cost of repairs not directly occasioned by the accident. The value of cargo will customarily be determined by the price for which it can be sold in the port where it is unloaded.

Another element not mentioned by Justice Clifford in *The Blackwall* that is taken into account is expenses incurred (and, less frequently, profits lost) by the salvor in the course of or as a result of a salvage service. Since the value of the salved property in any event ultimately determines the amount of the anard, the salvor does not necessarily recover all that he may have lost; if he has spent, or lost, $1,000 in saving property worth $100, the loss is for his account and not for that of the onner. Items of reimbursement for expenses or for lost profits are often stated separately from the general award for the salvage. It is unclear whether such items represent an addition to the award that the judge would othernise have made or whether all that is involved is a method of allocation. Since the expenses are incurred or the profits lost by the onner of the salving ship, such items are entirely for the onner's account and are not shared by him with the crew.

The amount of salvage awards, expressed in percentages of the value of the salved property, seems to have steadily decreased since the middle of the 19th century. This trend is obviously related to the tremendous increase in ship values that took place when steam replaced sail and. that continues with 20th-century giant liners and supertankers, to say nothing of atomic-powered ships. It was once said that the general rule was a "moiety"—half the value—of the salved property: awards on that basis for the salvage of a multimillion-dollar ship would result in fortunes for the lucky salvors and. needless to say. such awards are not made. Where great values are involved, the largest 20th-century awards do not exceed 20% of the value of the salved property and such awards have been made only for exceptionally difficult, and dangerous salvage. An example is *The Esso Greensboro* (122 F. Supp. 133 [S.D. Tex. 1954]) where the value of the salved ship was stipulated to be $1,000.000 and awards of over $200,000 were made to the officers and crew of the salving ship, whose onner made no claim for his own account. The salvors of the "Greens-

boro" came across her in mid ocean, burning and derelict; they boarded the burning hulk. searched for survivors, put out the fires. made necessary repairs and towed her to port, the whole affair taking eight days. At the other end of the scale, where the salvage barely rises above the level of simple towage, a customary award is double the usual towage rates.

Distribution of Awards.—A salvage award is divided between the officers and crew of a salving ship and her owner. It is said that owners who had not personally participated in a salvage operation were at one time not allowed to share in the an-ard, on the ground that the only purpose of the salvage rules n-as to encourage individual heroism ior to remove the temptation toward theft). Awards to absentee owners appear in U.S. cases as early as the end of the 18th century. In the course of the 19th century awards to owners. as owners and not as participants. came to be regularly made. The usual explanation for this development is the continuing increase in ship values, which meant that increasingly valuable property was being put at risk when used (typically in emergency situations. without the owner's prior consent) in dangerous salvage attempts. It is also true that the increased values were insured against an ever-wider range of risks, Thus the risk for which the owner is said to be compensated by being given a share of the salvage award is to a degree illusory, although it cannot, on the other hand. be gainsaid that a ship in being is, in most situations; *more* useful than a claim on an insurance policy. Whatever the reasons may be, the owner's share of the award has tended to increase. Early 19th-century cases seem to have allocated a quarter or a third of the award to the owner. Recent U.S. cases reveal that two-thirds of the award is customary and the leading British authority suggests that three-fourths of the award should go to the owner. When the salving ship is operated under charter, a term in the charter party will usually provide for a division of salvage money between owner and charterer. In the absence of such a provision salvage is for the owner's account except in the case of a so-called demise or bare-boat charter (one under which the charterer is responsible for manning. supplying and navigating the ship).

Among the officers and crew, basic awards are made according to rank or monthly pay. without regard to individual participation in the salvage work. Additional awards are often inade to individuals whose participation contributed to the success of the venture or who in situations of danger displayed unusual bravery. The officers' and crew's right to salvage cannot he defeated by agreement between the owners of the salving ship and the salved property or by arbitration proceedings to which they have not consented.

Cargo that may be carried on the salving ship is said not to have a right to share in the award. At first glance. it would appear that the absentee cargo interest has as much right to a share as the absentee shipowner, since the cargo is quite as likely as the ship to be damaged in the course of the salvage. Furthermore, under most biils of lading and charter parties. it will be provided that the ship is not liable to cargo for damage suffered in an attempt to save life or property at sea (although cargo, of course. carries its own insurance against such risks). There appear to be almost no modern cases in which cargo owners have demanded a share of the salvage award. As always in the law, the absence of litigation may he taken to mean either that the point is not settled at all (despite the statements in the books) or that it is settled beyond doubt.

Payment of Awards.— The owners of the salved property are liable to the salvors for the award in the ratio that the value of their properly (*i.e.*, such of it as is saved, valued in its condition after the salvage) bears to the aggregate value of all property saved. The usual contributing values are cargo. the ship and pending freight. For example, if the salved ship, including freight, is worth $1,000,000 and the salved cargo is also worth $1.000.000, being owned in equal shares by ten people, then the shipowner is liable for 50% of the award and each of the ten cargo owners for 5%. Since the salvors have a maritime lien against the salved property, they can proceed directly against the property by proceedings *in rem* or (unless the owner abandons his property) they can hold the owners liable in personam. It has been said by a distinguished judge that any person "who has a direct pecuniary interest" in the salved property may be held liable for salvage (Augustus Hand. J. in *The* G.L. *40*, 66 F. 2d 764 [2d Cir. 1933]). If that statement is true. it would seem that such persons as insurers, mortgagees or buyers of salved property might be held liable to salvors. There are. however, almost no cases in which salvors have attempted to proceed against such more or less remote interests and it may be doubted whether the attempt. if made, would be successful.

It is customary for the owner of a salved ship to pay the salvors in full and then to seek reimbursement from the owners of other salved property for the shares of the award for which they are liable. The shipowner has a lien against cargo for salvage money paid out on cargo's behalf and may refuse to deliver the cargo until his lien is satisfied. In any situation where large values are involved, the liability of ship and cargo for salvage will be worked out in a general average settlement. (*See* AVERAGE.)

Contract Salvage.— Much salvage work is also carried out under contract by professional salvors. In cases where the circumstances permit the bringing in of contract salvors, the owners will doubtless pay less for the work than under a judicially determined award to volunteers. The amount of compensation to which a contract salvor is entitled is of course determined by the terms of his contract and not by the rules that have been set out in this article. It is customary for professional salvors to operate under a so-called "no cure-no pay" arrangement; that is, they get nothing unless the salvage is, at least to some degree. successful. Conceivably this unusual arrangement may reflect one of the basic principles in the law of volunteer salvage. which is that there can be no award unless property is actually saved. A salvage contract under which a salvor would be paid for his labours, whether or not they were successful. would of course be quite as valid as the "no cure-no pay" contract..

BIBLIOGRAPHY.—The leading treatise is Sir W. R. Kennedy, **Civil** *Salvage*, 4th ed. *by* K. C. McGuffie (1958). This British test is usually considered authoritative by U.S. as well as by British courts. *See* also M. J. Norris, *The Law* of *Salvage* (1959); G. H. Robinson, *Handbook of Admiralty Law in the United States*, ch. 15 (1939); Grant Gilmore and C. L. Black, *The Law of Admiralty*, ch. *8* (1957). (G. GI.)

SALVAGE, MARINE, consists of the operations required to refloat a ship or other vessel that has sunk or run aground. There are many kinds of salvage operations, varying from those of utmost simplicity to those involving complicated technical studies and procedures which require special equipment, machinery and tools.

Ordinary Grounding.— The most common salvage problem is ordinary grounding in which all or part of the grounded ship is above water. It can be simple, difficult or impossible. It is a simple problem if the ship or vessel has run only slightly aground on a mudbank or sand bar. It is a difficult problem if grounding occurs on a rock-bound seacoast where wind and tide cause a pounding action which may spring plates or seams. thus opening the ship's interior to serious flooding from the sea. It is often impossible if the grounded vessel is "high and dry." having been lightly loaded when pushed up on the shore by heavy seas at high tide.

The first step in salvaging a ship that has run aground is to obtain the use of tugs. These powerful little vessels may be able to ton- the grounded ship hack into deep water. Another step is to place the ship's regular anchors, or special salvage anchors known as beach gear, in deep water so that the endangered vessel can hold to them and thus prevent heavy seas from forcing it farther up on the shore. A third method is to keep a strain on a towline while awaiting high tide in the hope that the grounded vessel will come afloat and can be towed away. This simple remedy of "tug and tide" is frequently successful. but when a vessel is hard aground it is usually not possible to move her by the few tons of pull exerted by a towline.

If the tug-and-tide method fails. the next step is usually to lighten ship. This consists of the removal of weight from the vessel to the extent computed to be necessary. The quickest and easiest items to remove are liquids such as water and oil that can

be pumped overboard. If further lightening is required, the cargo may be removed along with, in extreme cases, boats, booms, furniture and anything else that is portable. These items may be transferred to barges alongside by the ship's onn cargo-handling equipment or by onshore or floating equipment Such removal of neight, however, should never be begun until the ship is sufficiently secured to prevent her, in her lightened condition, from being pushed farther ashore by storm and tide. This is a rule that is often violated with the result that the ship suffers greater damage or may be lost completely.

If the ship has remained generally watertight, the steps outlined above should prove successful. If, however. the vessel has been opened to the sea it is necessary to make temporary repairs of the fractured plates or to isolate the compartments into which sea nater is flowing. If the ship is high and dry at low tide the diagnosis and treatment of ailing parts are easy. Temporary repairs. both inside and outside, are made as necessary. For submerged areas, trained divers may estimate damage, do underwater cutting and welding of steel and fit and secure steel or wooden patches. The securing of these patches is usually quite simple because water pressure tends to hold them in place and make them reasonably watertight. At times wooden patches are of the caisson (*q.v.*) type and are attached to the ship's hull by oakum packing or underwater concrete.

Water is removed from flooded spaces by the use of suction pumps or "push" pumps placed on the deck of the stricken vessel. The suction type of pump is not the best for a large ship because the maximum height to which water can be lifted under perfect operating conditions is only about 30 ft. The push-type pump is not so limited (see PUMP; VACUUM). One push type is the submerged electric pump: another is the deep-well type which has a centrifugal pump at the bottom of a steel pipe and is driven by a steel shaft rotated by an electric motor or gas engine. When enough pumps are operating, the water can be removed from the ship faster than it runs in; and, as the inflow is gradually lessened by repair work, the ship eventually comes afloat.

The use of compressed air to empty a vessel of water is a method which has proven very effective but requires that the structure to be emptied of water be made capable of withstanding the necessary air pressure. To lower the level of water in a compartment submerged 10 ft.. for example, would require a pressure of about 5 lb. per square inch (p.s.i.); for 30 ft., it would require about 15 p.s.i., which may cause bursting unless the structure is strengthened. The air compressors required are usually on the salvage tug or the ship's deck or on barges alongside, and are operated by electricity or gas.

With ail of the above operations completed a ship may come afloat at high tide. If it does not float, more of the same efforts may do the trick. If the ship is aground on a sloping shore a few additional steps are called for. When a ship is hard aground, or high and dry, it is customary to do something about removing some of the rocks and rough bottom to facilitate sliding the vessel toward deep water. This cutting of a channel is normally done by dredge or, at low tide, by bulldozer.

As noted above, beach gear is often employed to provide means for a strong and steady pull toward deep water. This gear consists of a number of heavy anchors strategically laid out toward deep water, to which chains or wire rope are attached. By using winches on the deck of the ship and tackle with high mechanical advantage, a tremendous pull can be exerted. Then, as the tide comes in, the bow or stern or both are skewed back and forth to break the suction between the ship and the ground and to start the ship moving. If calculations are correct. or the tide is especially favourable, the ship will come afloat.

Sunken and Submerged Ships.—As a result of collisions, explosions or other maritime disasters, vessels are sometimes sunk in deep water. Whether such vessels are salvable depends on the current, sea conditions, depth of water, equipment available, estimated cost and other considerations. Small vessels are salvable in depths up to about 300 ft., but salvage of large vessels in such deep water is rarely practicable. The lift required to bring a sunken vessel to the surface is furnished by such devices as compressed air, floating cranes or pontoons. Trained divers (see DIVING APPARATUS) must do the underwater work on a sunken ship. This may consist of connecting air lines to the ship's fittings, securing lifting chains or wire rope hawsers and girdling the sunken vessel's hull with lifting hawsers. Examples of such salvage are some of the vessels raised to clear the Suez canal in 193'7 and raising of sunken submarines from time to time. The amount of lift that can be applied by pumping compressed air into a ship or by lifting hawsers limits the size of the vessel that can be salvaged by these methods.

For salvaging larger ships, lift pontoons are attached directly to the hull or to cables that girdle the hull. The pontoons are large steel cylinders. usually sheathed with wood, and are equipped with heavy shackles and air connections. Usually they are filled with water, sunk and secured alongside the submerged ship. When their water is expelled by compressed air they become buoyant and exert lift. In raising sunken submarines pontoons are arranged in pairs connected by hawsers under the hull. Four or five pairs are usually employed to provide a combined lift of about 700 or 800 tons. A simpler type of pontoon, one not designed for use of compressed air, can be used on the surface where the rise and fall of tide is great enough to permit the wreck to be gradually moved to shallower water during succeeding high tides.

Capsized Ships.—Ordinarily, a ship lying on its side on the bottom must first be brought to an upright position. This is done by pumping air into selected compartments. Another method is to fasten pontoons to the ship. or to wire rope or chain hawsers which pass under the ship, and to exert lift on such hawsers by floating cranes. derricks or winches and tackle on the beach or pier. Raising the giant liner "Normandie," which caught fire and capsized alongside a pier in New York city in 1941, was a good example of this type of operation.

The decision as to which operations apply to a specific salvage problem depends upon study, calculations and experience. The old practice of "cut and try" is usually the rule. Ingenuity is indispensable on a complicated job. Oftentimes it is advisable to concentrate effort toward raising one end of a sunken vessel and then to proceed progressively. This is often requisite when equipment and facilities are limited.

Salvage companies and navies have in readiness well-equipped salvage tugs with crews trained to perform many operations without procuring much of the special equipment referred to above. They also have naval architects who can determine whether a ship will be stable after it is refloated. (H. N. W.)

SALVARSAN or "606." the trade name of arsphenamine, the dihydrochloride of dioxydiaminoarsenobenzene, a remedy for syphilis introduced by Paul Ehrlich in 1910. It is a yellow powder that was prepared for injection into a vein by a rather complicated process. Later, Ehrlich introduced a modification, "914" or neosalvarsan, that was much easier to use, and preparations of this type became those most commonly employed until the advent of Mapharsen and the antibiotics. A moderate dose of an arsenobenzene preparation usually caused the infecting organisms to disappear from the secretions of open sores within a day, and a rapid amelioration of symptoms followed, but it was necessary to treat for one and one-half to two years or more and to use in addition either the older remedy, mercury, or the newer one, bismuth.

The arsenobenzene preparations were not tolerated equally well by all patients. In a minute percentage of cases they could cause death by damaging the small vessels of the brain or the kidneys. Other toxic effects were jaundice and an inflammation of the skin (either of which might be fatal), and a variety of minor troubles. Serious effects from arsenobenzene injections were. however, far too rare to counteract their very great advantages. One of the most important of these was the rapidity with which patients were rendered noninfectious.

Salvarsan was the first successful drug developed out of Ehrlich's concept of chemotherapy, the cure of an infectious disease by the administration of a chemical agent that would kill the invading parasite without injuring the host. The use of quinine as an antimalarial represents an earlier application of chemotherapy, and sulfonamide and antibiotic therapy represent later develop-

ments embodying the same basic concept. See also EHRLICH, PAUL: VENEREAL DISEASES. (V. E.)

SALVATION ARMY, a religious philanthropic organization founded by William Booth (see BOOTH [family]), who in 1865 began to hold meetings for preaching in the streets in London and in tents. music halls, theatres and elsewhere. In 1878 the mission, which had spread beyond London, was reorganized on a quasi-military basis, and the title of the Salvation Army was definitely adopted in June of that year. with William Booth as "general" of the whole body., The spiritual operations of the army rapidly expanded. in spite of much disorderly opposition in some places.

In doctrine. the army is in harmony with the main principles of the evangelical bodies.

Its preaching is practical and direct., affirming the reality of sin and redemption. and the supreme duty of self-sacrifice for the sake of the salvation of others.

Organization. — The army was organized under the general for the time being, who issued all orders and regulations. Large powers devolved upon other officers. such as the chief of the staff, the foreign secretary and the chancellor. who directed affairs from the international headquarters in London. The system of government was autocratic. "unquestioning obedience" being required throughout all ranks. The army was divided. usually in harmony with national boundaries. into territories. each under a territorial commander. with headquarters in the capital of the country. The territories mere generally divided into divisions. which included a number of corps. each supporting its own captain and lieutenant. The soldiers or members were dran-n from all classes of the community. The property of the army in the United Kingdom was held by the general for the time being, for the benefit of the army exclusively. he being constituted the sole trustee of the property, in the disposal of which and in the appointment of his successor he was placed under the government of a deed poll. executed by Booth while the body was still known as the Christian Mission and enrolled in the court of chancery in Aug. 1878. In other countries various modifications were necessary. but the general's ultimate control was practically assured.

The announcement of the founder's death was accompanied by the intimation that his eldest son, William Bramwell Booth, formerly his chief of staff. had become the new general. Under the deed poll of 1878, each general appointed his successor under seal, but the name of the person so chosen was not divulged until the proper time. At an international staff council in 1904 a supplementary deed poll was adopted. the principal object of which was to set up machinery for removing from the position any general who proved to be unworthy of confidence and also for the selection of a general by a high council of the army called into being for this purpose, in the event of the position becoming vacant through failure to appoint or other cause. In Jan. 1929 the high council voted to remove General Booth on the ground of incapacity. but Booth carried the issue to the courts. The court decided that the removal was illegal because no hearing had been given the general or his representatives before the vote was taken. On Feb. 13 after such a hearing a second vote had the same result as the first: and the council proceeded to elect Edward J. Higgins, formerly chief of staff, as the new general. Booth intended to continue the fight; but he died in June. In Sept. 1934 Comdr. Evangeline Booth. the founder's daughter: and leader of the army in the U.S., was elected to succeed General Higgins, and assumed command in November.

Extension. — In many quarters it was feared that after the withdrawal of the forceful and picturesque personality who had dominated Salvation Army affairs for a generation. and had raised up a world-wide following from what was originally a despised and derided local effort in the slums of London. the army would decline. World Wars I and II also were a menace to all international organizations. These fears. however. proved to be groundless. The number of adherents steadily increased, and the "field" occupied grew greatly in extent.

New organizations were called into existence, especially, for influencing and instructing the young of both sexes. Careful provision was made to ensure a constant replenishment of officers by means of colleges for the training of cadets. Each year young men and women are trained for army work, to which they have to devote the whole of their time. Congresses on national and international lines are held frequently for the instruction and encouragement of officers; and constantly increasing use is made of the printing press.

Social Work. — The social work. which received its first great impetus in 1890 with the publication of *In Dnrkesf England and the Way Out,* by William Booth, became not only more extensive but more varied in character. This work from the first was regarded by the army leaders as an organized warfare against social evils in order to clear the way for evangelization.

It was realized that the physical and environmental condition of many of the people. especially in great cities. made it extremely difficult for them to apprehend the spiritual message which the army had to deliver. Therefore various social activities arose, diverse in character but all actuated by the same purpose, from the provision of free breakfasts and night shelters to the settlement of people in overseas dominions. This last was a department of work characterized by careful selection of the emigrants, and was coupled, particularly in the case of the young. with training beforehand and effective provision for future care. while work was assured upon arrival. The efforts of the army in getting men to work on the land. both in England and overseas, called forth many commendations from statesmen and others.

Rescue work among women was one of the earliest social tasks to which the army set its hand. In this work Florence Booth, wife of Gen. Bramwell Booth. was the responsible leader from its inception until 1912. Maternity work was carried out by the army's ministering women. and for this in 1918 the army received a grant from the British government — the first state subsidy made to the army in the country of its origin. In other lands also social work proceeded. adapted to the different national conditions and needs. and often commended and assisted by the governments concerned. This was true also of eastern lands; thus. settlements for criminals were established in India, and leper colonies in the Dutch Indies.

Spiritual Character of the Work. — The army maintained its original character as a body of spiritual witness and aggressive evangelism. In theory and creed it is at one in almost every respect with orthodox evangelical belief. but its methods — its realistic presentation of religion, and its use of various constraining means to bring people to salvation — distinguish it from other religious bodies. It continues to lay the greatest emphasis upon the need for conversion, preceded by penitence; and followed by growth in holiness. The people gathered into its ranks are cared for by its officers and trained in a real separation from the world and devotion to Christ. They are set to work immediately with a definite objective, their zeal is employed in the winning of others, and public testimony is required from them. however unlearned or backward in religious experience they may be.

A large place in the army's endeavours is given to music. In every country the band — usually a brass band — is a feature of army work. The strains of such a band. reaching farther than the human voice, draw numbers within earshot of the army's message who would otherwise not be attracted. The army also made use of improvisations of various kinds. not only because in this way public attention is more likely to be caught, but because these methods prevent the officers from falling into the conventional and the ordinary.

The army exacts a high standard of behaviour from its adherents. In the series of *Orders and Regulations* for officers and for the rank and file. definite guidance is given even in the smaller matters of everyday conduct. Officers accept a relative poverty, being content to receive sufficient for their simple needs. There are contributory funds from which they receive allowances on retirement. and from which provision is made for widows and orphans. Marriages are solemnized "under the flag." and children of members are dedicated to become soldiers or officers in the "war." Officers wear a regulation uniform, which it is not permissible for the individual to vary. The uniform is regarded as a means of confessing to the world the fact of separation and consecration, as

opening the way to many opportunities of usefulness which would not otherwise appear, and as making possible instant recognition and fellowship among Salvationists themselves. One of the great principles of the army. firmly adhered to, is that women have absolute parity of privilege. position and dignity.

Salvation Army funds are raised from the voluntary offerings of the corps. from open-air and other collections, from the profits on publications and general trading, and from friends interested in evangelical and charitable work. The financial statements of the various funds are annually published, certified by public accountants.

Reports and statistics of the spiritual and social operations of the army are given in the annual *Salvation Army Year Book* and in the *War Cry* and other publications issued at headquarters (Queen Victoria street, London, E. C. 4).

George Lyndon Carpenter was elected general in 1939, Albert Orsborn succeeded him in 1946 and in 1954 he retired and Wilfred Kitching became the seventh general.

The army had corps and outposts in 85 countries and territories throughout the world in 1954. Its 17,002 corps included 26.775 commissioned officers,, 104,778 local officers (laymen) and thousands of soldiers and adherents.

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THE UNITED STATES

The Salvation Army began its operations officially in March 1880 in the United States, the first country to which evangelists were sent from England. A family of converts had gone to Philadelphia in 1879 and started evangelical services. At their request Gen. William Booth sent Commissioner George Scott Railton and seven women assistants as pioneer officers. The original staff soon found it impossible to cope with the success attending their efforts, and more help was sent from England. The U.S., however, soon began to produce its own officers, a development which grew through the years until by the 1950s four training colleges were devoted exclusively to maintaining the requisite supply of officers. These send out annually into the field young men and women as officer reinforcements, in addition to providing help for the missionary countries of the world.

After having served in England and as national leader in Canada. Evangeline Booth. daughter of the founder. William Booth, became national commander for the U.S. in 1904. For 30 years she continued to direct Salvation Army work. much progress being made in the extension of welfare services. During World War I specialized services organized for the nation at war endeared the organization to the U.S. public, and Evangeline Booth was awarded the distinguished service medal.

Commander Booth was succeeded by Commissioner E. J. Parker when she was elected general in 1934 and became international leader of the organization. Commissioner Donald McMillan became national commander in 1953.

Again in World War II the services of the Salvation Army, which became a participant in the United Service organizations (U.S.O.). were helpful in maintaining morale among the fighting forces, and during the Korean war this service was continued.

Activities of the Salvation Army in the U.S. include sheltering, evangelistic meetings, rehabilitation centres, care for the unmarried mother and her child, children's homes, clinics, family welfare, aid to prisoners and their families, free employment bureaus, search for missing relatives, camps and summer outings for women and children, and social and religious instruction.

In 1952 the army held 91.854 meetings on street corners in the U.S. In its social service program 35,992 patients were treated in 8 clinics and dispensaries; 1,349 missing persons were located; 34 maternity homes and hospitals for unwed mothers cared for 9.384 women and children: and 16.874 mothers and children were sent to summer camps. A total of 108 men's social service centres provided shelter and work for 32,610 men.

In the field of prison work, 8.449 prisoners were assisted on discharge and given employment in 1952; 1,988 prisoners were paroled in care of the Salvation Army.

During 1953 emergency service was rendered by the Salvation Army in connection with the tornadoes at Waco (Tex.), Flint (Mich.), and Worcester (Mass.), and in other areas where emergencies of disastrous proportion took place. (Do. McM.)

SALVEMINI, GAETANO (1873–), Italian historian, was born in Molfetta in Sept. 1873. In 1902 he became professor of mediaeval and modern history at Messina university. He then went to Pisa university and in 1917 was appointed to the chair of history at Florence university. Historical works by Salvemini included *Magnati e popolani nel commune di Firenze dal 1280 al 1295* (1899), *La Rivoluzione francese 1789–92* (1906), *Mazzini* (1905) and *L'Italia e gl'Imperi Centrali dal 1871 al 1915*. He edited the Liberal newspaper *L'Unità* (1911–21).

Before World War I he vigorously criticized the Socialists for halfhearted social work and attacked Giovanni Giolitti's electoral methods. During the war he was a leading advocate of Italian. diplomatic moderation. He was a member of the Italian parliament, 1919–21.

After the fascists captured power, however, his political activity was made impossible, and, being suspect, he was in constant personal danger. In June 1925 he was arrested in Rome and taken to Florence, where he was charged on the hearsay evidence of a printer with complicity in the production of an antifascist newspaper, *Non-Mollare*. His case was postponed till July 1925, when he was provisionally released. In Oct. 1925 he left the country, going to London and later to the United States. In 1940 he became a naturalized citizen of the U.S. He was appointed in 1934 Lauro de Bosis lecturer in history of Italian civilization at Harvard university, Cambridge, Mass., a post he held until he became professor emeritus in 1948.

His later works included *The Fascist Dictatorship in Italy* (1927), *What To Do With Italy* (1943), *Historian and Scientist* (1939) and *Prelude to World War Two* (1949).

SALVI, NICCOLÒ (NICOLA) (1697–1751), Italian sculptor, whose masterpiece is the Trevi fountain in Rome, was born in 1697 at Rome. He began in the studio of the painter Niccolò Ricciolini and subsequently studied architecture under Antonio Canevari. In 1732 he competed unsuccessfully for the facade of S. Giovanni in Laterano, Rome, but in the same year his project for the Trevi fountain was chosen in preference to those of a great number of competitors. Most of his energy was absorbed by the work; he was responsible not only for the over-all design but also for the details of the decoration and the program of the statuary. After Salvi's death Giuseppe Pannini finished the fountain in 1762, somewhat altering the original scheme. The idea of combining palace front and fountain was derived from a project by Pietro de Cortona, but the grand pageantry of the central triumphal arch with its mythological and allegorical figures. of the natural rock formations and of the gushing water was Salvi's. This queen of fountains is the swan song of the Roman baroque era. Salvi also executed minor works in churches and has the doubtful merit (with Luigi Vanvitelli) of having enlarged G. L. Bernini's Palazzo Odescalchi. He died in 1; 51. (RF. W.)

SALVIA, a large genus belonging to the family Labiatae (*q.v.*), containing about 550 species in the temperate and warmer regions of both hemispheres. The name is derived from the Latin *salvo*, from the healing properties of the garden sage. *S. officinalis*, which has been known for at least three centuries and which has been cultivated in kitchen gardens for the grayish-green wrinkled

leaves that are commonly used in flavouring meats.

S. verbenaca is found in Great Britain in dry pastures and waste places, as is also *S. pratensis.*

Many native species of *Salvia* occur in western North America, especially in California. where 15 species are found. Among these are S. *carduacea* (thistle sage), cultivated for its thistlelike, white woolly foliage and blue flowers; *S. columbariae* and related, mostly Mexican. species are the source of chia.

Some Californian sages are important bee plants, among them the black sage *(S. mellifera)* and the bigflower sage (S. *grandiflora).*

Some of the salvias are among the most showy of soft-wooded plants, the blossoms being of a bright glowing scarlet. A useful species is *S. splendens,* a Brazilian shrub; commonly called scarlet sage. Treated as a tender annual, it is one of the most popular bedding plants in American gardens. There are other very ornamental species of easy growth, increased by cuttings in spring, and succeeding well in ordinary rich loamy soil.

SALVIAN OF MARSEILLES (*c.* 400–c. 490), church writer, was born probably in Trier or Cologne. He certainly was educated at ,Trier, studying among other things law, though he probably never was a lawyer. He married Palladia, a convert from paganism, and they had one daughter. By 435, with the consent of his wife, he retired to the new monastery of Lérins. He mas ordained priest. probably at Lérins, and moved to Marseilles. where he was a writer and preacher. He lived to an old age, dying in Marseilles toward the end of the 5th century. Two of his works are noteworthy: the four books *ad Ecclesiam* and the eight books *de gubernatione Dei.* The first. written under the name of Timotheus, is a plea for Christian socialism. against the evils of widespread poverty and iniquitous distribution of wealth. The second work is of greater importance because it describes the collapse of western Rome through the eye of a witness. The thesis is that the downfall of Rome was caused not by God's indifference to Roman fate but by the general viciousness of the Catholic Romans who were morally inferior to the German barbarians. Important as the book is to the historian. it must be used cautiously because the indignant Salvian is anxious to draw as black a picture of 5th-century Rome as is possible.

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See S. Dill, *Roman Society in tlze Last Century of the Western Empire (1933).* (G. WL.)

SALVINI, TOMMASO (1829–1915), Italian tragic actor, renon-ned especially for his Othello, was born at Milan on Jan. 1, 1829. to a family of actors. He made his debut as Pasquino in Carlo Goldoni's *Le Donne curiose* (1812) and won his title as tragic actor in Vittorio Xlfieri's *Oreste* (Teatro Valle, Rome, 1847) with Adelaide Ristori. Nine years later he played Othello at Vicenza. He visited America five times between 1873 and 1889 and made his debut in Othello at the Academy of Music in Brooklyn; N.Y. (Sept. 16, 1873); where in 1886 he was billed to play Othello to the Iago of Edwin Booth and the Ghost to Booth's Hamlet. Corrado in Paolo Giacometti's *Morte civile* was one of his most accepted roles. Other title roles were in Giovanni Battista Niccolini's *L'Edipo* a *Colono,* Alfieri's *Saul,* Giacometti's *Sofocle,* and *Macbeth, Lear* and *Coriolanus,* along with Egisto in Alfieri's *Merope* and Paolo in Silvio Pellico's *Francesca da Rimini.* He retired in 1890 and wrote his memoirs *Ricordi, aneddoti e impressioni* (1895). He appeared in Rome in 1902 for Ristori's 80th birthday. Salvini died in Firenze. Dec. 31, 1915.

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SALVINIA, a small genus of fern allies belonging to the Salviniaceae family of the class Filicinae, or true ferns, and consisting of small floating aquatic plants that are widely distributed in tropical regions. One species (S. *rotundifolia),* of a total of about ten species, is commonly grown in aquariums and has escaped to ponds and marshes in parts of southern United States.

(J. M. BL.)

SALWEEN, a river of Tibet, China (Yunnan) and Burma, having a total length of 1,750 mi. This river, called Nam Kong by the Shans, Thanlwin by the Burmese, Lu Kiang, Nu Kiang or Lu Tzu Kiang by the Chinese, is the longest river in Burma and one of the wildest and most picturesque streams in the world. It rises in Tibet south of the Kuen-lun, and is thus a much longer river than the Irrawaddy. From the time it leaves Tibet it has a very narrow basin, and for long stretches has no other affluents than the mountain torrents from the hills, which rise from 3,000 to 5,000 or 6,000 ft. above the level of the river bed. In the dry season the banks are alternate stretches of blinding white, fine sand, and a chaos of huge boulders, masses and slabs of rock, with here and there, usually where a tributary enters. long stretches of shingle. In the rains all these disappear, and the water laps against forest trees and the abrupt slope of the hills. The average difference between high and low water level of the Salween throughout the Shan state is between 50 and 60 ft., and in some places it is as much as 90.

There are many rapids, caused by reefs of rock running across the bed, or by a sudden fall of from one to several feet, which produce very rough water below the swift glide; but the most dangerous places for navigation are where a point juts out into the stream, and the current, thrown back, causes a violent double backwater. Nevertheless. long stretches of the river, extending to scores of miles, are habitually navigated by native boats. The current is extremely variable, from ½ m.p.h. to ten knots. Launches ply regularly from Moulmein to the mouth of the Yunzalin, in lower Burma. The worst part of the whole Salween, so far as is known, is the gorge between the mouth of the Yunzalin and Kyaulthnyat. It is quite certain that steam launches could ply over very long sections of the river above that, perhaps as far as the Kaw ferry, or even the Kunlong ferry. In Burma however, there are very few settlements on the river itself, and frequently the ferry villages are built 1.000 ft. above the river.

The Chinese believe the Salween valley to be deadly to all strangers, but it is in Chinese territory — particularly in the Lu Kiang, or Möng Hko state — that there is the largest population on the river until Lower Burma is reached. A description of the Salween resolves itself into a list of the ferries at which it can be crossed, for no one marches up the river. The river is bridged by the Chinese on the main route from Tēng Yüeh (Momien) and Bhamo to Tali-fu. Native boats can ply from Kyodan S., and light draught steamers ascend as far as Shwegūn, 63 mi. from Moulmein.

The Salween enters the sea in the Gulf of Martaban by two mouths, one to the north and one to the south of Bilugyun island. The southern mouth is the more important, and is the one by which ocean-going craft approach the port of Moulmein. The Salween is a formidable natural obstacle. It seems probable, however, that long stretches of it can be opened to trade. It is certainly no less navigable than the Middle Mekong or the Yangtsze-kiang above I-chang.

SALYES (SALLYES, SALYI, SALLUVII), a people occupying the plain south of the Druentia (Durance) between the Rhone and the Alps. According to Strabo (iv, p. 203) the older Greeks called them Ligyes. and their territory *Ligustikē.* In 154 B.C. the inhabitants of Massalia, who had been connected with the Romans by ties of friendship since the second Punic war, appealed for aid against the Oxybii and Decietes (or Deciates). These people, called by Livy (*Epit.* 47) "transalpine Ligurians," were perhaps two smaller tribes included under the general name of Salyes. They were defeated by Quintus Opimius. In 125–124 B.C. hostilities broke out between the Romans and the Salyes from the same cause.

Gaius Sextius Calvinus (123–122 B.C.), subdued the Salyes, de-

stroyed their chief town, and founded near its ruins the colony of Aquae Sextiae (Aix). Part of their territory was handed over to Massaliots. From this time the Salyes practically disappear from history.

SALZA, HERMANN VON *(c.* 1170–1239), master of the Teutonic order and councilor of the emperor Frederick II, entered the Teutonic order in early life, became very intimate with Frederick II, took part in the expedition to Damietta in *1221,* and accompanied the emperor on the crusade of *1228.* About *1210* he was appointed master of the Teutonic order and in *1226* received the province of Kulm from Conrad I, duke of Masovia, in return for help against the Prussians. In *1230* the conquest of Prussia was begun by the order, although not under his immediate leadership. In *1225* he reconciled Valdemar II, king of Denmark, with Henry I, count of Schwerin, and thus won again the land on the right bank of the Elbe for the empire and the recognition of imperial superiority over Denmark. Trusted by Pope Gregory IX and the emperor alike, he brought about the treaty of San Germano between them in *1230,* was the only witness when they met in conference at Anagni in the same year and it was he who, in *1235,* induced Frederick's son Henry to submit to his father. He died on March *19, 1239,* at Barletta in Apulia, and was buried there in the chapel of his order.

See A. Koch, *Hermann von Salza, Meister des deutschen Ordens* (1885).

SALZBURG, a Bundesland of Austria (area 2,762 sq.mi.), includes from south to north parts of the following lithological belts of the Alps: the crystalline, the slate and schist, the limestone High Alps and the flysch zones. The first named extends from the glacier-capped Hohe Tauern and southern slopes of the Niedere Tauern to the line of the Pinzgau eastward to the Mandling pass. This is a region much dissected by tributaries of the Salzach and characterized by forestry and pastoral pursuits. The most important valley is that of the Gastein leading to a col between the Hohe and Niedere Tauern ranges and followed by a railway to Carinthia. North of this belt is a wedge-shaped mass of slates and schist, with softer outlines and lower forested heights, which is in turn replaced by the lake-strewn plateau of Dachstein limestone, split into several detached blocks; *e.g.,* the eastern end of the Kitzbühl Alps, the Salzburg Alps (Birnhorn *8,642* ft.), the Reiteralpe and the glacier-capped Schonfeldspitze mass *(8.320* ft.). Part of the Dachstein group also belongs to Salzburg. Drainage is effected mainly by the Salzach which in its upper course follows a west-east marshy valley (Pinzgau) along the foot of the Hohe Tauern, at the junction of crystallines and slates, to Schwarzach St. Veit, where it takes a transverse course through a wider and more fertile valley (Ponzgau), breaking through a narrow pass between the Hagengebirge and the Tennegebirge and reaching the foreland at Salzburg; the upper waters of the Enns and blur take the drainage of the eastern half of the Niedere Tauern. Salzburg is noted for its numerous beautiful lakes and the many magnificent falls on its rivers, *e.g.,* the four Krimml falls, together 1,247 ft. high, the most important falls in the eastern Alps.

The enclosed basins of the higher mountain districts experience very hard winters and settlement in them is thin and confined to the sunny slopes and alluvial fans. About 16% of the total area is unproductive and of the remainder about 11% is given over to crops and 10% to meadows. Forestry and pastoral activities. aided by a wealth of alpine pasture (30% of the area) are most important. Mineral resources include: salt at Hallein, copper near Bischofshofen, iron ore at Werfen, marble (Adnet) and small quantities of gold, silver and arsenic. The absence of coal is compensated by the rich stores of water from which electrical power is developed at Lend Gastein, Barenwerk, etc., yet industry is only moderately progressive.

Catering for visitors to the spas, scenic resorts and centres' for winter sports is the most remunerative industry. Apart from Salzburg (*q.v.*), the capital, the population, which was *327.232* in *1951* and 351,970 in *1961* was largely rurally distributed, mainly along the valleys and chief lines of traffic. Many of the people are of German stock and they are mainly Roman Catholic in religion. The province *(Reichsgau)* was seized by Germany in March *1938* and held until *1945.*

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SALZBURG, the capital of the Bundesland of Salzburg, Austria, lies on both banks of the Salzach where this river leaves its narrow valley through the limestone Alps and enters the alpine foreland.

The situation is important economically and strategically, for there several types of physical region, with differing agricultural possibilities, meet and the Orient route from Germany through Munich joins the Orient route from France through Switzerland and branches along the Salzach valley and through the Hohe Tauern to Carinthia and Italy. The site has been occupied since pre-Roman time, the original settlement being replaced by a Roman trading town (*Juvavum*) which was sacked by the barbarians (477). The modern city grew up around the monastery and bishopric founded there about *700* by St. Rupert of Worms, who preached Christianity in the district at the invitation of its ruler Duke Theodo of Bavaria, and its history from that time is closely bound up with that of the see. The present name, due to the local abundance of salt, appears first in *816* by which time it had been raised to an archbishopric. Its archbishops gained in temporal power and dignity and were made imperial princes by Rudolf of Habsburg in *1278.*

Relations between the ecclesiastical rulers on the one hand and the nobles and people on the other were always difficult, *e.g.,* during the Peasants' War of 1525–26, quelled with the aid of the Swabian league. and contributing to a reaction against the church when Salzburg became a stronghold of resistance to the Reformation. Persecution was rife and Protestant citizens were driven from the town. Nevertheless, the movement grew and in 1731–*32,* aided by the intervention of Frederick William I of Prussia, *30,000* people sold their possessions and left the see, *6.000* of them leaving the capital. By the peace of Lunéville *(1802)* the see was secularized and given to the archduke of Austria. Follo ing the peace of Pressburg *(1805)* it fell to Austria but four years later passed to Bavaria, returning to Austria in *1816* with the exception of a small portion on the left bank of the Salzach. In *1849* it became a crownland, several of its districts being transferred to Tirol. and remained so until *1918,* when it became part of the Austrian republic. With the rest of Austria it was annexed to Germany by Hitler from March *1938* to *1945.*

Its ecclesiastical buildings include *8* convents and *25* churches, the majority interesting from their antiquity, architecture or associations. Of these, the 17th century cathedral. one of the largest and most perfect specimens of the Renaissance style in the Germanic countries, is on the model of St. Peter's at Rome. Though situated in the old town it is bounded on three sides by open squares, which permit its beauties to be appreciated. Other buildings of note are the old and new residences of the archbishops. the latter occupied by government offices. the present palace, the 15th century town hall and the Mozart house and museum. The only relic of the university *(1623–1810)* is a theological seminary. By the suppression of its university Salzburg has been prevented from making that contribution to Austrian culture that its importance as an administrative and spiritual centre leads one to expect.

Salzburg has had a heavy seasonal tourist traffic. favoured by a healthy climate. delightful scenic surroundings and excellent music.

Its manufactures include brewing, bookbinding, musical instruments and marble wares and light iron goods.

Pop. *(1961)* of the *Bundesland* of Salzburg was *351,970,* and of the town, *109.724.*

SALZGITTER, a town in the Land of Lower Saxony. Germany. on the Mittelland canal and the Hildesheini-Borssum railway, 12 mi. S.W. of Brunswick. Pop. (1959 est.) *106.761.* It was formerly a small town, known chiefly for its salt baths; however, after *1937* it was enlarged into a model housing settlement as the residence for workers in the newly created Hermann Goring Coal and Iron works factories nearby. Coal and coke for

smelting ore was brought cheaply and easily from the Ruhr by the Mittelland canal. opened in 1937.

SALZKAMMERGUT is a mountainous district of Austria forming the drainage area of the Traun and its tributaries above Gmunden. Originally its name (literally "salt-exchequer property") and its economic importance were derived from the valuable salt deposits. worked from prehistoric times at Hallstatt and Aussee, but although these are still valuable the region is rapidly developidg as a health and tourist resort. Belonging to the eastern Alps it contains the Dachstein group (Dachstein. 9.826 ft.) with the most easterly glaciers of the Alps, the Totes Gebirge (Grosser Priel. 8,277 ft.), the Hollengebirge (Hollenkogel, 6,109 ft.), the Ischler and Sensen groups. Among its lakes are Traun. Hallstatt. St. Wolfgang and Attersee, largest in Austria (18 sq.mi., 1.532 ft. above sea level, 560 ft. deep), each over-shadowed by forested heights. The district embraced parts of the Austrian provinces of Styria, Salzburg and Upper Austria, and the occupations of its population, apart from those suggested above, are cattle rearing. forestry and the development of electricity. The towns are small, along the valleys and lake shores. Among them Gmunden (*q.v.*) is the chief, while Hallstatt is famous for its museum of local finds illustrative of the cultural period to which it gave its name. Germany annexed the district in 1938.

SAMAIN, ALBERT VICTOR (1858–1900), French poet. was born at Lille on April 4, 1858. He was educated at the lycée of that town, and on leaving it entered a bank as a clerk. He enjoyed no literary associations, and his talent developed slowly in solitude. About 1884 Samain went to Paris, having obtained a clerkship in the Prefecture de la Seine, which he held for most of his life. His earliest volume of poems, *Au Jardin de l'infante,* led to the sudden recognition of his talent, and to applause from critics of widely different schools. In 1897 this book was reprinted in a more popular form! with the addition of a section entitled *L'Urne penchée.* Samain's second volume, *Aux flancs* du vase, appeared in 1898. His health began to fail and he withdrew to the country, where he died, in the neighbourhood of the village of Magny-les-Hameaux, on Aug. 18, 1900. A third volume of his poems, *Le* Chariot *d'or,* appeared after his death. with a lyrical drama, *Polyphème* (1901), which was produced at the Théâtre de l'Oeuvre in 1904. Samain's natural life was patiently spent in squalid conditions; he escaped from them into an imaginative world of the most exquisite refinement.

See also *R.* Doumic, "Trois Poètes," in the *Revue des deux mondes* (Oct. 1900); L. Bocquet, *Albert Samain, sa vie, son oeuvre* (1905); and *E.* W. Gosse, French *Profiles* (1905); *F.* Gohin, *L'Oeuvre poétique d'Albert Samain, 1858–1900* (1919); G. Bonneau, *A. Samain, poète Symboliste* (1925).

SAMANÁ, a province in northeastern Dominican Republic. Area 848 sq.mi., pop. (1950) 83.263. It occupies the mountainous (to 1,673 ft.) Samaná peninsula. the delta region of the Yuna river and a large part of the northeastern coastal plain. It is a rich coconut region. a leading rice producer from reclaimed marshlands and a significant producer of cacao. corn and tropical hardwood. The province was created in 1908 from El Seibo province. The capital. Santa Bárbara de Samaná (1950 pop. 2,480), was founded in 1756 by Spaniards from the Canary Islands, and in 1825 there was a notable influx of Negro immigrants from the U.S. Sánchez is a railroad terminus and port.

SAMANÁ BAY, which is bounded on the north by the Samaná peninsula is approximately 40 mi. long and 15 mi. wide. with deep water and well-protected anchorages. and is one of the finest natural harbours in the West Indies. Apart from its importance as a fishing and tourist site. it is used relatively little for commerce. However the bay's location. on the Mona passage between the Atlantic and the Caribbean, makes it potentially important strategically, and several times in the 19th century the United States or other powers showed an interest in acquiring it. Two treaties. one leasing the bay to the United States and the other providing for the annexation of the Dominican Republic were signed in 1869. but both agreements were defeated by opposition in the U.S. senate when it was learned that U.S. speculators were promoting the annexation in the hope of profiting by concessions in the Samaná region. (D. G. Mo.; D. R. D.)

SAMANA RANGE, mountain ridge in the Kohat district of the North-West Frontier Province of Pakistan, commanding the south boundary of Tirah. The ridge lies between the Khanki valley on the north and the Miranzai valley on the south, and extends for some 30 mi. W. from Hangu to the Samana Suk. It is some 6,000 to 7,000 ft. high. Beyond the Samana Suk lies the pass, known as the Chagru Kotal, across which the Tirah Expedition marched in 1897. On the opposite hill on the other side of this road is the famous position of Dargai (see TIRAH: Campaign). After the Miranzai Expedition of 1891 this range was occupied by British troops and eleven posts were established along its crest, the two chief posts being Fort Lockhart and Fort Gulistan. In 1897 all the forts on the Samana were attacked by the Orakzais, and this and the Afridi attack on the Khyber pass were the two chief causes of the Tirah Expedition. When Lord Curzon reorganized the frontier in 1900, British garrisons were withdrawn from most of the Samana forts, which were later held by a corps of tribal police 450 strong, called the Samana Rifles.

SAMANIDS, the first great native dynasty which arose in Persia after the Arab conquest. In the 8th century Saman, a Persian noble of Balkh, who was a close friend of the Arab governor of Khurasan, Asad ibn 'Abdullah, was converted from Zoroastrianism to Islam. His son Asad, named after Asad ibn 'Abdullah, had four sons who rendered distinguished service to the caliph al-Ma'mun. In return they all received provinces: Nuh obtained Samarkand; Ahmad, Ferghana; Yahya, Shash; and Ilyas, Herat. In 875 Ahmad's son Nasr was recognized by the caliph al-Mu'tamid as governor of Transoxiana. He was succeeded in 892 by his brother Isma'il, who overthrew the Saffarids (*q.v.*) in Khurasan and the Zaidites of Tabaristan and thus, though remaining nominally a provincial governor under the caliph of Baghdad, established an almost independent rule over Transoxiana and eastern Persia, with Bukhara as his capital.

The descendants and successors of Isma'il, almost all renowned for the impulse that they gave both to the patriotic feelings and the national poetry of modern Persia (see PERSIAN LITERATGRE), were Ahmad ibn Isma'il (907–914); Nasr II, ibn Ahmad, the patron and friend of the great poet Rudagi (914–943); Nuh I, ibn Nasr (943–954); 'Abd ul-Malik I, ibn Nuh (954–961); Mansur I, ibn Nuh, whose vizier Bal'ami translated Tabari's universal history into Persian (961–976); Nuh II, ibn Mansur, whose court poet Dakiki began the Shahnama (976–997); Mansur II, ibn Nuh (997–999); and 'Abd ul-Malik II, ibn Nuh (999). Under their government, which was organized on a loosely centralized feudal system, the provinces of Transoxiana and Khurasan attained a high degree of prosperity. The expansion of their industry and commerce is attested by the use of Samanid silver dirhems as currency all over the north of Asia, and they have been found in great numbers in Pomerania, Sweden and Norway, brought by Russian traders. The later interruption of the northern trade routes was a factor in weakening the dynasty; and it succumbed eventually to the internal feuds and rivalries of the nobles and to the pressure of the rising Turkish powers in central Asia and Afghanistan.

Under Mansur I a Turkish slave, Alptagin, formerly commander of 'Abd ul-Malik's guard at Bukhara, had to flee for refuge to the mountainous regions of Ghazni, nhere he established a semi-independent rule. to which, after his death in 977, his son-in-law Sabuktagin, likewise a former Turkish slave, succeeded. Nuh II, in order to retain at least a nominal sway over those Afghan territories confirmed him in his position and invested Sabuktagin's son Mahmud with the governorship of Khurasan, in reward for the help they had given him in his struggles with a confederation of disaffected nobles under the leadership of Fa'ik. During this conflict, the greater part of Transoxiana was occupied by the Turkish Kara-khanids, whose chief. Boghra Khan, occupied Bukhara for a short time in 992. Sabuktagin died in the same year as Nuh II (99;) : and Mahmud (see MAHMUD OF GHAZNI), confronted with an internal contest against his own brother Isma'il, had to withdraw for a short time from Khurasan. This interval sufficed for Fa'ik. supported by a Kara-khanid force under the Ilek khan Nasr I. to concentrate poner in his onn hands and

to involve Mansur II in a conflict with Mahmud. After the deposition of Mansur, who was suspected of intending to come to an agreement with Mahmud, the latter took possession of Khurasan. A few months later, the Ilek khan Nasr marched on Bukhara and carried 'Abd ul-Malik and his relatives into captivity. The last prince of the Samanid house, Muntasir, a bold warrior and a poet of no mean talent. carried on guerrilla warfare for some years against both Mahmud and the Kara-khanids, till he was assassinated in 1005.

See CALIPHATE and PERSIA: *History*.

See W. Barthold. *Turkestan Down to the Mongol Invasion* (1928); S. Lane-Poole, *Muhammadan Dynasties* (1894).

SAMAR, an island in the east central part of the Philippine archipelago, which with several dozen surrounding islets constitutes a province. Area 5,050 sq.mi.; pop. (1959 est.) 927,630. Samar is the third largest island in the Philippines (after Luzon and Mindanao). It lacks the high mountains which characterize many of the islands in the group but is exceedingly hilly. with extensive level land found only in the coastal areas. The highest point is Mt. Capotoan (2,789 ft.). in the north central section. Annual rainfall varies from 100 to 170 in. and is evenly distributed throughout the year except on the east coast where there is a marked winter maximum. Samar receives considerable wind and flood damage from frequent typhoons.

Rice is the main food crop followed by root crops such as sweet potatoes and cassava. Coconuts and bananas are raised for cash along the coastal lowlands. Iron ore in small quantities is mined in the southeastern part of the island and is shipped from the port of General MacArthur. There are deposits of coal and phosphate rock near the west coast.

The provincial capital and important trading town is Catbalogan, pop. (1959 est.) 32.839. on the west coast; Calbayog. a chartered city. is also a trading centre located on the northwest coast.

(R. E. HE.)

SAMARA (now KUIBYSHEV), an *oblast* of the Russian Soviet Federated Socialist Republic. U.S.S.R.. lying east of the Volga. except for the territory enclosed in the great Volga loop, and south of the Tatar Autonomous Soviet Socialist Republic. Its southern boundary lies between the Great Irgiz and the railway from Saratov to Uralsk. and runs parallel to the latter to the boundary of the Kazakh S.S.R.. on the Obschiy Syrt plateau. Chkalov *oblast* and the Bashkir A.S.S.R. lie to the east.

South of the Volga loop (Samarskaya Luka) is a low flat steppe recently emerged from the post-Pliocene Aral-Caspian basin; from the Samara to the Sok are Permian formations. The region is a transition area between the black earth and salt steppe soils. The most fertile black earth, humus content of 18%, lies northeast of the region in the lyesso-steppe area—*i.e.,* steppe with patches of forest, mainly oak. Between the Samara and the Moksha, except for a patch north and south along the eastern part of the latter the black earth is of poorer humus content, of a sandy type, and patches of salted soil appear. especially near the Volga. South of the Great Irgiz the soil is salt steppe. and there are salt marshes. South of the Samara there is no forest, but the land in the loop and north of it is forested, and there is a patch of forest on the north bank, west of Buzuluk.

The region is undergoing a process of rapid desiccation. It has an arid climate, the rainfall varying from 8 to 16 in. per annum, mostly falling in spring and summer in heavy showers, so that the runoff is excessive and only the surface becomes saturated. The prevailing winds are from the northeast, dry and strong. and blowing with great violence in winter, so that snow does not lie and the ground is exposed to the severe winter frost. The average July temperature at Kuibyshev is 70.4° F. and January 9.3° F. An added disadvantage is the liability to years of excessive drought such as 1911 and 1921. Winter lasts for five months and rain falls on an average of 95 days per annum, 34 of which are in June–August. Thunderstorms are frequent in June and July and, if accompanied by dry hail, may ruin the crops.

Diminution in the spring rainfall causes the disastrous famines to which the region is subject. Of the inhabitants, 90% are occupied in agriculture, depending on the crops for sustenance and for purchase of necessities. Bad harvests, therefore, such as those of 1911 and 1921, bring disaster. In 1921 great numbers died of starvation and starvation diseases and others fled from the region, many to perish on the road. Bands of starving children, whose parents had succumbed first in their efforts to feed the children, penetrated even as far as the Caucasus. Livestock diminished, and when the weakened survivors of the terrible period faced the next year there was a shortage of everything, from seeds and instruments to working cattle.

The area subsequently revived to an extraordinary degree, an evidence of the fertility of its famous black soil. Attention had been concentrated on the drought problem and the need for more intensive agriculture in Samara as early as 1864, and some efforts were made to improve the type of cultivation. Further evidence of the crisis of extensive agriculture in the region is the great variation in the harvest. In 1911 there was not enough to satisfy local needs, in 1913 a surplus of 110,000,000 poods (3,972,430,000 lb.). Six experimental stations were established to study local problems, Resenchuk, Buguruslan, Alekseyev, Bugulma, Buzuluk, and one connected with the Kuibyshev agricultural school at Kinel. In 1927 collective farming became the foundation of agricultural policy. Mechanized agriculture achieved considerable success in its struggle with drought.

The main lines along which attempts are being made to improve agriculture and lessen the chances of famine in the district are the increasing practice of irrigation; a wider range of variety in crops, and especially the sowing of grasses and lucerne, in which respect Kuibyshev stands first in the regions of the famine area; the preservation of what forest is left, and the planting of more trees, in view of their protective value in a windswept region, and their influence on moisture conditions in the soil; the greater extension of stock raising, in view of the increasing importance of meat, dairy products, fats and wool for the growing industrial regions. Though many experiments have been made, no kind of winter corn able to withstand the severe conditions has yet been discovered, but more drought resisting varieties of hard wheat, which commands a better market than soft wheat, have been introduced.

About 90% of Kuibyshev region is favourable for vegetation, and of this about two-thirds is ploughed land, about one-tenth is forest and scrub, and the rest is pasture, meadowland or garden. In the stock-raising areas, cattle, sheep and pigs are at pre-1914 level, but horses are still much below that level. Cattle plague often devastates the herds. A few dairy artels have been established. Bee-keeping and poultry raising are subsidiary occupations. The manufactures in the region are entirely dependent on local products and include flour milling, distilling, starch manufacture, tobacco making, confectionery, woollen goods, leather and matches. Most of them are of the small scale, peasant type. Two sugar factories were working before 1914, and there is one factory producing agricultural machinery.

The population (1959) was 2,257,000 of which 1,391,000 was urban. The population consists mainly of Great Russians, with Mordvas, Chuvashes, Tatars and Bashkirs. The ethnographic variety is great, and the colonies of Poles, Mennonites from Danzig, and Circassians settled there in 1847–59 by the government added to it. Difficulties of overcoming illiteracy under these conditions are great. Area of the region is 20,772 sq.mi. The Volga is the great artery of commerce, but its tributaries are shallow and not suitable for navigation, with the exception of the Great Irgiz up to Kushum. Kuibyshev is linked by rail with Moscow on the west. and with Ufa and Chkalov on the east, while a branch line reaches the Sok river. Roads are poor. there are few bridges, and transport difficulties hamper development.

The chief towns are Kuibyshev (*see* SAMARA), Pugachevsk, Buzuluk and Buguruslan.

See P. A. Preobrazhenskiy *The Restoration of Agriculture in the Famine Area of Russia* (1922, in English); *Colonisation of the Samara Region* (1923, in Russian); M. M. Dubenskiy, *The Central Volga Region* (1927, in Russian).

SAMARA (now KUIBYSHEV), a town of the Russian S.F.S.R. in the Kuibyshev *oblast,* 53" 11' N., 50° 9' E., on the left

bank of the Volga loop, at the junction of the Samara river. Pop. (1959) 806,000. It is a fine river port, and acts as an entrepôt for goods brought by rail and transhipped, or vice versa. Its industries include the making of machinery, distilling, brewing, matchmaking, sawmilling, leatherwork and flour milling. There are municipal electricity, water and canal and tram services. Near the town is a *kumiss* or fermented mare's milk sanatorium. Samara was built in 1586 to secure communication between the recently conquered principalities of Kazan and Astrakhan. Later discontent among the serfs led to a rising in the district in 1774 and the town was the centre for its leader, Pugachev. In 1670 it had been captured by the rebel Stenka Razin. Its importance as a trading centre dates from the end of the 18th century, when colonization spread eastward. In 1918 the Russian state gold treasure was transferred from Kazan to Samara, under the charge of employees of the tsarist government, but when the military situation became critical it was removed under an escort of Czech soldiers.

SAMARIA, ancient city of Palestine in the tribe of Ephraim, 6 mi. N. of Shechem (Nablus). The site, an isolated hill in the centre of Palestine, is one of great natural strength. Sebastiyeh, a village of 600 inhabitants, occupies part of the area of the royal city; its houses are mostly built with ancient materials.

History.—Omri, king of Israel, bought the hill from its owner, Shemer, for two talents of silver, and erected a city which he made his capital (I Kings xvi, 24). The evidence of the excavations establishes that the site was unoccupied prior to the time of Omri (10th century B.C.). Ahab occupied the city, built a temple and remodelled Omri's palace, which was further extended later and probably by Jeroboam II. Ben-hadad II of Syria in the days of Elijah and Elisha, after having been repulsed from its walls (I Kings xx, 34) returned to besiege it and bring it to dire straits through famine (II Kings vi, vii). Shalmaneser IV laid siege to it for three years (724–22 B.C.), but died during its progress. The operation was completed by Sargon. who deported its inhabitants and substituted for them a new body of settlers from Cutha, according to Jewish tradition, the ancestors of the Samaritans. Alexander the Great conquered it in 331 B.C., as did also later Ptolemy Lagos and Antiochus Poliorcetes. It offered a lively resistance to the fanatical John Hyrcanus. Pompey rebuilt it, and Gabinius restored it. Herod the Great was its chief benefactor. A temple, hippodrome and colonnaded streets were among his endowments; their remains still arrest attention. He made it his capital and it took the name Sebaste (commemorating Augustus). The rise of Nablus (Neapolis), restored by Vespasian, involved the gradual decay of Sebaste. The crusaders built a church on the hill and established a bishopric. The church, like so many others. was later converted into a mosque. Here were shown the tombs of Elisha, Obadiah and John the Baptist.

Archaeology.—From 1908 to 1910 excavations, under the auspices of Harvard university were carried out on the site, the results of which were published in 1924. The oldest edifice found on the hill was the palace of Omri, added to and enlarged by Ahab and Jeroboam II. An interesting discovery was that of a number of Hebrew texts traced in ink on tiles in Hebrew writing of a beautiful type belonging to the 9th century B.C. The foundations of a forum, senate house, palace, city gate flanked by two round towers, etc., have been laid bare. The low ground to the northeast was the site of the stadium.

See G. A. Reisner, C. S. Fisher, D. G. Lyon, Harvard Excavations *at Samaria (1908–10)* (1924); R. Dussaud, "Samarie au temps d'Achab," Syria 6, 314 et seq. (1925). (E. Ro.)

SAMARITANS, the name given to a peculiar religious community formerly widespread throughout Samaria in Palestine and now represented by a few families at Nablus, near the site of the ancient Shechem. They claim to be descendants of the ten tribes, denying that the latter were ever deported en masse to Assyria, as related in the Old Testament (II Kings xvii, 2.3). Their religion, they assert, represents the true, unalloyed teaching of Moses, since they accept the Pentateuch alone as holy scripture. This they transmit in an archaic script resembling ancient Phoenician characters and in a text which differs slightly (sometimes only through dogmatic manipulation) from that of the Jews. They identify the "chosen place" of God not, as do the Jews, with Zion, but with Mt. Gerizim, overlooking Shechem. In their version of Deuteronomy xxvii, 4, the altar of God is enjoined to be erected on that mountain, not on Mt. Ebal, as in the Jewish recension, and a similar injunction is appended to the Ten Commandments, after Exodus xx, 17, and Deuteronomy v, 21. The temple at Jerusalem and the earlier shrine at Shiloh are regarded as apostatic.

The origin of the sect is obscure because the native and the Jewish accounts (in Josephus, Jewish *Antiquities,* xi, 7, 2; c. 8) are alike tendentious, the former deliberately apologetic and the latter deliberately defamatory. Most probably, the inhabitants of Samaria first organized themselves as a schismatic community when the Jews, regarding them as mongrel stock, refused their aid in the building of the Second Temple (Ezra iv, 1–3). The schism seems to have crystallized, however, only about 200 years later, when a rival temple was established, about 332 B.C., on Mt. Gerizim.

In spite of the differences which separated the two communities, their external histories at first ran parallel. Samaritans as well as Jews were deported to Egypt by Ptolemy Lagos, the two parties subsequently continuing their rivalry in Alexandria; while under Antiochus IV Epiphanes they too were compelled to devote their sanctuary to the worship of a heathen god (II Maccabees v, 23; vi, 2). Open hostility would appear to have developed especially when the Hasmonaean state of the Jews embarked upon a policy of expansion. and this reached its climax with the destruction of the Samaritan temple by John Hyrcanus I in 129 B.C. Thereupon the Samaritans found themselves caught between the Jews on the one hand and the Romans on the other. When the Jews were subjugated in 63, Samaria was liberated from Jewish domination and entered briefly upon a new lease of life. The capital city was restored by the Roman governor Gabinius and enjoyed the special favour of Herod, who there celebrated his marriage with Mariamne. On the other hand, the Samaritans supported the Jews in an uprising against Vespasian and paid dearly in a retributive massacre, and like the Jews they were grievously oppressed by Hadrian, who burned their traditional writings. They seem also to have shared in the Jewish dispersion, for in later times we hear of Samaritans and their synagogues in Egypt, in Rome and in other parts of the empire. During the 4th century, however, they enjoyed a brief renascence on their native soil under the leadership of a certain Baba Rabba, who built many synagogues (some of them excavated in the second quarter of the 20th century) in the villages around Shechem. Eventually, hostility to the Christians brought about their final eclipse. In 529 a rigorous edict against them was promulgated by Justinian, and although he subsequently softened its terms, renewed hostility on their part resulted, in 572, in a definitive withdrawal of all their rights and privileges by Justin II.

Under Arab and, later, under Turkish rule, the history of the Samaritans is generally one of constant oppression and subjection, relieved only by occasional bright intervals. Although they are mentioned in later times by such Arab writers as Masudi (943) and Sharastani (d. 1153), by Jewish travellers such as Benjamin of Tudela (1163) and Obadiah Bertinoro (1488 in Egypt), by Jehan de Mandeville (1322), William of Baldensel (1336) and others, little was known of them in Europe until Joseph Scaliger opened communications with them in 1583. In consequence of the interest thus aroused, the traveller Pietro della Valle visited them in 1616 and obtained from them a copy of their Pentateuch, of their ancient Aramaic translation (Targum) of it and of various other writings. At that time they had already quit their colony in Damascus and were beginning also to abandon their other settlements and to concentrate themselves in Nablus. By mid-20th century they lived mainly in a special quarter of that city, about 190 in number, though a few families had migrated to Tel Xviv and Jaffa. Their economic and cultural level is extremely low, and their principal problem is how to perpetuate themselves without infringing the forbidden degrees of marriage.

Religion.—Briefly summarized, the creed of the Samaritans is as follows: (1) God is one, incorporeal and without associate; (2) Moses is the only prophet, a preordained creature sui generis, the vessel of the divine "light" and "image" and the intercessor for man on the final Day of Judgment; (3) the Law of Moses, coeval with the world, is the only divine revelation and is immutable; (4) Mt. Gerizim is the chosen place of Cod, the only centre of worship and the "navel of the earth"; (5) there will be a Day of Requital and Reward, when the dead will emerge from their graves, the righteous to enter paradise, the guilty to roast in eternal fire. The Samaritans divide their history into a period of Divine Pleasure (Rahuta), when their temple was standing, and one of Divine Displeasure (*Fanuta*), which has continued ever since it was destroyed. Eventually, 6,000 years after creation, a Restorer (Taheb) will arise to ameliorate their fortunes. He will live 110 years.

In religious practice, the Samaritans observe only those laws and institutions that are prescribed in the Pentateuch. They interpret them, however, in a manner divergent from normative Jewish tradition, often agreeing with the Sadducees against the Pharisees and with sectarian Jewish usages later revived by the Qaraites. Passover, for example, begins on the 14th day of that lunar month the beginning of which falls in April (*Abib; cf.* Deuteronomy xvi, 1); Pentecost falls always on a Sunday, since the law (Leviticus xxiii, 15) which dates it seven weeks "from the morrow of the sabbath" is taken to refer to the sabbath in the paschal week. They do not wear prayer shawls or phylacteries, interpreting the laws of Numbers xv, 37–41, and Deuteronomy vi, 8,

symbolically. The law of levirate marriage (Deuteronomy xxv, 5) is taken to enjoin the marriage oi a widow to any near kinsman of her deceased husband, not specifically to his blood brother. The paschal sacrifice is still offered on Mt. Gerizim, and pilgrimages are made thither on each of the seasonal festivals.

The religious direction of the community is vested in a high priest. Formerly he traced his ancestry to Aaron, but in 1623 the Aaronid line died out, and ever since he has been known as the "priest levite," claiming descent from Aaron's uncle Uzziel (Exodus vi, 18).

In Jewish tradition, the Samaritans are styled Cuthaeans, the implication being that they are not genuine Israelites but simply descendants of the ioreign colonists irom Cutha allegedly imported into Samaria by the Assyrian conqueror when the kingdom of Israel fell in 722 B.C. (II Kings xvii, 24). Various restrictions are imposed on intercourse with them, and intermarriage is forbidden.

Language and Literature.— The Samaritan language is a dialect of Western Aramaic. After the Moslem conquest in 632, however, it was superseded by Arabic ior all but liturgical purposes.

During the Hellenistic period, the Samaritans appear to have composed several works, including a translation of their Pentateuch in Greek, but all of these perished except for a few iragments. Of extant writings there is none which can be dated before the 4th century A.D. The Targum or Samaritan-Aramaic version of the Pentateuch was most probably redacted about that time, though it was clearly based on a much older tradition and must have undergone various recensions. It bears a strange similarity in many points to the contemporary Jewish Targum of Onkelos. To the same period belong the liturgical compositions of Amram Darah and Marqah, as well as the latter's midrashic commentary (called "The Book of Wonders") on parts of the Pentateuch, all in Aramaic. The last named is especially valuable not only from the linguistic viewpoint but also because it exemplifies a tradition of exegesis divergent from that of the Jews and because it anticipates several concepts and even idioms found later in the Koran. With the possible exception of one or two hymns there is nothing further until the 11th century, when there appears an Arabic version of the Pentateuch probably composed by Abul-hasan oi Tyre and later revised by Abu Said and Abul-barakat. Oi the same date (1053) is an anonymous commentary on Genesis, interesting because it quotes from books of the Bible other than the Pentateuch and from the Mishnah. Other mediaeval writings oi note are: (1) the *Kafi*, or "Ritual Compendium," by Joseph ben Solomon oi Askar, a village near Shechem (1042); (2) the *Masa'il al-Khilaf*, a disquisition on differences between the Samaritans and the Jews, by Munajja ben Sadaqah (*c.* 1150): and (3) the Tabakh, or "Potpourri," a collection of ritualistic and doctrinal discussions by Abul-hasan of Tyre. All these works are in Arabic. To the same period probably belongs also an Aramaic book of biblical legends known as "The Stories (*Asatir*) of Moses," though this would appear to draw upon far older sources. Of Samaritan chronicles, mention may be made especially of the *Taulida*, commenced in 1149 by Eleazar ben Amram and continued in 1334 by Jacob ben Ishmael in Damascus, as well as oi the so-called Samaritan Book of Joshua, a record of events irom the death of Moses until the 4th century A.D. This work appears to have been compiled irom traditional material at some time in the 13th century. An Arabic chronicle by Abul-fath, written in Egypt in 1355, has also survived. There are also several minor theological treatises and a more ambitious work entitled "Way of the Heart" (Sirr all-Qalb) by Abraham Qabazi of Damascus (1532), as well as a poetic book of praises in honour of Moses (*Molad Mosheh*) by Qabazi's pupil Ismail ar-Rumaihi (1537). In the 19th century, translations of these works were made from Arabic into Samaritan by the priests Pinehas ben Isaac and Jacob ben Aaron. and such activity was continued later by Abisha ben Pinehas and Ab Hasda (Abul-hasan) ben Jacob.

The principal collections oi Samaritan manuscripts are in the British Museum and the Vatican library. Most of the literature remains unedited and unrranslated.

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SAMARIUM (symbol Sm, atomic number 62. atomic weight 150.43) is a metallic element belonging to the rare-earth group. The element, as well as the mineral samarskite. is named after the Russian engineer Col. M. Samarski. It has seven natural. stable isotopes: Sm^{144} (3.16%); Sm^{147} (15.07%); Sm^{148} (11.27%); Sm^{149} (13.84%); Sm^{150} (7.47%); Sm^{152} (26.63%): and Sm^{154} (22.53%). One of these, Sm^{147}. is a naturally occurring radioactive isotope: it has a half life of 1.4×10^{11} years and is an a-particle emitter. The element was discovered in 1879 by L. de Boisbaudran and was obtained in the form of very pure compounds by E. Demarcay about 1901. Samarium occurs in many minerals such as monazite, gadolinite, samarskite, etc.; it is also found among the fission products of uranium, thorium and plutonium.

Formerly it was usually separated from other members of the rare-earth group by the fractional crystallization of the double magnesium nitrate from 50% nitric acid: many other procedures were also used nhich involved long-continued fractionations. Since 1945, rapid separation has been achieved on adsorption columns. Bands of adsorbed rare earths containing samarium are eluted down an ion-exchange column with a buffered solution of citric acid or ethylenediamine tetra-acetic acid. Very pure samarium can be obtained by this means. The common oxide (Sm_2O_3) has a pale yellow colour and is rapidly soluble in most acids, giving topaz-yellow salts such as samarium sulphate ($Sm_2[SO_4]_3.8H_2O$). The salts are paramagnetic. The metal is a silver colour and oxidizes slowly in air. It melts around 1,052° C. and has a density of 7.54 g. per cubic centimetre. The crystal structure of samarium is rhombohedral. with $a = 8.996$ Å (Å $= 10^{-10}$ m.), $\alpha = 23° 13'$, $Z = 3$. The metal has been prepared by electrolysis of the fused halides and by thermal reduction with some alkaline-earth metals. It is several hundred times as volatile at a given temperature as lanthanum, and the metal can be prepared readily by mixing lanthanum metal with samarium oxide and distilling the samarium metal away in a high vacuum at around 1,400° C.

A divalent oxide (SmO) and a divalent series of compounds exist. Most of these divalent compounds are soluble in water but rapidly bring about its decomposition. It has been found desirable to take advantage of the divalent state in rapidly separating samarium from the other rare earths. J. K. Marsh (1942) found that sodium amalgams will reduce samarium salts. The samarium is subsequently extracted from the amalgam in a fairly pure state by the use of acids. although special procedures have to be followed in order to separate the samarium from europium and ytterbium. which are also reduced. While it readily forms an amalgam with mercury. it is extremely difficult to separate the pure samarium metal from the mercury. The trivalent solutions give a characteristic absorption spectrum and the element has a characteristic spark spectrum. It has found rather limited use in the ceramic industry and as a catalyst for certain organic reactions. One of its isotopes has a high capture cross section for neutrons. Therefore, samarium acts as a powerful poison to some nuclear chain reactions. (See RARE EARTHS.) (F. H. SF.)

SAMARKAND, a city of Asiatic U.S.S.R.. in 39° 39' N.. 66° 56' E., situated in the Uzbek S.S.R. Pop. (1939) 134.346. The city is the ancient Maracanda, the capital of Sogdiana, then the residence of the Moslem Samanid dynasty, and subsequently the capital of the Mongol prince Timur. It was captured by the Russians under General Kaufmann, after a fierce struggle. in 1868 and for a time declined. In 1900 its population was 58,194, but after the foundation of the Uzbek republic in 1924, with Samarkand as its administrative centre. the town grew rapidly; an electric power station was constructed, and there are leather factories, cotton cleaning mills, flour mills. distilleries and pencil and brick factories. It is linked by rail with Chkalov and with the Caspian, and these lines are joined up via Seinipalatinsk with the trans-Siberian line.

Samarkand is situated at a height of 2.358 ft. in the fertile loess valley of the Zaraf-shan. at the point where the river issues from the western spurs of the Tien-shan, on a high plain, with the snow-clad Hissar range rising to the south, from which bracing winds blow and make the city more healthful than others in central Asia. Within a journey of a couple of days lie the glacier snouts of the Archa-Maidan, "Place of Junipers."

The Russian part of the town has wide streets lined with poplar, acacia, willow and elm trees, but the Moslem part is an intricate labyrinth of narrow, winding streets. Gardening. the making of pottery and metal goods. and trade in cotton. silk. wheat. rice, horses, asses, fruit and cutlery are among the occupations of the people. The native city. with its maze of yellow houses nestling among the trees, and from which rises the turquoise cupola of the Bibi-Khanum (a college erected in 1388 by a Chinese wife of Timur), centres on the Rigistan, a square around which are three

madrasahs (Moslem colleges), Ulug-beg, Shir-dar and Tilla-kari, of great architectural symmetry and beauty, decorated with enamelled tiles of various colours. Outside the walls of Samarkand are the Hazret Shah-Zindeh, the summer palace of Timur, on a terrace reached by 40 marble steps, and the grave of Shah-Zindeh (Kasim ibn Abbas), a companion of Timur. The latter was a famous shrine in the 14th century (Ibn Batuta's Travels, iii, 52). The Gur Amir, the tomb of Timur, a dome-crowned chapel, has suffered much from time and earthquakes; on its interior walls are turquoise arabesques and inscriptions in gold.

Maracanda was destroyed by Alexander the Great in 329 B.C. and was the scene of the murder of Cleitus. Ruins of its buildings, among which are plain and enamelled tiles and Graeco-Bactrian coins, lie outside Samarkand and are now called Aphrosiab. The city reappears as Samarkand at the time of the Arab conquest, when it was finally reduced by Kotaiba ibn Muslim in A.D. 711–712. Under the Samanids it became a brilliant seat of Arabic civilization and is reported to have been defended by 110,000 men when besieged by Jenghiz Khan in 1221, by whom it was destroyed and pillaged. When Timur (Tamerlane) made it his residence in 1369, its inhabitants numbered 150,000. The magnificent buildings of Timur's successors, which still remain, testify to its former wealth, but by the beginning of the 18th century it was almost uninhabited. It fell under Chinese dominion and subsequently under that of the amir of Bukhara, and finally under that of Russia.

SAMAWA, a town on the Euphrates in 31° N., 45° E., at the junction of the Hindieh and Hilla branches of the Euphrates. The town is on the Baghdad-Basra railway and there is a good clear stretch of river as far as Nasiriyeh 71 m. down stream (up stream the river is practically impassable). It is also situated on the caravan routes to Hilla, Nejef and Basra, in a fertile area and is a centre of trade in local agricultural products, including vegetables, rice and wheat and barley. Like most of the Euphrates towns it is a market for such imported goods as sugar, indigo and coffee and also Manchester goods. A good deal of wool is raised locally and woollen carpets are manufactured in the town. Pop. (1947) 15,292.

SAMBALPUR, a municipal town and district in Orissa state. India. The town is on the left bank of the Mahanadi river, and the terminus of a branch of the Eastern railway. Pop. (1951) 23,523. It contains a ruined fort with old temples. and is the site of the Gangadhar Meher college, affiliated to Utkal university.

SAMBALPUR DISTRICT has an area of 6,767 sq.mi. and a population (1951) of 1,301,804. The Mahanadi, which is the only important river. divides it into unequal parts. The greater portion is an undulating plain. with ranges of rugged hills. the largest of which is the Bara Pahar. covering an area of 300 sq.mi., and attaining at Debrigarh a height of 2,267 ft. The Mahanadi affords means of water communication for 90 mi., its principal tributaries in Sambalpur are the Ib, Kelo and Jhira. To the west of the Mahanadi the district is under close cultivation; to the east the country is broken by hills and a considerable area is under forest. Gold dust and diamonds have been found near Hirakud. at the junction of the Ib and Mahanadi. At Hirakud in the late 1950s a dam was being completed across the Mahanadi for irrigation, flood control and power production.

Sambalpur lapsed to the British in 1849. On the outbreak of the Mutiny in 1857 a general rising took place, and it was not until 1864 that tranquillity was restored.

SAMBOURNE, EDWARD LINLEY (1844–1910), English draughtsman, illustrator and designer, was born in London, on Jan. 4, 1844. He was educated at the City of London school, and aiso received a few months' education at the South Kensington school of art. After a six years' "gentleman apprenticeship" with John Penn and Son, marine engineers, Greenwich, his humorous and fanciful sketches made surreptitiously in the drawing-office of that firm were shown to Mark Lemon, editor of Punch, and at once secured him an invitation to draw for that journal. In April 1867 appeared his-first sketch, "Pros and Cons," and from that time his work was regularly seen, with rare exceptions, in the weekly pages of ***Punch.*** In 1871 he was called to the Punch "table." He drew his first political cartoon, properly so-called, in 1884, and ten years later began regularly to design the weekly second cartoon, following Sir John Tenniel as chief cartoonist in 1901. He died on Aug. 3, 1910.

See M. H. Spielmann, The History of Punch (1895).

SAMBUCA, SAMBUTE, SAMBIUT, SAMBUE, SAMBUQUE, an ancient stringed instrument of Asiatic origin generally supposed to be a small triangular harp of shrill tone (Arist. Quint. Meib. ii. p. 101). But there is no certainty on the point and the most widely different characters have been ascribed to the instrument from time to time in the older records. Thus it has been described as a kind of tambourine, as a sort of flute, as a cithara, as another form of the sackbut, and so on.

SAMLAND, a peninsula of Germany, in the province of East Prussia, on the Baltic. It separates the Frisches Haff on the west from the Kurisches Haff on the north-east, and is bounded on the south by the river Pregel and on the east by the Deime. Its shape is oblong; it is 43 m. long, and 18 broad, and has an area of goo sq.m. The surface is mostly flat, but on the west sand-hills rise to a height of 300 ft. The chief product is amber. The former episcopal see of Samland was founded by Pope Innocent IV. in 1249 and subordinated to the archbishop of Riga. Bishop Georg von Polentz embraced the Reformation in 1523, and in 1525 the district was incorporated with the duchy of Prussia.

SAMNAN: see SEMNAN.

SAMNITES, the name given by the Romans to the warlike tribes inhabiting the mountainous centre of the southern half of Italy. The word *Samnites* was not the name, so far as we know, used by the Samnites themselves, which would seem rather to have been (the Oscan form of) the word which in Latin appears as *Sabini* (*see* below). The ending of *Samnites* seems to be connected with the name by which they were known to the Greeks of the Campanian coast. Both from tradition and from surviving inscriptions (*see* OSCAN and R. S. Conway, Italic Dialects, pp. 169–206) it is clear that they spoke Oscan; and tradition records that the Samnites were an offshoot of the Sabines (see *e.g.,* Festus, p. 326 Miiller). On two inscriptions, of which one is unfortunately incomplete, and the other is the legend on a coin of the Social War, we have the form *Safinim,* which would be in Latin *Sabinium,* and is best regarded as the nominative or accusative singular, neuter or masculine, agreeing with some substantive understood, such as *nummum* (*see* Conway, ibid., pp. 188, 216).

The abundance of the group names ending in the suffix *-no-* in all the Samnite districts classes them unmistakably with the great Safine stock (see SABINI). The Samnites are intimately related to the patrician class at Rome (see ROME: Ancient History).

The longest and most important monument of the Oscan language, as it was spoken by the Samnites (in, probably, the 3rd century B.C.) is the small bronze tablet, engraved on both sides, known as the *Tabula Agnonensis,* found in 1848 at the modern village Agnone, not very far from the site of Bovianum, which was the centre of the northern group of Samnites called *Pentri.* This inscription, now preserved in the British Museum, is carefully engraved in full Oscan alphabet.

The text and commentary will be found in Conway, *op. cit.,* p. 191: it contains a list of deities to whom statues were erected in the precinct sacred to Ceres, or some allied divinity, and on the back a list of deities to whom altars were erected.

See R. S. Conway, *Dialectorum Italicarum exempla selecta,* and C. D. Buck, Oscan and Umbrian Grammar.

SAMO, a tall, robust-looking people inhabiting the borders of Upper Volta and the French Sudan. They speak a language, still little known, apparently related to Sia, and live in independent villages, distributed in quarters consisting of flat-roofed houses of mud. Marriage is restricted within the village but must be outside the extended family group. In the case of a divorce the children remain with the father The family property passes to the brother of the deceased, and personal goods, or individual property, is inherited by the eldest son The Samo are skilled cultivators, and raise cattle. They are animists and perform seasonal sacrifices and worship sacred animals protecting the

villages. The dead are exposed and then buried in special places set apart for (1) old men, (2) young men, (3) old women and (4) young women.

See Tauxier, Le *Noir* du Yatenga (1917).

SAMOA. The Samoan group of islands extends from 13° 26' to 14° 22' S. lat. and from 168° 10' to 172° 48' W. long., and is about 1,600 mi. E. of New Zealand, 2,700 mi. E. of Australia and 2,200 mi. S. of the Hawaiian Islands. The archipelago is divided administratively into two parts: the six islands east of 171° W. long. constitute American Samoa, a dependency of the U.S., and the nine islands west of the 171° meridian constitute Western Samoa, a UN trust territory administered by New Zealand. American Samoa consists of the inhabited islands of Tutuila, Tau. Olosega, Ofu and Aunuu and the uninhabited coral atoll Rose Island. Swains Island, 210 mi. N.W. of Tutuila and considered to be outside the Samoan archipelago, was made a part of American Samoa in 1925. Western Samoa consists of the inhabited islands of Upolu, Savaii, Manono and Apolima and the uninhabited islands of Fanuatapu, Namua, Nuutele, Naulua and Nuusafee.

The total area of American Samoa is 76 sq.mi. Tutuila, the largest island of American Samoa, has an area of about 52 sq.mi. and is about 18 mi. long and about 3 mi. across in the widest part.

Western Samoa has a total land area of 1,133 sq.mi. Savaii, the largest island, has an area of 703 sq.mi. and is 60 mi. long. Upolu has an area of 430 sq.mi. and is 58 mi. long. The other seven islands of Western Samoa are quite small.

All the Samoan islands, except Nuusafee, are rocky and of volcanic origin. Upolu, Savaii and Tutuila have high inland ridges rising to peaks of 6,095 ft. in Savaii, 3,608 ft. in Upolu and 2,141 ft. in Tutuila. These islands have little level land except along the coast and in the case of Tutuila there is a broad fertile plain in the southwestern part of the island. The soil is alluvial and quite fertile in the valleys. Because of the heavy rainfall, the soil on hillsides is thin and there is no subsoil.

The climate of the islands is tropical but equable for a good portion of the year. From May to November strong southeast winds blow and the islands have experienced many severe hurricanes. June and July are the coolest and most pleasant months. The average temperature is 79.3° F. with a mean range from 73.8° to 84.7". Rainfall is generally heavy; the central ridges receive over 200 in. annually.

History. — The archipelago was probably discovered by Jacob Roggeveen, a Dutchman, in 1722. The islands were subsequently visited by Louis de Bougainville in 1768, the comte de la Pérouse in 1787, Edwards in 1791 and Otto von Kotzebue in 1824. The first missionaries to go to Samoa were two members of the London Missionary society who established a mission in 1830. Charles Wilkes, a U.S. explorer, surveyed the islands in 1839. Great Britain, the U.S. and Germany appointed representatives on the islands in 1847, 1853 and 1861, respectively.

In Jan. 1878 the U.S. signed a treaty with the then independent Samoan kingdom which gave the U.S. the right to establish a coaling station in the harbour of Pago Pago, best in the archipelago. A trading agreement was also concluded. Germany and Great Britain received similar privileges the following year, but the interests of the three countries were often in conflict. A conference of the three powers, held in Berlin in 1889, concluded a general act providing for the neutrality of the islands and establishing in effect a tripartite protectorate over the islands.

This arrangement did not operate so successfully as planned, and on Dec. 2, 1899, a convention was signed by Great Britain. Germany and the U.S. by which the paramount interests of the United States in those Samoan islands east of 171° W. long. were recognized and Germany's interests in the other Samoan islands were similarly recognized. Great Britain withdrew from Samoa altogether in consideration of rights in Tonga and the Solomon Islands. The high chiefs of the islands of Tutuila and Aunuu ceded those islands to the U.S. on April 17, 1900, and the chiefs of Tau, Olosega and Ofu Islands ceded their islands to the U.S. on July 16, 1904. The U.S. congress accepted the islands under a joint resolution approved Feb. 20, 1929.

Germany controlled Western Samoa until World War I. New Zealand troops occupied the islands on Aug. 30, 1914, and the League of Nations granted New Zealand a mandate over them in 1920. Western Samoa was made a trust territory by the United Nations with New Zealand as the administering authority on Jan. 25, 1947.

Population. — The population of American Samoa totalled 20,040 in 1960 with about four-fifths of the population on the main island of Tutuila. The population of Western Samoa was 97,327 in 1956, with about three-fourths on Upolu. The Samoans are Polynesian and closely akin to the people of Hawaii and the Maoris of New Zealand.

The Samoan language is believed to be the oldest form of Polynesian speech in existence. It is closely related to the Maori, Tahitian, Hawaiian and Tongan languages.

Despite the increasing contacts with the western world, Samoan culture is still the dominant influence in the lives of the people. The basic unit of Samoan society is the *aiga,* an extended family system headed by the *matni.* Kinship ties are important in Samoan social and economic life and all who are related by birth or adoption are recognized as belonging to one *aiga.*

Samoa differs from most large Polynesian communities in its system of chieftanships. The basis of this system is an intricate hierarchy of graded titles. Essentially, those titles are of two kinds—ali'i and tulafale. The former may be called titular chiefs and the latter orator chiefs. All chiefs are referred to by the generic title *matai.* Succession to a title is elective within a family and while heredity is a contributory qualification, general ability, popularity and the capacity to make a good speech are governing qualifications.

Most of the population have become converts to Christianity. In Western Samoa, one-half of the population is affiliated with the London Missionary society. Other major religious affiliations in Samoa are Roman Catholic. Methodist, Mormon and Seventh-Day Adventist.

Government. — American *Samoa.*—American Samoa is an unorganized U.S. possession with a governor appointed by the president of the United States. The islands were under the jurisdiction of the navy department between 1900 and July 1, 1951, when administration was transferred to the department of the interior.

American Samoa is divided into 14 counties grouped into three administrative districts; the counties and districts correspond to the old Samoan political units. Each district has a governor who is appointed by the governor of American Samoa from the ranks of county chiefs. In each village of the district a chief is appointed by the district governor.

The legislature, as established in 1948 and reorganized effective Nov. 21, 1952, was made bicameral and given only advisory powers. The upper house, or senate, was allotted 15 members, 5 being selected in accordance with Samoan tradition from each of the three districts. It was provided that election of the 18 members of the lower house, or house of representatives, be by direct popular secret vote. In addition, a 12-member council of paramount chiefs, of the highest-ranking chiefs in American Samoa, was established to advise the governor on matters pertaining to Samoan ceremony and custom.

The judiciary consists of a high court presided over by a chief justice and two to four associate judges, and five district courts, each of which has one judge. The seat of the government is at Pago Pago on Tutuila.

Western Samoa.—An act of the parliament of New Zealand, effective March 10, 1948, reorganized the government of Western Samoa. The administration is headed by a high commissioner (formerly the administrator) appointed by the governor general of New Zealand. He governs with the aid of the council of state, which consists of Samoan leaders. The high commissioner consults the council of state on all proposals for legislation and on matters affecting Samoan customs and welfare. An executive council was created in 1952 to advise the high commissioner in forming and implementing policy measures.

The legislative assembly (formerly the legislative council) was created, presided over by the high commissioner or his nominee. The assembly consists of the Samoan members of the council of state, 12 additional Samoans who are nominated by a native fono, or assembly, no more than 5 elected Europeans and no more than 6 official members, of whom 3 are nominated by the governor general of New Zealand and 3 by the high commissioner. The legislative powers of the assembly are wide, with certain notable exceptions such as laws relating to defense questions and foreign affairs. Village and local affairs are controlled by native village officials nominated by the villagers. The seat of government is at Apia on Upolu.

Education. — Education in American Samoa was made compulsory for all children from 7 to 15 years of age, inclusive. It was estimated in 1954 that 99% of all persons ten years of age or older were literate. In that year about 7,000 children were enrolled in 61 public and 6 missionary schools with a total of 213 teachers; about 80% of the enrolment was in public schools.

Education in Western Samoa is dependent to a great extent on the

activities of various missions. Education was not compulsory in the mid-1950s and there was no age limit on attendance. In 1951, 14% of those ten years of age or older were illiterate. In 1953 there were 132 primary schools with 571 teachers and 20,607 pupils, 4 secondary schools with 173 students, 8 technical schools with 469 students and 1 normal school with 189 students.

Economy.—The natural resources of Samoa are of little economic consequence. There are no minerals and no timber of sufficient quantity to warrant industrial development for export. A cannery was established at Pago Pago in 1953 to process and export tuna caught by Japanese fishing vessels under contract. The main products of American Samoa are copra and native handicraft consisting principally of mats and rugs woven from local grasses. Western Samoa's main products are copra, cocoa beans, desiccated coconut and bananas.

Agriculture is the basis of the Samoan economy. Crops cultivated are corn, beans, peas, watermelons, cucumbers, squash. eggplant, tomatoes, lettuce, radishes, sweet potatoes, breadfruit, papayas, bananas, taro and pineapple. There are also some cattle and in American Samoa a small dairy industry.

Imports by American Samoa in the fiscal year ending June 30, 1954, were valued at $992,543. The United States was the major source, followed by Australia and New Zealand. Export's totalled $546,238, of which about two-thirds was copra and one-fifth canned tuna. Western Samoa's imports in 1955 totalled £1,894,542. New Zealand was the major source, followed by the United Kingdom and Australia. Exports totalled £2,511,899, of which 46% was copra (17,178 long tons) and 35% cacao (3,118 tons). The United Kingdom was the principal customer, followed by New Zealand and the United States. (*See* also PACIFIC ISLANDS.)

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(S. NR.; J. W. MW.)

SÁMOS, an island in the Aegean sea, separated from the mainland of Turkey by a strait of only about a mile in width; about 27 mi. in length, by 14 in greatest breadth; occupied by mountains, of which the highest, Mt. Kerkis, near its western end, is 4,710 ft. high. This range continues from Mt. Mycale on the mainland. Samos was annexed to Greece in 1912. The capital is at Vathy, in a deep bay on the north coast, a quite modern town, well paved and connected by carriage roads with villages round both sides of the bay, and with Tigani on the south coast, the site of the ancient city. A third port, Carlovasi, farther west on the northern coast, serves a separate lowland district. The island is remarkably fertile, and a great portion of it is covered with vineyards. Oil, raisins, silk, cotton and tobacco are also grown, and barges and sailing vessels are built at Tigani, almost wholly from native timber. Cigarette making employs many women and girls, the tobacco coming chiefly from Thrace. The population in 1951 was 47,865. The predominant religion is the Orthodox Greek; the metropolitan district is Samos and Icaria.

History.—At the time of the great migrations, in the 11th century B.C., Samos received an Ionian population mainly from Epidaurus in Argolis. By the 7th century B.C. it had become one of the leading commercial centres of Greece through its position near the Maeander and Caÿster trade-routes from inner Asia Minor. The Samians also traded with the Black sea and with Egypt, and claimed to be the first Greeks to reach the Straits of Gibraltar. Their commerce brought them into close relations with Cyrene, Corinth and Chalcis, but made them bitter rivals of their neighbour, Miletus. The feud involved both cities in the Levantine war (7th century B.C.) when Corinth built triremes for the Samians. The result favoured Miletus, but in the 6th century the insular position of Samos preserved it from mainland aggressions to which Miletus was exposed. About 535 B.C., when its oligarchy was overturned by the tyrant Polycrates (*q.v.*), Samos reached the height of its prosperity. Its navy "ruled the waves" from its new deep-sea harbour, and blockaded the mainland subjects of Persia; the tunnelled aqueduct (still open) secured copious water, and the great Temple of Hera was built. Polycrates first intrigued, and then quarrelled, with the Persian governor of Lydia, and after his death by treachery, Darius conquered Samos and partly depopulated it. It had regained much when, in 499, it joined the general revolt of the Ionians against Persia; but owing to jealousy of Miletus, part of its contingent, at the decisive battle of Lade (4943, deserted. In 479, however, following Xerxes' defeats in Greece, Samos betrayed the Persian fleet to the Greeks at Mycale. In the Delian League the Samians held special privilege and remained loyal to Athens until 440, when a dispute with Miletus, which the Athenians had decided against them, provoked them to secede. With a fleet of 60 ships they held their own for some time against a large Athenian fleet led by Pericles himself, but after a siege, capitulated and were degraded to a tributary rank. Towards the end of the Peloponnesian war, when Miletus became a Spartan naval base, Samos appears as one of the most loyal dependencies of Athens; and a temporary home of the Athenian democracy during the revolution of the Four Hundred at Athens (411 B.C.), and in the last stage of the war, it was rewarded with the Athenian franchise. This friendly attitude towards Athens was accompanied by the establishment of democracy. After the downfall of Athens, Samos was besieged by Lysander and again placed under an oligarchy. In 394, when the Spartan navy withdrew, the island declared its independence and re-established a democracy, but by the Peace of Antalcidas (387) it fell under Persian dominion. Recovered by the Athenians in 366, after a siege, it received a body of military settlers. After 322, when Athens was again deprived of Samos, its fate is obscure. For some time (about 275–270 B.C.) it served as a base for the Egyptian fleet, at other periods it recognized the overlordship of Syria; in 189 B.C. it was transferred by the Romans to the kings of Pergamum. Enrolled from 133 in the Roman province of Asia, it revolted to Aristonicus (132) and Mithridates (88), and forfeited its autonomy, but recovered it between the reigns of Augustus and Vespasian, and remained prosperous. Under Byzantine rule Samos became the head of the Aegean *theme* (military district). After the 13th century it passed through much the same changes as Chios (*q.v.*), and became the property of the Genoese firm of Giustiniani (1346–1566). At the Turkish conquest it was severely depopulated, and provided with new settlers, partly Albanians.

During the Greek War of Independence Samos bore a conspicuous part, and it was in the strait between the island and Mt. Mycale that Canaris blew up a Turkish frigate, in the presence of the army assembled for invasion. The enterprise was abandoned and Samos held its own to the end of the war. On the conclusion of peace the island was, indeed, again handed over to the Turks, but since 1835 held an exceptionally advantageous position, being in fact self-governed, though tributary to the Turkish empire, and ruled by a Greek governor nominated by the Porte, who had the title of "Prince of Samos," and was supported and controlled by a Greek council and assembly. The prosperity of the island bore witness to the wisdom of this arrangement, but did not prevent annexation to Greece when the political situation allowed it.

The ancient capital was on the south coast, at the modern Tigani, directly opposite to the promontory of Mycale. A natural cove, dominated by a low hill, has been converted' by ancient and modern breakwaters into a safe port for small vessels. Behind the modern town rises a steep enclosing ridge, Astypalaea, crowned by Polycrates' wall, and perforated by his aqueduct. From this city a road led about 4m. W. to the Temple of Hera, whose site, close to the shore, is still marked by a single column, which has given to the neighbouring headland the name of Capo Colonna. Though so little remains standing, German excavators have revealed its massive foundations.

The modern capital of the island was, until recently, at Khora, about zm. from the sea and from Tigani, but in the 19th century the capital was transferred to Vathy, on the north coast.

Samos was the birthplace of Pythagoras (*q.v.*), the philosopher, whose name and figure are found on coins of the city in imperial times. It also produced a school of sculptors beginning with Rhoecus and Theodorus, who are said to have invented the art of casting statues in bronze. Rhoecus was also the architect of

the Temple of Hera. Another famous Samian sculptor was Pythagoras, who migrated to Rhegium. The vases of Samos are among the most characteristic Ionian pottery in the 6th century.

SAMOSATA (SUMEISAT, modern SAMSAT), a city on the right bank of the upper Euphrates in Malatya, Turkey. Pop. (1955) 851. Samosata is an important crossing place of the river close to the point where it enters the plain. It forms one of the series of border forts (Edessa (*q.v.*) was the most important), which had a stormy history in relation to the frontier defense of Upper Mesopotamia. It had an additional importance as forming a point at which the 'crossing of the river could be made. Although it is uncertain whether it was ever on the Persian royal road, there was a bridge at this point in Strabo's time! when the city is described as being strongly fortified and the centre of a small but very fertile district.

The fortunes of Samosata followed those of the great empires at whose boundaries it stood. It appears originally to have been a Hittite city and was incorporated in the Assyrian empire in 708 B.C. Later it passed into the hands of the successors of Alexander and became the capital of Commagene. In A.D. 72 it became a Roman province; later it passed through a series of changes, losing its status as the capital city of a district under Constantine. and in the 10th century became temporarily an administrative military district of the Byzantine empire. It is said in the 13th century to have been an Armenian settlement, but in modern times is mainly occupied by Kurds.

SAMOTHRACE (mod. Gr. SAMOTHRAKI, Turk. SEMADREK), an island in the north of the Aegean sea belonging to Greece, nearly opposite the mouth of the Hebrus (Maritza) north of Imbros and northeast of Lemnos. It has a population (1951) of 4,258, nearly all Greek. Though of small extent it is, next to Mount Athos, the most conspicuous natural feature in this part of the Aegean (5,240 ft.). In *Iliad* xiii, 12, the poet represents Poseidon using its summit to survey the plain of Troy. This mountainous character and the absence of harbours precluded political importance. It permitted the survival of the archaic worship of the Cabeiri (*q.v.*) which Herodotus (ii. 51) and others attributed to "Pelasgian" aborigines. Probably on account of its sacred character the island always enjoyed autonomy, even in the time of Pliny. The "Victory of Samothrace." set up by Demetrius Poliorcetes *c.* 305 B.C., was discovered in the island in 1863. and is now in the Louvre. The ancient city was situated at Palaeopoli below the modern village on the north side of the island close to the sea; it has considerable remains of ancient walls, in Cyclopean style, of the sanctuary of the Cabeiri and of other edifices of Ptolemaic and later date.

SAMOYED, a division of the Uralic linguistic stock found in the northern U.S.S.R. and comprising two language groups, Northern and Southern Samoyedic. The former includes the Yurak or Nenets (16.000 in 1926), reindeer pastoralists, sea-mammal hunters and fishermen occupying tundras from Kanin peninsula on the White sea 900 mi. eastward to the Yenisei river in Siberia as well as the forested basin of the Pur; the Tenets (800 in 1926). sedentary fishermen on the lower Yenisei; and the Tavgi or Nganasany (800 in 1926), wild-reindeer hunters of the Taimyr peninsula in the far north. In the 20th century the Sel'kup alone represent Southern Samoyedic. They include fishermen and trappers of the Taz river basin (1.500 in 1947); fishermen, cattle and horse breeders and trappers on the Tym and Ket (southeast branches of the Ob or Obi river), who numbered 4,500 in 1947, with 2,000 of them speaking only Russian. In the Sayan ranges. the Samoyedic dialects (Kamasin, Karagas, Mator or Koybal and Taigi) have been totally replaced by the Turkic languages and Russian.

Early in the Christian era, proto-Samoyedic peoples lived in southwest Siberia, probably occupying the Ob–Irtysh (Irtish) basin. They traded with archaic Turkic folk, borrowing from them terms for horses, sable and ermine, bells and money; early contacts with Kettic peoples are also evident. Proto-Samoyedic culture included reindeer domestication (with castration); the casting of bronze and forging of iron; tailored arctic clothing (parka is an indirect Samoyedic loan to English); the conical tent and the cache raised off the ground; and, in religion, shamans, enchantment by singing accompanied by a drum, wooden idols and the idea of luck. Furthermore, the archaeology of early Samoyedic sites (and, in part, Sel'kup ethnology) reveal villages with semisubterranean houses fortified by earthen walls and moats; subsistence from domesticated horses, cattle and sheep as well as fishing and hunting; pit-and-comb marked pottery; birchbark manufactures; bone as well as metal tools and weapons; helmets and armour; cemeteries and votive hoards, with cast images of men. beasts and fantastic creatures, with imported wares and money.

Ostyak pressures from the west, beginning about 700 A.D., displaced the Samoyeds. The Mator were identified east of the Irtysh river in the 10th century; other Samoyeds reached north Russia before 1100 AD. Cultural change accompanied migration. Pottery disappeared. In the Tundra, the Samoyeds adopted arctic aboriginal elements, such as sea-mammal hunting, reindeer hunting with decoys and enclosures, and sacrificial mounds of reindeer antlers. They transmitted reindeer domestication and many religious beliefs to the Ostyaks. the Zyryanians and the Yukaghir; they had less influence on the Lapps.

Despite variant subsistence patterns, recent Samoyedic cultures have retained similar forms of social organization and religion. All have patrilineal, named clans owning definite territories, with sanctuaries, cemeteries and exclusive economic rights. Marriage is strictly exogamic (outside the clan) and residence is usually patrilocal; widows normally marry a younger clansman of the deceased. Older sons receive allotments, leaving to form new lineages; the youngest inherits the residual. Shamans are clan officials, curing. divining luck and ill-doing (see SHAMANISM). The cosmogony includes a high god; a universe tree upholding seven heavens; an underworld; sun, moon, forest. water and ancestral spirits. Shamanistic magic "flights." animal sacrifices and dedications and the "feeding" of household idols are prominent rituals.

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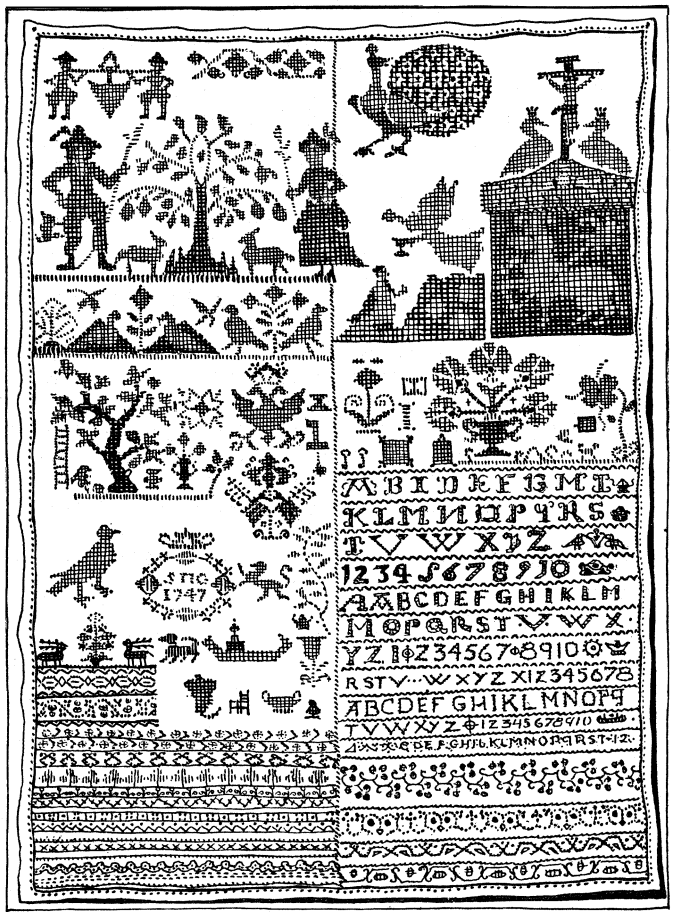
(D. B. SH.)

SAMPAN: see BOAT.

SAMPLER, a model or pattern to be copied, particularly a small rectangular piece of embroidery worked on canvas or other material as a pattern or example of a beginner's skill in needlework, as a means of teaching the stitches. Down to comparatively recent times every little girl worked her "sampler," and examples of 17th century work are still found and have become the object of the collector's search. See ill. on p. 924. They usually contained the alphabet, the worker's name, the date and Bible texts, verses, mottoes, the whole surrounded with some conventional design. The earliest sampler in existence is dated 1643 and is in the Victoria and Albert museum, South Kensington.

See M. B. Huish, *Samplers and Tapestry Entbroideries* (1900).

SAMPSON, WILLIAM THOMAS (1840–1902), U.S. naval commander, was born at Palmyra, N.Y., on Feb. 9, 1840. and graduated at the head of his class from the U.S. Naval academy, Annapolis, Md., in 1861. In that year he was promoted to master, and in the following year was made lieutenant. He mas executive officer in the "Patapsco" when she mas blown up in Charleston harbour in Jan. 1865. He served on distant stations and (1868–71 and 1876–78) at the Naval academy, and became lieutenant commander in 1866 and commander in 1874. He mas a member of the International Prime Meridian and Time conference in 1884, and of the board of fortifications in 1885–86; was superintendent of the Naval academy from 1886 to 1890; and was promoted to captain and served as delegate at the International Maritime conference at Washington in 1889. He was chief of the Bureau of Ordnance in 1893–97. About 95% of the guns employed in the Spanish-American War were made under his superintendence. His influence was felt decisively in the distribution of guns and armour, and in the training of the personnel of the navy. He



BY COURTESY OF THE METROPOLITAN MUSEUM OF ART
A SAMPLER OF 1747, FROM THE FISHBACK COLLECTION

superintended the gunnery training and prepared a new drill book for the fleet. In Feb. 1898 Sampson, then a captain, was president of the board of inquiry as to the cause of destruction of the "Maine" At the outbreak of the war nith Spain he was placed in charge of the North Atlantic squadron, and conducted the blockade of Cuba. When it was known that Admiral Cervera, with a Spanish fleet. had left the Cape Verde Islands. Sampson withdrew a force from the blockade to cruise in the A7indnard passage, and made an attack upon the forts at San Juan, Puerto Rico After his return to the coast of Cuba he conducted the blockade of Santiago, and the ships under his command destroyed the Spanish vessels when they issued from the harbour of Santiago and attempted to escape. (See SPANISH-AMERICAN WAR OF 1898.) Sampson himself was not actually present at the battle, having started for Siboney just before it began in order to confer with General Shafter, commanding the land forces. He reached the scene of battle as the last Spanish vessel surrendered, and the engagement was fought in accordance with his instructions. He was promoted to commodore in 1898, to rear admiral on March 3, 1899, and was made commandant of the. Boston (Charlestomn) navy yard in October of the same year. He died in Washington, D.C., on May 6, 1902.

BIBLIOGRAPHY.—W. A. M. Goode, *With Sampson Through the War* (1899); A. T. Mahan, "Sampson's Naval Career," *McClure's Magazine*, vol. xix (1902); James Parker, *Rear Admirals Schley, Sampson and Cervera* (1910).

SAMSON, whose deeds are recorded in Judges xiv.–xvi., was a hero of early Hebrew folk-tales. He belonged to the tribe of Dan, and was renowned for his exploits against the Philistines. The narratives are marked by a grim and boisterous humour, and are so little concerned with religion that they may almost be called pagan. But, though they contribute little towards the understanding of Hebrew religion, they add much to our knowledge of early customs, and throw light on Philistine civilization. Their account of the relationships between Hebrews and Philistines, too, is of some historical worth. (*See* PHILISTINES.)

It has often been noted that there are points of resemblance between the story of Samson and the myths of Gilgamesh, Melkart, and Hercules; but, while the kinship must be admitted, Samson is much more human than his counterparts in pagan myth and legend, and is probably to be regarded as a historical person. The story contains many features drawn from solar mythology. The name Samson is a derivative, of uncertain meaning, from the Hebrew word Sun—shemesh. It is noteworthy that a shrine of the Sun, Beth-Shemesh, stood in the neighbourhood of Samson's home. Long hair, in which according to the story lay the secret of his strength, is a familiar feature of solar heroes, as a symbol of the sun's rays. His exploit with the gates of Gaza may be connected with the myth which represents the sun as passing through a double-gated door on the eastern horizon. It has, indeed, been argued that the entire Samson story is a solar myth; but it is apparently much more highly probable that in this case the story of a popular hero has been expanded and decorated by mythological motifs.

Why does a story so lacking in religious interest appear in the book, and why is an almost pagan character like Samson reckoned among the saviours of Israel, when the story itself does not record any deliverance of the people from Philistine oppression? There is some evidence that the story was not included in an earlier form of Judges, and that a later editor was constrained by its popularity to insert it. The account of Samson's birth—suspiciously reminiscent of an incident in the history of Gideon—and dedication as a Nazirite, Judges xiii., is an editorial attempt to fit for more respectable company the boisterous, sensual Samson of the folk-tales, who wears his Nazirite costume with some obvious difficulty, and is moved far more by his own erratic impulses than by the spirit of Yahweh. S. A. Cook, comparing Judges xiii. with vi. 11–24, suggests that Samson may have been regarded as the founder of a local Manahathite cult.

See Burney, *Judges*, pp. 335–408, A. S. Palmer, *The Samson-Saga, and its place in comparative Religion;* S. A. Cook, *Journ.* of *Theol. Stud.* 1927, pp. 372 *sqq.* (W. L. W.)

SAMSUN (anc. AMISUS), the chief town of Samsun vilayet in Turkey, on the south coast of the Black sea between the deltas of the Kizil and Yeshil Irmaks. Pop. (1955) 62,618. Its district is one of the principal sources of Turkish tobacco. Samsun exports cereals. tobacco and wool. Amisus, which stood on a promontory about 1½ mi. N.W. of Samsun, was, next to Sinope, the most flourishing of the Greek settlements on the Euxine and under the kings of Pontus it was a rich trading town. By the 1st century A.D. it had displaced Sinope as the north port of the great trade route from central Asia.

SAMUEL, the most outstanding character in Israel's history betneen Moses and David, is represented in I Samuel in every role of leadership open to a man of his day—seer. Nazirite, priest, judge and military leader. The traditions concerning him have been much edited and embellished with legend, so that it is not easy to form a clear historical picture of him. One episode must be dismissed as fabrication: the story of his miraculous and conclusive defeat of the Philistines (vii) is contradicted by the subsequent military exploits of Saul and David and is best ascribed to a late editor who wished to belittle the achievement of Saul. The story of Samuel's childhood (i–iii) contains elements of folklore, but there is no reason to doubt that he grew up as a Nazirite associated with the priesthood at Shiloh, or that he had prophetic clairvoyance. As a Nazirite, dedicated to the defense of the religion of Yahweh against syncretism with the fertility cults of the Canaanite Baals, he had some affinity with the prophetic guilds of wandering ecstatics who made their first appearance at this time; but his visions, in his role of seer, owed nothing to their collective and contagious ecstasy, so that he resembled more closely the great prophets of later times than those who bore the name of prophet in his own day. As priest his chief function was the giving of authoritative decisions from God, including perhaps the dispensation of justice; and here too his gifts as seer differentiated him from ordinary priests who derived their decisions from the sacred lot (xiv, 36–42; xxiii, 6–12; xxx, 7–8).

Samuel's greatest claim to fame was the establishment of monarchy in Israel. The biblical account of this is a conflation of two apparently irreconcilable sources. According to the earlier one (ix; x, 1–16; xi, 1–11, 15), written probably in the reign of Solomon', Samuel, prompted by God, took the initiative in anointing Saul as king, to give unity to the divided tribes of Israel and to lead them to freedom from Philistine domination. According to the later source (viii; x, 17–24), written when the monarchy had fallen into disrepute, Samuel, already the theocratic ruler of a united Israel, resisted the popular demand for a king. because it involved a repudiation of the sovereignty of Yahweh. The early source is the more trustworthy, and it is possible to regard the later one as evidence only for the antimonarchical feeling of the prophetic school that produced it. On the other hand, it is unlikely that these prophetic writers would have depicted Samuel as the critic of monarchy if he had in fact been its wholehearted advocate.

It may be, then, that the two sources preserve the two sides of an early and long-continued debate, and that Samuel the kingmaker was a big enough man to see both the advantages and the dangers of his innovation. See also SAMUEL, BOOKS OF.

(G. B. CA.)

SAMUEL OF NEHARDEA. usually called MAR SAMUEL or YARHIÑAI (*c.* 165–*c.* 257), Babylonian rabbi. was born and died in Nehardea in Babylonia. He is associated with the fame of his great contemporary 'Abba 'Arika. Besides his mastery in the traditional law. Samuel was famed for his scientific attainments. He was one of the first to compile a calendar of the Jewish year, thus preparing the way for the fixation of the festivals by means of scientific calculations. But Samuel's fame rests on the service he rendered in adapting the life of the Jews of the diaspora to the law of the land: "The law of the state is binding law" was the principle he enunciated. When the king of Persia, Shapur, captured Caesarea Mazaca, the Cappadocian capital (modern Kayseri, Turk.), Samuel refused to mourn for the 12,000 Jews who lost their lives in its defense.

See H. Graetz, History of the *Jews*, vol. ii. ch. xix (1893). (I. A.)

SAMUEL, HERBERT LOUIS SAMUEL, 1ST VISCOUNT (1870–). British statesman. owed his position as leader of the Liberal party in the house of commons (1931–35) and in the house of lords (1944–55) to his combination of loyalty to principle and ability to persuade others to compromise. Born in, Liverpool on Nov. 6. 1370. he was educated at Balliol college, Oxford, and entered parliament in 1902, inspired toward politics and Liberalism by seeing slum conditions in Whitechapel. As parliamentary undersecretary to the home office, 1905–09, he established the probation and juvenile court systems. He joined the cabinet as chancellor of the duchy of Lancaster in 1909 and became postmaster general in 1910 and home secretary in 1916, but resigned when David Lloyd George took office. His flair for mediation was given full scope in his guidance of Palestine as its first high commissioner. 1920–25; in his conduct or' the negotiations which ended the general strike (1926); and in his ability as the Liberal party chairman. 1927–29, to hold a balance between H. H. Asquith and Lloyd George. He was home secretary in Ramsay MacDonald's national government, 1931–32, but resigned on the signing of the Ottawa trade agreements (*see* LIBERAL PARTY). He was raised to the peerage in 1937.

Empiricism. Lord Samuel's great gift as a politician, also marks his work as a philosopher. His best-known books are Belief and *Action* (1937); *The Tree of Good and Evil* (1933); and *Practical* Ethics (1935). He published his *Memoirs* in 1945.

SAMUEL, BOOKS OF, two books of the Old Testament, which in the Jewish canon are ranked among the Former Prophets (Joshua–Kings) in contrast to the Latter Prophets (Isaiah–Malachi).

Contents. — The books of Judges, Samuel and Kings are made up of a series of extracts from various sources, and freely handled by copyists down to a late date, as is shown by the numerous and often important variations between the Hebrew text and the Greek version (Septuagint). The main redaction of Judges and Kings was made under the influence of the ideas which characterize Deuteronomy, that is, after the reforms ascribed to Josiah (2 Kings, xxiii); but in Samuel the "Deuteronomic" hand is much less prominent and the chronological system which runs through Judges and Kings occurs only occasionally.

The book of Samuel completes the history of the "Judges" of Israel (11th century B.C.), and begins by relating the events which led to the institution of the monarchy under Saul, the part played by Samuel being especially prominent (1 Sam. i–xiv). The interest is then transferred to David, the founder of the Judaean dynasty, and his early life is narrated with great wealth of detail. As Saul loses the divine favour, David's position advances, until, after the death of Saul and the overthrow of Israel, he gains the allegiance of a disorganized people (1 Sam. xv–2 Sam. iv), and Jerusalem becomes the centre of his empire (v–viii)—*c.* 1000 B.C. A more connected narrative is now given of the history of David (ix–xx), which is separated from the account of his death and Solomon's accession (1 Ki. i., ii.) by an appendix of miscellaneous contents (xxi.–xxiv.).

Samuel and Saul. — The introductory account (i.–iv. 1*a*) of the birth, dedication and calling of the young prophet Samuel is a valuable picture of religious life at the sanctuary at Shiloh. It is connected by the prophecy of the punishment of the house of Eli (iii. 11 *sqq.*) with the defeat of the Israelites by the Philistines at Ebenezer near Aphek, the loss of the ark (iv. 1*b*–22), and its subsequent fortunes (v.–vii. 1). A Philistine oppression of 20 years ends when Samuel, here the recognized "judge" of Israel, gains a great victory at Ebenezer near Mizpah (vii.). But the deliverance of Israel from the Philistines is also ascribed to Saul (xiv.); there is no room for both in the history of the prophet (*see* vii. 14), and it is now generally recognized that two conflicting representations have been combined: (*a*) vii., viii., x. 17–24, xii., (*b*) ix. 1–x. 16, xiii., xiv. (*See* further SAMUEL, SAUL.) The account of Eli, Shiloh and the ark (i.–iii.) is a natural prelude to iv.–vii., where, however, we lose sight of Samuel and the prophecy. The punishment of Eli and his sons (iv.) becomes a passing interest. The sequel of the defeat in iv. is not stated, although other allusions to the fall of Shiloh (Jer. vii. 12–15, xxvi. 6, 9, Ps. lxxviii. 60 sqq.), and the subsequent reappearance of the priestly family at Nob (xxi. *seq.*) suggest that a fuller account of the events must have been extant. A narrative of Eli and the priesthood of Shiloh has probably been used to form an introduction to Samuel's victory (vii.), and it has been supplemented partly by the account of the early life of the future prophet and judge (note the present abrupt introduction of Eli in i. 3) and partly by narratives of the history of the ark (v. *seq.*). The section was handled at a relatively late period. This is clear from the presence of the Deuteronomic prophecy in ii. 27–36, which hints at the rise of the Zadokite priests of Jerusalem. Also, Hannah's psalm (ii. 1–10)—the prototype of the "Magnificat"—is a post-exilic passage, "probably composed in celebration of some national success" (Driver); its present suitability rests upon the interpretation of verse 5.

Saul.—Saul's reign is introduced in xiii. 1, where a blank has been left for his age at accession (some mss. insert "30"); the duration of his reign is also textually uncertain. The formula is parallel to that in 2 Sam. ii. 10 *seq.*, v. 4 seq., and frequently in the Book of Kings, with the additional feature that the age at accession, there usually confined to the Judaean kings, is here given for the Israelite Saul and his son Ishbosheth (*i.e.*, Ishbaal). The summary in xiv. 47 *sqq.* is immediately followed by a reference to the continuous Philistine warfare (*v.* 52, contrast vii. 13) which forms an introduction to the life of David. But the summary gives a picture of Saul's ability and position which differs so markedly from the subsequent more extensive narratives of David's history that its genuineness has sometimes been questioned; nevertheless, it is substantiated by the old poem quoted from the Book of Jashar in 2 Sam. i. 17–27, and a fundamental divergence in the traditions may be assumed. Similarly in 2 Sam. ii. 8–IOU,the length of Ishbaal's reign conflicts with the history of David (ii. 11 and iv. 1–v. 3), and the reorganization of (north) Israel with the aid of Abner does not accord with other traditions: which represent David as the deliverer of (all?) Israel

from the Philistine yoke (iii. 18, xix. 9). But ii. 8–IOU,in common with 1 Sam. xiii. 1, xiv. 47–51 (*cf.,* also the introduction in 1 Sam. vii 2 and the conclusion vii 15–17), are of a literary character different from the detailed narratives; the redactional or annalistic style is noticeable, and they contain features characteristic of the annals which form the framework of Kings. In Kings the Israelite and Judaean records are kept carefully separate and the independent standpoint of each is at once obvious. Here, however, much complication arises from the combination of traditions of distinct origin, independent records of Saul having been revised or supplemented by writers whose interest lay in David.

David.—The stories of the relations between the founders of the respective monarchies of Israel and of Judah reflect the popular interest in DAVID (*q.v.*). Apart from the more detailed and continuous history, there are miscellaneous passages in 2 Sam. v.–viii., with an introduction (v. 1–3), and a concluding chapter rounding off David's reign (viii.). A similar collection in xxi.–xxiv. severs the closely-knit sequence of narratives in ix.–xx. (the "Court history of David") from David's death in 1 Ki. i.–ii. Their contents range over all periods, from the Amalekite war (viii. 12, *cf.* 1 Sam. xxx) to David's "last words" (xxiii. 1; but see 1 Kings i. 1 and ii. 1). In particular they narrate the capture of Jerusalem from the Jebusites (v. 6–10) and other fights in that district as far as Gezer (vv. 17–2j), the purchase of land from a Jebusite for the erection of an altar (xxiv.; *see* 1 Chron. xxi.–xxii. 1, 2 Chron. iii. 1), and the pacification of the Gibeonites (xxi. 1–14). The last two inter-related narratives are severed by the no lees inter-related material in xxi. 1j sqq., xxiii. 8 *sq.* (connected with the conflicts in ch. v); and these in turn are now separated by the psalm in xxii. (Ps. xviii) and by David's "last words." The repetition of the list of officials in viii. 15–18 and xx. 23–26 is attributed by several authorities (after Budde) to the later insertion of ix.–xx. 22. On this view, the two groups v.–viii, xxi–xxiv. were once contiguous—though not necessarily in their *present* form or order.

The compiler of 2 Sam. v.–viii. has placed affer the capture of Jerusalem (v. 6 sqq.) the conflict with the Philistines (v. 17 sqq), where the "hold" is not Zion but some place of retreat, perhaps Adullam (cf. xxiii. 14). Similarly, the conflicts in xxi. 1j sqq., xxiii. 8 sqq., which are located around Gath, Lehi (so read xxiii. 11), Pas-dammim (so v. 9; see 1 Chron. xi. 13), Bethlehem, and the valley of Rephaim, should also precede the occupation of Jerusalem and the subsequent partition of territory among David's sons and others (*e.g.*, xiii. 23, near Bethel). These passages combine to furnish a representation of the events leading to the capture of the capital which is distinct from and now superseded by the detailed narratives in ii. 12–iv. Here, Ishbaal is east of the Jordan, David's men are engaged in fighting Benjamin and Israel—even at Gibeon (about 6 m. N.W. of Jerusalem), the interest of the history is in David's former relations with Israel at Saul's court, and he is regarded as the future deliverer of the oppressed people. The fragments preserved in 2 Sam. v.–viii., xxi.–xxiv. throw another light upon David's relations to Saul's family (xxi. 1–14, contrast ix.); and the stories of heroic conflicts with giant-like figures of Gath, etc. (xxiii. g seq., 18, *cf.* 1 Chron. xi. 11, 20) find no place by the side of the more detailed records of his sojourn under the protection of a king of Gath, one of a confederation of Philistine cities (1 Sam. xxvii., xxix). It is possible that popular stories cf the conquest of the earlier inhabitants have been applied to the PHILISTINES (*q.v.*); their general character associates them with the legends of the "sons of Anak," who enter into Judaean (perhaps originally Calebite) tradition elsewhere (Num. xiii. 22, 28), and who according to one group of traditions occupied all the hill-country from Hebron northwards (Josh. xi. 21 sqq, xv 14)

Saul and David.—The accounts of David's conflicts with giant heroes and of the conquest of Jerusalem and its district belong to Judaean traditions which have been almost superseded by other traditions of the rise of the Hebrew monarchy and by popular narratives of early relations between the Judaean David and the (north) Israelite king and people. The emphasis (in 1 Sam.) upon the rejection of Saul, his enmity towards David, the latter's chivalry, and his friendship for Jonathan, partly account for the present literary intricacies. On quite general grounds, divine traditions of distinct origin (Calebite or Jerahmeelite; indigenous Judaean; North Israelite or Benjamite) are to be expected in a work now in post-exilic form. Moreover, the late genealogy of Saul in 1 Chron. viii. 29 sqq., ix. 35 sqq., is evidence of a keen interest in the Saulidae in post-exilic times. David's history is handled independently of Saul in 1 Sam. xxv.; and the narrative, now editorially connected with the context (v. 1, see xxviii. 3; and v. 44, see 2 Sam. iii. 1j), gives a valuable picture of his life in the south of Palestine, with which we may compare his relations with south Judaean cities in xxx. 26–31. (The chapter with the prophecy of Abigail may be of Calebite origin.) His flight northwards to the Philistine king of Gath (xxvii.) is hardly connected with the preceding situations in xxiv. 17–22, xxv., or xxvi. 21–25, or with his previous slaughter of Philistines at Keilah (xxiii. 1–15). His earlier successes over them are ignored in xxix. 5, although the couplet there quoted now finds its only explanation in xviii. 7 after the death of Goliath and the defeat of the Philistines. These traditions of the relations between Judah and the Philistines (cf. xxvii. 5 seq.) are distinct from the popular stories of giants of Gath, and now form part of the joint history of David and Saul.

The independent narrative of Saul's fate represents one of the disastrous attacks which recur in earlier and later history of the north (xxviii.–4, xxix.). The geographical data are confused by the stories of David (see 1 Sam. xxviii. 4, xxix. 1), and while the "Philistines" march north to Jezreel to deliver their attack, David's presence is not discovered until Aphek is reached (xxix.). His journey is the opportunity for an Amalekite raid (xxx. cf. xxvii. 8 seq.), and a defeat of Amalek by David proves more successful than that which led to Saul's rejection (*xv. 20 seq.* 26–28). Similarly, Saul's disaster leaves Israel again in the hands of the "Philistines" (xxxi. 7, cf. xiii. 6 seq.), and it is for David to save the people of Israel out of their hands (2 Sam. iii. 18, cf. 1 Sam. ix. 16); so, also, David's wars (2 Sam. viii.) bear a certain resemblance to those of Saul (1 Sam. xiv. 47). The sequel to the joint history has another version of Saul's death (2 Sam. i. 6–10, 13–16), and an Amalekite is the offender; contrast his death in i. 15 seq. with iv. 10 seq. The chapter explains the transference of the royal insignia from Israel to Judah. Here is quoted (from the "Book of Jashar") the old poetical lament over the death of the valiant friends Saul and Jonathan, describing their successful warlike career, the wealth they brought the people, and the vivid sense of national misfortune (i. 19–27). It is utilized for the history of David, to whom it is attributed.

In general, it appears that those narratives wherein the histories of Saul and David are combined—very much in favour of the latter—were originally distinct from those where (a) Saul's figure is more in accord with the old poem from the Book of Jashar, and (b) where David's victories over prehistoric giants and his warlike movements to Jerusalem pave the way for the foundation—from a particular Judaean standpoint—of his remarkably long dynasty, for the literary problem of 1 and 2 Samuel is that of the writing of the history of the early monarchy and how it came to be formed.

BIBLIOGRAPHY.—*See* further the (German) commentaries of Löhr (1894), Nowack, Budde (1902) and Caspari (1926); H. P. Smith in the *Internat.* Crit. *Comm.* (1899) with his *O.T. History* (pp. 107–155), and A. R. S. Kennedy, *Cent.* Bible (1905); articles by Stenning in Hastings' *Dict.* and Stade in Ency. Bib. For the text *see* especially Wellhausen's model commentary (1871); Driver, *Text* of *Samuel* (1913); Budde in Haupt's *Sacred Books* of the *O.T.* (1894); Dhorme, *Livres* de *Samuel* (1910). For the psychological character of the several narratives *see* Gressmann's *Schriften d. A.T. in Auswahl.* (S. A. C.)

SAMURAI, the Japanese warrior caste. In Japan in the 11th century, the power of the imperial government to maintain order in the provinces waned. It was then that the samurai emerged as a distinct social group. Held together by personal loyalty to powerful chiefs, warrior groups brought ever more territory under their control. fighting wars for local and. eventually. national supremacy. From the end of the 11th century until 1868, government was exclusively in the hands of the samurai class. In the

early years of almost continual warfare. when manpower was short and physical courage and prowess were at a premium, entry into the group was relatively open. But after 1600, when, under the strict rule of the Tokugawa shogun. the country was at peace for 250 years. warriors became a closed caste.

The establishment of warrior dominance at the end of the 12th century marked a break with the classical culture of the court. New forms of literature, religion and drama emerged. forms congenial to the samurai. nhich helped mold samurai taste. But samurai political dominance lasted longer than samurai cultural dominance. which was surpassed around 1700 by the lusty plebeian culture of Japan's growing cities.

The samurai virtues of pride and loyalty are illustrated in the story of the Forty-Seven Ronin (*q.v.*). See also JAPAN: History: *Minamoto Yoritomo.* (T. C. SH.)

SANA (Arabic SAN'A'), a town of Yemen, southwestern Arabia, situated in a broad depression, running locally nearly north and south, on the lofty uptilted western edge of the great Arabian land block.

The population in 1953 was estimated at 50,000.

Early traditions of ancient Sana connect it with the old kingdom of Himyar. Its early name was Azal, possibly associated with Uzal of Gen. x, 27. A Syriac writer of the 6th century mentions a Himyarite nation of Auzalites. Its later name. signifying "fortified," is associated with the Abyssinian conquerors of Yemen. Sana was the capital of the Abyssinian, Abraha (A.D. 525). who built there the famous church (*al-qalis*) which was destroyed two centuries later by order of the caliph Mansur. Its later history has been a record of desert raids interspersed with periods of prosperity. After the withdrawal of the Turks (1918), Sana became the capital of the imam of Yemen proper.

The town consists of three parts: (1) The Medina, the old city and Arab quarter, on the east, containing the principal mosques. There also, at its southeast corner, is the citadel al-Qasr. On the crest of Jabal Nukum (2,000 ft. above the valley) are the ruins of the old fort of al-Birash and the Mutawakkil, formerly containing the palace of the imams. covering its western face. (2) The Bir 'Azab, west of the city, the residential area; and (3), on the extreme west. the Qa' al-Yahud or Jewish quarter. The city, with the Qasr and Mutawakkil, is surrounded by a lofty and thick wall. The Bir 'Azab and Qa' al-Yahud are enclosed in a similar mall. but of more recent construction. The Jami' Masjid or principal mosque, with a model of the Ka'ba at Mecca in the centre, stands on the site of the Christian church built by Abraha.

The neighbourhood of Sana suffers from a lack of water, but in places where this is brought from the hill streams on the west fields of barley and alfalfa (lucerne) and market gardens are seen, particularly at Raudha, a suburb 6 mi. N. of the town, and in the deep gorges of the Wadi Dhahr and Wadi Hadda, the terraced orchards of which are celebrated for their fine fruit trees.

SANA'I (ABU'L-MAJD MAJDUD) (c. 1070–c. 1140), Persian poet and mystic, author of the first great mystical epic in Persian. He was born in Ghazni, where as a young man he served as a panegyrist at the court of the Ghaznavid sultans. He later traveled to Balkh and other cities of Khorasan, and as a result of his association with mystics and philosophers abandoned the life of the court. and devoted himself to the pursuit of the mystical life. Late in life he returned to Ghazni. where he lived in retirement, resisting the blandishments of the Ghaznavid ruler Bahramshah, and completed the composition of his most important work, the philosophical poem Hadiqat al-Haqiqa ("Garden of Truth"; Eng. trans. of book i by J. Stephenson, 1911).

Sana'i's poetical writings show clearly the spiritual change that divided his life; his early court panegyrics, though skillful, lack originality, whereas his mystical and philosophical poetry is full of deep feeling and sensibility. Sana'i wrote five or six other *mathnavi* (rhymed couplet) poems in addition to the Hadiqa, and also a considerable number of fine *ghazals* (lyrics). He was the first major Persian poet to use verse for the expression of the mystical, philosophical and ethical ideas of Sufiism (*q.v.*) and so influenced the whole trend of Persian poetry. In particular he paved the way for both Farid-ud-din 'Attar and Jalal-ud-din Rumi (*qq.v.*).

For discussions of Sana'i's life and work *see* E. G. Browne, *A Literary History of Persia,* vol. ii (1928); T. W. Haig in *Encyclopaedia of Islam,* vol. iv (1934). (L. P. E.-S.)

SAN ANDRÉS Y PROVIDENCIA, an intendancy of Colombia, consisting of St. Andrew's Island. Old Providence Island and three small keys in the Caribbean sea, 250 mi. S.W. of Jamaica and 100 mi. E. of Nicaragua. Pop. (1951) 5,675 (3,705 are on San Andrés); area 21 sq.mi. The islands were settled in 1629 by English Puritans and later by planters, woodcutters and Negro slaves from Jamaica. They were awarded to Spain in 1786 and became part of Colombia in 1821. The population remains English-speaking and Protestant but decreased after 1938 by emigration. San Andrés produces coconuts, copra and oranges; Providencia relies on subsistence agriculture. (G. J. B.)

SAN ANGELO, a city of southwestern Texas, U.S., is located 90 mi. S.W. of Abilene; the seat of Tom Green county. It was founded in 1867 near Ft. Concho at the confluence of the Concho rivers; the fort, abandoned as an army installation in 1889, is now a public museum. The mild climate (mean temperature 65° F.) and diversified recreational facilities attract tourists and sportsmen. San Angelo is also the educational, cultural, medical and trade centre for an area larger than New England; its public-school system includes a municipal junior college. The region produces oil, gas, sheep, wool, a major portion of the nation's Angora goats and mohair, and diversified farm crops; San Angelo is a major wool market. Oil and Goodfellow air force base, converted in 1958 from flight to security-service training, have been important in the growth of the city. Manufactures include boots, saddles, western-style jewelry, meat and dairy products, shoes and moccasins, cottonseed products. tile, trailers, printing and binding and metal products. The multipurpose Twin Buttes dam, completed in 1961, provides the municipal water supply. The city has a large coliseum in which a ram show, fat-stock show and rodeo are presented annually. San Angelo has a council-manager form of government, in effect since 1916. The population of the city in 1960 was 58,815, an increase of 11.4% from 1950; that of the standard metropolitan statistical area (Tom Green county) was 64,630, an increase of 8.8%. For comparative population figures see table in TEXAS: Population. (J. S. SP.)

SAN ANTONIO, a city of Texas, U.S., is located 80 mi. S.S.W. of Austin on the headwaters of the San Antonio river; the seat of Bexar county. San Antonio is exceptional among the larger cities of the U.S. in that its modern American character is blended with a considerable amount of foreign influence. This effect is due less to the fact that it was for 118 years a Spanish-Mexican outpost than to the close cultural ties which the city now has with Mexico. Situated on the plains of south-central Texas (see LLANO ESTACADO) at the foot of the Edwards plateau to the northwest, San Antonio is only 150 mi. from the Mexican border at Laredo and is on the most traveled route between the U.S. and Mexico by air, rail or highway. Spanish is spoken in most downtown retail establishments. The Latin section of the city, south and west of the business district,,resembles an indigenous Mexican city, with its own shops, theatres, cafés, clubs, a weekly newspaper (La *Prensa*) and a Spanish-language television station. The population of the city in 1960 was 587,718, an increase of 43.9% over 1950; that part of the population which is of Spanish-Indian origin (estimated at 40%) has increased by a steady flow of immigration as well as by birth. The population of the standard metropolitan statistical area (Bexar county) was 687,151 in 1960, an increase of 37.3% during the decade. (For comparative population figures see table in TEXAS: Population.)

History.—San Antonio was founded on May 1, 1718, by a Spanish military expedition from Monclova, then capital of Coahuila, in northern Mexico, on the trail through the Texas wilderness to the recently opened trading posts of the French in Louisiana. The site was chosen for the springs welling up within what is now the city to form the San Antonio river, which flows southeastward into the Gulf of Mexico. Before the Spaniards came the site had been occupied by a Coahuiltecan Indian village, Yanaguana.

On the west side of the river the soldiers built a small fort which they called the presidio of Béjar; on the other side arose a Franciscan mission, San Antonio de Valero. In 1731 a party of 55 indigent settlers arrived, after an arduous journey from the Canary Islands (a Spanish possession), to colonize the lonely frontier post. Given land. they laid out a town near the fort and named it San Fernando. In time the three settlements grew together into a pueblo which was called San Antonio de Béjar. Eventually the presidio gave its name to Bexar county, of which modern San Antonio is the major part. For reasons which are no obscure. Mission San Antonio de Valero came to be known as the Alamo. from the Spanish word for "cottonwood tree."

Between 1720 and 1731 four more Franciscan missions were established at intervals for a distance of eight miles down the San Antonio river. When the missions were secularized in 1794 their cultivated lands were distributed among the Indians under their tutelage and the buildings were abandoned. The Alamo was then used as a garrison by the soldiers defending San Antonio, replacing the old presidio.

With the Mexican revolution of 1821 San Antonio passed out of the hands of Spain and became a part of Mexico. It was still one of only three established communities in Texas, the others being Goliad, on the San Antonio river toward the Gulf, and Nacogdoches, near the Louisiana border. In August of that year. however, Stephen F. Austin arrived in San Antonio. where he arranged with the Mexican government to admit 300 families into Texas from the U S. By 1836, when Texas in turn declared its independence, the Anglo-American settlers around the Gulf coast had grown to at least 35.000.

The high moment in San Antonio's history was the battle of the Alamo during the war between Texas and Mexico (see TEXAS: *Revolution* and Republic). At that time San Antonio had 2.500 inhabitants and was still the foremost city of Texas. Within 14 years, while it continued to grow, it had lost first place to Galveston, the Gulf port through which immigrants were pouring into Texas, and nas being challenged by the new city of Houston.

During the last decades of the 19th century San Antonio was a major cattle centre, where herds were assembled for the long drives overland to the railroads in Kansas The famous Chisholm trail, uith its various offshoots, began in San Antonio; and it was usually to this city that cattlemen and cowhands repaired for relaxation after the drives. They brought a resurgence of prosperity to San Antonio. From 1900. when a hurricane virtually destroyed Galveston, until 1930. when both Houston and Dallas overtook San Antonio, it was again the first city of Texas.

The Economy.—Lacking the oil and chemical deposits around Houston and the rich trade area around Dallas, San Antonio after World War I gradually fell behind as a business and industrial capital. On the other hand. it acquired a new distinction as the home of what is probably the largest military establishment in the U.S Ft. Sam Houston, on a tract of 3,365 ac. inside the present city. is the headquarters of the 4th U.S army. an administrative district covering the five states of Texas, Louisiana. Arkansas. Oklahoma and New Mexico. Also at Ft. Sam Houston is Brooke army medical centre. which includes a large hospital, research laboratories and the army's basic school for medical officers, nurses and technicians.

Surrounding the city are four important U.S. air force bases. Kelly, the oldest, was established in 1917. Until 1943 it was the advanced flight training centre of the air force. Then it was converted into an aircraft maintenance and supply base. By the end of World War II Kelly had grown into a vast industrial complex, with 24,000 civilian employees, acres of shops and warehouses, 8 mi. of concrete runways and 28 mi. of railway spurs and sidings.

An offshoot of Kelly, and adjacent to it. is Lackland air force base, the principal air force training school for recruits and officer candidates. Randolph air force base, 17 mi N.E. of the city, is the headquarters of the Air Training command.

Brooks air force base, near Kelly and Lackland, is the site of the new Aerospace medical centre occupied in 1959 by the former school of aviation medicine. There the air force gives postgraduate training to flight surgeons and conducts advanced research on problems of atmospheric and space flight. The model air force hospital at Lackland is a unit of the centre.

These military operations largely account for the phenomenal growth of San Antonio after 1940, the city being without private industry of any great significance. They also explain its attraction for retired members of the armed forces, who permeate its social, business and professional life.

Education and Cultural **Activities.**—Among the many educational institutions in San Antonio are St. Mary's university (Roman Catholic; established 1852) and Trinity university (Presbyterian; established 1869); two Roman Catholic colleges for women, Incarnate Word (chartered 1881) and Our Lady of the Lake (founded 1896); and two private schools administered by the Protestant Episcopal Church, St. Mary's hall for girls and Texas Military institute for boys. The Protestant Episcopal bishop of west Texas has his diocesan centre in San Antonio. Cultural exhibits are found in the Witte Memorial museum and in the Marion Koogler McNay Art institute, which contains a notable collection of modern French paintings.

Historic Sites.—Among places of interest to visitors in San Antonio, the most notable is the Alamo (*q.v.*). A small section of the Spanish colonial town near the Alamo has been restored with later additions; it is known as La Villita and is used as a civic centre. San Fernando cathedral. built by the Canary Islanders, is the seat of a Roman Catholic archbishop. For a discussion of the missions and the governor's palace, all of great architectural and historic interest) see TEXAS: State *and National* Parks. San Antonio river: formally channeled and landscaped, winds unobtrusively below the level of the downtown streets.

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SANATRUCES (*Sinatruces,* Pers. *Sanatruk*), Parthian king. In the troublous times after the death of Mithradates II (c. 88 B.C.) he mas made king by the Sacaraucae, a Mongolian tribe which had invaded Iran in 76 B.C. He was 80 years old and reigned 7 years: his successor was his son Phraates III. (Lucian, *Macrob.* 15; Phlegon, fr. 12 *ap.* Phot. cod. 97; Appian, *Mithr.* 104: Dio Cass. xxxvi, 45.)

SAN BERNARDINO, central city of the San Bernardino-Riverside-Ontario standard metropolitan area in southern California, is the seat of San Bernardino county (area 20,160 sq.mi., comprising 12% of the area of California). The city lies 60 mi. E. of Los Angeles at an elevation of 1,054 ft. at the southern base of the San Bernardino mountains (maximum altitude 11,502 ft.). Pop. (1960) of city 91,922; of standard metropolitan statistical area comprising San Bernardino and Riverside counties 809.782.

Spanish military commandant Pedro Fages first explored the area in 1772. On May 20, 1810, Franciscan Father Francisco Dumetz from the San Gabriel mission named the valley for St. Bernardino of Siena. About 1820 a *mayordomo* mas sent out by the mission fathers and an irrigation ditch and *asistencia* ("chapel") were started. In 1842 the valley was granted to the Lugo brothers and Diego Sepulveda, who had established a great cattle ranch there in 1839. The Rancho San Bernardino was sold to Mormon immigrants who came by wagon train from Salt Lake City in 1851. In that year the leaders of this group, Charles C. Rich and Amasa Lyman, founded the city of San Bernardino. The county was created in 1853. The city was incorporated in 1854, and its present charter dates from 1904.

San Bernardino city, surrounded by orange groves and vineyards, is the centre of a rich, irrigated agricultural region. Adjoining is Norton air force base, headquarters of the San Bernardino air materiél area. Numerous other large military installations are located in the vicinity. Seven miles west of the city is the largest integrated steel operation in the western U.S. The Santa Fe railroad maintains extensive shops; other important industries are foundries, aircraft and rocket factories, plumbing material, cement, and colour printing plants. San Bernardino is the centre of a large trade area with numerous wholesale distributors.

The city has fine churches and schools and is the site of San Bernardino Valley college (1926). In the metropolitan area are

the University of Redlands (1907), the University of California at Riverside (1905) with its Citrus Experiment station, the Loma Linda university (1905), Chaffey college (established in 1883 as Chaffey College of Agriculture) and Riverside City college (1916). The state. county and municipal buildings are grouped in a civic centre. The National Orange show, held annually since 1915, has permanent exposition buildings.

Immediately to the north of the city the San Bernardino mountains and national forest provide a resort area with fishing, boating and swimming in summer and facilities for skiing in winter. Beyond the mountains, on the way to Las Vegas and Palm Springs, are the numerous playgrounds of the Mojave desert (*q.v.*).

(E. L. S.)

SAN BLAS: see CUNA.

SAN BRUNO, a city of California, U.S., in San Mateo county, is located 14 mi. S. of San Francisco near the west shore of San Francisco bay. Tanforan race track, established in 1899, attracted early settlements, and the town was incorporated in 1914. Favoured by a cool, sunny climate and easy access to the metropolis, the city grew slowly as a commuter's suburb until the 1940s. Sharing in the bay area's rapid population growth, its size tripled between 1940 and 1960. Many of its residents work in San Francisco but a number are employed locally in printing, aircraft operation and maintenance (San Francisco International airport) and electronics. A U.S. naval personnel depot and the U.S. marine corps reserve 7th infantry battalion were stationed in San Bruno after World War II. For comparative population figures see table in CALIFORNIA: *Population.* (J. H. ST.)

SAN BUENAVENTURA: see VENTURA.

SAN CARLOS, a city in California, U.S., in San Mateo county on the San Francisco peninsula, is located 26 mi. S.E. of San Francisco on historic El Camino Real, now a federal highway. Local tradition seems to have suggested the city's name, for it is believed that it was on the feast day (Nov. 4) of St. Carlo Borromeo, in 1769, that the expedition of Gaspar de Portolá first sighted San Francisco bay from the nearby hills. The original townsite was plotted in 1888 for the Southern Pacific railway on sections of an old Spanish land grant, but the city was not incorporated until 1925. The city-manager form of government was adopted in 1949. San Carlos shared in California's spectacular growth after World War II; its population increased about 80% from 1940 to 1960. Although predominantly a suburban residential community, it includes within its limits some light industry. mainly electronics. For comparative population figures see table in CALIFORNIA: Population. (S. B. KN.)

SANCHEZ COELLO, ALONSO (1515–1590), Spanish painter, according to some authorities a native of Portugal, was born, according to others, at Benifacio, near the city of Valencia. He studied many years in Italy and, returning to Spain in 1541 he settled at Madrid, and worked on religious themes for most of the palaces and larger churches. He was a follower of Titian, and, like him, excelled in portraits and single figures, elaborating the textures of his armours, draperies and such accessories in a manner so masterly as strongly to influence Velázquez in his treatment of like objects. Many of Sanchez' pictures were destroyed in the fires that consumed the Madrid and Prado palaces, but many good examples are yet extant, among which may be noted the portraits of the infantes Carlos and Isabella and the St. Sebastian painted in the church of San Gerónimo in Madrid.

SANCHI, a village in Madhya Pradesh state, India, the site of probably the oldest surviving buildings in the Indian subcontinent, apart from the Indus valley remains of the Harappan civilization (see INDIA: History) which belong to an earlier and different archaeological period. Pop. (1950) 448. The main structures of interest are the Buddhist stupas (religious buildings) on Sanchi hill, a sandstone feature, some 300-ft. high on the left bank of the Betwa river. Although the remains include an Asokan pillar, a fact which points to its importance in the early growth of the Buddhist religion and community, it has not proved possible to identify Sanchi in the textual geography of early Buddhism. The evolved style at Sanchi seems to form part of an artistic sequence from the Bhaja cave. near Poona, through the material from Bharhut and Gaya, to the great stupa which is Sanchi's chief glory. The conclusions to be drawn from art historical studies suggest that the railings and gateways from Bharhut, Gaya and the great stupa can be assigned to the period about 150–50 B.C. in that sequence. Stupa II, which was found to contain the relics of two of the Buddha's disciples, may, in fact, be older than Bharhut, to judge from the archaic nature of its carvings. but the great stupa in its final form is undoubtedly the work of developed schools of craftsmen who fully mastered the technique of work in stone in an idiom which, although it may owe some of its motifs to the west, is wholly Indian in feeling and treatment. Though the railings and gateways preserve details of constructional techniques appropriate to wood, the technique of the sculpture is unmistakably that of workers in stone, showing a marked technical progression from the north and south gateways, where the treatment is essentially that of the bas-relief, to the "free-swinging" bracket figures of the east and the west. The stupa consists of a base bearing a hemispherical dome (*anda*) representing the dome of heaven enclosing the earth, which is surmounted by a square railed unit (*harmika*), the world mountain, from which rises a mast (*yasti*) to symbolize the cosmic axis. The mast bears umbrellas (*chatra*) which represent. by their tiered arrangement, the various heavens of the gods (*devaloka*). Provision is made for a railed circumambulatory (*pradaksinapatha*) about 16-ft. above the base of the dome. and the whole is surrounded by a flagged path with an enclosing railing and ceremonial gateways (*torana*) at the cardinal points, the actual entrance being slightly offset,apparently to avoid direct, undeviating access to the enclosure. The whole edifice is at once a funerary monument and a microcosm. The great stupa in its present form—the basal diameter of the dome is about 11j ft. rising to a height of about 50 ft. at the *harmika* platform of which the diameter is some 40 ft.—is the result of additions to an original. probably Asokan foundation of much less imposing proportions and ornamentation. The dome is covered with well-laid masonry, while the railings of *harmika, pradaksinapatha,* and of the outer ring are splendidly masoned and well-proportioned, though, in contrast to those from Bharhut, Gaya and even from stupa II, they are left uncarved. But this is more than compensated by the magnificent gateways, probably to be dated in the order south. north, east, west. These portray upon their square uprights, their triple architraves and their brackets, scenes from the life of the Buddha, of his previous existences (jutukas), and a mass of space-filling motifs and figures: mythical animals, floral designs, the representations of spirits and godlings. The gates are topped with religious emblems. The carvings are not arranged in accordance with any master plan, but were commissioned by individuals and guilds as offerings of piety.

Despite this lack of planned arrangement, the effect is that of a coherent, if exuberant. whole. The Buddha figure does not appear, his presence being indicated by symbols, the Wheel, the Stupa, Footprints and the like.

Other features of interest include a caitya or assembly hall, apparently forming part of a complex, Asokan pillar-stupa-caityu, monastic buildings, perhaps to be assigned to the Sthaviravadin sect, and a small early Gupta temple (No. 17; early 5th century A.D.). This is a beautiful example of the flat-roofed type with a small *cella* and pillared verandah of which the architrave is carried around the building as a string course.

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SAN CRISTÓBAL, name, from 1962, of former Dominican Republic province, of Trujillo: see TRUJILLO.

SAN CRISTOBAL (formerly called SAN CRISTÓBAL DE LOS LLANOS. CICDAD DE LAS CASAS and CIUDAD REAL), a town of Mexico, in the State of Chiapas, on a level tableland about 6,700 ft. above sea level and 48 mi. E.N.E. of Tuxtla Gutiérrez. Pop. (1950) 17,448. The surrounding country is fertile and healthful and is populated chiefly with Indians. San Cristóbal was founded

in 1528 on the site of an Indian village, and afterwards was famous as the residence of Las Casas, bishop of Chiapas. It was the capital of Chiapas until near the end of the 19th century.

SANCROFT, WILLIAM (1616–1693), archbishop of Canterbury, was born at Fressingfield, Suffolk, on Jan. 30, 1616, and entered Emmanuel college, Cambridge, in July 1634. He became fellow in 1642, but was ejected in 1649 for refusing to accept the "Engagement." He remained abroad till the Restoration, after which he was chosen one of the university preachers, and in 1663 was nominated to the deanery of York. In 1664 he was installed dean of St. Paul's, to the rebuilding of which, after the fire of 1666, he gave £1,400. He also rebuilt the deanery, and improved its revenue. In 1668 he was admitted archdeacon of Canterbury upon the king's presentation, but he resigned the post in 1670. In 1677, being now prolocutor of the Convocation, he was unexpectedly advanced to the archbishopric of Canterbury (1678). He attended Charles II upon his deathbed. He wrote with his own hand the petition presented in 1687 against the reading of the Declaration of Indulgence. which was signed by himself and six of his suffragans. For this they were all committed to the Tower, but were acquitted. Upon the withdrawal of James II he concurred with the lords in a declaration to the prince of Orange for a free parliament. and due indulgence to the Protestant dissenters. But, when that prince and his consort were declared king and queen, he refused to take the oath to them. and was accordingly suspended and deprived. From Aug. 5, 1691, till his death on Nov. 24, 1693. he retired to his native place.

He published *Fur praedestinatus* (1651), *Modern Politics* (1652), and *Three Sermons* (1694). *Nineteen Familiar Letters to Mr. North* (afterwards Sir Henry North) appeared in 1757. *See* G. O'Oyly, *Life of Sancroft* (a vols., 1821); A. Strickland, *Lives of the Seven Bishops* (1866).

SANCTIONS AND GUARANTEES in international law correspond to the means adopted in national law to enforce legal decisions. During the years which followed the World War it became increasingly apparent that the most important and the most enduring of European political problems was that known as the problem of "security" (*q.v.*).

As a deduction from the new conception of security the word "sanctions" began to replace in the language of diplomacy the word "alliance." Security was now to be sought not in limited agreements between small groups of states to fight together whenever any of them should, for whatever cause, be involved in international conflict, but in common agreements among a greater or smaller number of states to act together when—and only when—the established rights of one of them had been violated by force. Security, therefore, must be found in "sanctions" against the wrongdoer. For some time indeed, the word "guarantees" was used instead of, or on an equal footing with, the word "sanctions," but gradually the use of the word "guarantee" disappeared and the word "sanctions" took its place.

The discussions which occurred after the war soon showed that there were two ways by which Governments believed the result in view could be achieved; first, by creating a general system embracing all the States throughout the world; and second, by creating limited arrangements applying to a certain number of States situated in geographical proximity to each other and bound together by common bonds of material interest.

Article 16 of the Covenant.— It was by the general method that the first step was made towards the organization of a true system of international sanctions. This first step consisted in the adoption of the Covenant of the League of Nations, Article 16 of which imposes obligations upon every member of the League to adopt common coercive measures, including especially a financial and economic boycott, against states which, in violation of the undertakings of the Covenant, resort to war. But unfortunately Article 16 contained ambiguities which seriously diminished the confidence of Governments in its efficiency. It was not, therefore, generally regarded as by itself creating a sufficiently sound system of sanctions to solve the problem of security. For that reason the Temporary Mixed Commission set up by the Council of the League of Nations prepared in 1923 the draft treaty of mutual guarantee (or assistance), on the basis of which was prepared the Geneva Protocol of 1924. Both instruments were founded on the clear acceptance by all signatory states of obligations to co-operate by military or other necessary means against an aggressor.

Regional Guarantees.— The second method received its first application in the Anglo-American-French guarantee treaties drawn up in 1919 at Paris. These treaties failed to secure ratification, and were replaced by the Franco-Belgian, Franco-Polish and other similar treaties of alliance. The Little Entente was another example of the same method. But it was recognized even by the authors of these treaties that although they were subject to the Covenant of the League they were, nevertheless, liable to degenerate into alliances of the old sort, and that therefore they would be dangerous unless they were effectively controlled by the League. The Temporary Mixed Commission above mentioned in its draft treaty of mutual assistance for the first time combined the two methods into one coherent system. The Protocol similarly recognized the utility of special treaties in support of general sanctions, but on condition that such special treaties could only be applied *after* it had been recognized by some impartial arbitrator that aggression had taken place. After the failure of the combination method of the Geneva Protocol, a return was made in the Locarno Agreements to the method of partial treaties. These agreements, however, in no way resembled an old-time alliance; the concern of their authors was plainly to create one more stable element in a new system of general international sanctions against aggression. *(See* LEAGUE OF NATIONS and bibliography thereto and INTERNATIONAL LAW, PUBLIC.) (P. J. N.-B.)

On Oct. 9, 1935, the League Assembly, with Austria and Hungary dissenting, declared that Italy had resorted to war contrary to Article XII of the Covenant. Fifty member states pledged to apply collective sanctions against Italy and, in due course, these countries adopted an arms embargo. A financial embargo was added by 48 states, a boycott of imports from Italy by 47 states, a ban on certain exports to Italy by 47 states, and a pact of mutual support by 34 states. The U.S., acting independently, applied an embargo to both belligerents. League sanctions did not include oil and, as limited, they failed to arrest Italy's invasion of Ethiopia. In June 1936, sanctions were abandoned and an endeavour by France to apply sanctions to Germany when it marched troops into the Rhineland did not materialize.

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SANCTI SPÍRITUS, an old Cuban city in Las Villas Province, is on a sandy plain in an angle of the Yayabo river, which winds through the city. Pop. (1953) 58,160. It is connected by railway with Zaza del Medio, on the main railway line of the island, and with its port, Tunas de Zaza, 30 mi. (by rail) to the south. Sancti Spíritus was one of the seven cities founded by Diego Velásquez. Its settlement was ordered in 1514 and accomplished in 1516. The present city is about two miles from the original site (Pueblo Viejo). In 1518, as a result of the war of the Comunidades of Castille, a mimic war broke out in Sancti Spíritus among its two score villagers. The place was sacked by French and English corsairs in 1719. Sancti Spíritus grew rapidly in the second quarter of the 20th century in consequence of the expansion of the hide and dairy industries. (C. E. Mc.)

SANCTORIUS (the Latin form of SANTORIO SANTORIO) (1561–1636), professor at Padua and colleague of Galileo, owes his medical fame to his demonstration that loss by "insensible perspiration" exceeds all other bodily excretions combined. Being inspired by the devices of Galileo, he invented a thermometer and an apparatus for measuring the pulse, and also a trocar and a cannula. His chief works are the *De Medicina Statica* (1614) and a commentary on the *Canon* of Avicenna.

SANCTUARY, a sacred or consecrated place, particularly one affording refuge, protection or right of asylum. The word is also applied to the privilege itself, the right of safe refuge, and even to places of refuge for animals, such as a "bird sanctuary." In Egyptian, Greek or Roman temples it was applied to the *cella* in which stood the statue of the god, and the Latin word for

altar, *ara,* was used for protection as well. In Roman Catholic usage sanctuary is sometimes applied to the whole church, as a consecrated building, but is generally limited to the choir. The idea that such places afforded refuge to criminals or refugees is founded upon the primitive and universal belief in the contagion of holiness. Hence it was sacrilege to remove the man who had gained the holy precincts; he was henceforth invested with a part of the sacredness of the place, and was inviolable so long as he remained there. The story of the death of Demosthenes (*q.v.*) is a famous instance. Not all Greek and Roman temples, however, had the right of sanctuary. But where it existed, the action of the Roman civil law was suspended, and in imperial times the statues and pictures of the emperors were a protection against pursuit. Roman law did not recognize the use of Christian sanctuaries until toward the end of the 4th century, but the growing recognition of the office of bishop as intercessor helped much to develop it. In 399 the right of Christian sanctuary was finally and definitely recognized, and in 419 the privilege was extended in the western empire to 50 paces from the church door. In 431, by an edict of Theodosius and Valentinian it was extended to include the church court-yard and whatever stood therein, in order to provide some other place than the church for the fugitives to eat and sleep. Justinian in a Novel of the year 535 limited the privilege to those not guilty of the grosser crimes. In the new Germanic kingdoms, while violent molestation of the right of sanctuary was forbidden, the fugitive was given up after an oath had been taken not to put him to death. This legislation was copied by the Church at the council of Orleans in 511; the penalty of penance was added, and the whole decree backed by the threat of excommunication. Thus it passed into Gratian's Decretum, but historians like Gregory of Tours have many tales to tell showing how frequently it was violated.

The earliest extant mention of the right of sanctuary in England is contained in the code of laws issued by the Anglo-Saxon king Aethelberht in A.D. 600. By these he who infringed the church's privilege was to pay twice the fine attaching to an ordinary breach of the peace. Crosses inscribed with the word "Sanctuarium," were common on the highways, serving probably as sign-posts to guide fugitives to neighbouring sanctuaries. The canon law allowed the protection of sanctuary to those guilty of crimes of violence for a limited time only, in order that some compensation (*wergild*) should be made, or to check blood-vengeance. The procedure, upon seeking sanctuary, was regulated in the minutest detail. The fugitive had to make confession of his crime to one of the clergy, to surrender his arms, swear to observe the rules and regulations of the religious houses, pay an admission fee, give, under oath, fullest details of his crime (the instrument use , the name of the victim, etc.), and at Durham he had to toll a special bell as a formal signal that he prayed sanctuary, and put on a gown of black cloth on the left shoulder of which was embroidered a St. Cuthbert's cross. The protection afforded by a sanctuary at common law was this: a person accused of felony might fly for safeguard of his life to sanctuary, and there, within 40 days, go, clothed in sack-cloth, before the coroner, confess the felony and take an oath of *abjuration of the realm,* whereby he undertook to quit the kingdom, and not return without the king's leave. Upon confession he was, *ipso facto,* convicted of the felony, suffered attainder of blood and forfeited all his goods, but had time allowed him to fulfil his oath. The abjurer started forth on his journey, armed only with a wooden cross, bareheaded and clothed in a long white robe, which made him consoicuous among mediaeval wayfarers. He had to keep to the king's highway, was not allowed to remain more than two nights in any one place, and must make his way to the coast quickly. The time allowed for his journey was not long. In Edward III.'s reign only nine days were given an abjurer to walk from Yorkshire to Dover.

Under the Norman kings there appear to have been two kinds of sanctuary; one *general,* which belonged to every church, and another *peculiar,* which had its force in a grant by charter from the king. This latter type could not be claimed by prescription, and had to be supported by usage within legal memory. General sanctuaries protected only those guilty of felonies, while those by special grant gave immunity even to those accused of high or petty treason, not for a time only but apparently for life. Of chartered sanctuaries there were at least 22: Abingdon, Armathwaite, Beaulieu, Battle Abbey, Beverley, Colchester, Derby, Durham, Dover, Hexham, Lancaster, St. Mary le Bow (London), St. Martin's le Grand (London), Merton Priory, Northampton, Norwich, Ripon, Ramsey, Wells, Westminster, Winchester, York. At the Reformation general and peculiar sanctuaries both suffered drastic curtailment of their privileges, but the great chartered ones suffered most. By the reforming act of 1540 Henry VIII. established seven cities as peculiar sanctuaries. These were Wells, Westminster, Northampton, Manchester (afterwards transferred to Chester), York, Derby and Launceston. By an act of James I. (1623), sanctuary, as far as crime was concerned, was abolished throughout the kingdom. The privilege lingered on for civil processes in certain districts which had been the site of former sanctuaries and which became the haunts of criminals who there resisted arrest—a notable example being that known as Whitefriars between Fleet Street and the Thames, east of the Temple. This locality was nicknamed Alsatia (the name first occurs in Shadwell's plays in Charles II.'s reign), and there criminals were able to a large extent to defy the law, arrests only being possible under writs of the lord chief justice. So flagrant became the abuses that in 1697 the "Escape from Prison Act," finally abolished all such alleged privileges. A further amending act of 1723 completed the work of destruction.' The privileged places named in the two acts were the Minories, Salisbury Court, Whiteiriars, Fulwood's Rents, Mitre Court, Baldwin's Gardens, The Savoy, The Clink, Deadman's Place, Montague Close, The Mint and Stepney.

In Scotland the most famous sanctuaries were those attaching to the Church of Wedale, now Stow, near Galashiels, and that of Lesmahagow, Lanark. All religious sanctuaries were abolished in the northern kingdom at the Reformation. But the debtor found sanctuary from "diligence" in Holyrood House and its precincts until late in the 17th century. This sanctuary did not protect criminals, or even all debtors, *e.g.,* not crown debtors or fraudulent bankrupts; and it was possible to execute a *meditatio fugae* warrant within the sanctuary. The abolition of imprisonment for debt in 1881 practically abolished this privilege of sanctuary.

A presumptive right of sanctuary attached to the royal palaces, and arrests could not be made there. In Anglo-Saxon times the king's peace extended to the palace and 3,000 paces around it: it extended to the king himself beyond the precincts. At the present day members of parliament cannot be served with writs or arrested within the precincts of the houses of parliament, which extend to the railings of Palace yard. During the Irish agitation of the 'eighties Parnell and others of the Irish members avoided arrest for some little while by living in the house and never passing outside the gates of the yard. The houses of ambassadors were in the past quasi-sanctuaries. This was a natural corollary of their diplomatic immunities *(see* DIPLOMACY).

In Europe, generally, the right of sanctuary survived under restrictions down to the end of the 18th century. In Germany the more serious crimes of violence were always excepted. Highwaymen, robbers, traitors and habitual criminals could not claim church protection. In 1418 sanctuary was further regulated by a bull of Martin V. and in 1504 by another of Julius II. In a modified form the German *Asylrecht* lasted to modern times, not being finally abolished till about 1780. In France *le droit d'asile* existed throughout the middle ages, but was much limited by an edict of Francis I. in 1539. It was entirely abolished at the Revolution.

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SAND, GEORGE (1804–1876), the pseudonym of Madame Amandine Lucile Aurore Dudevant, *née* Dupin.

George Sand was the daughter of Maurice Dupin, a retired lieutenant, and of Sophie Delaborde, the daughter of a Paris bird-fancier. Their ill-assorted marriage took place only a month

before the birth of the child (July 1, 1804; at Paris). Her paternal grandfather was M. Dupin de Francueil, a farmer-general of the revenue, who married the widow of Count Horn, a natural son of Louis XV., she in her turn being the natural daughter of Maurice de Saxe, the most famous of the many illegitimate children of Augustus the Strong, by Marie Rinteau ("Mlle. de Verrières"). George Sand, who was a firm believer in the doctrine of heredity, devotes a whole volume of her autobiography (*Histoire de ma vie*, 1857 *seq.*) to the elaboration of this strange pedigree. She boasts of the royal blood which ran through her veins, but she is no less frank in declaring that she is *vilaine et très vilaine*, a daughter of the people who shares by birth their instincts and sympathies. Her birth itself was romantic. Her father died when she was a small child, and her mother, after a struggle, abandoned Aurore to the care of her grandmother, Madame Dupin de Francueil, who was a survival of the ancien régime.

Her childhood was spent at Nohant, near La Châtre in Berry, Madame Dupin's country house. Here she imbibed the passionate love of country scenes and country life which neither absence, politics nor dissipation could uproot; here she learnt to understand the ways and thoughts of the peasants, and laid up that rich store of scenes and characters which a marvellously retentive memory enabled her to draw upon at will. Next to the grandmother, the most important person in the household at Nohant was Deschatres. He was an ex-abbé who had shown his devotion to his mistress when her life was threatened during the Revolution, and henceforward was installed at Nohant as factotum. He was maire of the village, tutor to Aurore's half-brother, and undertook the education of the girl. At odd hours of lessons she picked up a smattering of Latin, music and natural science, but most days were holidays and spent in country rambles and games with village children.

From the free out-door life at Nohant she passed at thirteen to the convent of the English Augustinians at Paris, where for the first two years she never went outside the walls. Nothing better shows the plasticity of her character than the ease with which she adapted herself to this sudden change. One day in the convent chapel she underwent conversion in the mystical sense. There is no doubt of the sincerity of her narrative, or even the permanence of her religious feelings under all her many phases of faith and aberrations of conduct.

Again in 1820 Aurore exchanged the restraint of a convent for freedom, being recalled to Nohant by Mme. de Francueil, who had no intention of letting her granddaughter grow up a *dkvote*. She rode across country with hey brother, she went out shooting with Deschatres, she sat by the cottage doors on the long summer evenings and heard the flax-dressers tell their tales of witches and warlocks. She was a considerable linguist and knew English, Italian and some Latin, though she never tackled Greek. She read widely though unsystematically, studying philosophy in Aristotle, Leibnitz, Locke and Condillac, and feeding her imagination with *Rend* and *Childe Harold*. Her confessor lent her the *Génie du Christianisme*, and to this book she ascribes the first change in her religious views.

On her grandmother's death she married on Dec. 11, 1822, Casimir Dudevant, natural son of Baron Dudevant. He seems then to have been neither better nor worse than the Berrichon squires around him, and the first years of her married life, during which her son Maurice and her daughter Solange were born, except for lovers' quarrels, were passed in peace and quietness, though signs were not wanting of the coming storm. Among these must be mentioned her friendship with Aurélien de Sèze, advocate-general at Bourdeau, which her husband resented. So long as the conventions were preserved she endured her life, but when her husband took to drinking and made love to the maids under her eyes she resolved to break a yoke that had grown intolerable. She then discovered a paper docketed "Not to be opened till after my death," which was nothing but a railing accusation against herself. She at once quitted Nohant, taking with her Solange, and in 1831 an amicable separation was agreed upon, by which her whole estate was surrendered to the husband with the stipulation that she should receive, in return for this relinquishment on her part, an allowance of £120 *a* year.

Aurore Dudevant had regained her liberty, and made no secret of her intention to use it to the full. She endeavoured unsuccessfully to eke out her irregularly paid allowance by various expedients, and lived in a garret. She found a friend in Delatouche, the editor of *Figaro*. He was a native of Berry, like herself, a stern but kindly taskmaster who taught her the trade of journalism. On the staff of *Figaro* was another compatriot, Jules Sandeau, a clever and attractive young lawyer. Articles written in common soon led to a complete literary partnership, and in 1831 there appeared in the *Revue de Paris* a joint novel entitled *Prima Donna* and signed Jules Sand. Shortly after this was published in book form with the same signature a second novel, *Rose et Blanche*. The sequel to this literary alliance is best recounted in George Sand's own words: "I resisted him for three months but then yielded; I lived in my own apartment in an unconventional style." Her first independent novel, *Indiana* (1832), was written at the instigation of Delatouche, and the world-famous pseudonym George (originally Georges) Sand was adopted as a compromise between herself and her partner. The one wished to throw *Indiana* into the common stock, the other refused to lend his name, or even part of his name, to a work in which he had had no share. The novel was received with instant acclamation. *Indiana* is a direct transcript of the author's personal experiences (the disagreeable husband is M. Dudevant to the life), and an exposition of her theory of sexual relations which is founded thereon. To many critics it seemed that she had said her whole say and that nothing but replicas could follow. *Valentine*, which was published in the same year, indicated that it was but the first chapter in a life of endless adventures, and that the imagination which turned the crude facts into poetry, and the fancy which played about them like a rainbow, were inexhaustible.

Her liaison with Jules Sandeau, which lasted more than *a* year, was abruptly terminated by the discovery in their apartment on an unexpected return from Nohant of *une blanchisseuse quelconque*. For a short while she was broken hearted:—"My heart is a cemetery!" she wrote to Sainte-Beuve. "A necropolis," was the comment of her discarded lover when years later the remark was repeated to him.

Her third novel, *Lélia* (1833), is in the same vein, a stronger and more outspoken diatribe against society and the marriage law. Lélia is a female Manfred, and Dumas had some reason to complain that George Sand was giving them "du lord Byron au kilo." But a new chapter in her life was now to open. In her despair she turned for comfort and counsel to Sainte-Beuve, now constituted her regular father confessor. He recommended new friendships, but she found Dumas "trop commis-voyageur," Jouffroy too serenely virtuous and Musset "trop dandy." Mérimée was tried for a week, but the cool cynic and the perfervid apostle of women's rights proved mutually repulsive. Alfred de Musset was introduced, and the two natures leapt together.

The Musset Episode.—Towards the end of 1833 George Sand, after winning the reluctant consent of Musset's mother, set out in the poet's company for Italy, and in January 1834 the pair reached Venice, staying first at the Hôtel Danieli and then in lodgings. At first it was a veritable honeyrnoon; conversation never flagged and either found in the other his soul's complement. But there is a limit to love-making, and George Sand, always practical, set to work to provide the means of living. Musset, though he depended on her exertions, was first bored and then irritated at the sight of this *terrible vache à écrire*, whose pen was going for eight hours a day, and sought diversion in the cafés and other less reputable resorts of pleasure. The consequence was a nervous illness, through which George Sand nursed him with tenderness and care. But she made love at the same time to a young Venetian doctor whom she had called in, by name Pagello. The two found their way eventually to Paris, leaving Musset in Italy, deeply wounded in his affections, but, to do him justice, taking all the blame for the rupture on himself. George Sand soon tired of her new love, and even before she had given him his congé was dying to be on again with the old. She cut off her hair and sent it to Musset as a token of penitence, but Musset, though he still

flirted with her, never quite forgave her infidelity and refused to admit her to his deathbed. Among the mass of *romans à clef* and pamphlets which the adventure produced, two only have any literary importance, Musset's *Confessions d'un enfant du siècle* and George Sand's *Elle et lui.* In the former woman appears as the serpent whose trail is over all; in the latter, written twenty-five years after the event, she is the guardian angel abused and maltreated by men. *Lui et elle,* the rejoinder of the poet's brother Paul de Musset, was even more a travesty of the facts with no redeeming graces of style.

It remains to trace the influence, direct or indirect, of the poet on the novelist. *Jacques* was the first outcome of the journey to Italy, and in precision and splendour of style it marks a distinct progress. In *Les Lettres d'un voyageur,* which ran in the *Revue des deux mondes* between 1834 and 1836, we have not only impressions of travel. but the direct impressions of men and things not distorted by the exigencies of a novel. The Everard of the *Lettres* introduces us to a new and for the time a dominant influence on the life and writings. Michel de Bourges was the counsel whose eloquent pleadings brought the suit for a judicial separation to a successful issue in 1836. Unlike her former lovers, he was a man of masterful will, a philosopher who carried her intellect by storm before he laid siege to her heart. He preached republicanism to her by the hour, and even locked her up in her bedroom to reflect on his sermons. She was but half converted, and fled before long from a republic in which art and poetry had no place. Other celebrities who figure in the *Lettres* under a transparent disguise are Liszt and Mme. d'Agoult (known to literature as Daniel Stern), whom she met in Switzerland and entertained for some months at Nohant. Liszt, in after years when they had drifted apart. wrote of her: "George Sand catches her butterfly and tames it in her rage by feeding it on flowers and nectar — this is the love period. Then she sticks her pin into it when it struggles — that is the congé and it always comes from her. Afterwards she vivisects it. stuffs it, and adds it to her collection of heroes for novels." There is some truth in the satire, but it wholly misrepresents her rupture with Chopin.

Liaison with Chopin. — It was doubtless a revulsion of feeling against the doctrinaires, especially the strong influence of Lamennais and P. Leroux, and in particular against the puritanic reign of Michel that made her turn to Chopin. She found the *maestro* towards the end of 1837 dispirited by a temporary eclipse of popularity and in the first stage of his fatal malady, and carried him off to winter with her in the south. How she roughed it on an island unknown to tourists is told in *Un hiver à Majorque* (1842), *a* book of travel that may take rank with Heine's *Reisebilder.* In nearly all George Sand's loves there was a strong strain of motherly feeling. Chopin was first petted by her like a spoilt darling and then nursed for years like a sick child. In the end Chopin remonstrated with her for refusing to receive her ne'er do well son-in-law, Clésinger, at Nohant, and when she resented his interference, he left her in anger.

Meanwhile, during this, her second period, George Sand allowed herself to be the mouthpiece of others—"un écho qui embellissait la voix," as Delatouche expressed it. *Spiridion* (1838) and *Les Sept cordes de la lyre* (1840) are mystic echoes of Lamennais. *Le Compagnon du tour de France* (1841), *Les Maîtres mosaïstes* and *Le Meunier d'Angibault* (1845), *Le Péché de M. Antoine* (1847) are all socialistic novels. George Sand had adopted her socialism from Pierre Leroux, and many works of this period are inspired by his humanitarianism. *Consuelo* (1842–1844) and its seque! *La Comtesse de Rudolstadt* (1843–1845) are *fantaisies à la Chopin,* though the stage on which they are played is the Venice of Musset. Chopin is the Prince Karol of *Lucrezia Floriani* (1847), a self-portraiture unabashed as the *Tagebuch diner Verlorenen* and innocent as *Paul et Virginie.*

George Sand wrote with the rapidity of Walter Scott and the regularity of Anthony Trollope. For years her custom was to retire to her desk at 10 P.M. and not to rise from it till 5 A.M. She wrcte *à la diable,* starting with some central thesis to set forth or some problem to investigate, but with no predetermined plot or plan of action. Round this nucleus her characters (too often mere puppets) grouped themselves, and the story gradually crystallized. This unmethodical method produces in her longer and more ambitious novels, in *Consuelo* for instance and its continuation, a tangled wilderness, the clue to which is lost or forgotten; but in her novelettes, when there is no change of scenery and the characters are few and simple, it results in the perfection of artistic writing, "an art that nature makes."

The Pastoral Novels. — From novels of revolt and tendency novels George Sand turned at last to simple stories of rustic life, the genuine pastoral. It is here that she shows her true originality and by these she will chiefly live. George Sand by her birth and bringing-up was half a peasant herself, in M. Faguet's phrase, "un paysan qui savait parler." She had got to know the heart of the peasant — his superstitions, his suspiciousness and low cunning, no less than his shrewdness, his sturdy independence and his strong domestic attachments. *Jeanne* (1844) begins the series which has been happily called the Bucolics of France. To paint a Joan of Arc who lives and dies inglorious is the theme she sets herself, and through most of the novel it is perfectly executed. The last chapters when Jeanne appears as the Velida of, Mont Barbot and the Grande Pastoure are a falling off and a survival of the romanticism of her second manner. *La Mare au diable* (1846) is a clear-cut gem, perfect as a work of Greek art. *François le champi* and *La Petite Fadette* are of no less exquisite workmanship. Les *Maîtres sonneurs* (1853) brings the series of village novels to a close, but as closely akin to them must be mentioned the *Contes d'une grande-mère,* delightful fairy tales of the Talking Oak, Wings of Courage and Queen Coax, told to her grandchildren in the last years of her life.

The revolution of 1848 arrested for a while her novelistic activities. She composed manifestos for her friends, addressed letters to the people, and even started a newspaper. But her political ardour was short-lived; she cared little about forms of government, and, when the days of June dashed to the ground her hopes of social regeneration, she returned to her quiet country ways and her true vocation as an interpreter of nature, a spiritualizer ot the commonest sights of earth and the homeliest household affections. In 1849 she writes from Berry to a political friend: "You thought that I was drinking blood from the skulls of aristocrats. No, I am studying Virgil and learning Latin!" In her latest works she went back to her earlier themes of romantic and unchartered love, but the scene is shifted from Berry, which she felt she had exhausted, to other provinces of France, and instead of passionate manifestos we have a gallery of *genre* pictures treated in the spirit of *François le champi.* "Vous faites," she said to her friend Honoré de Balzac, "la comédie humaine; et moi, c'est l'églogue humaine que j'ai voulu faire."

George Sand was as fond of acting as Goethe, and like him began with a puppet stage, succeeded by amateur theatricals, the chief entertainment provided for her guests at Nohant. Undaunted by many failures, she dramatized several of her novels with moderate success—*François le champi,* played at the Odéon in 1849, and *Les Beaux Messieurs de Bois-Doré* (1862) were the best; *Claudie,* produced in 1851, is a charming pastoral play, and *Le Marquis de Villemer* (1864) (in which she was helped by Dumas fils) was a genuine triumph. Her statue by Clésinger was placed in the foyer of the Théâtre Français in 1877.

George Sand died at Nohant on the 8th of June 1876. To a youth and womanhood of storm and stress had succeeded an old age of serene activity and then of calm decay. Hrr nights were spent in writing, which seemed in her case a relaxation from the real business of the day. playing with her grandchildren, gardening, conversing with her visitors — it might be Balzac or Dumas, or Octave Feuillet or Matthew Arnold — or writing long letters to Sainte-Beuve and Flaubert. "Calme, toujours plus de calme," was her last prayer, and her dying words, "Ne détruisez pas la verdure."

BIBLIOGRAPHY.—The collected edition of George Sand's works was published in Paris (1862–83) in 96 volumes, with supplement 109 volumes; the *Histoire* de *ma vie* appeared in 20 volumes in 1854–55. The *Étude bibliographique sur les œuvres de George Sand by* the vicomte de Spoelberch de Lovenjoul (Brussels. 1868) gives the most complete bibliography. Of Vladimir Karenin's (pseudonym of

Mme. Komarova) *George Sand,* the most complete life, the first two volumes (1899–1901) carry the life down to 1839. There is much new material in *George Sand et sa fille,* by S. Rocheblave (1905), *Correspondance de G. Sand et d'Alfred de Musset* (Brussels, 1904), *Correspondance entre George Sand et Gustave Flaubert* (1904), and *Lettres à Alfred de Musset et à Sainte-Beuve* (1897). E. M. Caro's *George Sand* (1887) is rather a critique than a life. *See* studies by Sainte-Beuve in the *Causeries du lundi* and in *Portraits contemporains;* Jules Lemaitre in *Les Contemporains,* vol. iv.; E. Faguet, *XIX^e Siècle;* F. W. H. Myers, *Essays Ancient and Modern* (1883); Henry James in *North American Review* (April 1902); Matthew Arnold, *Mixed Essays* (1879). *See* also René Doumic's *George Sand* (1909), which has been translated into English by Alys Hallard as *George Sand: Some Aspects of her Life and Writings* (1910); C. Maurras, *Les Amants de Venise; George Sand et Musset* (1916); L. Vincent, *George Sand et le Berry* (2 vols. 1919); E. A. L. Seillière, *George Sand* (1920); E. W. Schermerhorn, *The Seven Strings of the Lyre. The Life of George Sand (1804–76)* (1928); and Eng. trans., by M. J. Howe, of her *Journal Intime* as *The Intimate Journal of George Sand* (1929).

SAND. The products of rocks and minerals broken down by natural or artificial agencies are gravels, sands. silts and clays. In the U.S. the term sand is applied to particles $\frac{1}{16}$ to 2 mm. diameter. and in Europe to those from .02 to 2 mm. diameter. Although most of the rock-making minerals occurring on the earth's crust are found in sands, only a limited number are met with at all frequently.

For several reasons quartz is by far the commonest; it is abundant in rocks, is comparatively hard and has practically no cleavage so that it is not readily worn down to a fine state. Moreover it is nearly insoluble in water and does not decompose. In certain localities feldspar, calcareous material, iron ores and volcanic glass, among other substances, have been found to be dominant constituents of sand. Most quartzose sands contain a small quantity of feldspar. Small plates of white mica. which, though soft and very fissile, decompose slowly, are often present. In addition, all sands contain small quantities of "heavy" rock-forming minerals among which may be garnet, tourmaline, zircon, rutile. topaz, pyroxenes, amphiboles, iron ores, etc.

In certain shore and river sands these heavier constituents become concentrated as a result of current action and the removal of the lighter constituents. Economically valuable deposits may then be yielded. Such are the sands worked for diamonds and other gem stones, gold, platinum, tin, monazite and other ores. The greensands. widely distributed over the floor of the ocean and found in ancient strata on the continents, owe their colour to the presence of glauconite, a potash-bearing mineral. These sands are used for nater softening and for land dressing, and attempts have been made to extract potash from them.

In the pottery, glassmaking and silicate (water glass) industries very pure quartzose sands are used in large quantities as a source of silica. Similar sands are required for lining the hearths of acid-steel furnaces. Molding sands, that is, the sands utilized in foundries for making the molds in nhich metal is cast, usually have a clayey bond uniting the grains of quartz Because of the hardness and poor cleavage of quartz, sands are used extensively as abrasives. Garnet sands. although of more restricted occurrence, are similarly used. Ordinary sands find a multitude of other uses. among which may be mentioned the preparation of mortar, cement and concrete. In underground formations, sand strata are frequently sources of water supply. (P. G. H. B.; X.)

SANDALWOOD, a fragrant wood obtained from various trees of the natural order Santalaceae, and principally from *Santalum album,* a native of India. The use of sandalwood dates at least as far back as the 5th century B.C. It is still extensively used in India and China, wherever Buddhism prevails, being employed in funeral rites and religious ceremonies. In India it is used in the manufacture of boxes, fans and other ornamenfal articles of inlaid work.

The oil, obtained by distilling the wood in chips, is used as a perfume. few native Indian attars or essential oils being free from admixture with it. As a ponder or paste the wood is employed in the pigments used by the Brahmans for their distinguishing caste marks.

Red sandalwood is the product of a small leguminous tree, *Pterocarpus santalinus,* native to southern India, Ceylon and the Philippine Islands. A fresh surface of the wood has a rich deep red colour, which on exposure, however, assumes a dark brownish tint; its principal application is in wool dyeing. Several other species of *Pterocarpus,* notably P. *indicus,* contain the same dyeing principle and can be used as substitutes for red sandalwood. The barwood and camwood of the Guinea coast of Africa. from *Baphia nitida* or an allied species, called *santal rouge d'Afrique* by the French, are also closely allied to the red sandalwood of oriental countries.

As a substitute for copaiba (*q.v.*), which is used as a diuretic and stimulant, sandalwood oil. distilled from the wood of *Santalum album,* is pleasanter to take, but it is less efficient and more expensive.

SANDARAC, in mineralogy realgar or native arsenic disulfide, but generally a resinous exudation obtained from the small coniferous tree *Tetraclinis articulata,* native to the northwest regions of Africa, and especially the Atlas mountains. The resin, a natural exudation on the stems, comes into commerce as small round balls or elongated tears, transparent, and having a delicate yellow tinge. It is used as a varnish and as incense. and by the Arabs medicinally as a remedy for diarrhea. An analogous resin is procured in China from *Callitris sinensis,* and in southern Australia, under the name of pine gum, from various species of *Callitris.* (F. L. A.)

SANDAWE, the name of a tribe of about 20,000 persons living near Kilimatinde. Tanganyika. between the Bubu and Mponde rivers. The Sandawe have been known to anthropological and linguistic science since 1891.

Many aspects of their culture show the influence of their Bantu neighbours. Their isolated wooden houses with roofs of clay are built in the lee of the wind. The staple food is millet, supplemented with fat, milk and butter. meat being rarely eaten: culinary utensils are largely wooden. Their traditional clothes were of *hika*-grass, feathers and hides. and the dominant cosmetic practices include shaving of the hair, ear lobe piercing and face tattooing. Circumcision, general for both sexes, seems a recently acquired practice. Their weapons are bows and iron-tipped arrows; they also trap animals but regard hunting with a net as an occupation of the poor. Their hunting weapons. as well as the conservative beehive huts which are occasionally seen. resemble those of the Hadzapi.

The Sandane cultivate the soil with a mattock. fertilize with manure and keep cattle, sheep and goats. The men clear the land. tend the animals and hunt. while the women do the cultivation and food gathering. They drink beer and mead. but the term for the latter is borroned from Bantu.

Their legal practices. which have an indigenous terminology. relate to such subjects as inheritance and indemnity for adultery; the latter is not as serious a transgression as it is among the Bantu.

Households, each comprising a nuclear family, are organized into patrilineal exogamous clans which form the basis for autonomous local communities. Marriage, which is monogamous (as with the nearby Mbugwe) with a bride-price, is forbidden with parallel cousins and preferred with the maternal uncle's daughter. Residence is patrilocal, often after an initial period near the wife's parents.

The kinship terminology is classificatory: the paternal uncle is called a "father." as with most Bantu and contrary to Bushman-Hottentot. Paternal cousins are called by sibling terms. while maternal cousins are distinguished. The same term is used reciprocally for maternal uncle and a man's sister's child. while the children of one's sibling of one's own sex are termed the same as one's own children.

Language.— Sandawe shares certain syntactic features with Bushman-Hottentot: inflection is accomplished by suffixes, and not by prefixes as in Bantu languages; the modifying noun precedes the modified ("cow's head"; not "head of-cow" as in Bantu); and the basic sentence order is subject — object — verb.

Pronominal reference is expressed either by independent words or by suffixes to verbs and nouns; it distinguishes subject function from other relationships, including possession. Pronouns and

many nouns distinguish two grammatical genders. feminine and "indifferent." and indifferent forms also show plural (feminine rarely so). Nouns are inflected in a limited way for case, such as instrumental and locative. Suffixes serve, too. to mark commands and interrogations. Certain of the most common verbs are anomalous in having totally unrelated shapes in the singular and plural.

The most striking feature is the presence, in addition to a rich set of about 26 conventional consonants. of three types of clicks (*q.v.*): alveolar, lateral and palatal. In acoustic effect, these match the corresponding clicks of Hottentot and Hadzapi (which each have a fourth type) and of Bushman (Southern Bushman has five varieties). Like Bushman-Hottentot, Sandawe has tones, but no accurate description of them has been made.

Sandawe. Bushman-Hottentot and Hadzapi are genetically related not only by lexical agreements but also by specific suffixal correspondences: noun plural *-ko* = Hottentot masculine plural *-ku;* feminine singular *-su* = Hottentot *-s,* Naron Bushman and Hadzapi *-sa;* feminine plural *-tsi, -si* = Hottentot and Hadzapi *-ti,* Naron *-si;* predicative indifferent *-we* = Hottentot masculine singular *-p,* Naron *-ba,* Hadzapi *-wa.* Among pronominal correspondences there are first singular *ts-, s-* = Hottentot first singular prefix *ti-* and Hottentot and Southern Bushman first exclusive *si-,* respectively; first singular subject form *tsa* = Hadzapi and Hottentot first singular *-ta.* The vocalism of Bushman *ha* "that" and *he* "this" exactly matches that of Sandawe *ha* "that." *he* "this," and *na* "there." *ne* "here." Thus in perfect accord are Sandawe *ha-we,* Hadzapi *ha-.;'a,* Naron *xa-ba* "he."

Despite their geographic proximity, the relationship of Sandawe seems no closer to Hadzapi than to Bushman-Hottentot.

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SANDAY, WILLIAM (1843–1920). English New Testament scholar, one of the pioneers in introducing to English students the mass of work done by continental scholars in biblical criticism, was born at Holme Pierrepont, Notts., Aug. 1, 1843. Educated at Repton and Balliol college, Oxford, he became a scholar of Corpus Christi in 1863. He was a fellow and lecturer at Trinity in 1866, and was ordained in 1867. In 1876 after holding various college livings. he was appointed principal of Hatfield hall, Durham. ,In 1882 he was appointed Ireland professor of exegesis at Oxford, and in 1895 Lady Margaret professor of divinity and canon of Christ Church. positions he held until 1919. He died at Oxford on Sept. 16, 1920.

Sanday's chief works are *The Authorship and Historical Character of the Fourth Gospel* (1872); *The Gospels in the Second Century* (1876); *Inspiration* (Bampton lectures) (1893); *Commentary on the Epistle to the Romans,* with A. C. Headlam (1895); *Clzristologies, Ancient and Modern* (1910).

See obituary by W. Lock in *Journal of Theological Studies,* 22:97–104, also pp. 193–205 of the same issue list a bibliography of his published works by A. Souter.

SANDBLASTING: *see* BLAST CLEASISG AND SHOT PEENING.

SANDBURG, CARL (1878–), U.S. poet, historian, novelist and folklorist. one of the group of writers responsible for the pre-World War I "Chicago Renaissance" in letters. was born Jan. 6, 1878, at Galesburg, Ill. The son of a Swedish immigrant. he began earning his keep at the age of 11. He worked in a barbershop. drove a milk wagon and turned hobo for a time in the Kansas wheat fields. When the Spanish-American War broke out, he enlisted in the 6th Illinois infantry. These early years Sandburg later described in his autobiography *Always the Young Strangers* (1953).

After attending Lombard college in Galesburg. he acted as an organizer for the Social Democratic party and secretary to the mayor of Milwaukee (1910–12). Moving to Chicago in 1913, he was an editor of *System* and then joined the staff of the *Daily News.*

In 1914 he made his appearance in Harriet Monroe's *Poetry* magazine with a group of his *Chicago Poems,* which were issued in book form in 1916. Sandburg's poetry made an instant and favourable impression. In this and succeeding volumes—*Cornhuskers* (1918), *Smoke and Steel* (1920) and *Slabs of the Sunburnt West* (1922)—he was recognized as a genuine poet of the people. In *Good Morning, America* (1928) Sandburg seemed to have lost some of his faith in democracy, but from the depths of the depression he wrote a poetic testament, unique in form, to the power of the people to go forward, *The People, Yes* (1936).

Few Americans have known the lore of their country as has Sandburg. Some of its folk say is in *The People, Yes.* The folk songs that he sang before delighted audiences were issued in two collections, *The American Songbag* (1927) and *Carl Sandburg's New American Songbag* (1950). In 1923 his publishers suggested that he write a life of Lincoln for young people. The project grew into one of the most deservedly popular of biographies. *Abraham Lincoln: the Prairie Yeavs* (2 vol., 1926) and *Abraham Lincoln: the War Years* (4 vol., 1939; Pulitzer prize, history, 1940). In 1948 Sandburg published a long novel, *Remembrance Rock,* which recapitulates the American experience from Plymouth rock to World War I. *Complete Poems* (1950) won the Pulitzer prize for poetry in 1951.

The Sandburg Range (1957) contains selections from the entire gamut of his work. It is abundantly illustrated with photographs taken at various stages in his career.

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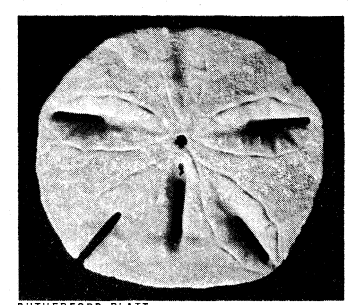
(W. T.)

SAND DOLLAR, a common name for small. disk-shaped marine animals, the most specialized members of the Clypeastroidea. a group of sea urchins (*q.v.*). Throughout the temperate and tropical zones. they live molelike in sand at moderate depths. The sand dollar has a flattened body. from less than $\frac{1}{2}$ in. to about 4 in. in diameter. with the plates of the test (or shell) firmly united and rather thick; the inside of the test is reinforced by pillars. The spines on the upper side are short and crowded. forming a dense fur which holds the sand out, while those on the underside are longer and assist in pushing the animal through the sand. The colour varies but is usually a dark shade—olive. purplish. brown or black.



RUTHERFORD PLATT

TEST (SHELL) OF KEYHOLE SAND DOLLAR

Showing underside with mouth opening in the centre

A bilateral symmetry is superimposed upon the original five-rayed symmetry. and these forms can only move forward, not in all directions as can the ordinary five-rayed sea urchins. When it meets an obstacle, the sand dollar stops and. nith the aid of ventral spines. pivots around the axis which runs vertical through the mouth. and then continues in the new direction. The anus lies on the underside. In these forms the tube feet spread out from the radial canals over large parts of the underside. whereas those on the central part of the upper side are modified for respiration and form flattened leaves. On the dead tests, after the spines have dropped off. the characteristic star-shaped pattern of the gill pores is revealed. The centrally placed mouth has five ciliated grooves radiating out from it, along which food particles are carried in. sifted and subdivided by the teeth.

Sand dollars live more or less concealed in the sand. at a depth of a few icet—sometimes placed at a sharp angle with the anterior edge downward. They have been extremely successful in utilizing a niche in nature which few other forms have invaded, and they occur usually in very large numbers, as evidenced by the thousands of shells washed up after a heavy storm.

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SANDEAU, LÉONARD SYLVAIN JULIEN (JULES) (1811–1883), French novelist, was born at Aubusson, Fr., on Feb. 19, 1811. Sent to Paris to study law, he spent much of his time with unruly students. In 1831 he and Amandine Lucile Aurore Dudevant (George Sand) were living in Paris. The intimacy did not last long, but it produced Rose et Blanche (1831), a novel written in common under the name Jules Sand, from which George Sand took the idea of her famous pseudonym.

Sandeau continued for nearly 50 years to produce novels and to collaborate in plays. His works include Marianna (1839), in which he drew a portrait of George Sand; Le Docteur *Herbeau* (1841); Catherine (1845); and Mademoiselle de *la Seiglière* (1848), a picture of society under Louis Philippe, dramatized in 1851. Le Gendre de M. Poirier (1854) was one of several plays he wrote with Émile Augier.

Sandeau was made conservateur of the Mazarin library in 1853, elected to the French academy in 1858 and the next year appointed librarian of St. Cloud.

He died in Paris on April 24. 1883.

SAND-EEL, or SAND-LANCE. The fishes known under these names form a small family (Ammodytidae). Their body is of an elongate-cylindrical shape. with the head terminating in a long conical snout, the projecting lower jaw forming the pointed end. A low dorsal fin occupies nearly the whole length of the back. and a long anal fin commences immediately behind the vent, which is placed about midway between the head and caudal fin. The tail is forked and the pectorals are short. The absence of ventral fins indicates the burrowing habits of these fishes. In the Japanese Bleekeria small jugular ventral fins are present. The scales, when present, are small, but generally the development of scales has only proceeded to the formation of oblique folds of the integument. The dentition is quite rudimentary.

Sand-eels are small littoral marine fishes, only one species attaining a length of 18 in. (*Ammodytes* lunceolatus). They live in shoals at various depths on a sandy bottom and bury themselves in the sand on the slightest alarm. Sand-eels destroy a great quantity of fry and other small creatures, such as the lancelet (Amphioxus), which lives in similar localities. They are excellent eating and are much sought after for bait. The eggs of sand-eels are small, heavier than sea water and slightly adhesive; they are scattered among the grains of sand in which the fishes live.

Sand-eels are common in the north Atlantic; a species scarcely distinct from the European common sand-lance occurs on the Pacific side of North America, another on the east coast of South Africa. On the British coast three species are found.

SANDERS (SANDER), **NICHOLAS** (c. 1530–1581), English Roman Catholic scholar. controversialist and historian of the English reformation. was born in Surrey about 1530 and educated at Winchester and New college, Oxford, at which university he became a lecturer in canon law. He left England shortly after the accession of Elizabeth I in order to be free to practise Roman Catholicism, and by 1561 had been ordained priest at Rome. Stanislaus Cardinal Hosius, prince-bishop of Ermeland, having been appointed one of the five papal legates at the renewed sessions of the council of Trent, took Sanders with him as one of his theologians. Sanders' immense reputation among the English Catholic exiles in the Low Countries, however, caused the cardinal to allow him to go to Louvain, where Sanders became professor of theology and was soon busy controverting the claims of Episcopalian divines, especially Bishop John Jewel.

Of Sanders' many books the best known was a history of the English Reformation written in Latin, left unfinished at his death, and published with additions by a fellow exile. Father Edward Rishton, at Cologne in 1585. Many editions and translations followed rapidly; eventually it was put into English by David Lewis, entitled The Rise and Growth of the Anglican Schism (1877). Bitterly attacked at first by English Protestant writers as malicious and erroneous, it has come more and more to be appreciated as an outstanding piece of historical writing for its time.

The later part of Sanders' life was occupied in promoting a military invasion of England for the restoration of Catholicism. Lengthy and unsatisfactory negotiations for this purpose in both Rome and Madrid culminated in his landing in Ireland in 1579 as a papal agent to promote rebellion and his failure and death there in 1581.

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SANDERSON, FREDERICK WILLIAM (1857–1922), distinguished English schoolmaster whose practical outlook, exemplified during his headmastership of Oundle school. near Peterborough. Northamptonshire, from 1892 until his death, has had considerable influence on the curriculum and methods of secondary education, was born at Brancepeth, county Durham, on May 13. 1857. He nas educated at the local school. at Durham university and at Christ's college, Cambridge. In 1889 he became senior physics master at Dulwich college. where he formed a successful "engineering side." His appointment as headmaster of Oundle in 1892 came at a critical period in the fortunes of the school. In spite of initial opposition he transformed the school and completed an ambitious building program which included laboratories, workshops, a foundry, an observatory, an experimental farm and a spacious library.

A scientist and a practical teacher who understood boys and their interests, Sanderson's maxim was "Education must be fitted to the boy. not the boy to education." During his headship Oundle developed from a school of less than 100 pupils to one which accommodated five times that number. Though not mentioning him by name, the Hadow report on the Education of the Adolescent (1926) was strongly influenced by his ideas.

Sanderson died in London on June 15, 1922.

See *Sanderson of Oundle* (1923), an account of his work compiled by his colleagues; H. G. Wells, *The Story of a Great Schoolmaster* (1924). (S. J. C.)

SAND FLY, any of the bloodsucking biting midges belonging to the family Ceratopogonidae of the order Diptera (*q.v.*). They belong to the genera Culicoides, *Lasiohelia* and Leptoconops and attack man and warm-blooded animals most viciously. All are small, under 3 mm., and generally grayish or brownish in colour, but a few are yellow; the wings are covered with tiny hairs forming a weak pattern; the strong veins are in front, the other veins weak. Because of their minute: size and difficulty of seeing them when they bite they are called "no-see-ums" in parts of North America; also "punkies." The larvae are aquatic, live in the tide zone of sandy beaches, in decaying vegetation, tree holes and mud. The adults are crepuscular and nocturnal but bite viciously on dark days; they are so fragile that they remain in hiding with even a moderate breeze, but may form large swarms in the lee of buildings and enter houses through mosquito screens. Many seashore areas are made extremely uncomfortable by them. Species of Culicoides are vectors in Africa and tropical America of the filarial worms, Acanthocheilonoma perstans and Mansonella ozzardi, but these are nonpathogenic in man. There are 33 species of Culicoides in the British Isles. The name sand fly is also applied to species of *Simulium* in some parts of the world. (C. H. CN.)

SAND-FLY FEVER (FLEBOTOMUS FEVER, PAPPATACI FEVER) is an acute, infectious, febrile disease caused by a specific filterable virus and producing temporary incapacitation. It is transmitted by the female sand fly, Flebotomus *papatasii,* and is prevalent in the moist subtropical countries of the eastern hemisphere lying between latitude 20° and 45° N., particularly around the Mediterranean sea, in the middle east and parts of India. It breaks out in epidemic form during the summer season following the breeding of this species of fly, but between epidemics the reservoir is unknown and there is no conclusive evidence that the virus is congenitally transmitted in the insect host. The sand fly becomes infected from biting infected persons when the virus is circulating in the patient's blood, not more than 48 hours before the clinical onset and no more than the first 24 hours thereafter. The virus then requires seven to ten days incubation, after which the sand fly remains infected for life.

Pathogenesis and **Symptomatology.**—Man becomes infected from the bites of infected sand flies. Using human adults of both sexes and different racial groups as volunteers, A. B. Sabin, C. B. Philip and J. R. Paul (1944) obtained 95% infection following skin exposure to infected *Flebotomus papatasii.* The virus multiplies and becomes widely disseminated throughout the body, and within two and one-half to five days after exposure there is suddenly a feeling of lassitude, abdominal distress and dizziness, followed within one day by a chilly sensation and a rapid rise in temperature during the next 24 to 48 hours to 102°–104.5° F. (38.8°–40.3° C.). As in dengue (*q.v.*) there are typically severe frontal headache and postorbital pain, intense muscular and joint pains, likewise a flushed appearance of the face, but no true rash or subsequent desquamation. During the first day of fever there is an accelerated pulse. Usually after two days the temperature slowly returns to normal; only rarely is there a second episode of fever. Following the febrile period there is great fatigue and weakness, accompanied by slow pulse and frequently subnormal blood pressure. Convalescence may require only a few days or several weeks.

Prognosis is always favourable in sand-fly fever. The average case is considerably less severe than in dengue. Diagnosis is based on the clinical manifestations, the geographical area in which the disease occurs, the prevalence of *Flebotomus papatasii* and the epidemic development of the disease. More specifically, although there is no change in the total number of white blood corpuscles, there is an increase in the proportion of immature neutrophilic forms (*e.g.*, a marked shift to the left in the Schilling count). Treatment is entirely symptomatic.

Prevention.— Sand flies breed in vegetation within a few hundred feet of human habitations. These breeding places are difficult to discover, hence larvicidal control is impractical. The bloodsucking females feed only from sunset to sunrise and only at ground level, so that sleeping quarters above the ground floor provide moderately good protection. Ordinary mosquito netting and screening are useless, since the unfed female flies can pass through 18-mesh squares. Insect repellents such as dimethyl phthalate, dibutyl phthalate and benzyl benzoate, when applied to exposed skin, will keep sand flies away for a few hours, but the use of DDT-pyrethrum sprays on verandas, on screens, around doors and windows and within habitations will readily kill all adult sand flies which alight on the sprayed surfaces. With this procedure an epidemic can be rapidly terminated.

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SAND GROUSE, the name applied to birds resembling grouse (*q.v.*) in certain features but more closely related to the pigeons. They inhabit desert regions. They comprise the family Pteroclidae. A common form is Pallas's sand grouse *(Syrrhaptes paradoxus*), of central Asia which occasionally invades Europe in large flocks. The nest is on the ground and contains four inconspicuous eggs. The wings are long. The birds' plumage is adapted to the colour of the desert. Sand grouse supply their young with water by soaking the breast feathers in water, which the little birds drink *(see* P. A. Buxton, *Animal Life in Deserts,* New York, 1923). Fossil species occur in the Miocene formation. (K. P. S.)

SANDHURST, a large village in the Wokingham parliamentary division of Berkshire, Eng., 9 mi. N. of Aldershot. Pop. (1951) 5,244. Between the village and the town of Camberley, in wooded grounds with a lake and playing fields, lies the Royal Military academy, Sandhurst, where most of the potential regular officers for the British army undergo a course of general and military education as officer cadets. The present R M.A. is heir to the functions performed up to 1939 by both the Royal Military academy at Woolwich and the Royal Military college at Sandhurst. The R.M.C. was established by royal warrant in 1802 at Great Marlow, largely as a result of the efforts of Col. J. G. Le Marchant and Gen. Francis Jarry, an exiled French officer, who had organized a training school for officers at High Wycombe three years earlier. The move to Sandhurst took place in 1812 when the "Old Building" there was completed. The college at first included a senior department for the training of staff officers, but in 1858 this was made entirely separate and in 1862 was transferred to the present staff college building in the same grounds. In 1911 a new building was added to accommodate the increasing numbers of cadets. After World War I, during which it was for a time reduced to four months, the length of the course was fixed at 18 months and officers were trained for commissions in all branches of the British and Indian armies except the artillery, engineers and signals which were separately provided for at Woolwich. In order to educate and train all regular army officers on a common basis it was planned to amalgamate the R.M.A. and the R.M.C. at Sandhurst in 1940. World War II intervened and Sandhurst became temporarily the location of an O.C.T.U. (Officer Cadet Training unit), but in Jan. 1947 the present academy came into being.

Most cadets enter the academy at 18½–19½ years after passing the competitive army entrance examination and doing a short period of army training as other ranks. Others are selected while doing national service and. if not up to the educational standard required, go to a special company attached to Sandhurst for a preliminary course. Another source of cadets is the college established by the war office at Welbeck abbey in 1953 for boys of about 16½ who intend to obtain commissions in technical arms. In the early 1960s about one-tenth of the cadets were from commonwealth overseas territories.

The academy has a major general as commandant and is organized into three colleges, each of four companies. with training and administrative staff. There are also more than 70 civilian lecturers in the four departments of mathematics, science; modern subjects and languages, headed by a director of studies responsible to the commandant. Some cadets are prepared with a view to taking the mechanical sciences tripos at Cambridge university or the degree course at the military college of science, others for the army interpretership examination. Atomic physics and the problems of government. especially within the Commonwealth. are studied The military courses include history, organization and administration, military law. tactics, drill, signals and weapon training. In addition to the usual games and societies, mountaineering, exploration and ocean sailing are officially sponsored.

At the end of the course commissions are allotted in the arms of the service according to existing vacancies First choice of regiment is usually given to those high up in the order of merit, which is determined by a formula which combines educational achievement with an assessment of personal qualities. Each term the Queen's medal is awarded to the first cadet in this order and the Sword of Honour to the cadet considered by the commandant to be the best of the term.

Cadets at Sandhurst receive the pay of their rank during their previous service in the army. The course in military subjects is common to candidates for commissions in all arms. appropriate specialist training is provided for each officer immediately after commissioning.

See also MILITARY, NAVAL AND AIR ACADEMIES. (W. F. G.)

SAN DIEGO, a Pacific coast city of California. U S , an important naval base and seat of San Diego county, is situated 16 mi N. of the Mexican border and about 110 mi S.S E of Los Angeles Between 1950 and 1960. the population. stimulated by industrial gron th. naval and military activities. and a mild climate. increased from 334,387 to 573,223. one of the highest percentage increases for any major U.S. city. The population of the San Diego standard metropolitan statistical area, comprising San Diego county. was 556,808 in 1950 and 1.003.011 in 1960. (For comparative population figures *see* table in CALIFORNIA: *Population.*)

History.— Juan Rodriguez Cabrillo, a Portuguese explorer in the service of Spain, discovered the bay on Sept 23, 1542, and named it San Miguel. The next visitor was Sebastián Vizcaíno,

who was sent in 1602 to reconnoitre California preparatory to the establishment of a Spanish colony. He renamed the bay for San Diego de Alcalb de Henares, a Spanish monk whose name Vizcaíno's flagship bore.

In 1769 the harbour was chosen as the base for the exploration and settlement of California because of its excellence and its relative proximity to Mexico. The sacred expedition of that year, led by the first governor, Gaspar de Portolb, founded the San Diego presidio as the initial settlement in the new colony. On the same day, July 16, 1769. Father Junipero Serra dedicated San Diego mission, the first of the California missions. The settlement was slow to spread beyond the presidio walls because of the menace of Indian and foreign attack. In 1774 the missionaries removed to the site of an Indian village, but the new mission buildings were soon destroyed by Indians and a brief return to the protection of the ramparts was necessary. Not until 50 years had passed did the town itself expand outside the presidio. which was strategically located on a hill. Then, with the overthrow of Spanish control by Mexico. and the pacification of savage tribes, it became possible for inhabitants to go below the walls onto flat lands to build what has become known as Old Town, which was organized a pueblo in 1834.

American conquest in 1846 brought few immediate changes. The Old Town was incorporated in 1850 but did not grow and lost its charter two years later. San Diego then remained a Mexican adobe village until Alonzo E Horton arrived in 1867 with the intention of founding a nen town. He purchased a tract by the bay, 3 mi. S. of Old Town, for 26 cents an acre. In a few years his promotion became the largest California community south of Los Angeles, and has remained so ever since. The new city was incorporated in 1872. In 1931 the council-manager form of government was adopted.

Favourable year-round climate proved the great attraction to early settlement. Rainfall averages only 10 in. a year, which comes mostly in the mild winters. Growth tended to be extremely influenced by California land booms. The Santa Fe railway arrived in 1884, at the time of a general boom. and population and real estate values multiplied. Most of the towns in San Diego county were founded at that time. Except for the hard times that followed and lasted through the early 1890s, the city's growth thereafter was rapid.

Commerce and **Industry.**—San Diego is the headquarters of the 11th naval district and the extensive development of installations including army, marine and coast guard establishments added a great government payroll to the income of the area. The pleasant living conditions attract retired persons, especially naval personnel.

Equable climate and recreational facilities have encouraged a considerable tourist trade. Before World War II, climatic factors attracted San Diego's principal industry. aircraft construction, and later stimulated an increase of management personnel and the establishment of important new industries, such as electronics and rocketry.

San Diego is one of the leading agricultural counties in the United States in the value of production. Citrus, avocado, truck garden crops and livestock are the major products.

The roomy (22 sq.mi.), landlocked bay, one of the great natural harbours of the world, is a first port of call for coastwise and foreign shipping, operating through the Panama canal. As an outlet for growing amounts of Imperial valley cotton, its export tonnage is increasing yearly. Shipbuilding developed as an industry in the mid-1950s. San Diego was once the country's leading tuna-packing area; a post-World War II decline was blamed on Japanese competition.

Recreation and Culture.—Deep-sea fishing is a popular recreation. Opportunities for other aquatic sports, swimming, motorboat racing, water skiing and sailing, were expanded by the development of Mission bay, a shallow harbour just north of San Diego bay, as a large aquatic park area. There are many well-situated golf courses about the metropolitan area.

Cultural establishments are centred in Balboa park. An annual Shakespeare festival, which offers scholarships to promising actors, is centred around a replica of London's Old Globe theatre. The art gallery, the Museum of Man, the Natural History museum, an open-air amphitheatre and one of the world's largest outdoor organs are all set amid the park's landscaped area. Light opera productions are given outdoors in summer. Also in Balboa park is the San Diego zoo, housing one of the largest collections of animals in the world.

The southern city limit is also the Mexican border. The international gate is the busiest crossing on the southern frontier of the United States. Principal attractions in Mexico are bullfights, horse and dog racing, jai alai and Mexican and foreign merchandise.

Educational facilities include San Diego State college (1897), San Diego College for Women (Roman Catholic; 1949), University of San Diego College for Men (Roman Catholic; 1949), California Western university (Methodist; chartered in 1924 as Balboa university and rechartered in 1952) and a rapidly developing branch of the University of California at La Jolla which is also the site of the Scripps Institution of Oceanography. (A. P. N.)

SAND LILY (*Leucocrinum* montanum), a North American plant of the lily family (Liliaceae), native to plains and mountain valleys from South Dakota and Nebraska west to the Pacific coast. It is a small stemless perennial with long. narrow, grasslike leaves tufted on a short rootstock from which rise also the nearly stalkless, pure white, fragrant, slender-tubed, lilylike flowers, about two inches long and half an inch across. The sand lily, often called star lily, is a conspicuous early spring flower in many parts of its range. See SOAP PLANTS.

SANDOMIERZ, a town of Poland in the province of Kielce, 140 mi. S.S E. of Warsaw on the left bank of the Vistula. It is mentioned as early as 1079; from 1139 to 1332 it was the chief town of the principality of the same name. In 1240 and in 1259 it was burned by the Mongols. In 1429 it was the seat of a congress for the establishment of peace with Lithuania, and in 1570 the "Consensus Sandomiriensis" was held there for uniting the Lutherans. Calvinists and Moravian Brethren. Subsequent wars ruined the town. There in 1702 the Polish supporters of Augustus of Saxony banded together against Charles XII of Sweden. The cathedral was built between 1120 and 1191; rebuilt in stone in 1360. Pop. (1957 est.) 10,600.

SANDOWAY, a town and district in the Arakan division of Burma. The town (pop. [1953] 5,172) is said to have once been the capital of Arakan. The district has an area of 4.157 sq.mi.; pop. about 140.000. The country is mountainous. The hills are clad with evergreen forest or useless bamboo brake on their lower slopes; by evergreen oak forests on the higher parts. Except for a few acres of tobacco nearly all the cultivation is rice. Sandoway was ceded to the British, with the rest of Arakan (*q.v*) by the treaty of Yandabo in 1826. It became part of the independent Union of Burma on Jan. 4, 1948.

SANDOWN-SHANKLIN, a holiday resort and urban district in the Isle of Wight, Hampshire, Eng. Sandown is 6 mi. and Shanklin 8 mi. S. of Ryde by road. Pop. (1961) 14,257. Area 5.5 sqmi. Sandown rises from the wide sandy shore of Sandown bay, on the southeast of the island, and is bordered to the north by the white Culver cliff. Shanklin stands on the cliffs at the southerly end of the bay, with the esplanade below, and the winding chasm of Shanklin chine lies to the south of the town. The district is noted for its floral beauty and long hours of sunshine.

SANDPAPER, an abrasive material prepared by coating heavy paper with glue and sifting fine sand over its surface before the glue sets. It is used for smoothing the surface of wood, for rubbing down paint and similar purposes. See ABRASIVE.

SANDPIPER, the name given to all the smaller limicoline birds which are not plovers (*q.v.*), snipe (*q.v.*) or phalaropes (*q.v.*). The greenshank (*q.v.*) and the redshank (*q.v.*) are also related to the common sandpiper or summer snipe (Tringa *hypoleucus*). This little bird is a summer visitor to northern Europe and Asia. In the British Isles it arrives in May. It frequents clear streams, beside which it nests on the ground. There are four eggs, protectively coloured, as is also the case with the young. It winters in India, Australia and the Cape. In America it is replaced by *Actitis* macularia, the peetweet or spotted sandpiper, having similar

habits. The green sandpiper (*T. ochropus*) is unique among the group, except for the North American solitary sandpiper (*Calidris solitarius*), in using the old nests of other birds wherein to lay eggs. Another European species is the wood sandpiper (T. *glareola*), like the last very dark in colour.

Other forms include the knot (*q.v.*), the dunlin (*q.v.*), the sanderling (*Calidris arenaria*), which lacks the hind toe, the purple sandpiper (C. *striata*) and the little, Temminck's and American stints (*T. minuta*, *T. temmincki* and *Pisobia minutilla*). The American stint, often called the least sandpiper, is darker and ranges from the arctic to Brazil. Ronaparte's sandpiper (P. *fuscicollis*), distinguished by its white tail coverts, is a common American form. It is called the white-rumped sandpiper. The semipalmated sandpiper (*Ereunetes pusillus*) has partially webbed feet; it is a small form, breeding in arctic America. The buff-breasted sandpiper (*Tryngites subruficollis*) is common in the Mississippi valley in autumn and breeds in Alaska and Keewatin, wintering in Argentina and Uruguay.

SANDRINGHAM, a civil parish in the Freebridge Lynn rural district of Norfolk, Eng., 9 mi. S.N E. of King's Lynn by road. Pop. (1951) 608. Sandringham house, a country seat of the sovereign, was acquired by Edward VII in 1563. The estate, of 19.500 ac., includes a park of 200 ac. The church of St. Mary Magdalene contains memorials of the royal family. George VI died at Sandringham on Feb. 6. 1952.

SANDSTONE is a consolidated rock built up dominantly of grains of sand (*q.v.*) held together by a cementing substance. Sandstones are composed mainly of quartz, but may vary in composition in the same manner as sands. By increase in the size of their constituents they pass into conglomerates (*q.v.*) and by decrease into arenaceous shales and clay rocks. When the grains of sand are angular, the rock is termed a grit.

The minerals of sandstones are the same as those of sands. Quartz is the commonest; with it often occurs a certain amount of feldspar (as in the rock arkose) and frequently white mica. The flakes of mica may often be seen lying on the bedding planes and may give the sandstone a cleavable character (*e.g.*, paving stone) of much value in quarrying. The cementing material is often fine chalcedonic silica, or it may be secondary quartz, producing a quartzitelike rock. Calcareous material (calcite), glauconite, iron oxides, carbonaceous matter and other substances also act as cements and give the sandstones characteristic colours. Glauconitic sandstones are greenish, ferruginous sandstones, red, brown and yellow or gray. When the cementing substance is clay, the rock is often of white or gray colour and firmly compacted.

Pure sandstones may contain as much as 99% of silica. If relatively soft they are crushed to sand for commercial purposes. If firmly cemented they are utilized. on account of the resistance of silica to heat, for the manufacture of silica bricks. furnace linings, hearths, etc. Of this character is the well-known rock "ganister" worked in the districts of Sheffield. South Wales. etc. Less pure, but firmly-cemented siliceous sandstones are used for the making of grindstones and millstones. Similar rocks, as well as calcareous, dolomitic (see DOLOMITE) and ferruginous sandstones are extensively worked as building stones, mostly by quarries but sometimes by mines. As sandstones are always porous, they do not take a good polish. and are not used as ornamental stones. but this property makes the sandstone formations valuable storage basins and sources of water. (P. G. H. B.)

SANDUSKY, a city of northern Ohio, U.S., a port of entry and the seat of Erie county, is situated on Sandusky bay off Lake Erie, 56 mi. S.W. of Cleveland. It was platted in 1818 and incorporated in 1824; the name is Indian. referring to "clear water." Both French and British traders established posts in the area and the English fort built in 1761 was burned during Pontiac's conspiracy in 1763. During the War of 1812 Sandusky was a supply depot; Perry's naval victory of Sept. 10, 1813, occurred about 25 mi. N.W., near Put-in-Bay. (See WAR OF 1812.)

This terminated Indian and British aggressions in the area and it was then settled by Connecticut residents; the townsite was in that portion of the Connecticut Western Reserve set aside for persons who had suffered losses from British raids in Connecticut during the American Revolution. A large number of Germans came in 1840–60. Bypassed as a terminus of a lake to Ohio river canal, Sandusky obtained the first Ohio railroad charter and service began in 1838. Johnson's Island in Sandusky bay was a prison for Confederate officers from 1862 to 1865. Sandusky's early trade was in lumber, fish, and wood and agricultural products. Principal trade items in modern times include crayons, school paints. ball bearings, automotive and small steel castings, corrugated paper products, pleasure boats, rubber toys, radios, paper and textile machine rolls. quarry products and lake shipment of coal. The city is located in boating, fishing and sand beach vacationing area and has many municipal parks. Sandusky has a commission-manager form of government. in effect since 1916. For comparative population figures see table in OHIO: *Population.* (C. E. F.)

SAND VERBENA (*Abronia*), a large genus of plants of the four-o'clock family (Nyctaginaceae), allied to the *Mirabilis* of the gardens, comprising about 50 species, native chiefly to dry sandy soils in western North America. They are low, often prostrate annuals or biennials, with opposite, entire, thick, sometimes viscid leaves; showy, red, yellow or white, usually fragrant flowers, clustered in stalked heads encircled at the base by bracts, and a broadly winged fruiting achene enclosing a single shining seed. The white sand verbena (*A. fragrans*), with very numerous fragrant flowers, occurs from Iowa to Idaho and south to Texas and Mexico. The yellow sand verbena (*A.* latifolia) and the pink sand verbena (*A. umbellata*), found along the seashore from southern California to British Columbia, are grown as ornamentals in borders and rockeries. Various species bloom in immense profusion in deserts during the short rainy season.

SANDWICH, EDWARD MONTAGU or MOUNTAGU, 1ST EARL OF (1625–1672), English admiral, was born on July 27, 1625, son of Sir Sidney Montagu (d. 1644) of Hinchinbrooke, who was a brother of Sir Henry Montagu, 1st earl of Manchester, and of Edward Montagu, 1st Lord Montagu of Boughton. He joined the parliamentary party at the outbreak of the Civil War. In 1643 he raised a regiment. and he fought at Marston Moor. Naseby and at the siege of Bristol. Though one of Oliver Cromwell's intimate friends and M.P. for Huntingdonshire, 1645–48, he took little part in public affairs until 1653, when he was appointed a member of the council of state. In 1656 he was made a general at sea, his colleague being Robert Blake. He took part in the covering operations against Dunkirk in 1657 and was chosen a member of Cromwell's house of lords in the same year. In 1659 he was sent by Richard Cromwell with a fleet to arrange a peace between Sweden and Denmark. After the fall of Richard he resigned his command and assisted in the restoration of Charles II. Again general at sea early in 1660. Montagu carried the fleet over to the side of the exiled king, and was entrusted with the duty of fetching Charles from the Netherlands. He mas then made a knight of the Garter, and in July 1660 was created earl of Sandwich.

During the war with the Dutch in 1664–65 Lord Sandwich commanded a squadron under the duke of York and distinguished himself in the battle off Lowestoft on June 3, 1665. When the duke retired later in the same year he became commander in chief. Trouble arose over certain valuable Dutch prizes which he had taken, and Lord Sandwich was dismissed from his command, but as a solatium was sent to Madrid as ambassador extraordinary. He arranged a treaty with Spain and mediated a treaty between Spain and Portugal (Feb. 1668). In 1670 he was appointed president of the council of trade and plantations. When the third Dutch war broke out in 1672 Lord Sandwich again commanded a squadron under the duke of York and during the fight in Solebay (Southwold bay) on May 28, 1672, his ship, the "Royal James," after having taken a conspicuous part in the action, caught on fire and was blown up. The earl's body was found some days later and was buried in Westminster Abbey.

Lord Sandwich claimed to have a certain knowledge of science, and his translation of a Spanish work on the *Art of Metals* appeared in *1674.* He is mentioned frequently in the *Diary* of his kinsman, Samuel Pepys. *See* also F. R. Harris, *Life of Edward Montague,* 2 vol. (London, 1912).

SANDWICH, JOHN MONTAGU, 4TH EARL OF (1718–1792), was born on Nov. 3, 1718, and succeeded his grandfather, Edward, the 3rd earl, in the earldom in 1729. Educated at Eton and at Trinity college, Cambridge, he spent some time in travelling, and on his return to England in 1739 he took his seat in the house of lords as a follower of the duke of Bedford. He was a

commissioner of the admiralty, plenipotentiary to the congress at Breda (1746), first lord of the admiralty (1748), and in 1753 a principal secretary of state. He took a leading part in the prosecution of John Wilkes. He had been associated with Wilkes in the notorious fraternity of Medmenham, and his attitude now in turning against the former companion of his pleasures made him very unpopular, and, from a line in the *Beggar's Opera,* he was known henceforward as "Jemmy Twitcher." He was postmaster general in 1768, secretary of state in 1770, and again first lord of the admiralty from 1771 to 1782. For corruption and incapacity Sandwich's administration is unique in the history of the British navy. He died on April 30, 1792.

The Sandwich Islands *(see* HAWAII) were named after him by Captain Cook. His *Voyage round the Mediterranean in the Years 1738 and 1739* was published posthumously in 1799, with a flattering memoir by J. Cooke; the *Life, Adventures, Intrigues and Amours of the celebrated Jemmy Twitcher* (1770), which is extremely rare, tells a very different tale. *See* also the various collections of letters, memoirs and papers of the time, including Horace Walpole's *Letters* and *Memoirs* and the *Bedford Correspondence.*

SANDWICH, a market town and municipal borough in the Dover parliamentary division of Kent, Eng., 12 mi. E. of Canterbury on the Stour river. Pop. (1951) 4,140. Area 3.3 sq.mi. One of the original Cinque Ports, and second in precedence to Hastings, it is now 2 mi, from the sea. In the line of the old defensive ramparts, now marked by a public walk, the Fisher gate (dating from 1384, restored 1954) is the only gateway remaining. the other three —Newgate, Sandown and Canterbury gates—having been pulled down in the 18th century; the Barbican was built in 1539 as one of a chain of blockhouses along the coast. In the twisting streets of Sandwich are timber-framed houses, and others built by the Flemings; *e.g.,* White Friars on the site of a 13th-century Carmelite priory; three ancient hospitals—St. Bartholomew's (probably founded 1217), just outside the town, with a fine Early English chapel, St. Thomas' dating from 1392 and rebuilt in 1864, and St. John's; three old churches—St. Clement's (the parish church since 1948) which dates from the 12th century and has a beautiful Norman tower, St. Mary the Virgin which stands on the site of a 7th-century monastery, but is not now in regular use, and St. Peter's. of various dates from the 12th century, where the curfew is still rung at 8 p.m. on the tenor bell and which is now the chapel of Sir Roger Manwood's grammar school (1563). The school's present buildings were put up in 1895 and the old house, Manwood court (1564), is now a private house. The guildhall, a 16th-century building, is still in use.

Rutupiae (Richborough, *q.v.*), 1¼ mi. *N.* of Sandwich, was established as a Roman town in A.D. 43 and was the centre of administration and one of the main entries from the continent. Sandwich was called Lundenvic by the Saxons and later became Sandwic; it was a borough by prescription before 1226, when the record of mayors begins. The governing charter until 1835 was that granted by Charles II in 1684. For many centuries the naval headquarters, the port for the wool trade and chief port of embarkation for the European continent, Sandwich lost its importance in the 16th century when the harbour became silted up. The town flourished again when the Flemish refugees were given permission by Elizabeth I to live there; during the Napoleonic Wars; during World War I; and in World War II when it was extensively used for the construction of Mulberry harbour. The chief industries are agriculture, and the manufacture of antibiotics, rubber products, shuttlecocks, textiles and welding equipment. It is also a holiday town with fine golf links and sands at Sandwich bay.

SANDYS (Sändz), **SIR EDWIN** (1561–1629), British statesman and a founder of the colony of Virginia, was the second son of Edwin Sandys, archbishop of York, and his wife Cecily Wilford. He was born in Worcestershire on Dec. 9, 1561. He was educated at Merchant Taylors' school and at Corpus Christi college, Oxford, and, though he never took orders, became a prebendary of York. He retained his prebend until 1599. He was entered in the Middle Temple in 1589. From the year 1593 till 1599 he travelled abroad. When in Venice he became closely connected with Fra Paolo Sarpi, who helped him in the composition of the treatise on the religious state of Europe, known as the *Europae speculum.* In 1605 this treatise was printed from a stolen copy under the title, *A Relation of the State of Religion in Europe.* Sandys procured the suppression of this edition, but the book was reprinted at the Hague in 1629. He was member for Andover in 1586 and for Plympton in 1589. On James I's accession Sandys was knighted. He sat in the king's first parliament as member for Stockbridge. He assailed the great monopolies, and he endeavoured to secure to all prisoners the right of employing counsel. He had been connected with the East India company before 1614. and took an active part in its affairs till 1629 His most memorable services were, however, rendered to the (London) Virginia company, to which he became treasurer in 1619. He sat in later parliaments as member for Sandwich in 1621, for Kent in 1624, and for Penrhyn in 1625. He died in Oct. 1629.

See Alex. Brown's *Genesis of the United States* (London, 1890).

SANDYS, GEORGE (1578–1644), English traveller, colonist and poet, the seventh and youngest son of Edwin Sandys, archbishop of York, was born on March 2, 1578. He studied at St. Mary hall. Oxford, but took no degree. In 1610 he set out on a journey which he described in *A Relation of a Journey begun An. Dom. 1610, in Four Books* (published in 1615 and dedicated, like all Sandys' works, to Charles I). He visited Italy, Constantinople, Egypt. Palestine and Cyprus and his observations on geography and ethnology made his work a valuable source book to Sir Francis Bacon. John Milton and Sir Thomas Browne. He took a great interest in the early colonization of America and in 1621 became colonial treasurer of the Virginia company and sailed for Virginia with Sir Francis Wyat, the new governor. who had married his niece. In 1624. when Virginia became a crown colony, he was created a member of the council He returned to England about 1631.

He had published a translation of part of Ovid's *Metamorphoses* in 1621; he completed this in 1626, and later added to it a translation of book I of the *Aenezd* (1632). On this rests his claim to be considered, by John Dryden, as "the best versifier of the former age." As a translator, he aimed at the closest possible rendering of the Latin text, and this led him to perform a remarkable feat of compression—his translation of the *Metamorphoses* occupies exactly the same number of lines as the original. His greatest importance was in the development of the closed, antithetically balanced couplet, which was later brought to perfection by Dryden and Alexander Pope, both of whom read Sandys' translation of Ovid in boyhood Also interesting was his use of a compressed, Latinate poetic diction; he was one of the first, and certainly the most influential, of the poets who adopted Latin syntax, chose Latin verbs rather than compound English ones, and, above all, used English words in their original Latin sense for the sake of brevity and wit. Many of the words of this type associated traditionally with Milton's style are borrowed from Sandys. The *Metamorphoses* is also of interest as the chief source of John Keats' knowledge of classical fable.

His other works include *A Paraphrase upon the Psalmes of David, etc.* (1636); *A Paraphrase upon the Divine Poems* (1638); and a translation of *Christ's Passion* from the Latin of Hugo Grotius (1640). His *Poetical Works* were edited in two volumes, with a memoir, by Richard Hooper (London, 1872).

See B. Penrose, *Urbane Travellers, 1591–1635* (Philadelphia, 1942); and, for an account of his influence on poetic diction, G. Tillotson, *On the Poetry of Pope,* 2nd ed (London, 1951).

SAN FERNANDO, a seaport of southern Spain. in the province of Cadiz, on the Isla de León, a rocky island among the salt marshes which line the southern shore of Cadiz bay. Pop. (1950) 38,174 (mun.). San Fernando was probably a Carthaginian settlement. On a hill to the south stood a temple dedicated to the Tyrian Hercules; to the east is a Roman bridge, rebuilt in the 15th century after partial demolition by the Moors. The arsenal was founded in 1790. During the Peninsular War the cortes met at San Fernando (1810), but the present name of the town dates only from 1813; it was previously known as Isla de León. In the neighbourhood salt is produced and stone is quarried. Manufactures include foundry products, spirits, beer, leather, esparto fabrics, soap, hats, sails and ropes.

SAN FRANCISCO, a city and port of California, U.S., co-

extensive with San Francisco county, is centrally located on the California coast about 350 mi. N.W. of Los Angeles at latitude 37° 47' N. and longitude 122" 26' W. It is the cultural, maritime, financial and trading centre of a densely populated metropolitan area.

PHYSICAL CHARACTERISTICS

Covering the tip of the southernmost of two peninsulas which guard the Golden Gate (*q.v.*) between the Pacific ocean and San Francisco bay, the city commands one of the world's finest land-locked harbours. Around the bay is a band of contiguous metropolitan subcentres. Inland lie the rich valleys and metropolitan zones which are linked geographically and economically to the bay area. Heavily traveled sea and air lanes make San Francisco the major U.S. Pacific coast port and the gateway to the orient.

From the ocean to the mid-line of the bay. the city controls 93 1 sq.mi., 44 6 on land. It is hilly with Telegraph. Nob, Russian and other hills rising almost from the water's edge; Twin Peaks. Mt Davidson and Mt. Sutro stand more than 900 ft. high. San Bruno mountain (1,315 ft) is just south of the city line. Encircling the bay, ridges of the Coast range rise from about 1,200 ft. to such peaks as Mt. Tamalpias (2,604 ft.), on the northern Marin peninsula; Mt. Diablo (3,849 ft.), east; and Mt. Hamilton (4,029 ft.), well south. The foothill vegetation varies from rich groves of redwood (Sequoia *sempervirens*) to oak, chaparral and grass. In some places, large stands of eucalyptus were planted in modern times. Green in winter and spring, golden brown in summer and autumn, marked irregularly by the deep blue of the trees, the hills are a dramatic amphitheatre for the bay.

San Francisco Bay.—Geologically, the bay is a drowned valley which drains the great central basin of California. The Golden Gate, the outlet carved by an ancient river before the valley was inundated, is 1 mi. to 1.7 mi. wide and about 3 mi long. The bay varies from 5 to 13 mi. in nidth and stretches its two arms northeast about 42 mi. through San Pablo bay. the Carquinez strait, and Suisun bay; and south about 35 mi. The total surface area is approximately 400 sq mi. Although the bay is 357 ft. deep in the Golden Gate channel, and from 100 to 140 ft. deep in the centre, about 70% of it is no more than 18 ft. in depth. At its northeastern extremity, the confluence of the Sacramento and the San Joaquin rivers passes through Carquinez strait, and numerous small streams descend from the surrounding hills.

Six highway and tno railroad bridges span the bay. Across the southern arm, a railroad bridge and two highway bridges were built in 1927 and 1929. The double-tiered bridge with tao main spans of 2.310 ft. each across the central bay betneen San Francisco and Oakland, and the spectacular suspension bridge with a span of 4.200 ft. across the Golden Gate were completed in 1936 and 1937, at costs of more than $77,000,000 and $35,000 000, respectively. A bridge across San Pablo bay was built in 1956, and a matching span to an older bridge at Carquinez strait mas completed in 1958. Suisun bay is crossed by a railroad bridge. With the completion of the newest of these spans, ferry service on the bay ended after a century of operation.

Several islands are within the bay. On Alcatraz, 12 ac. of rock just inside the Golden Gate, are a federal prison (1934) and a 214-ft. lighthouse. Farther inside the Gate, Angel Island, the largest in the bay. rises 771 ft. above sea level; on it is old Ft. McDowell. Yerba Buena (formerly Goat Island) and adjacent Treasure Island (built by fill for the 1939 Golden Gate International exposition) are approximately in the bay's centre. The first anchors the San Francisco-Oakland bridge midway in its course; the second is the site of a naval training centre.

Extending to the bay are two main valleys, the Santa Clara from the south and the Sonoma from the north. East of the ridges, more extensive valley systems open upon the delta and sedimentary lands of the central valley of California.

Climate.—San Francisco's climate is mild. cool and even. The annual mean temperature is 56.5° F., with an annual mean minimum of 50.4° F. and an annual mean maximum of 62.6° F. The average daily temperature range is but 12.2" F. The ocean's proximity produces not only equable temperatures but bracing breezes and a cooling fog. The annual mean wind velocity is only 9.1 m.p.h., and the city enjoys sun during 66% of the possible sunlight hours. Precipitation consists entirely of rain, the mean annual fall being 20.51 in.. most of which comes from November through March. The relative humidity is 73%, ranging monthly from 69% (Nov.) to 80% (Aug.). Greater climatic variation occurs in the surrounding metropolitan region. Some valley points are notably warmer and-dryer, while on the leeward slopes of the ridges greater precipitation and wider temperature ranges are encountered. Variability in rainfall characterizes the entire area, changes as high as 100% from year to year being not infrequent.

HISTORY

Inhabited by the Penutian linguistic family of Indians, the San Francisco area was unknown to Europeans until the late 18th century. From the 16th century onward the Spanish, who claimed California, had sailed along the coast without discovering the bay's entrance. although they had charted the Farallon Islands offshore. Sir Francis Drake. in 1579, had also sailed past the Golden Gate, anchoring briefly in a cove (Drake's bay) a few miles north. Rumours of Russian overseas expansion, however, stirred the Spanish into an effort to establish permanent control over Upper California. To that end Gaspar de Portolá (*q.v.*) led a party northward from San Diego during the summer of 1769. The expedition passed Monterey bay, its intended destination, without recognizing it, and continued northward until a scouting party under José Francisco de Ortega sighted San Francisco bay from the hills of the southern peninsula. Three years later, another party explored the region more thoroughly, and in 1775 the vessel "San Carlos," piloted by Juan Manuel de Ayala, sailed into the bay.

Early the following year, Capt. Juan Bautista de Anza selected a site for a permanent colony on the bay. Lieut. José Joaquin Moraga and Father Francisco Palóu, leading a band of settlers and soldiers from Monterey. then established a presidio (Sept. 17. 1776) and the Mission San Francisco de Asís (Oct. 9. 1776). The mission was soon more familiarly called for the stream near which it was situated, Mission Dolores Beside a shallow cove inside the Golden Gate, the colonists settled in the pueblo of Yerba Buena (named for the "good herb," an aromatic vine growing on the sand dunes). In 1777 Father Junipero Serra (*q.v.*), founder of the Upper California missions, visited the new colony. Within a few years a group of six missions was located in the region which, 150 years later, comprised the modern metropolitan area.

For a half-century, the small outpost led an isolated existence. Beginning in 1806, ho'wever. Russia spread its fur-trading activities into the area, unsuccessfully at San Francisco and nith moderate success after 1812 at Fort Ross, about 75 mi N. The Russian venture. which ended in 1841. was the forerunner of increasingly frequent visits from traders in hides and tallow. whalers and. by 1840. explorers, fur hunters and merchants. Meanwhile, Upper California became a province of Mexico (1825) and San Francisco bay was made a Mexican port of entry (1835). In the same year, the United States attempted to buy the bay from Mexico, after traders and whalers had reported the commercial possibilities of the area.

With the outbreak of war between Mexico and the United States on May 13, 1846, a new era began. North of the bay at Sonoma, the insurgents of Capt. John Charles Frémont (q *v.*) raised the "Bear Flag" of an independent California, and on July 9, 1846, Capt John B. Montgomery in the sloop of war "Portsmouth" entered the bay, hoisted the Stars and Stripes in the plaza, now known as Portsmouth plaza, and claimed the territory for the United States. On Jan. 30, 1847, the pueblo was renamed San Francisco. It was incorporated in 1850. Even without the political stir which this turn of history produced, the moment was propitious for change. By the mid-1840s, immigrant parties were struggling across the Rockies, bound for Oregon and California. However. the discovery of gold on the American river at Coloma in Jan. 1848 produced social and economic results overnight which no mere shift of political fortune could have produced in decades.

Within three months, San Francisco was almost deserted, its residents off to the mother lode country. Then, in Feb. 1849, fortune hunters from all over the world crowded into the town. Deserted ships choked the bay. Shacks and tents, mire and dust, fantastic prices and a spate of gambling, drinking and vice appeared ashore. While gold fever was acute, many people in the city were transients. An increasing number, however, stayed to provide equipment, supplies and capital to the Argonauts (prospectors). Maritime enterprises, of course, flourished from the start. Merchants extended wharves out toward deep water. More improvements followed the transfer of harbour management from the city to a state board of harbour commissioners in 1863. Between 1877 and 1914, a great stone wall was built well outside the early water front; the bay was filled in behind it; and out from it finger piers were projected. Sardine fishing began in the 1850s, followed soon by shrimp fishing and, on the Sacramento river, salmon fishing. Whalers based their operations at San Francisco more and more, and the bay was one of the world's most important whaling bases between 1885–1905. Oyster beds were planted in the bay after 1870.

Inland shippers busily covered the bay and built up river ports at Sacramento and Stockton. Shipbuilding and repair works rose at numerous points. The first dry dock was built in 1851; the Union Iron works launched the first steel ship built on the Pacific coast in 1885. Overseas trade thrived. Exports of $8,500,000 in 1860 had increased sixfold by 1890, a period which saw the fast grain clippers give may to the more prosaic freighter fleets plying with monthly regularity to the orient (after 1867), Hawaii (after 1878), Australia (after 1885), and Europe (after 1899).

As a trading centre, the city increased its range significantly after the first transcontinental railroad was completed in 1869. By then, its commerce and local industries were firmly founded upon the rich resources of central and northern California. Food processing, meat packing, flour milling, lumber milling, woolen textile, tanning, iron foundries and implement manufacturing establishments appeared in the 1850s. Sugar refining, smelting and refining of minerals, and a wide variety of fabricating industries developed in the 1860s. By 1870, the value of manufactured goods exceeded $22,000,000 and 20 years later manufacturing products had multiplied in value to $120,000,000.

In contrast to this steady development, the city's financial growth was spectacularly unstable. Connected to the risks of gold mining in the 1850s, the heavily capitalized silver mining of the 1860s. and the vast railroad construction projects, and to speculative land development, San Francisco capital not only sustained long-term growth in the entire west, but provided some of the most acute fluctuations in banking and stock exchange in U.S. history. Periodic panics wiped out fortunes; new waves of optimism and economic gro th built them up again repeatedly. The city remained the centre of regional finance, however, and, with the more stable fiscal practices enjoined by national and state legislation in the 20th century, it increased its pre-eminence and security in this economic domain.

Political and social turbulence matched economic growth. Vicious gangs nearly overwhelmed the early city until they were forcibly suppressed by citizen vigilance committees on two occasions in the 1850s (see VIGILANCE COMMITTEE). Demagoguery often swept the city in the 1860s and 1870s, sometimes mixed with demands on behalf of the working class or based on hostility toward Chinese labourers who, having been brought to work on the railroads, drifted into San Francisco. Reform programs in government intermittently succeeded careless or corrupt administration. A notable outburst of public indignation early in the 20th century gave rise to a series of trials of public officials and ushered in the more businesslike governments of the modern period.

Swept repeatedly by fire in the early days. the more substantially built city of the later 19th century spread back from the water front onto the hills. A few early architectural landmarks survived into the 20th century, including a sober Greek Revival mint and a dignified block of offices. The Victorian fantasies and eclecticism of mansions on Nob hill and hotels and offices in the commercial centre reflected the opulence and confidence of the period. Rapid introduction of technological improvements testified to the open physical structure of the ambitious city. Steam and horse-drawn street railroads appeared in the 1860s; these were replaced on the hills by cable-drawn cars (introduced by Andrew S. Hallidie in 1873), and by electric trams (1900), both of which continued in use in the 20th century. After the turn of the century, rail transportation to outlying districts and nearby villages provided means for daily commuting. The telegraph was introduced in 1853, the telephone in 1877, gas lighting in 1854 and electric lighting and power after 1876.

Cultural growth accompanied the improvement of economic and physical resources. Numerous educational institutions arose in the latter half of the 19th century. The city had welcomed the theatre and opera as early as 1849 and enthusiastically supported them thereafter. Symphony performances became annual occurrences after 1874, receiving public funds in 1911. In the sciences and arts, appropriate associations appeared in 1853 and 1871, respectively. In journalism, the Alta California (est. 1849) outlived many fugitive papers until its own demise in 1891, while the 20th-century San Francisco Examiner, Chronicle and *Call-Bulletin* (merged with the News in Nov. 1959 to become the *San* Francisco News-Call Bulletin) dated from the mid-1860s.

Earthquake and Reconstruction.— If the results of a city's early growth are measured not only by absolute achievement but by recuperative vitality, San Francisco met and passed the most severe of tests in 1906. The city had experienced earthquake disturbances in 1864, 1898 and 1900, but on April 18, a violent earthquake, folloned by fire, demolished most of the city's central business and residential districts. (See EARTHQUAKES: Great *Earthquakes:* California [1906].) Hundreds were killed or injured. Homeless residents camped in thousands on the dunes west of the city, while others fled to outlying towns (incidentally giving impetus for 20th-century suburban growth). The loss in buildings was estimated to be more than $100,000,000, while the total property loss was believed to be well over three times as much. Within a short time, relief shipments of food and clothing reached the city, and some $10,000,000 in financial aid came from Europe and America. Although insurance payments in the neighbourhood of $300,000,000 were forthcoming, the long task of reconstruction was sustained by local courage and persistence. Much of the city was rebuilt to be earthquake and fire resistant, and new plans for civic development made headway as the debris of the old city vanished. In 1915 San Francisco invited the world, with pardonable pride, to see the results of its efforts at the Panama-Pacific International exposition.

The opening of the Panama canal, celebrated by the aforementioned exposition; westward expansion of American population: and the continual agricultural and industrial gains in California all stimulated steady metropolitan centralization in the 20th century. War industry in the second decade, and general, diversified growth in the third brought the city's population to more than 500,000. Static during the world-wide depression of the 1930s, San Francisco thereafter entered a new period of metropolitan history—the development of a regional metropolitan complex of which the city was the heart, not the whole; and the explosion of the city not so much by internal growth as by the rapid rise of contiguous, peninsular or trans-bay urban communities.

Change at Mid-20th **Century.**—San Francisco was the scene of the historic conference, April–June 1945, at which the charter of the United Nations was promulgated. The peace treaty with Japan was signed there in 1951.

Kineteenth-century San Francisco had been the unrivaled urban centre of an agricultural region. During the 20th century it became a city of international rank, and the principal, but not dominant, star in a metropolitan galaxy. It retained leadership in many social, economic and cultural activities. But the remarkable growth of population, economic institutions and cultural centres elsewhere in the bay metropolitan area was the most prominent change of the era. The quality of leadership, rather than the quantity of activity and resources, became the basis on which San Francisco retained its traditional role of pace setter and lodestone of the west.

POPULATION

Rich agricultural valley regions support the concentrated urban life of the bay area and give rise to notable inland metropolises: those of San Jose, 45 mi. S.; Sacramento, 80 mi. N. on the Sacramento river; Stockton, 50 mi. E. on the San Joaquin river; and Fresno, 50 mi S W. Though self-sustaining, these are integrally related to the San Francisco-Oakland standard metropolitan statistical area of 3,314 sq mi , with a population of 2,783 359 in 1960, and which comprises Alameda. Contra Costa, Marin, San Francisco, San Mateo and Solano counties.

San Francisco has more than a quarter of the population (742,855 in 1960) of the metropolitan area which includes Oakland, Berkeley, Alameda across the bay to the east; Richmond, Vallejo, Benicia. Martinez and Pittsburg to the northeast; San Rafael. Mill Valley and Sausalito to the north; and a string of suburbs extending down the peninsula to the south — South San Francisco, Pacific& San Bruno, Burlingame, San Mateo, Redwood City. Menlo Park and Palo Alto. (For comparative population figures see table in CALIFORNIA: *Population.*) With its historical priority, and its advantageous westerly site on the bay, the ,city is the heart of the entire complex of urban and regional development of the central Pacific coast. Through finance, commerce and shipping its influence is extended still farther.

Social Characteristics. — After a century typified by population gains of more than 20% per decade, San Francisco by 1960 appeared to be approaching its maximum size, while the remaining cities and counties of the metropolitan area were experiencing remarkable growth. Oakland. half as large as San Francisco, was the next largest city of the bay area. The population of San Francisco. like that of the area, was predominantly white in 1960. Foreign-born and oriental peoples were relatively more numerous in San Francisco, honever. Added to the indigenous inhabitants of foreign extraction, they gave the city a pronounced cosmopolitan atmosphere; citizens of Italian and Chinese descent mere numerous. In total, but not among native-born white and Negro residents, slightly more men than women lived in the city; in the area, the same relationship prevailed except among Negroes, where it was reversed. The city population was much more dense and more mobile, somewhat older and more heavily weighted in upper income brackets than that of the area. However, the higher proportion of home owners in the metropolitan area was notable; ribbons of new houses encircled the hills and frantic programs of school construction had been undertaken in the suburbs, whereas the city was especially involved in projects to construct automobile freeways, parking centres and downtown office and public buildings. Reflecting this difference of emphasis was the heavy daily volume of traffic, especially automobiles, carrying commuters to and from San Francisco.

GOVERNMENT

San Francisco's five charters were granted respectively in 1850, 1856, 1861. 1898 and 1932. Initiative and referendum clauses were first included in the 1898 charter. Under its 1932 charter, San Francisco has a consolidated city and county government in which the mayor, certain executives, the judiciary and the 11-member board of supervisors are elected. The mayor appoints the city's chief administrative officer and a variety of administrative boards, including police, utilities, civil service and planning. Water supply, based on the Hetch-Hetchy system of dams and reservoirs, and a surface public transportation system are municipally owned; gas and electricity are supplied through private enterprise.

Peculiar to the mid-20th century were complex intergovernmental relationships involving the city with many overlapping county and community agencies, as well as with state and national institutions. Quasi-political boards with metropolitan area scope were developed to co-ordinate local attacks on regional problems, such as transportation, air pollution, waste disposal and economic resource development, but active authority remained divided. Although San Francisco exercises leadership in a number of such enterprises. it no longer has independent control over many problems of vital concern to it.

Foreign consulates and branches of national and state political agencies are located in the city. Both the navy and the army maintain important headquarters, the latter occupying the 1.500 ac. Presidio grounds.

Finance. — As the financial and insurance centre of the west, San Francisco's position grew far more rapidly than its population in the middle decades of the 20th century. In the Federal Reserve system (12th district headquarters), the city's banks ranked high in the nation in volume of transactions, debits and clearings, There are 15 banks (several with branches), including the headquarters of one of the world's largest. and 13 savings and loan associations. In the late 1950s deposits. resources and clearings attained figures above $13,000,000,000, $15,000,000,000 and $33,-000,000,000, respectively, having increased by about 300% after World War 1 More than half the insurance companies authorized to transact business in California have their headquarters in San Francisco. The nearly 700 carriers and 20 insurance associations received a total of more than $2,000,000,000 in premiums and paid about $900,000,000 for losses annually. The San Francisco Stock exchange, which became part of the Pacific Coast exchange in 1957, listed in the late 1950s transactions averaging $400,000,000. The San Francisco Mining exchange trades in millions of shares annually.

ECONOMY

The economic prosperity of San Francisco was founded on its maritime trade and its proximity to diversified resources It is a great cosmopolitan seaport, the commercial and distributing centre for inland California and the financial hub of the west.

Commerce. — In the early 1960s, San Francisco bay was sixth in importance as a U.S. port, and twice as active as any other on the Pacific coast. The water front (the Embarcadero) is state-owned and operated and has 1.912 ac. of harbour facilities, but port developments at Oakland, Richmond and Mare Island reduced its earlier relative eminence in the bay. However. by the late 1950s, its U.S. customs receipts had approached $1,000,000,000 annually and accounted for more than 30% of Pacific coast export and import tariffs. A World Trade centre was opened in 1956. Coastal and other domestic traffic accounted for about two-thirds of the port activity. In foreign trade, commerce nith Asia and the Pacific area took the lead; second. in imports, was trade with eastern South America (especially Brazil), and, in exports, Europe. Total value of customs exports in the late 1950s was about $500,000,000 annually; of imports. above $400,000.000. The totals of both had increased by more than 50% since 1950. Vegetable food products, machines, textiles and vehicles were the chief export items; foodstuffs (especially coffee and sugar) and petroleum were the major import items.

As a wholesale centre, San Francisco's activity comprised over half of that in the bay area, with annual sales about $5,000,000,000. The principal items handled were machinery and equipment, foodstuffs, apparel and electrical products For the metropolitan area, petroleum products distributed from the east bay refineries were far more important than for San Francisco, as were automotive products and construction materials. In the late 1950s San Francisco's retail establishments sold approximately $2,000,-000.000 of goods annually. Food. general merchandise. apparel and automobiles led in both San Francisco and the area, the former's share and growth in the trade approximating its share and growth in the population.

Industry and Labour. — By the 1960s, although San Francisco's historical lead in industry remained dominant in comparison to any other bay city, its industrial and labour strength had declined relatively from one-half to one-third that of the whole metropolitan area. The latter's economy was given tremendous impetus by World War II. Some evidence existed that declines of the late 1940s and early 1950s in the number of San Francisco industrial establishments and employees were accompanied by higher productivity and value added by manufacturing; reductions of about 20% in the former were balanced against increases of about the same amount in the latter. In both. however. the area as a whole recorded gains of from 30% to 50%. Leading products

included foods and beverages, apparel (for San Francisco, principally), furniture and fixtures, chemicals, petroleum, and fabricated and primary metals (for the area), machinery and equipment.

San Francisco's labour force in the 1960s nas equal to about half its population. It was highly organized and relatively heavily weighted with technically trained, skilled and semiskilled workers It comprised about 35% of the metropolitan area force. Women workers were relatively less numerous in the area than in San Francisco, finding employment in clerical, service, domestic and professional categories especially.

Transportation and Communication.— Serving the bay area and terminating in San Francisco are: 4 class 1 railroads connecting to 7 transcontinental routes; more than 100 truck lines; 2 transcontinental bus lines; and, at the International airport (opened 1954) south of the city, overseas and domestic airlines, as well as local and air freight lines. About 250 air and marine shippers have San Francisco offices. The great bridge system and the automobile freeways built in the 1940s and 1950s—and still expanding—nere key forces in both the growth and the internal shifts in activity within the metropolitan area. Vast increases in automobile and truck movements precipitated serious problems of city parking and traffic flow. as well as safety and air pollution. In air and maritime traffic, city and area growth was reflected by gains of more than 100% betneen 1950 and 1960. The fact that rail freight movements in and out of the city remained about level in the same period reflected changes in the economic relation of San Francisco to the rest of the metropolitan area, as well as technological changes in transportation.

As a communications centre. San Francisco is the trans-Pacific headquarters of five radio systems and western headquarters for all telephone and telegraph networks. Military. naval and aeronautical headquarters and communications grids are located in the city. There are nine standard and five frequency modulation radio stations, and four television stations, leading the area in these media of communications and entertainment.

EDUCATION AND CULTURAL ACTIVITIES

From its early days, San Francisco's concern with education was vigorous and area wide. It passed its first public school law in 1851. A century later there were 120,000 students enrolled in the public schools of the city. An additional 30,000 pupils were in Catholic and Protestant schools. About 40,000 more were students in the colleges and universities in or near San Francisco. Nearly 40.000 men and women were participants in various forms of adult education.

In higher education, St. Ignatius' college (Roman Catholic) was chartered in 1855 and rechartered in 1930 as the University of San Francisco, St, Mary's college (Roman Catholic, later moved to Oakland and, finally, to Moraga Valley) in 1863. Mills college (founded 1852) for women moved from Benicia to Oakland in 1871. The site of the University of California, a land-grant institution, was selected in Berkeley in 1857; and in 1855, at Palo Alto, Leland Stanford, California's Civil War governor and one of the "Big Four" in railroad development, began building the university he named as a memorial to his deceased son, Leland Stanford, Jr. Within the city, in addition to the University of San Francisco, are San Francisco State college (1899), San Francisco College for Women (Roman Catholic, 1930, formerly college of the Sacred Heart at Menlo Park, 1898), City College (1935, a two-year public junior college) and the California School of Fine Arts (established as School of Design, 1874). Important branches of the University of California are also located in the city. Extension programs of the colleges and universities, and public adult education programs engaged an increasingly large number of residents.

The city's 19th-century cultural history was distinguished in literature. Among its writers in the 1860s and 1870s were Samuel L. Clemens (Mark Twain), Bret Harte, Joaquin (Cincinnatus Heine) Miller and Henry George; followed by George Sterling. Gelett Burgess, Ambrose G. Bierce, Edwin Markham, Hubert H. Bancroft, the historian, and the turn-of-the-century naturalistic novelists Jack London and Frank Norris.

Early San Francisco theatres and concert halls were important centres of western American culture. They continued to flourish in the 20th century. Though dependent upon New York for its road shows. San Francisco's numerous professional and amateur little theatres are distinguished and lively. Annual opera and symphony seasons of first quality; continuous art exhibits at public and private galleries; touring concert artists and ensembles—as well as motion pictures and television—maintain a constant and varied cultural program unequaled elsewhere in the metropolitan area.

In the mid-20th century, San Francisco and its neighbouring cultural centres continued to foster the creative arts. Novelists such as Walter Clark. Wallace Stegner. George Stewart, Mark Harris and Arthur Foff; poets such as Yvor Winters, Josephine Miles. Kenneth Patchen and Kenneth Rexroth; and critics such as Mark Shorer were active. Many were on the faculties of bay area colleges and universities. From jazz to serious composition (*e.g.*, Darius Milhaud on the Mills college faculty) in music. in sculpture (Beniamino Bufano) and in painting and design. San Francisco's artists earned recognition for experiment, sharing attention with artists in such other centres as Sausalito on the Marin peninsula.

BUILDINGS, STRQETS AND PARKS

In its public and domestic buildings, San Francisco reflects all the prominent architectural styles of the later 19th century and modern periods. 4 distinguished group of 20th-century Renaissance classic buildings in the civic centre includes the city hall, public library, auditorium and state building. Elsewhere, a notable example of the mid-19th-century Greek Revival is found in the building formerly housing the U.S. branch mint. The California Palace of the Legion of Honour, overlooking the Golden Gate, is a replica of the Palace of the Legion of Honour in Paris. Reflecting Victorian and early 20th-century eclecticism are numerous homes originally designed for wealthy 19th-century business and financial leaders: the Palace of Fine Arts near the Presidio (a U.S. military reservation of 1,512 ac.. which includes Ft. Winfield Scott and Letterman General hospital); the post office: the Hall of Justice; the Ferry building built by the state in 1896, 659 ft. long and 156 ft. wide; and the outstanding churches of the city. Notable examples of contemporary design include the V. C. Morris store (Frank Lloyd Wright); the Maimonides Health centre (Eric Mendelsohn); and the Crown Zellerbach office building.

San Francisco churches include the historic Mission Dolores. Grace cathedral (Episcopalian), an unfinished gray stone building of modified Gothic design, and St. Patrick's church! an example of early Gothic architecture which was rebuilt in 1906 after Old St. Patrick's (1854) was destroyed by fire. St. hlary's Cathedral of the Assumption (seat of the Roman Catholic diocese) is a large red brick German Gothic structure completed in 1894, while Old St. Mary's church (Paulist fathers) in Chinatown dates from 1853. The SS. Peter and Paul church (1924) serving the Italian community is of Romanesque design. Temples Emanu-el and Sherith Israel are the San Francisco centres of Reform Judaism; the unique Kong Chow and Tin How temples are monuments to the pioneer Chinese.

Recreational facilities are provided by 54 parks and numerous recreational units. The municipal parks and the several government reservations account for an aggregate of about one-ninth of the city's area. All of San Francisco's parks are man made. The Golden Gate park, in the midst of residential districts, comprises 1,017 ac. and is about 3 mi. long and ½ mi. wide, extending from Stanyan street on the east to the Pacific ocean on the west. In the park are the De Young Memorial museum, Academy of Sciences, Steinhart aquarium, the Museum of Anthropology, an aviary, music temple, stadium, tennis courts, baseball and football grounds, bridle paths, an athletic field and running track, paddocks and children's playgrounds. Improved driveways in the park exceed 25 mi. in length. At the western end of the park is to be seen the sloop "Gjoa," the first vessel to navigate the northwest passage; it was given to San Francisco by its owner, Capt. Roald Amundsen. The Fleishhacker Playfield and Zoological gardens are

set in a landscaped area of a small valley. The city is the home of the national professional football team. the San Francisco Forty-niners, and, since 1958, of the National league baseball team, the San Francisco Giants.

San Francisco's street system was begun in 1835 when Calle de la Fundación, or Foundation street, was laid out. The first survey, made in 1839, covered what is now the financial and retail sections of the city. Other streets and avenues were gradually added until 1845 when Jasper O'Farrell made a second survey. This system applied the "checkerboard layout," with Market street the main artery and division point.

The streets north of Market run north and south and east and west; the streets south run parallel and at right angles to Market street. The Market street slant is about southwest and northeast Among the scenic boulevards are those in the Marina, Twin Peaks and the Market street extension districts, including the Lincoln, Embarcadero and Great Highway paralleling the ocean.

San Francisco's Chinatown, the largest Chinese settlement outside the orient, comprises an area paralleling Grant Ave. between Bush St and Columbus Ave. The "town" is hedged in by the financial, hotel and apartment house districts and a part of North Beach, where once the riotous "Barbary Coast" gave both colour and notoriety to the city The Latin Quarter, where many artists and colonies of Italians, French, Spanish and Portuguese reside, centres on Telegraph and Russian hills. Fisherman's wharf is the picturesque home of the fishing fleet and is renowned for its sea-food restaurants. Beaches, peninsular camping and picnic grounds. and other recreational facilities are within easy motoring distance.

See also Index references under "San Francisco (Calif)" in the Index volume. (J. H. St.)

SAN FRANCISCO CONFERENCE (1945). The United Nations Conference on International Organization (UNCIO) met in San Francisco, Calif., on April 25, 1945 It was attended by representatives of the 46 states that had signed the Declaration of the United Nations, Jan. 1, 1942. Four other states (Ukraine. Belorussia, Argentina and Denmark) were admitted during the conference. The conference ended with signature of the charter on June 26. 1945. Poland, though not represented at the conference. was permitted to become an original member of the United Nations, which thus began with 51 members.

Pres. Franklin D. Roosevelt having died shortly before the conference began, Pres Harry S. Truman formally opened the sessions with a radio message. All of the great powers and many other states were represented by their foreign ministers, some of whom left after the surrender by Germany on May 7. Six international organizations aere represented (the League of Nations. the International Labour organization, the Permanent Court of International Justice, the CN Relief and Rehabilitation administration, the Interim Commission on Food and Agriculture and the Pan American Union). Nearly 10.000 people participated officially or unofficially as members or advisers of delegations. officials or employees of the international secretariat, or as representatives of the press, radio or nensreels.

The San Francisco conference was the first major international conference for two millenniums not dominated by Europe Not only was it remote from Europe geographically, but only nine continental European states west of Russia were represented The 21 American republics, 7 near eastern states, 6 commonwealth nations. 3 Soviet republics, 2 far eastern and 2 African states represented all parts of the world. Nine enemy states (Germany, Italy, Japan, Hungary, Austria, Rumania, Bulgaria. Finland and Thailand), eight neutral states (Switzerland, Spain, Portugal, Sweden, Ireland, Afghanistan, Iceland and Yemen) and Poland, which was unable to organize a government until the conference was over, were not represented.

The Dumbarton Oaks proposals, certain Chinese proposals later adapted by the "big four" (U.S.. U.K.. U.S.S.R. and China) and the Yalta (*q.v.*) agreement on voting procedure provided the agenda of the conference. These documents together with 24 amendments proposed by the "sponsoring powers" (Dumbarton Oaks) and 72 submitted by 40 other nations were classified in a book of over 400 pages for the benefit of the delegates.

The international secretariat provided interpreters, translators and stenographers and distributed documents and speeches every day in the five official languages (English, French, Spanish, Russian and Chinese). The chairmanship of the plenary sessions rotated among the big four. The private consultations of the big four. to which France was later added, in the penthouse apartment of U.S. Secretary of State Edward R. Stettinius, Jr., exerted great influence. The rule of unanimity, usual in political conferences, was abandoned. Measures could be carried in committees, commissions and plenary sessions by a two-thirds vote.

No political conference ever worked so much under the public eye. Plenary sessions and commission meetings were open to the press and the public, thus relegating confidential discussions to the big four consultations and the committees, but even these discussions soon reached the public. Many private organizations were represented by "consultants" who exerted an important influence on certain questions such as human rights and nonself-governing territories.

The charter which emerged from the conference followed the general lines of the Dumbarton Oaks proposals, but gave greater weight to the general assembly. "Justice" was insisted on as well as peace in the settlement of disputes, and the provisions concerning human rights, social and economic progress, nonself-governing territories and trusteeships were greatly elaborated.

Political issues arose, especially between the western powers and Russia, over the admission of the Ukraine, Belorussia and Argentina, the recognition of a government of Poland and the extension of the great-power veto in the Security council to discussion as well as recommendations and decisions. These controversies were settled by compromises. The issues concerning domestic jurisdiction v. international competence, the status of colonial areas, regional and defense arrangements and great power dominance *v.* the equality of states involved other groupings. In these matters the small states, the oriental states and the Latin-American states succeeded in obtaining modifications of the Dumbarton Oaks proposals.

The conference was successful in launching the United Nations with general concurrence, but the release of atomic energy a month after the conference was over, the rising tensions between communism and free democracy and the emergence of many new states in Asia and Africa developed conditions that had not been foreseen and required much adjustment in the actual functioning of the United Nations (*q.v.*).

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SAN GABRIEL, a city of California, U.S., 9 mi. E. of Los Angeles and a part of the Los Angeles standard metropolitan statistical area, is famous as the site of the fourth Franciscan mission in the settlement of the region. Founded in 1771, the well-preserved mission (dating from 1775) owes its massive style of architecture to Father Antonio Gruzado, who modeled the church after a fortress of his native Andalusia.

The first settlement was composed of Indians and their mission guardians who engaged in agriculture until 1834 when the Mexican government took over the lands. After years of confusion, during which California became part of the United States. the mission lands passed almost completely into private ownership. This second community was made up of wheat farms, cattle ranches, vineyards and citrus groves. Modern San Gabriel, incorporated in 1913, is a residential town whose inhabitants work mostly in neighbouring Alhambra and Los Angeles.

It has a council-manager form of government, in effect since 1943. For comparative population figures *see* table in CALIFORNIA: *Population.* (J. A. Sz.)

SANGALLO, the name of a family of Italian Renaissance architects and military engineers active in Florence and Rome.

GIULIANO DA SANGALLO (1445?–1516), who worked. for the Medici in Florence and built their villa at Poggio a Caiano in 1485. His masterpiece is a church of Greek cross plan, the Madonna delle

Carceri in Prato (1485–91). Strongly influenced by Filippo Brunelleschi, it is the purest, most classic expression of that style of 15th-century architecture. In Rome Giuliano was overshadowed by Bramante. He designed influential facade projects for S. Lorenzo. Florence, in 1515–16.

ANTONIO DA SANGALLO, THE ELDER (1455?–1534), who often worked with his brother Giuliano but, under the influence of Bramante, became a more powerful designer. In S. Biagio, Montepulciano (1518–29), he created an ideal central church of the High Renaissance.

ANTONIO PICCONI DA SANGALLO, THE YOUNGER (1483–1546), nephew of the two preceding, was trained in Rome under Bramante and became the most influential architect of his time. In 1520 he succeeded Raphael as architect of St Peter's and held the position until the end of his life. His design, an elaboration of Bramante's, survives in a wooden model. He designed buildings for the Farnese family, including a palace-fortress at Caprarola; his most important work is the Farnese palace in Rome, beguh in 1541. Antonio the younger was an important military engineer and city planner as well as a keen student of ancient architectural remains.

See G. Clausse, *Les San Gallo* (1900–02); G. Giovannoni, *Antonio da Sangallo il giovane* (1959) (B H H.)

SANGER, FREDERICK (1918–), British biochemist awarded the Nobel prize for chemistry in 1958 in recognition of his outstanding achievement in determining the structure of the insulin molecule, was born on Aug. 13, 1918. Educated at Bryanston school and at St. John's college, Cambridge, he worked continuously from 1939 on biochemical research at Cambridge. He was a Beit memorial fellow from 1944 to 1951, and thereafter worked under the auspices of the Medical Research council. In 1951 he was awarded the Corday-Morgan medal and prize of the Chemical society, and in 1954 was elected a fellow of the Royal society and a fellow of King's college, Cambridge. At the time of the completion in 1955 of Sanger's ten years' research on the insulin molecule, this was the largest protein molecule to have its chemical structure elucidated. Sanger's discovery opened the road to the determination of protein structure in general. and it was an essential preliminary to any chemical synthesis of insulin and of related substances which might enable diabetes to be treated more conveniently. (W. J. BP.)

SANGER, JOHN (1816–1889), English circus proprietor, was born at Chew Magna, Somerset, in 1816, the son of a former sailor who had turned showman. In 1845 he started with his brother George a conjuring exhibition at Birmingham. The venture was successful, and the brothers, who had been interested spectators of the equestrian performances at Astley's amphitheatre, London, then started touring the country with a circus entertainment consisting of a horse and pony and three or four human performers. Eventually John and George Sanger became lessees of the Agricultural hall, London, and there produced a large number of elaborate spectacles. In 1871 the Sangers leased Astley's, where they gave an equestrian pantomime every winter, touring in the summer with a large circus Subsequently the partnership was dissolved, each brother producing his own show. John Sanger died while touring, at Ipswich on Aug. 22, 1889, the business being continued by his son.

SAN GERMÁN, a town in the southwestern part of Puerto Rico, is one of the two original settlements established by the Spaniards on the island. Pop. (1960), town 7,779, municipal district 27,658. Founded in 1508 by order of Diego Colón, a son of Columbus, San Germbn was repeatedly destroyed by attacks of Indians and French pirates and was moved inland from the exposed seacoast in 1573. The modern town was the seat of government for the western district during several centuries. Along one of the town's plazas stands the Porta Coeli convent, more than 400 years old and one of the oldest buildings in the West Indies. It is now a museum. San Germbn is the home of Inter-American university, a private and fully accredited institution whose campus is built on a series of hills near the town.

Modern highways connect San Germbn with Ponce on the south coast and Mayagüez on the west coast. The rural area surrounding San German produces sugar and coffee. To the south on the Caribbean coast near the fishing village of La Parguera is a famous phosphorescent bay where the college of agriculture and mechanical arts of the University of Puerto Rico maintains an institute of marine biology and a zoological park. (T. G. Ms.)

SANGIHE (SANGIR) AND TALAUT (TALAUD) ISLANDS, two groups of islands off the northeast coast of Celebes, Indonesia. Area of the Sangihe Islands 217 sq.mi.; of Talaut Islands 495 sq.mi. Pop. (1956 est.) of Sangihe Islands 86,232; of Talaut Islands 30.632.

The Sangihe Islands continue the northeastern extension of Celebes toward Mindanao, in the Philippines, and are set upon a long, narrow ridge, along a volcanic band, with very deep water on either side.

Although fringed with recent coral formation, they are distinctly volcanic, with active volcanoes, Mount Awu, on Sangihe Island, having experienced recent severe eruptions, while earthquakes also have occurred. Sangihe, Siau and Tagulanda are the chief islands, and Talisse and Banka (Banka lies off the east coast of Sumatra) are between Tagulanda and the mainland of Celebes.

Banka gives its name to Banka passage, the channel by which entry is obtained from Celebes sea to the Molucca passage. Sangihe is 28 mi. long, and from 4 to 13 mi. in width, is mountainous in the north, elevation decreasing considerably in the south, and has a coast which is generally steep. There is extensive cultivation of nutmegs, coconuts and Manila hemp. Taruna. on the west coast, and Peta, on the east coast, are regular ports of call; also Hulu, the capital and port of Siau, and Tagulandang, and Talisse. on the islands of that name. Ruang, a small island west of Tagulandang, has an active volcano.

The people of Sangihe and Siau are closely related to the people of Minahasa and of portions of the Philippine Islands. The Talaut. or Talaud. Islands consist of a group lying northeast of Sangihe, the chief of which is Karakelang. The coast is steep. except on the south shore. which is fringed by a wide reef. Some tiny islands known as the Nanusa Islands lie northeast of Karakelang. (E. E. L.; X.)

SAN GIMIGNANO, a town of Toscana, Italy, in the province of Siena, 24 mi N W. of Siena. Pop. (1951) 3.616. It is a medieval town in appearance. In the Palazzo Comunale (1288–1323) is a fresco by Lippo Memmi of the Madonna enthroned (1317). The Collegiata of the 12th century was enlarged after 1466 by Giuliano da Maiano. whose brother Benedetto carved the altar and ciborium in the chapel of S. Fina. The beautiful frescoes are the earliest work of Domenico Ghirlandajo (1475). The cathedral also contains New Testament scenes by Barna da Siena (1380) and some fine choir stalls. S. Agostino (1280–1298) contains frescoes by Benozzo Gozzoli, with scenes irom the liie of St. Augustine (1463–1467). The town was independent in the 13th century, but in 1353, because of the dissensions of the Salvucci (Ghibellines) and Ardinghelli (Guelphs), it fell into the hands of Florence.

SAN GIULIANO, ANTONINO PATERNO-CASTELLI, MARQUIS DI (1852–1914), Italian statesman, was born at Catania on Dec. 10, 1852. After graduating in law at the University of Catania he became, in 1879, mayor of his native city, and in 1882 was elected to parliament. When in 1892 G. Giolitti became premier. San Giuliano was selected as undersecretary for agriculture, while in the second Pelloux ministry (1899–1900) he held the portfolio of posts and telegraphs. Having been defeated at the election of 1904, he was nominated senator. In Dec. 1905 A. Fortis appointed him minister for foreign affairs, and in 1906 he was appointed ambassador in London. Transferred to Paris, he returned to the Consulta in 1910 as foreign minister. San Giuliano believed in the Triple Alliance but he carried out the policy of neutrality adopted by Italy on the outbreak of World War I. San Giuliano died in Rome on Oct. 16, 1914.

SANGLI, formerly a princely state composed of scattered territories (total area 1,146 sq.mi.; pop., 1941, 293,381) in the Deccan Kolhapur agency; merged into Bombay state on March 8. 1948. Sangli town (pop., 1951, 50.287) is the headquarters of Satara South district, Bombay state, India. It is known for the manufacture of brass and copper vessels and has a textile mill.

Willingdon college and the New Engineering college are institutions of Poona university.

SANGRE DE CRISTO, a range of the Rocky mountains, consists of a narrow, elongated, steep anticlinal uplift extending for about 220 mi. from Salida, Colo., southward to Santa Fe, N.M., U.S. The range was supposedly named by the Spanish explorer Antonio Valverde y Cosio in 1719 while breaking camp in the Purgatoire valley in Colorado. He was so impressed by the red-tinted. snowy peaks at sunrise that he uttered a fervent "Sangre de Cristo" ("blood of Christ"). These colourfully named mountains have many spectacularly glaciated peaks including the highest elevation, Blanca peak, 14,317 ft. Two outstanding land forms, Great Sand Dunes National monument and the volcanic Spanish peaks (13,623 ft.), are located near the western and eastern foothills. (A. W. SM.)

SANHEDRIN (sometimes incorrectly written SYNEDRIUM or SANHEDRIM), the supreme rabbinic court in Jerusalem during the Second Commonwealth era. The term is a hebraization of the Greek *synedrion,* meaning "assembly"; the term also is used for the Areopagus in Athens.

Rabbinic sources speak of a Great Sanhedrin of 71 members and of smaller Sanhedrins, trial courts of 23. judging criminal cases or violations of Jewish law. The Great Sanhedrin as a permanent institution is to be distinguished from the temporary Great Assembly of that era. Meetings of the Great Sanhedrin were held on the Temple Mount in Lishkat Hagazit (Chamber of Hewn Stone [or Decision]). Talmudic tradition pictures the Great Sanhedrin as the highest legislative and judicial court of Halakah (rabbinic law), headed by a duumvirate known as nasi (head) and ab bet din (father of the court), whereas nonrabbinic sources describe the institution as a political-executive and judicial body headed by the high priest. Though some scholars have sought to regard the rabbinic picture as an academic reconstruction, descriptive of the patriarchal court of the 2nd century C.E., the discrepancy of sources is easily explained in recognizing the existence of two contemporary bodies, one strictly religious, the other wholly secular or the civil authority.

The Mishnaic Sanhedrin consisted of scribes (soferim) who interpreted the Halakah, whereas the Synedrion, described in Josephus and the Gospels, was composed of the aristocracy of the state. including Pharisees and Sadducees. and served only as the secular state council of the high priest. The trials of Jesus and the Apostles as portrayed in the New Testament were before the priestly state Synedrion, sanctioned by Pontius Pilate. Jesus was crucified by the Romans and not by the Great Sanhedrin as "king of the Jews." Though the Jews were allowed to administer capital punishment, this right was restricted to religious lam.

In biblical days justice was administered by the kings (such as David or Solomon) or by the chieftains (*shofetim*). In early postexilic days (4th and 3rd centuries B.C.E.) the priests with their *gerousia* (council of elders) served as the judges. However, in 141 B.C.E., with the Hasmonaean victory over the Syrian Greeks, a new commonwealth mas established. The Great Sanhedrin was then instituted as a specialized body of Halakah to interpret Jewish law. Ritual matters of the Temple were left to the council of priests, and the government administration belonged to the monarchs and city officials in their executive boule (council).

Among the functions of the Great Sanhedrin were the enactment of decrees for religious observances, judging violations thereof, serving as the court of higher appeal, supervising smaller courts and controlling the priestly ceremonials in the Temple. Particularly did the body uphold the sanctity of the traditional lam and its oral interpretations as based upon the written law of the Torah. The functions and procedure of the Great Sanhedrin are discussed in the talmudic tractate Sanhedrin.

The first heads of the Sanhedrin were known as *zugot* (pairs). They were not merely president and vice-president of the body, but majority and minority leaders, representing the conflicting opinions current in the institution. The Sanhedrin was dissolved in 66 C.E., four years before the destruction of Jerusalem by the Romans in 70 C.E.

Among the leaders of the Great Sanhedrin were such men as Simon ben Shetah, who enacted laws for universal education, for rights of women and for the administration of trial courts and acceptance of testimony; he was a contemporary of Alexander Jannaeus (*c.* 100 B.C.E.). Another head nas Hillel (*q.v.*), whose dictum, "That which is hateful to you, do not do unto your neighbour." is considered as the basis for the similar maxim found in the Sermon on the Mount. Hillel's leniency in halakic interpretation illustrates the mode of Jewish harmonization of law and life. His descendants established the patriarchate in Palestine.

In the course of Jewish history many rabbinic institutions sought to exercise the power of this traditional Sanhedrin. Such were the patriarchate in Palestine (100–415 C E.) and the gaonate (see GAON) of Babylonia (660–1040 C.E.). where various academies of learning thrived. A bold attempt to reinstitute the body was made by Rabbi Jacob Birab and Rabbi Joseph Qaro in the early 16th century, after the expulsion of the Jews from Spain. with the direct purpose of receiving the marranos back to Judaism. Napoleon Bonaparte also. in 1806, sought to organize a Sanhedrin to decide the conduct of laws for the French Jews. The Paris Sanhedrin met in Feb. 1807 and agreed that the principles of a liberal, secular state were compatible with the laws of the Jewish religion. With the establishment of the state of Israel in 1948, hopes rose among some Orthodox Jews for the revival of the Great Sanhedrin. Many groups within Orthodoxy and outside its ranks oppose any such effort.

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SANITATION: see HYGIENE; PREVENTIVE MEDICINE; PUBLIC HEALTH; and such specific related articles as PLUMBING; SEWAGE DISPOSAL; etc.

SANITATION, MILITARY. Simply stated, military sanitation is the practical application of the laws and principles of sanitary science within a military framework. Its scope and underlying principles are basically the same as sanitation and hygiene elsewhere.

Sanitation is the effective use of measures that will create and maintain healthful environmental conditions. Traditional among these are treatment of water, safeguarding of food and control of disease-bearing insects and rodents. More recently, measures directed against air pollution, noise, radiation and chemical hazards have been included.

Hygiene is the employment by the individual of practices that a-ill keep him healthy. These include proper nourishment, personal cleanliness and the avoidance of known sources of disease.

Military sanitation includes the practice of both environmental sanitation and personal hygiene, within the situations and experiences associated with military life. Thus it is a special application of general sanitation; the nature of the population toward which it is directed and the environment within which it must be applied are sufficiently distinct to warrant its consideration as a distinct specialty of the art.

The predominant characteristic of military populations that affects military sanitation is their lack of permanence. They are constituted by bringing together large numbers of individuals of many different backgrounds, generally in an environment that is comparatively primitive. Even after formation into military units they do not become static. Training requirements, changing political forces and constant turnover of personnel keep individuals and units ever moving. In peacetime these forces may be less intense and a degree of stability may be achieved. Gnder such circumstances sanitary problems lose their peculiar military character and sanitary practices more nearly resemble those of fixed civilian communities.

Another special characteristic that affects the nature of military sanitation is the composition of the population. Military forces are made up predominantly of young adult males in good physical condition. Although the armed forces are often responsible for civilian employees and for the families of both military and civilian personnel. this responsibility does not usually require significant deviations from customary civilian practice. In striking contrast, however, are the problems attendant upon the care of large num-

bers of refugees, displaced persons and other civilian populations which may come under military control, especially during wartime. Planning of military sanitary programs must include provision for these groups.

Military activities are generally group activities that continue for protracted periods of time. Therefore there is great opportunity for multiple and extended contact, a factor which fosters outbreaks of disease. Though basically healthy, military personnel are subjected to a great deal of mixing with other individuals of markedly different disease experience. This loss of protection afforded by the group immunity of the civilian groups from which they come leaves them potentially more susceptible to epidemic disease until their own group immunity is developed either artificially by immunization or naturally by infection.

Historical Background. — Whenever large groups of people have gathered in temporary locations, some efforts at sanitation have undoubtedly been made. Classically quoted is the Mosaic dictum (Deut. xxiii, 12–13), "You shall have a place outside the camp and you shall go out to it; and you shall have a stick with your weapons; and when you sit down outside, you shall dig a hole with it, and turn back and cover up your excrement." Although sanitary benefit undoubtedly derived from the law, an examination of the next verse makes it clear that its basis was aesthetic. "Because the Lord pour God walks in the midst of your camp, . . . therefore your camp must be holy. that he may not see anything indecent among you. . . ." This confusion of the sanitary and the aesthetic has plagued practitioners of the sanitary art ever since. Cleanliness rather than disease prevention has often erroneously been considered the goal of sanitation.

Herodotus described what is probably the earliest known instance of treating water for human consumption in a military organization. He wrote that, when going to war, Cyrus the Great, king of Persia (6th century B.C.), transported boiled water in silver flagons loaded on four-wheeled cars drawn by mules. It is likely that this was an effort to convert fresh water into a more stable product through killing of algae, etc., rather than a true sanitary measure.

More likely to have been a military application of a sanitary practice was the order issued by Timur (Tamerlane) that his troops were to drink only water that had been previously boiled. It is believed that this practice, rigidly enforced, may be credited with having protected his army from the decimating epidemics of enteric infection so common in armies. Whether this order stemmed from superstition, magic or pragmatic observation is not recorded.

In spite of these efforts, military history is replete with examples of the devastating effect of epidemic diseases upon military operations. It has been said that soldiers rarely win wars; they more often mop up after a barrage of epidemics. Until the 20th century, epidemics of dysentery, typhoid fever, malaria, typhus fever, yellow fever, etc., decided the course of military campaigns more often than did the force of arms.

As late as World War I disease significantly affected the course of military operations. The Austrian attack and the Serbian counterattack in the fall and winter of 1914 left northern Serbia a shambles. Villages were in ruins and the civilian population had fled to the south. Typhus appeared in the Serbian army in Nov. 1914; in February and March of 1915 the epidemic exploded violently, reaching a case fatality rate of 70%. In less than six months. 150,000 people had died of typhus. During this period a military stalemate existed in the Balkans; Serbia was helpless, yet Austria dared not attack because of fear of the disease. Typhus fever held the battlefield. It is not unlikely that this delay of six months in the Austrian attack may have tipped the balance of victory. A quick drive to Salonika, neutralization of Turkey, Bulgaria and Greece and the development of a southern front against Russia might have led to an early capitulation to the Central Powers. Typhus may not have won the war for the Allies, but it probably helped avert defeat.

In contrast was the experience less than 30 years later of the U.S. army when it met typhus in Naples during its drive northward through Italy. There, because of DDT and an effective sanitary organization to use it, for the first time in history an epidemic of typhus fever was brought to a standstill in midwinter. Because of effective environmental sanitation, armies need no longer fear their traditional scourge.

Scope of Military Sanitation. — The primary function of military sanitation is that of all military health programs — conservation of fighting strength. Effective manpower is a nation's most valuable military asset; its protection is an essential military mission. Even though in recent wars more deaths have resulted from enemy action than from disease, disease still causes the greatest loss of military manpower through disability and time lost from duty. Success in battle — the ultimate objective of any military force — demands that personnel be maintained in a constant state of combat readiness. Military sanitation contributes to this effort by employing measures to protect and improve the health of personnel.

Because there is little in the environment and in personal action that does not ultimately affect health, the scope of military sanitation is broad. Problems generated by the creation of a temporary community must be solved. These include the disposal of excreta, sewage and community waste in a safe and economical manner. Attention must be paid to the logistic problems of the supply and handling of water, milk and other foods to ensure that these items do not become health hazards. Definition of the potential or actual role of insects and rodents in the transmission of human disease and the implementation of effective measures for their control loom large in military sanitation programs. The safety, industrial and radiation hazards of the environment are of ever-increasing importance in the domain of the sanitary engineer. Associated with all of these may be the problems inherent in arctic, desert and jungle operations.

In general, the measures employed in combating these problems, as well as others in the field of environmental hygiene, are carried out for the individual, often without his knowledge. Their effectiveness does not necessarily depend upon his co-operation. In contrast are the measures employed in personal hygiene. These must be carried out by the individual. They include personal cleanliness, care of the feet and skin (particularly in tropical and arctic areas), rest and recreation, protection against the elements, protection against insects and personal protective action to avoid potential sources of disease such as those of malaria, enteric disease and the venereal diseases. In such a broad field, the military sanitarian must select his targets so that his efforts will not become merely diffuse and ineffective. He must continually evaluate the situation to determine which health hazards are of real military significance. Maximum results from the effort expended may then be expected.

Contributions of Military Sanitation. — Though military sanitation is but a segment of the field of sanitation as a whole, it has made many significant contributions to the general body of knowledge and guided the way to many practical advances. Military forces are commonly thrust into foreign areas where health hazards are little understood. Such conditions provide both the opportunity and the necessity for the development of simple, effective techniques for the control of environmental hazards.

Sometimes the problem requires research to determine the cause of disease. The linking of Aedes *aegypti* to yellow fever by Maj. Walter Reed (*q.v.*) and Lieut. Bailey K. Ashford's demonstration that malignant Puerto Rican anemia was caused by massive hookworm infection are examples. Sometimes the contribution has taken the form of the practical application of knowledge. Such was the work of Maj. William Crawford Gorgas (*q.v.*) in Havana and Panama in mosquito control and Maj. Frederick F. Russell's inoculation of the U.S. army against typhoid fever.

One of the most significant contributions of military sanitation, and probably the one most nidely adopted in civilian practice, relates to the chlorination of water to make it potable. In 1910 Maj. Carl R. Darnall, who had previously developed a widely used mechanical filter for water treatment, first used chlorine gas supplied from steel cylinders of liquid chlorine to sterilize drinking water. Chlorination of public water supplies is now practised throughout the world. In addition, Maj. William J. L.

Lyster's (1913) method of treatment of small water supplies with calcium hypochlorite or a similar chemical is still commonly used.

Program Planning. — Of all the many principles that military sanitation has in common with civilian practice, at least two are worthy of special mention. Not that they are any more applicable in military practice, but here the cost of failure to observe them is measured in human life. not in dollars.

Environmental sanitation deals with health problems whose importance and nature demand long-range planning and the use of special skills for their solution. In order that personnel and facilities may be available at the proper place when needed to meet such problems as water treatment and distribution, sewerage and sewage treatment. refuse collection and disposal and insect and rodent control. the skills of sanitary engineers should be utilized early in the planning stages of military operations. These experts should be consulted in selection of campsites. approval of designs, planning of landing operations and movement of large bodies of troops. Prior planning here may not only preclude poor performance, but may sometimes avert disaster.

Because sanitary engineers. in common with others possessing special technical skills. are always in short supply during periods of emergency. they should be utilized only in work that requires this specialized knowledge and experience for its performance. For example, such knowledge is needed in selecting designs for water-treatment and sewage-treatment plants to ensure efficient operation. It is needed in many phases of insect and rodent control, such as area survey and determination of how engineering can best contribute to the over-all program. Although the purpose of environmental-control measures is medical. the method by which they are accomplished is engineering. The skill and knowledge of the highly trained engineer should be brought to bear where they may do the most good. His talents must not be dissipated in the routine day-to-day sanitary housekeeping at military camps, for the handling of which nonprofessional technical skills are normally sufficient. *See* also MEDICAL SERVICES. MILITARY. (H. E. GR.)

SANJŌ SANETOMI (1837–1891), was one of the court noble statesmen in the Japanese imperial government established in 1868. Sanjō's service in high office helped emphasize the importance of the throne and the imperial court. whose power the feudal lords had usurped for so long. He held the post of first minister of the council of state during most of the period from 1871 to 1885. His most important function mas to serve as spokesman for the bureaucracy which ruled in the name of the emperor Meiji. For example, it was Sanjō who promulgated the imperial rescript of Oct. 12, 1881, promising a parliament and constitution. The most important and dramatic moment in his career occurred in 1873, when the faction which advocated war with Korea pressed him to secure imperial approval. Unable to bear the pressure of decision, he turned his post over to his colleague, Iwakura Tomomi, who was able to defeat the plans of the war party. Finally. in 1885, when the modern cabinet system was instituted in preparation for constitutional government, Sanjō was elevated to the post of lord keeper of the privy seal. (GE. M. B.)

SAN JOSE, a department in southern Uruguay. Pop. (1954 est.) 106.789. Area 1.912 sq.mi. A major steel railroad bridge permits easy communication with Montēvideo. about 60 mi. away. There are also road, sea and air routes to the national capital. As elsewhere in southern Uruguay. closeness to Montevideo's markets encourages dairying and agriculture. Poultry and swine are increasingly important. San José is a ranching region and its breeding establishments service a wide area; both cattle and sheep are raised. The departmental capital is San José (pop., [1954 est.] 13,500). (M. I. V.)

SAN JOSE (Sax JOSÉ DE COSTA RICA), the capital of the republic of Costa Rica, is located on the Jleseta Central, 3.880 ft. above sea level. It is an important point on the Inter-American highway and the junction of the Northern railway from Limón and the Pacific railway from Puntarenas. Pop. (1950) 86,909. The year-round climate is moderate, divided into a wet and a dry season. San José developed very slowly in the Spanish colonial era; it was called Villa Nueva when it was founded in 1736. Its early source of wealth was the tobacco trade. Following independence in 1821, San José citizens briefly fought those of Cartago and in 1823 the capital of the republic of Costa Rica was moved from Cartago to San José.

In the 1840s San José emerged as the centre of coffee production. chief source of Costa Rican wealth throughout the 19th century. The political, social and economic centre of Costa Rica and an episcopal see. San José grew very rapidly in the 20th century, especially in its suburbs. The number of industrial establishments doubled between 1952 and 1956. Commerce is carried on mainly by a large number of small operations. Costa Rica's substantial import trade is centred in San José.

The city has paved. electrically lighted streets, a large central market and excellent hospitals. schools and parks. The University of Costa Rica is in San José as are the 18th-century cathedral and the imposing national theatre. The city is the capital of San José province (1.892 sq.mi.), a fertile coffee- and livestock-raising area. The population of the province increased 84% between 1927 and 1950. Serving the province is the international airport. El Coco, about 12 mi. from San José. Just outside the city is the beautiful plain known as La Sabana, lined with lovely homes. The National stadium occupies one section of the Sabana. The city is increasingly popular with foreign tourists.

(T. L. K.)

SAN JOSE, known as the "Garden city," in west central California, U.S., is the principal city and county seat of Santa Clara county. Located on the level floor of the Santa Clara valley between the Diablo range and the Santa Cruz mountains. it is 50 mi. S. of San Francisco and 30 mi. N.E. of Monterey bay. Pop. (1960) city 204,196; standard metropolitan statistical area (Santa Clara county) 642,315. Included within the metropolitan area are the cities of Palo Alto, Santa Clara and Sunnyvale (*qq.v.*). For comparative population figures see the table in CALIFORNIA: *Population.*

Founded on Nov. 29. 1777, as El Pueblo de San José de Guadalupe by José Joaquin hloraga under orders from Felipe de Neve, Spanish governor of Alta California, and named for St. Joseph, California's patron saint. it was California's first civil community. During the Spanish and Mexican periods it supplied wheat, vegetables and cattle to the garrisons of the presidios in Monterey and San Francisco. Located 3 mi. from Mission Santa Clara (founded 1777) and 16 mi. from Mission San José (founded 1797). San Jose also became the centre for ecclesiastical activities in the area. Some of this rich heritage is retained in the colourful Spanish place names for streets and districts.

The U.S. flag was raised above San Jose during the Mexican War on July 14. 1846, and it remained a U.S. city. It became California's first state capital. and the first state legislature ("the legislature of 1,000 drinks") convened there on Dec. 15. 1849. It was also the home of Peter H. Burnett, the state's first elected governor. However, San Jose was not destined to be the seat of government for long; in Jan. 1852 the capital was removed to Vallejo. One of California's first cities. San Jose was incorporated in March 1850. and by this date had changed from a drowsy little Spanish pueblo to a bustling trading centre and quicksilver denot for the gold fields. Most of California's auicksilver. used in the amalgamation process of extracting gold from ores, came from New Almaden, 13 mi. S.

In 1864 the coming of the railroad from San Francisco gave San Jose improved trade connections and new industries began to vie nith the agriculture of the valley. The area soon developed into a fruit-producing region nith French prunes (introduced by Louis Pellier, 1856) and apricots predominating. San Jose was long the centre of the world's dried-fruit and canning industry and until 1940 most of its industry was concerned with food processing or preserving and with manufacturing orchard supplies and food machinery. After World War II, honever, there was a meteoric rise in the manufacture of durable goods such as electrical machinery. ordnance, aircraft parts and automobiles. During this period the population of San Jose doubled and thousands of new single-story, single-family homes began to replace the orchards and farms Displaying the better features of suburbia and without the worst features of a metropolis, San Jose's newer districts contain dis-

persed shopping facilities in several subcentres like Willow Glen, Valley Fair and East San Jose, each a complete community for family living within the confines of the city. With a moderate climate and only one hour's drive from San Francisco, San Jose also became an attractive suburban settlement for many workers in the bay area.

The council-manager type of government came into effect in 1916. The city's public-school system includes a large modern junior college, established in 1921. San Jose State college (founded 1857) is the oldest and the largest California state college. Two universities, Santa Clara (Roman Catholic) and Stanford (private), are nearby. The civic auditorium, city symphony. Alum Rock park, the municipal rose garden, the Egyptian museum and numerous parks and playgrounds are other noteworthy community assets of San Jose. (D. T. M.)

SAN JUAN, an Andean province of Argentina, bounded north and east by La Rioja, south by San Luis and hfendoza and west by Chile, from which it is separated by the Andean cordilleras. Area 33,257 sq.mi. Pop. (1960) 352,461. It is roughly mountainous. and belongs to the closed drainage basin of western Argentina, centring in the province of hfendoza. It is traversed by several rivers, fed by the melting snows of the Andes and discharging into the swamps and lagoons in the southeastern part of the province, the largest of which is Huanacache. The largest of these rivers are the Bermejo, Jachal or Zonion and San Juan, all used for irrigation. The climate is extremely hot and dry in summer, but the winter temperature is mild and pleasant. Agriculture is the principal occupation of the inhabitants, though the soil is generally sterile and the rainfall uncertain and very light. Cereals are grown in some localities. and fruits and wine grapes of excellent quality are cultivated under irrigation on a large scale.

The province contains gold, silver, copper. iron, lead, coal and salt. Pastoral interests are largely in feeding cattle for the Chilean markets, for which large areas of alfalfa are grown in the irrigated valleys of the Andes. Rail communication is provided by the Belgrano and the San Martin railways.

The capital of the province is San Juan (pop. [1960] 106,776), in a great bend of the San Juan river, 97 mi. N. of Mendoza and about 750 mi. from Buenos Aires by rail. The city was founded in 1562 by Juan Jufré, a companion of Pedro del Castillo, the founder of Mendoza, and was the capital of the province after 1820. The original settlement, named San Juan de la Frontera and now referred to as Pueblo Viejo, 4 mi. N., was abandoned in 1593 because of frequent inundations. The present town is about 2,163' ft. above sea level and is defended from inundations by an embankment called the Murallón. The city has suffered severely from political disorders. In 1894 and 1944 it was nearly destroyed by earthquake. With the possible exception of the earthquake of March 20, 1861, which completely destroyed the city of Mendoza, Argentina never suffered a greater disaster than the earthquake that occurred in San Juan province on Jan. 15, 1944. Whatever the intensity of the shock may have been elsewhere in the province, the worst damage and greatest loss of lives were sustained by the city of San Juan. More than 90% of the buildings, including the cathedral, the government house, municipal building, churches, schools, hospitals, railway station and historical monuments, were either destroyed or damaged beyond repair, and the toll of lives was numbered in the thousands.

(R. W. Rd.; X.)

SAN JUAN, the capital of the island of Puerto Rico, is the oldest city under the U.S. flag. Pop. (1960) 432,377. In 1508 Ponce de Leon founded the original settlement, called Villa de Caparra. near the shore of a perfectly protected harbour opposite the present site of San Juan. The unhealthful conditions forced the Spaniards to move in 1521 to the present location on a very small island protecting the entrance to the harbour (see PUERTO RICO: History). Since the city was subject to frequent foreign attacks, the Spanish constructed several large fortifications and a massive wall, two parts of which still stand. with moats, gates and bridges. On a high bluff guarding the entrance to the harbour is the formidable Morro castle; and to the east overlooking the Atlantic is the great fortress of San Cristóbal.

Other buildings of historical interest include La Fortaleza, the home and office of the governors, the construction of which was started in 1533; the Casa Blanca, built for the descendants of Ponce de León (1523); the cathedral, originally constructed in 1512 but rebuilt in 1549; and the city hall. built on the principal plaza in 1602. The government of Puerto Rico, through the Institute of Puerto Rican Culture, has undertaken in every way possible the restoration of the historical aspect of old San Juan, with its narrow cobblestone streets, overhanging balconies, cool porticoes and 19th-century lights.

In the 20th century the city expanded rapidly beyond its walled confines, incorporating such suburban areas as Miramar, Santurce and El Condado along the coast and Rio Piedras and Hato Rey inland. In 1960 the standard metropolitan area of San Juan, with a population of 588,805, included the urban areas of Bayamón, Cataño, Guaynabo and San Juan. In these newer areas are found beautiful modern buildings, such as the Lawyers' Association building in Santurce, the Roman Catholic church of Cataño and in Rio Piedras the library of the University of Puerto Rico with its famous mural by the Mexican painter Rufino Tamayo.

Politically, culturally, socially and commercially the metropolitan area is the centre of Puerto Rico. The governor's home and office are still in the Fortaleza in old San Juan. A marble capitol of the classic type houses the bicameral legislature and nearby, in the same area of Puerto de Tierra, is the modern building of the supreme court of the island. In an effort to decentralize the metropolitan area many government offices and agencies have been moved back across the bay to a location not too distant from the original site of Caparra.

The Institute of Puerto Rican Culture, Carnegie library, the Atheneum and the School of Tropical Medicine are centrally located near old San Juan. In addition to the University of Puerto Rico an excellent bicultural education is offered by such schools as the College of the Sacred Heart and Robinson school. The Casa de España, the Puerto Rico casino, the Yacht club and a number of private country clubs offer social activity for their members. Entertainment facilities include horse racing at a large modern hippodrome between Río Piedras and Carolina and night baseball during the winter season with big league players.

San Juan has one of the largest and best protected harbours in the West Indies. Fully equipped with modern docking facilities and a dry-dock service, the harbour receives freight and passengers from the Atlantic! Gulf and Pacific ports of the U.S., from South and Central America, the countries of Europe and the other West Indian islands. hfost of the people coming to the island arrive by air at the San Juan International airport. The airlines of three continents and the West Indies make San Juan a regular stop. Most of those arriving for the first time, whether by plane or boat. are tourists staying for short periods at the ultramodern tourist hotels located for the most part along the Atlantic coast between old San Juan and the airport to the east. In the commercial centres of San Juan, Santurce and the other suburban areas many U.S. chain stores, banks and important corporations have local offices and distributing centres. (T. G. hls.)

SAN JUAN DE LA MAGUANA: see BENEFACTOR.

SAN JUAN (HARO) ISLANDS, an archipelago of 172 habitable islands and several hundred tide-mashed rocks in upper Puget sound south of Georgia strait and east of the Strait of Juan de Fuca; politically it is a part of the state of Washington. The islands are geologically part of a submerged mountain chain whose summits appear in the ocean-filled trough where British Columbia and Washington meet. They were first explored and named during the expedition of Francisco Eliza in 1790–92. They were also visited by Capt. George Vancouver in 1792 and Charles Wilkes of the U.S. navy in 1831. They were occupied for a time by the Hudson's Bay company, then subjected to a dispute between Great Britain and the United States over their ownership. In 183'9 troops of both nations landed on San Juan Island. For a few weeks there was imminent danger of war but trouble was averted when both nations agreed to arbitration. In 1872 the emperor of Germany assigned them to the United States. The population is almost exclusively Caucasian and the permanent population is sta-

ble. Between 1940 and 1950 the number of permanent residents increased only 3% while the population of the rest of the state increased 37%. The islands are used extensively for summer homes and camps. The highest point in the group is Mt. Constitution on Orcas Island. at 2,408 ft. The rainfall of the islands is light, averaging less than 30 in. a year. Of the total area of the islands (265 sq.mi.), 79% is in the three largest islands of San Juan. Orcas and Lopez.

See David Lavender, Land of **Giants** (1958) ; Dorothy O. Johansen and Charles M. Gates, *Empire of the Columbia (1957).* (K. A. M.)

SAN JUAN RIVER, low-gradient. easterly flowing Central American stream through which Lake Nicaragua discharges to the Caribbean sea. For much of its 120-mi. course the right bank marks a segment of the Nicaragua-Costa Rica frontier. Anglo-American rivalry for this potential transisthmian water route was adjusted by the Clayton-Bulwer (1850) and Hay-Pauncefote (1901) treaties. In the Bryan-Chamorro treaty (signed 1914; ratified 1916) Nicaragua granted the United States rights to construct a canal. (J. T.)

SAN JUAN RIVER, in the southwestern United States. the second most important tributary of the Colorado river system, rises in the San Juan mountains of southwestern Colorado on the west side of the continental divide in Mineral county. The river flows west and is 360 mi. long; it empties into the Colorado 80 mi. upstream from Lee Ferry, Ariz. Important tributaries of the San Juan in northwestern New Mexico are the Animas, Los Pinos, Piedra. La Plata and Mancos rivers. In this area the river valley widens and some irrigation agriculture is practised. At "Four Corners," where the boundaries of New Mexico, Utah, Arizona and Colorado meet, the San Juan enters the Colorado plateau into which it has carved numerous S-shaped canyons over 1,000 ft. deep. This section of the river is known as the Goosenecks. From the Goosenecks the San Juan flows through wild. rugged, desert country in a relatively straight, deep canyon to the Colorado. The San Juan is one of the important rivers in the multiple-purpose development of the upper Colorado river. discharging almost 2,000,000 ac.ft. of water annually into the Colorado. The Navajo dam is an irrigation and flood-control project on the San Juan in northnest New Mexico. (M. J. L.)

SANKA, a pariah group in Japan, one of a series of so-called tribes or ethnic enclaves against whom the Japanese developed a marked sense of prejudice and discrimination. These groups. commonly designated as the *senmin,* a term referring to their low social status. became in effect outcastes: living at the very bottom of the rigidly structured social system of feudal Japan. The Sanka are sometimes called the Japanese gypsies, being a wandering people traditionally limited to the mountainous regions of Honshu. Their descendants are generally located in the mountains behind Niigata and in the area of Mt. Chausu. Although such people are mentioned in Japanese chronicles from the 11th century A.D., much of the information about them is vague, being dependent in some measure on Japanese folklore. There seems no reason to equate the Sanka with the aboriginal Japanese Ainu; indeed, they are not distinguishable in either physical type or language from the Japanese proper. In general. the Sanka may be appraised along with such other outcaste elements in Japan as the Hinin and Eta. The fact that they were landless people, living isolated lives, may have served to establish their unfortunate reputation.

When it is remembered that traditional Japanese society viewed the nonagriculturalist with contempt. the position of the Sanka may become clearer. Little is known of Sanka organization. Like other depressed castes in Japan, they had chiefs through whom they dealt with feudal authority and who were responsible for the conduct of the group. Socially they were forced into endogamy. There is no evidence to support the common Japanese claim that the Sanka were a wild people who lacked houses and lived in caves. In their mountain habitat they seem to have been wood gatherers and charcoal burners as well as hunters. Although the Japanese-in 1869 legislated against social discrimination, the feelings of contempt still apply to the descendants of the Sanka as they do to the Eta. (R. F. Sr.)

SANKARAN NAIR, SIR CHETTUR (1857–1934), Indian jurist, rose to high positions in the government rarely open to Indians of his time and was noted for his robust independence and frank expression of views. Born in Malabar on July 11, 1857, he was educated at the Madras presidency college. A member of the Madras legislature and a prominent delegate to the Indian National Congress for a number of years, he was a keen social reformer; he presided at the Amraoti session of the Congress (1897) and at the Indian Social Reform conference, Madras. He became advocate general of Madras in 1907 and judge of the Madras high court in 1908. As a judge he expressed himself fearlessly even against the government, and in a famous judgment upheld conversion to Hinduism and decided that such converts were not outcastes. In 1915 he became a member of the viceroy's council. and as such had many conferences with the secretary of state for India in connection with constitutional reforms. Holding that martial law was continued too long in the Punjab, he resigned; however, for his sympathies with the Montague-Chelmsford reforms he was appointed in 1920 to the council of the secretary of state for India in London. He resigned in 1921 to take office in Indore. In his book *Gandhi and Anarchy* (1922) he attacked both the nonco-operation movement and the government actions under martial law; a costly libel action brought by Sir Michael O'Dwyer, then governor of the Punjab, followed. In 1925 he was elected to the council of state, and in 1928 was appointed chairman of the All-India committee to sit with the Simon commission to report on constitutional progress. He was founder and editor of the *Madras Review* and the *Madras Law Journal.* He was knighted in 1912. He died at Madras on April 24. 1934. (L. R. S.)

SANKEY, JOHN SANKEY, 1st Viscount (1866–1948), British lord chancellor, was born at Moreton, Gloucestershire, on Oct. 26, 1866. Educated at Lancing college and at Jesus college, Oxford. he was called to the bar at the Middle Temple in 1892. He took silk in 1909 and from that time advanced rapidly in his profession. He became a judge in the king's bench division in 1914 and a lord justice of appeal in 1928. He was chairman of the royal commission on the coal industry in 1919. In 1929 he was raised to the peerage and appointed lord chancellor in the second Labour government, retaining the appointment in the national government formed in 1931. He was created a viscount in 1932 and retired in 1935. He died in London on Feb. 6, 1948.

SANKHYA (Samkhya), the oldest system of Indian philosophy. its founder. Rapila, having been born probably a century before Buddha's birth. *See* Indian Philosophy: *The Samkhya;* Sanskrit Language and Literature: *Philosophical Systems.*

SAN LEANDRO, a city of Alameda county, Calif., U.S., bordered by Oakland on the north and Hayward on the south, a part of the San Francisco-Oakland standard metropolitan statistical area. The city lies on a coastal plain 47 ft. above sea level, adjacent to San Francisco bay. It forms part of the East bay metropolitan strip characterized by suburban developments, commercial trading centres and water-front industries. Manufacturing includes tractors, calculating machines. electrical appliances, paper products, hosiery and processed foods. The area also has a large cut-flower business.

José Joaquin Estudillo established the first residence in 1837 and named the site after St. Leander, a former bishop and patron saint of Seville, Spain. From 1855 to 1871 the town was the county seat of Alameda county. It was incorporated in 1872. It has a council-manager form of government, in effect from 1928. Pop. (1960) 65.962. (R. M. W.)

SAN LÚCAR (Sanlúcar de Barrameda), a fortified seaport of southern Spain, in the province of Cádiz; 27 mi. by sea from Cádiz, on the left bank of the Guadalquivir estuary. Pop. (1950) mun. 35.517. Inscriptions and ruins prove that San Lúcar and Bonanza were Roman settlements, though the original names are unknown. San Lúcar was captured from the Moors in 1264, after an occupation lasting more than five and a half centuries. After 1492 it became an important centre of trade with America. From this port Columbus sailed across the Atlantic in 1498, and Magellan started in 1519 to circumnavigate the world. The 14th-century church and the palace of the dukes of Medina Sidonia contain many valuable pictures. The hospital of St. George was

established by Henry VIII of England. The Guadalquivir estuary is deep and sheltered. Bonanza, 2 mi. by rail up the river, and on the same bank, is the headquarters of the shipping and fishing trades. It is named after a chapel dedicated there by the South American Company of Seville to the Virgin of Fair Weather (*Virgen* de la Bonanza). The fisheries and agricultural trade of San Lucar are considerable; there are flour mills in the town.

SAN LUIS, one of the three Argentine provinces forming the region of Cuyo, an Araucanian word meaning "land of sand." Area 29.632 sq.mi. Pop. (1960) 174.251. Although the province is in the Andean plain. much of its surface is broken by chains of mountains, the largest of which is the Sierra de San Luis. Forests are extensive and provide an important source of wealth, as do also the mineral resources (copper, iron, wolfram, gold, silver; mica and lead). There are relatively few rivers, the principal ones being the Desaguadero. Quinto. Conlara and San Luis. The economy is based chiefly on mining, lumbering, agriculture and stock raising, the emphasis with respect to the latter two categories being placed on cattle, sheep, cereals and fruits. The capital is San Luis (pop. [1956 est.] 28,024), founded in 1596 by Martin de Loyola, governor of the captaincy general of Chile. Mercedes, the largest city in the province, has a population of 28.879 (1956 est.). (R. W. Rd.; X.)

SAN LUIS POTOSÍ, a central state of Mexico, bounded north by Coahuila, east by Nuevo Leon, Tamaulipas and Veracruz, south by Hidalgo. Querétaro and Guanajuato and west by Zacatecas. Area 24,417 sq.mi. Pop. (1560) 1,054,206. The state comprises the high plateau region with the exception of a small area in the southeast angle, where the tableland breaks down into the tropical valley of the Pánuco. The surface is comparatively level, with some low mountainous wooded ridges. The mean elevation is about 6,000 ft.. ensuring a temperate climate. The rainfall is light and uncertain and the state is poorly provided with rivers. The soil is fertile and in favourable seasons large crops of wheat, maize. beans and cotton are grown on the uplands. In the low tropical valleys, sugar, coffee, tobacco, peppers and fruit are staple products. Stock raising is an important industry and hides, tallow and wool are exported. Fine cabinet and construction woods are also exported to a limited extent.

San Luis Potosi ranks among the leading mining states of Mexico. The Catorce district, which includes Matehuala and the once-important mining station of Real de Catorce, has some of the richest silver mines in the country. Other well-known silver-mining districts are Peñón Blanco, Ramos and Guadalcázar. The development of Guadalcázar dates from 1620 and its ores yield gold, copper, zinc and bismuth as well as silver. In the Ramos district, Cocinera lode is said to have had a total yield of more than $60.000.000. The state has good air. rail and highaay connections. Rio Verde, an agricultural centre with a national agricultural experiment station in its vicinity. is 65 mi. E.S E. of the state capital, San Luis Potosí. (J. A. Cw.)

SAN LUIS POTOSÍ, a city of Mexico and capital of the state of the same name, 215 air miles (327 mi. via rail; 409 mi. via paved highway) N.W. of Mexico City. Pop. (1560) 173,886. Its altitude, 6,168 ft. above sea level, ensures a temperate climate.

San Luis Potosi is the hub of a rich silver-mining and agricultural region and a leading manufacturing centre. The city produces a variety of products including rope, brushes, shoes. cotton and woolen textiles and clothing. There are several large plants for the smelting and refining of various ores and crude metals brought from adjacent states. It has a large arsenic plant. The state-supported Instituto Cientifico offers courses in law, medicine and science. Notable buildings include the cathedral, conspicuous for its typical Churrigueresque style; the state capitol, noted for its façade of rose-coloured stone; the churches of Nuestra Señora del Carmen, San Francisco and Guadalupe; and the mint.

The city dates from the founding of the Franciscan mission of San Luis Rey by Diego de la Magdalena in 1583, and takes its name from the Cerro de Potosi, a nearby hill of silver, said to resemble the famous Potosi mines of upper Peru (Bolivia). It was the centre of the region's colonial administration and played an important part in the political disorders following Mexican independence. For a brief time in 1863 it was the seat of the government of Benito Juárez. Imprisoned there by Porfirio Diaz in June 1910, Francisco I. Madero drew up his famous "Plan of San Luis Potosi" (Oct. 7) which contained the political and social goals for the Mexican revolution launched Nov. 20, 1910. (R. B. McCk.)

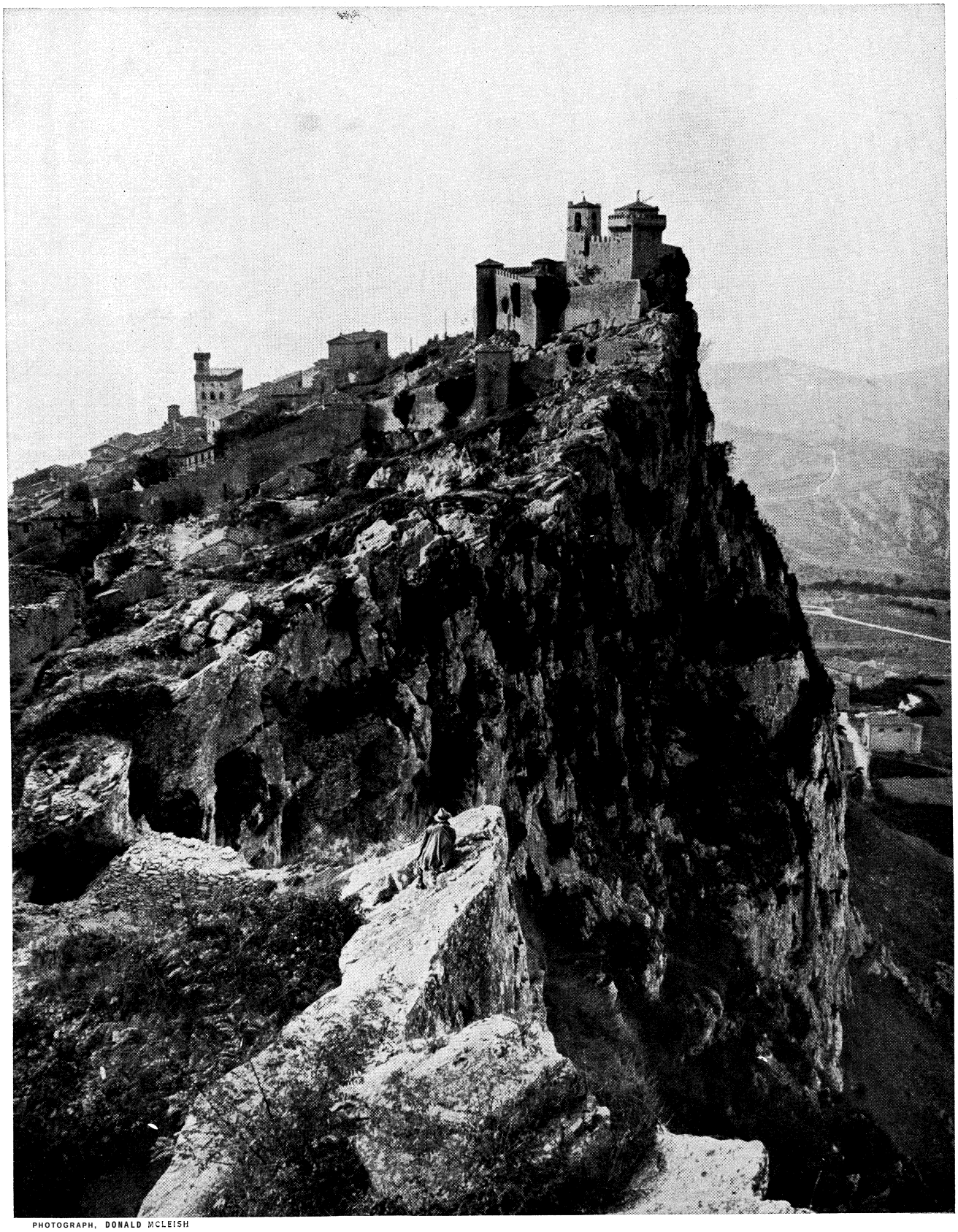
SAN MARCOS, the department in western Guatemala that borders Mexico. Area 1.464 sq.mi. Pop. (1957 est.) 282,951. Its capital is San Marcos (pop. [1960 est.] 5.058). In the highlands the Maya Indian farmers raise maize. beans and wheat. On the south-facing slopes there are plantations of coffee. On the coastal lowland there are bananas, sugar cane and rice. A branch of the Inter-American highway passes through San Marcos to the Mexican border. Ayutla is the railroad terminus opposite the end of the Mexican railroad. Ocos is the port. (P. E. J.)

SAN MARINO, a republic in northern Italy, 14 mi. S.W. of Rimini by road. It is the smallest republic in the world (24 sq.mi. in area) and is entirely surrounded by the region of Emilia-Romagna. It is situated mostly on the slopes of Monte Titano, in the northern Apennines, the three peaks of which, each surmounted by a tower, are pictured on the arms of the republic. The estimated population in 1957 was 14,421. The capital is San Marino. Most of the republic falls within the diocese of Montefeltro, a small portion within that of Rimini.

According to tradition, the republic was founded by Marinus, a native of Arbe, probably after the middle of the 4th century. The Castellum Sancti Marini is mentioned in 755; the oldest document in the republican archives mentions the abbot of San Marino in 885. The republic, as a rule, avoided the factional fights of the middle ages but joined the Ghibellines and was interdicted by the pope in 1247–49. After this it was protected by the Montefeltro family (later dukes of Urbino) and the papacy and successfully resisted the attempts of Sigismondo Malatesta against its liberty. It fell into the hands of Cesare Borgia in 1503 but soon regained its freedom. Other attacks failed, but civil discords increased. Its independence was recognized in 1631 by the papacy. In 1739 Cardinal Alberoni attempted to deprive it of its independence, but this was restored in 1740 and was respected by Napoleon. It put itself under the protection of the kingdom of Italy in 1862. In World War II San Marino remained neutral, but suffered a severe bombing raid and other infringements of its neutrality. The fascist regime was overthrown in 1943.

The general council consists of 60 members and is elected by proportional representation from single-party lists. Its functions are deliberative and legislative, while a grand council of 12 exercises the executive functions of government. The councils are elected every four years. The peaceful revolution of March 25, 1506, restored the original system of election to the council (which had become a close corporation, renewed by co-option) by the Arengo, or assembly of heads of families, one-third of the council being henceforth renewable every three years. In 1909 the household suffrage was replaced by universal male suffrage, but women were not given the vote until 1958. Residence in the republic is not necessary for voting. The election of the two *capitani* reggenti ("captains regent") takes place every six months. They enter into office on April 1 and Oct. 1 with much traditional pomp and preside over the two councils; but the real governmental power is in the hands of two secretaries of state.

The available armed forces of the republic include about 1,200 men, all citizens able to bear arms being technically obliged to do so from 16 to 60 years. The language spoken is Italian and the inhabitants are Roman Catholics. Italian money is current. A considerable part of the revenue is drawn from the Italian government in exchange for an acknowledgment of the Italian state monopolies in tobacco. playing cards, etc. Only in 1922 did San Marino introduce an income tax. A fruitful source of revenue is found in the frequent change of postage stamps (first issued in 1877); other chief exports are stone from Monte Titano — the legendary founder of San Marino was a Dalmatian stonecutter— and the strong wine made from the grapes which flourish on the

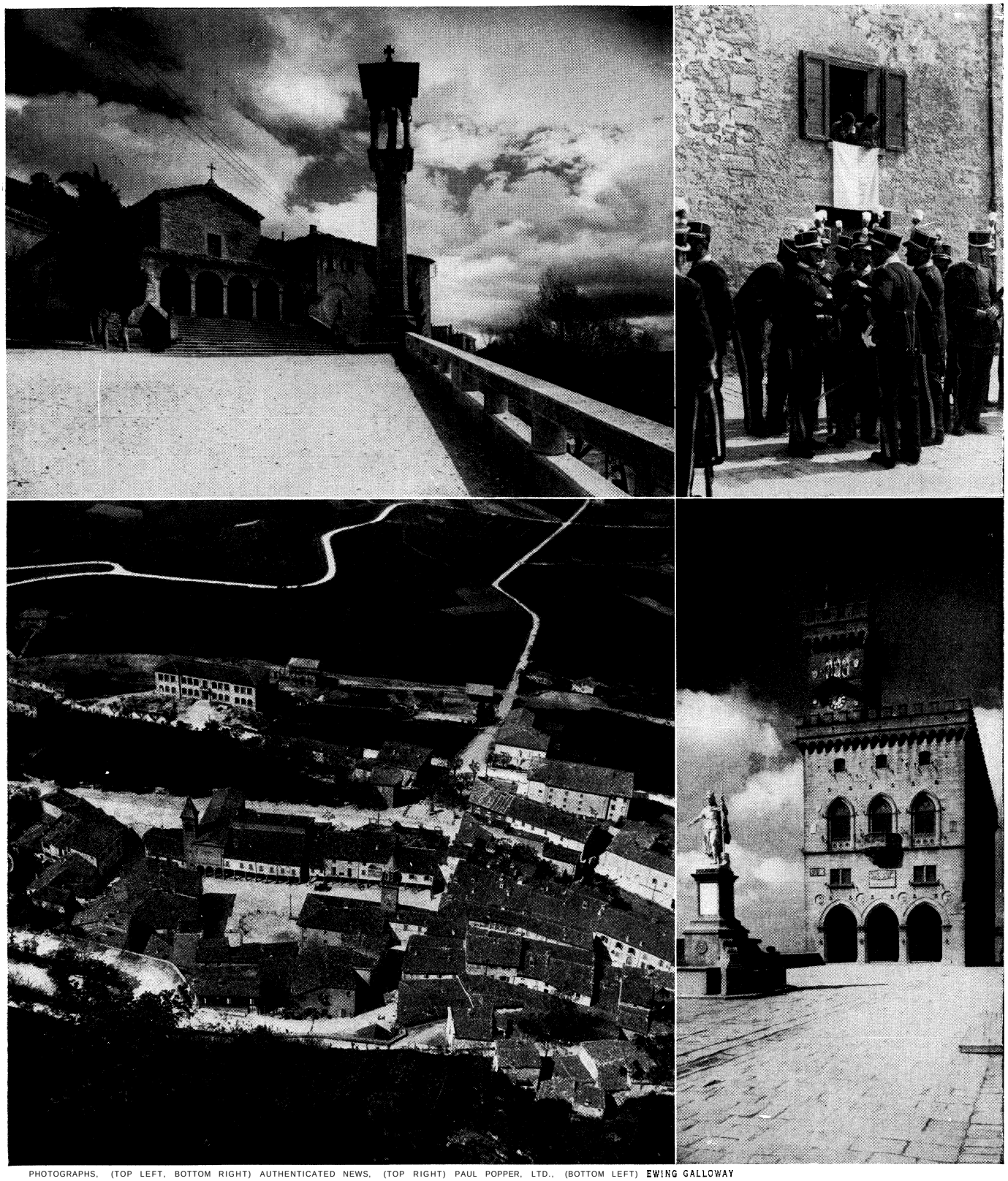


PHOTOGRAPH, DONALD MCLEISH

THE TOWN OF SAN MARINO, CAPITAL OF THE REPUBLIC

San Marino, founded probably in the 4th century, is situated on the slopes of the mountain whose steep sides and crags constitute in great part the territory of the Republic. It has three citadels, all overlookina Rimini (Italy) and the Adriatic. The turreted building on the left is the Parliament house

SAN MARINO



PHOTOGRAPHS, (TOP LEFT, BOTTOM RIGHT) AUTHENTICATED NEWS, (TOP RIGHT) PAUL POPPER, LTD., (BOTTOM LEFT) EWING GALLOWAY

SCENES IN SAN MARINO

Top ***left:*** Capuchin church and statue of St. Francis of Assisi
Top right: Members of the militia of San Marino
Bottom ***left:*** The Borgo, or Lower Town, at the base of Monte Titano
Bottom right: The Parliament house and statue of Liberty in the city of San Marino

country's volcanic soil. The main occupation is agriculture.

There are traces of three different circles of walls surrounding the three peaks of Monte Titano and dating from the 14th. 15th and 16th centuries. The town of San Marino is on the most northerly peak. on top of which stands a castle. The old church, first mentioned in 951. was rebuilt as a Franciscan church in the 14th century. The principal church (Pieve), in classical style, dates from 1826–38 and contains the body of St. Marinus. The museum contains among other curiosities the banner of Garibaldi's "Italic legion" which sought refuge at San Marino in 1849. The archives were rearranged and described by C Malagola. On the southern side of the town is a new suburb and to the northeast is Borgo Maggiore, the main suburb. Serravalle is the only other town in the republic.

SAN MARTIN, JOSÉ DE (1778–1850), South American soldier and statesman, whose heroic efforts together with those of Simón Bolivar (q *v.*) helped to make South American independence a reality. was born on Feb. 25, 1778, in Yapeyú, a Jesuit village at the northern frontier of Argentina. He was the son of an aristocratic Spanish family which. when he was seven. returned to Spain. His upbringing therefore was European. His biographer, Ricardo Rojas, divides San Martin's life into three periods: 1778–1817, the years of initiation; 1817–22, the years of achievement; 1822–50, the years of renunciation.

San Martin served 22 years in the Spanish army. attaining the rank of lieutenant colonel. When in 1812 he learned that a movement for the independence of his native Argentina had flared up in Buenos Aires, he offered his services to the revolutionary government. On his return to Argentina he found his homeland in chaos. No stable government had emerged, nor had the ties with Spain been severed by a formal declaration of independence. San Martín did not aspire to political power. He was a soldier first and foremost, though he expressed a preference for constitutional monarchy. His primary purpose was to defeat the Spanish forces and establish the independence of the Americas. He was convinced that the Spanish hold on America would not be broken until Peru should be liberated: "The war," he said. "will not end until me are in Lima." His plan therefore was to train a small, disciplined army in western Argentina, then go to Chile and clear out the Spaniards, establish a friendly and stable government there and finally lead his army across the sea to Peru.

Argentina proclaimed its independence in 1816, while San Martín patiently bided his time. For three years he organized and drilled his army and then. at the beginning of 1817, crossed the .Andes at two points. Los Patos and Uspallata, catching the Spanish off guard. He defeated them at Chacabuco and entered Santiago de Chile on Feb. 15, 1817. Naming his friend and collaborator Bernardo O'Higgins as political director of Chile, he braced himself for the next step. A second victory over the Spaniards at Maipú sealed the independence of Chile.

The conquest of Peru, however. was another matter. San Martin spent nearly two years in assembling a fleet for the transportation of his army. At last. in Aug. 1820, he set sail for Lima. and entering the city on July 9. 1821. he proclaimed the independence of Peru. But the Spanish forces retreated into the Peruvian highlands. and San Martin was unable to cope with them. It was natural that his mind should turn toward Bolivar, who was then moving southward in his campaign to liberate Ecuador. The two men met in Guayaquil in July 1822. The content of their conversation is one of the most debated issues in Hispano-American history. One thing is certain: no agreement was reached on a plan to liberate Peru or to design a political future for Latin America that would be pleasing to both. Disappointed. San Martín left Gunyaquil. confessing that Bolivar was "not the man we imagined him to be." In Sept. 1822 he presented his resignation to the Peruvian congress. Whether he took this action to give Bolívar a free field or because of his own blighted hopes will never be completely clear. His farewell to America was a silent one. He wrote to O'Higgins: "I am tired of being called a tyrant . . . of having the people say that I want to be king, emperor, or even the devil." His life in exile was spent first in Belgium, later in Paris and finally in Boulogne-sur-Mer. He died at Boulogne on Aug. 17, 1850.

San Martin's influence on the South American independence movement is not so great as Bolivar's. nor have his political ideas found acceptance. He favoured a centralized constitutional monarchy. which most Latin-American nations believed unsatisfactory. As soldier and human being, he reaches a place among South America's great men. For San Martin one precept was essential: "Be what you must be or you will be nothing." By this principle he lived, in action as well as in exile, tactiturn, proud, stoic. selfless. The victories of Chacabuco and Maipú are landmarks in the independence of Argentina, Chile and Peru, but even so, the final triumph over the Spanish forces was obtained only after San Martin had retired from the struggle.

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SAN MARTÍN, a department in northeastern Peru, bounded on the north by Amazonas and Loreto, on the east by Loreto, on the south by Huánuco and on the west by La Libertad and Amazonas. Area 20.488 sq.mi. Pop. (1958 est.) 165,924. The department was created from a part of Loreto in 1906. The chief centre of settlement is around the capital. Moyobamba (pop. [1958 est.] 11.340). Most of the inhabitants are farmers. whose products include sugar cane. cacao, coca, rice, maize, coffee, tobacco. cassava and fruit. San Martin is known to contain mineral resources such as gold: salt, gypsum, lignite. lime and petroleum, but these resources are little developed. The warm: rainy climate supports dense forests in which there are sources of rubber, balata, vanilla and cabinet woods. At Moyobamba straw hats are woven and *aguardiente* or sugar brandy is distilled. (P. E. J.)

SAN MATEO, in San Mateo county, a city on the shore of San Francisco bay. 18 mi. S. of San Francisco, Calif., U.S., and a part of the San Francisco-Oakland standard metropolitan statistical area; it is served by the San Francisco International airport. Sheltered by hills from ocean wind and fog, San Mateo enjoys a mild marine climate.

A Spanish exploring party (1776) named the creek at this place after St. Matthew. Later a mission outpost was established there, and in the 1850s an American village appeared. surrounded by farms. After a railroad was built (1863). men with gold-rush fortunes bought up farms to establish their country "estates." surrounding the village and preventing its expansion but supplying much of its economic sustenance.

The village was incorporated in 1894 and by 1900 had a population of 1,832. Some estates were then being subdivided and the number of "commuters" to San Francisco was growing, a trend that continued until about 1950. Thereafter the proportion of commuters in the city's population declined because of employment opportunities presented by the increasing number of administrative offices, mercantile businesses and light industries in San Mateo.

Cultural and recreational facilities include a public library with neighbourhood branches. a two-year public junior college, two museums. a little theatre, a city park system, a county-owned beach and yacht harbour and a municipal golf course. The city has a council-manager form of government, in effect from 1923.

Pop. (1960) 69,870. (F. M. ST.)

SANMICHELI, MICHELE (1484–1559), architect of the Italian Renaissance, noted for his original treatment of military fortifications. was born in San Michele near Verona. He was a pupil of his father, Giovanni, and his uncle Bartolommeo, both architects at Verona. and went at an early age to Rome to study classical sculpture and architecture. Among his first works are the *duomo* of Montefiascone, the church of S. Domenico at Orvieto. several palaces and a fine tomb in S. Domenico. He was also employed by the *signoria* of Venice as a military architect and designed elaborate fortresses for Venice: Cyprus and Crete. One of his most graceful designs is the Cappella Pellegrini in the church of S. Bernardino at Verona. He built a number of fine palaces at Verona, including those of Canossa, Bevilacqua and Pompei, as well as the graceful Ponte Nuovo. In 1527 Sanmicheli began to

transform the fortifications of Verona according to the newer system of corner bastions which he did much to advance. His last work (1559) uas the round church of the Madonna di Campagna, 1½ mi. from Verona. He also urote a work on classical architecture. I *cinque ordini dell' architettura,* printed in 1735.

SAN MIGUEL, a department in east central El Salvador and its capital city. Pop. of department (1958) 224,888. Extending from the Pacific ocean to the Honduran border, the department has some large lowlands along the Rio Grande de San Miguel. the second river in the country, and also some of the country's highest mountains, including San Miguel volcano. 6.957 ft. Important agriculturally, the department produces significant quantities of sesame, cattle, poultry, cheese, corn, tobacco, cotton and swine.

SAN MIGUEL city (pop. [1958] 72,956) was founded in 1530 by Spanish settlers near the right bank of the Rio Grande. Near it are the ruins of an ancient Indian town. It is 80 mi. S E. of San Salvador (*q.v.*) on the Inter-American highway and the International Railways of Central America, and 29 mi. by road from La Unión (*q.v*), its port. Because of these transportation facilities it is an important commercial centre for eastern El Salvador. It possesses handsome municipal buildings, several churches. law courts, well-equipped hospitals and schools. It has cotton-textile, vegetable-oil, meat-processing, grain-milling, clothing, clay-product, leather, cordage and tobacco factories. (C. F. J)

SANNAZZARO, JACOPO (1456–1530), Italian poet whose *Arcadia* was, until the rise of the romantic movement, one of the most influential and popular aorks of Italian literature, was born at Naples on July 28, 1456 He spent his early years in San Giovanni Picentino. Returning to Naples at the age of 20, he became court poet of the kings of the house of Aragon, whom he served devotedly In 1501 when Frederic. last king of the dynasty, lost his throne, Sannazzaro accompanied him into exile in France. During this period he brought to light several lost Latin works. including Ovid's *Halieutica* and h'emesianus' *Cynegetica.* After Frederic's death in 1504 Sannazzaro returned to Naples, where he spent the rest of his life and died on April 24. 1530

Sannazzaro wrote both in Italian and in Latin. His Italian uorks include a *canzoniere* in Petrarchan style, but he is remembered chiefly for *Arcadia* (1504; critical edition. 1926), a pastoral romance, partly autobiographical, partly allegorical, consisting of eclogues linked by prose narrative. Its hero, Sincero, wishing to forget his unrequited love, decides to leave Naples and retire into Arcadia. There he shares the simple life of the shepherds, joining in their poetical contests and pagan festivals To this central part of the work. written betneen 1480 and 1485, was subsequently added a second part. more erudite and elaborate, describing how Sincero, unable to find in Arcadia the peace he desires. returns through underground caves, guided by a nymph, to Naples. The success of *Arcadia* is due not so much to Sannazzaro's use of many formal artifices as to his delicate and introspective analyses of the impulses of the human mind and to his fanciful creation of a dream world which introduced a new type of poetic sensibility. Less important were his works in Latin, including the *Eclogae piscatoriae* (1526; Eng trans., 1726; critical edition, 1914) in which he revived the classical bucolics, substituting the world of fishermen for that of shepherds, and the *De partu virginis* (1526; critical edition, 1948). a poem in hexameters in which Sannazzaro, a sincere Christian. celebrates in a classical and sometimes pagan form the birth of the Redeemer. His best achievement in Latin was, however. the *Elegiae* and *Epigrammata,* in which he expressed his upright and tender personality.

See F. Torraca, "Jacopo Sannazzaro" in *Scritti critici* (1907); *E.* Percopo, "Vita di Jacopo Sannazzaro," in *Archivio Storico per le Provincie Napoletane,* vol. 56 (1931) ; E. Carrara, in *La poesia pastorale* (1908) ; *A.* Momigliano, in *Studi* di *poesia* (1938). (G. P. G.)

SAN NICOLÁS, a town and river port of Argentina, in the province of Buenos Aires, on the west bank of the Paraná, 150 mi. N.W. of the city of Buenos Aires by rail. Pop. (1956 est.) 30,179. It is a flourishing commercial town and a port of call for both river and ocean-going steamers of medium tonnage. It is a rail station on the main line from Buenos Aires to Rosario and the north, and also the terminus of a branch line running from Pergamino. It exports uheat. flour, wool and meat. During the Perón régime San Nicolás was chosen as the site for a large thermoelectric station (which now provides electric power to Buenos Aires and the province of Santa Fe) and for the construction of a completely integrated steel plant. These have greatly increased the town's importance. It was founded in 1748 as San Nicolas de Bari y de los Arroyos. (GE. P.)

SANOCRYSIN. A proprietary gold preparation (gold and sodium thiosulfate) which is of proved value in the treatment of certain skin diseases and of doubtful value in rheumatoid arthritis and tuberculosis. Incautious use may lead to widespread toxic manifestations including skin rashes, gastrointestinal upsets and blood changes.

SAN PABLO, CITY OF, a chartered city in Laguna province. Phil., 45 mi. S.S.E. of Manila. The city was created May 7, 1940. Its 52 6 sq.mi. constitute a single municipality divided into 43 barrios (villages) and a *poblacidn* (administrative centre). Pop. (1960) 70,772, about 45% of which was in the *poblacidn.* The main line of the Manila railroad traverses the city, while four important highways radiate from the *poblacidn.* The city lies in a fertile pocket of volcanic soil and is almost surrounded by quiescent cones. Within the city are seven small crater lakes. The *poblacidn* is an important copra-processing and shipping centre as well as the trading centre for a well-populated hinterland. (R. E. HE.)

SAN PEDRO, a department of central Paraguay, drains toward the Paraguay river which forms its 100-mi.-long western boundary. Area 7,723 sq.mi. **A** well-watered lowland of savanna and forest, it is one of the principal maté (Paraguayan tea)-producing areas. Lumbering, cattle raising and a little agriculture (oranges and petitgrain) provide for the department's 80,125 population (1960). There are several small river ports and centres processing the region's products; San Pedro is the largest town and the departmental capital. There are no railways or all-weather roads.

Limestone is quarried for cement in the south and there are also iron-ore deposits. (G. J. B.)

SAN PEDRO DE MACORÍS, a province and its capital city in southeastern Dominican Republic. Area 450 sq.mi. The province occupies a wide strip of the southern coastal plain and a part of the rolling interior (to 950 ft. elevation) that slopes gently southward from the centre of the country. It is a region given over chiefly to sugar-cane cultivation. The province is the nation's leading sugar producer, accounting for one-fourth of the national output. Cattle raising is important in the drier parts. Lumbering of tropical hardwoods is also significant. The province was established in 1908. Pop. (1960) 68,953.

The capital city is situated at the mouth of the wide estuary of the Higuamo river, 38 mi. E. of Ciudad Trujillo. As the chief city of the southeastern region of the sugar industry, the most vital economic activity in the country, it serves actively as a commercial and industrial centre. The port has been developed along modern lines and handles about one-fifth of the nation's exports, including sugar, molasses, cattle and timber. Its industries include corn milling, manufacture of clothing and soap and alcohol distilling. Its international airport signifies its importance as a transport centre. Pop. (1960) 22,935. (D. R. D.)

SAN PEDRO SULA, capital of the department of Cortés Honduras. Pop. (1961) 58,126. San Pedro Sula, the second city of Honduras. is the centre of an important agricultural area, producing bananas for export, and sugar, rice, plantains, bananas, corn, sweet potatoes, yuca, cattle, swine and poultry for domestic consumption.

Located 48 mi. by railway from Puerto Cortés (the leading port of the country). 182 mi. by the Inter-Ocean highway from Tegucigalpa and with other railway and road connections, San Pedro Sula is a financial and distributing point for northern and western Honduras. It manufactures foodstuffs, clothing, hats, beer, soap, candles, cigarettes, shoes, brick and other clay products and furniture, and it has fine public buildings and some beautiful private residences. (C. F. J.)

SANQUHAR, a royal and 'small burgh of Dumfriesshire, Scot.. situated on the Nith, 58 mi. S.W. of Edinburgh by road. Pop. (1961) 2,182. Area .5 sq.mi. Sanquhar castle. on a hill overlooking the Nith, is now in ruins. It was re-erected a burgh of barony in 1484 and was created a royal burgh by James VI in 1598. The first "declaration of Sanquhar" was affixed to the market cross in 1680 by the covenanter Richard Cameron, the second in 1685 by James Renwick (*qq.v.*). The town is a summer resort and the principal coal mart in the county. Industries include coal mining (considerably developed after World War 11), iron and brick works. The Riding of the Marches (the confirmation of the town boundaries) is celebrated each year in August.

SAN RAFAEL: *see* ELÍAS PIÑA.

SAN RAFAEL, a city of California. U.S., about 15 mi. N. of San Francisco on San Pablo straits at the foot of Mt. Tamalpais; the seat of Marin county. A Franciscan mission (iater destroyed) was established there in 1817 and the town grew up around it. A replica of the original mission has been built on the site. The city was incorporated in 1874. Manufactures include oil burners, bricks, aluminum products and footwear. Dominican College of San Rafael (Roman Catholic, founded in 1850 at Monterey) for women is located there. For comparative population figures *see* table in CALIFORNIA: *Population.*

SAN REMO, a seaport of Liguria, Italy, in the province of Imperia, on the Riviera di Ponente, $9\frac{3}{4}$ mi. E. of Ventimiglia by rail, and 84 mi. S.W. of Genoa. Pop. (1957 est.) 47,609 (commune). Climbing the slope of a steep hill it looks south over a small bay, and, protected towards the north by hills rising gradually from 500 to 8,000 ft., it is in climate one of the most favoured places on the whole coast, which accounts for its reputation as a winter resort. The older town, with its narrow steep streets and lofty sombre houses protected against earthquakes by arches connecting them, contrasts with the new visitors' town, containing all the public buildings, which has grown up at the foot of the hill. The small harbour is sheltered by its sickle-shaped mole, 1,300 ft. long. Besides the Romanesque cathedral of San Siro, the white-domed church of the Madonna della Costa, at the top of the old town, may be mentioned. The emperor Frederick's residence at San Remo in 1887–88 greatly increased its repute as a winter resort. Flowers, especially roses and carnations, are extensively grown for export, and olives, lemons and palms are also cultivated.

SAN REMO, CONFERENCE OF (April 19–26, 1920). This conference was preceded by a meeting of the Supreme Allied council from Feb. 12 to 23 in London, where the main lines of the future treaty of Sèvres (*see* SÈVRES, TREATY OF) with Turkey were laid down, and the draft treaty with Hungary and the Fiume question were discussed. At San Remo itself, where Great Britain, France and Italy mere joined by those from Greece, Belgium and Japan, the Turkish treaty was the first and principal business dealt with, and the framework of the Sèvres treaty was there constructed. The mandates for Syria. Palestine and Iraq were assigned to France and Great Britain, respectively. and an Anglo-French oil agreement was negotiated which covered Rumania and the French and British nonself-governing colonies as well as the middle east. The most controversial question dealt with. as between the Allies, was that of the maximum strength of the German army—both its total and the number of troops allowed in the neutral zone skirting the area under Allied occupation. On account of the Kapp *Putsch* and other internal disorders the German government asked the conference to permit the increase of the German army to twice the strength allowed by the Versailles treaty. This request was refused and Germany charged with default in respect both of reparations and disarmament.

SAN SALVADOR, a department near the centre of El Salvador; extending from near the Pacific ocean on the south to the deep Lempa valley on the north. Pop. (1958 est.) 395,284, of which about 75% was urban. Population is concentrated in the highland portion of the department, the southern lowlands and the slopes to the Lempa valley having few people. In the western part of the department rises the massive volcano San Salvador, 6,398 ft. high. The department produces tobacco, sugar, fruits and cotton and also has considerable manufacturing. (C. F. J.)

SAN SALVADOR, the capital of the republic of El Salvador, is situated in Las Hamacas valley, a tributary of the Rio Acelhaute, at an altitude of 2,115 ft. Pop. (1958 est.) 232,659, about one-fourth of the urban population of the country. It is connected by modern highways with all principal cities of the country and with the ports of La Libertad (24 mi.), Acajutla (53 mi.) and La Unión (116 mi.), and is served by International Railways of Central America, which connect it with Guatemala and La Union, and by the older El Salvador railway to Acajutla.

San Salvador was founded in 1524 at a spot near the present site, to which it was transferred in 1528. It served as capital of the colonial province of Cuscatlán and of San Salvador province of the United Provinces of Central America, and except for the period 1854–59 it has been capital of El Salvador since 1841. It was temporarily ruined by earthquakes in 1854 and 1873.

San Salvador has sturdy government buildings, a modest cathedral, a handsome national university, an academy of science and literature. several theatres, a national astronomical observatory, a national library, several modern hospitals and charitable institutions, a country club, excellent botanical gardens, several beautiful parks and plazas and a modern water system. Among its several rapidly growing residential suburbs are Mejicanos and Villa Delgado in the hills to the northeast and Soyapango to the east. Six miles to the east is beautiful Lake Ilopango, the largest lake in country. in an ancient volcanic crater. With shores dotted with private homes, resort hotels and older fishing villages, the lake is San Salvador's playground.

San Salvador is the leading financial, commercial and industrial centre of the country. It manufactures cotton and silk textiles, clothing, hosiery, hats, foodstuffs, leather goods, wood products, liquors, clay products, cement, soap, matches, cordage, cigarettes and cigars. (C. F. J.)

SANS-CULOTTES, the term originally given during the early years of the French Revolution to the ill-clad and ill-equipped volunteers of the Revoluntionary army, and later applied generally to the ultrademocrats of the Revolution. They were for the most part men of the poorer classes. or leaders of the populace. but during the Terror public functionaries and persons of good education styled themselves *citoyens sans-culottes* ("citizens without knee-breeches"). The distinctive costume of the typical sans-culotte was the *pantnlon* (long trousers)—in place of the *culottes* worn by the upper classes—the *carmagnole* (short-skirted coat), the red cap of liberty and *sabots* (wooden shoes). The influence of the sans-culottes ceased with the reaction that followed the fall of Robespierre (July 1794), and the name itself was proscribed. In the Republican calendar the complementary days at the end of the year were at first called *Sans-culottides;* this name was, however, suppressed by the Convention when the constitution of the year III (1795) was adopted, that of *jours complémentaires* being substituted.

SAN SEBASTIAN (Basque IRUCHULO; officially GUIPÚZCOA), a seaport and capital of the Spanish province of Guipúzcoa, on the Bay of Biscay. Pop. (1960 est. mun.) 123,935. The city became the summer residence of the court in 1886. It occupies a narrow sandy peninsula. which terminates on the northern or seaward side in a lofty mass of sandstone. Monte Urgull. The old town, rebuilt after the fire of 1813, lies partly at the foot of Monte Urgull. partly on its lower slopes. Until 1863 it was enclosed by walls and a strong fort, the Castillo de la Mola, still. crowns the heights of Urgull. There are saw and flour mills, and manufactures of preserves, soap, candles. glass and paper, especially in the suburb on the right bank of the Urumea. The fisheries are important.

SAN SEVERINO (anc. SEPTEMPEDA), a town and episcopal see of Marche, Italy, in the province of Macerata. Pop. (1957 est.) 15.358 (commune). The lower town contains the new cathedral of S. Agostina, with a fine altarpiece by Pinturicchio (1489). S. Lorenzo in Doliolo and S. Domenico are both Romanesque churches. The Palazzo Coinunale has pictures by artists of the Marches. The old cathedral of S. Severino is in the upper town.

The ancient Septempeda lay 1 mi. below the modern town, on

the branch road which ran from Nuceria Camellaria, on the Via Flaminia.

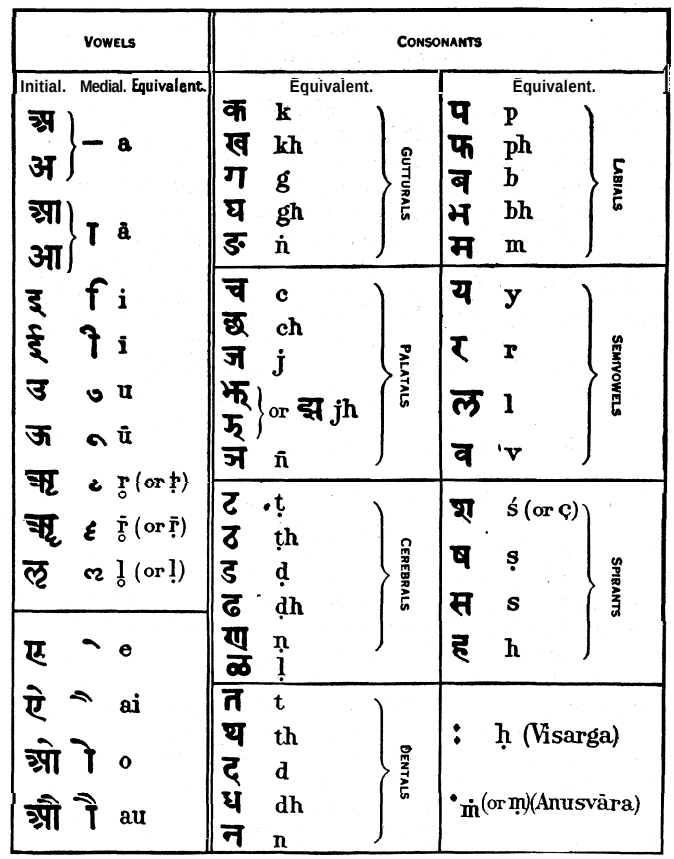
SAN SEVERO, a city in Apulia, It., in the province of Foggia, from which it is 17 mi. N.N.W. by rail. Pop. (1951) 47,875. It lies at the foot of the spurs of Monte Gargano, 292 ft. above sea level. It is the see of a bishop (since 1580), and has some remains of its old fortifications. San Severo dates from the middle ages. It was laid in ruins by Frederick II. In 1799 the town was almost entirely destroyed by the French. In 1627, 1828 and 1851 the town suffered from earthquakes. It is surrounded by fertile vineyards and oliveyards.

SANSEVIERIA, a genus of herbaceous perennials of the lily family, commonly known as bowstring-hemp or snake-plant. The genus is important in the production of a strong fibre. Sansevierias are commonly grown as porch and house plants in the north and out-of-doors in the south, requiring little direct sun and doing best in a rather heavy soil. Propagation is by division or by leaf cuttings about 3 in. long set in sand. The plant is frequently called old-woman's tongue or mother-in-law's tongue.

(J. M. BL.)

SANSKRIT LANGUAGE AND LITERATURE. The most important branch of the Indo-European family of languages in Asia is Aryan or Indo-Iranian, with two main divisions: Iranian and Indo-Aryan. Languages belonging to the latter are spoken to-day by 250 million people in India, where they are the dominant languages except in the south, in Ceylon and the Maldive Islands, and throughout western Asia and Europe by colonies of Gypsies (see ROMANY LANGUAGE). As languages of administration they spread at one time far into central Asia, where now is Chinese Turkestan; and as vehicles of Buddhism they have influenced through translation the whole of central and eastern Asia; Hindu civilization carried their vocabulary into the East Indies and the Malay peninsula. The oldest documents of Indo-Aryan are composed in Sanskrit. These are the Vedic texts. Their exact date is unknown, but it is probable that the oldest of them belong to the latter half of the second millennium B.C. They were probably composed before the Aryans had learned the use of writing; but being religious texts uhich it was essential to preserve unchanged they were handed down by an oral tradition which by various controls was made exceedingly exact. Even at the time of entry into India there must have been some dialectical differences in the language as spoken by the various invading tribes; with their further extension into India itself these differences became accentuated. The language of the Vedic texts shows a certain mixture, but is in the main founded upon the dialect of the north-west of India. With the advance of Aryan culture into the Punjab and the Gangetic plain the eastern dialects gained in importance; and this eastern influence, discernible in the earliest texts, constantly gains ground.

The most archaic of these texts is the Rig-veda, a collection of liturgical hymns; this is followed by the Atharva-veda, consisting chiefly of magical formulas, of prayers, curses and incantations. Considerably later come the first compositions in prose, commentaries on the Veda and philosophical treatises termed Brāhmaṇas and Upanishads. Although originally preserved as a religious language, Sanskrit was finally used for secular purposes. The earliest inscription in Sanskrit dates from 150 A.D., but it became the regular language of official inscriptions only in the 4th century A.D. But long before that the grammarians (of whom the most celebrated was Pāṇini in the 4th century B.C.) had fixed it as a learned language to which alone a strict interpretation confines the name Sanskrit, "the perfected." but which may conveniently be termed Classical Sanskrit as opposed to the Vedic or older form. As a literary language it is still cultivated; and a vast literature—philosophical, narrative, lyrical, dramatic, technical—has been written in it. Standing, in form at least, between the later Vedic and the Classical, but more nearly approaching the latter, is the language of the two great epics, the Mahābhārata and the Rāmāyaṇa, in which the influence of the spoken language can clearly be seen. For in the meantime the spoken dialects continued to develop. Some of these, such as Pali and the Prakrits (*qq.v.*), were in turn crystallized and used as religious languages by new sects as well as for secular purposes before Sanskrit was so employed. From these vernaculars are eventually derived the modern Indo-Aryan languages (*q.v.*). Sanskrit, the literary language, although preserving the sound-system of Vedic practically unchanged, did not escape the influence of its descendants. The grammar was considerably changed, chiefly in a simplifying and normalizing direction; meanings of words were altered and developed, and vast quantities of new words were gradually absorbed after being given a Sanskrit form. On the other hand



FROM MACDONELL, "SANSKRIT GRAMMAR FOR STUDENTS" (CLARENDON PRESS)

Sanskrit has continued to influence the spoken languages.

Sounds.—The sound-system of Sanskrit consisted of: (a) Fourteen vowels, viz.: Twelve simple vowels: a, *ā,* i, i, *u, ū, r̥, r̥̄, l̥,* (*l̥̄*), *ē, ō.* Two diphthongs: ai, au.

(b) Thirty-six consonants, viz.: Five series of stops and nasals: guttural: k, kh, g, gh, *ṅ;* palatal: c, ch, *j,* jh, *ñ;* cerebral: *ṭ,* th, d, dh, *ṇ;* dental: t, th, d, dh, *n;* labial: *p,* ph, b, bh, m. Four semi-vowels: y, r, l, v. Three sibilants: palatal *ś,* cerebral *ṣ,* dental s. Two aspirates: voiced h, unvoiced h (visarga). A nasal with loose closure of the lips *ṁ* (*anusvāra*), and another nasal *m̃* (*anunāsika*) which probably was a simple nasalization of the vowel rather than a consonant proper.

Vowels.—The vowel-system was inherited practically unchanged from the common Indo-Iranian period, the only specific Sanskrit development being the change of the Indo-Iranian short diphthongs **ai, *au* (=Avestic *aē,* ao) to *ē,* 6 (still classed as diphthongs by Indian grammarians) and of the long diphthongs **āi, *āu* to ai, au. Thus to Avestic dudvo haomo *uxδāiš gāuš* Sanskrit corresponds with *dēvāḥ sōmāḥ ukthāiḥ gáuḥ.* The comparative simplicity of the vowel-system and the great predominance of the vowels a and *ā* were due to the fact that in the Indo-Iranian period four distinct Indo-European sounds—e, o, a, *r̥* (*ṅ, ṇ, m*)—had coalesced in the one sound a (similarly *ē, ō, ā* had all become *ā*). The only trace left of the earlier differentiation was the fact that an original guttural before *ā* representing older *ē* had became a palatal: thus we have sdcatd, "follows," from **sekʷetai* (Greek *hépetai,* Latin sequitur), but *sákṣat,* "he shall follow" beside Gk. *hépsetai.* Similarly the 12 I.E. diphthongs—ei, oi, *ai,* eu,

ou, au, *ēi, ōi, āi, ēu, ōu, āu*—were merged in four Skt. sounds 6, *ō, ai*, au. In this way the vowel alternation (especially between e and o), a characteristic feature of Indo-European, was largely lost. Nevertheless, where the word contained a sonant the alternation, although diminished in scope, was still discernible: *e.g.*, I.E. ei: oi: *i* became Skt. 6: *i* (*e.g.*, Gk. leipei: *loipós: élipe* = Skt. *rēcati: rēkaḥ:* aricat), I.E. e, *o:* 6, *ō* became Skt. a: 6. The correspondences thus resulting—a: 6; *i: ē:* ai; u: 6: au; *ṛ:* ar: *ār*—being associated with particular grammatical formations were still further developed in Sanskrit into a system, which, early recognized by the Indian grammarians, was used by them in their description of the formation of the language.

Consonants.—The consonant-system has remained much truer to the original Indo-European. It is characterized by the rarity of spirants and by the opposition of unaspirated and aspirated stops (both surd and voiced) in each series. In preserving the voiced aspirate stops unchanged, Sanskrit and its descendants (for most of the modern Indo-Aryan languages still possess these sounds) are unique among the Indo-European languages, in which these sounds either became surd aspirates and later spirants (as in Greek and Latin) or lost their aspiration (as in Iranian, Balto-Slavonic, Armenian, Albanian, Germanic, Celtic). Thus to Greek *phérō*, Latin fero, Eng. bear, Sanskrit corresponds with *bhárāmi*, to Gk. *éthēke*, Lat. *fēcit*, Eng. deed with *ádhāt*.

Some consonants were restricted in their use: *ñ* appeared only before or after palatals, *ṁ* only finally or before gutturals (and where a guttural had subsequently disappeared), *ṇ* only between vowels and semivowels or before cerebral stops, h only finally or before sibilants and surd gutturals or labials, *ṁ* only finally or before consonants. Neither aspirate nor h nor *ś* ended a word. At the end of a sentence only the following consonants were used: *k, ṭ, t, p, ṅ, n, m, ḥ*.

Of the palatals *ch* appears as a single consonant only initially: elsewhere it is always doubled unless preceded by another consonant, for it corresponds to the Indo-European group sk_1: *e.g.*, chindinti "they cut" = Latin *scindunt*, *gácchāmi* "I go" = Greek *báskō*, *vāñchā* "wish" = Germ. *Wunsch*. *j* represents two I.E. sounds (1) palatal g_1 (= Gk. g, Avestic *z*): *jánaḥ* "birth" = Av, *zanō*, Gk. *génos*, Lat. genus; (2) velar g^w before an original *ĕ* or *ĭ* (= Av. j): *jīváḥ* "alive" = Av. *jīvō*, Lat. *vīvos*, cf. Gk. *bíos*, Eng. quick, jh does not belong to the Indo-European part of the vocabulary, but appears only in onomatopoeic and borrowed words, or in words taken from the vernacular in which the frequent Sanskrit groups dhy and hy became *(j)jh*.

Of the sibilants *ś* corresponds to I.E. palatal k_1: in this Sanskrit agrees with the other eastern I.E. languages (Balto-Slavonic, Albanian, Armenian, Iranian) which have an *s* or sh sound as opposed to the k (h in Germanic) of the western languages: *e.g.*, *śatám* "100" = Av. *satem*, Lithuanian *šimtas*, but Gk. *he-katón*, Lat. centum, Eng. hundred. Before the surd dentals this *ś* became *s: viśáti* "enters," *viṣṭáḥ* "entered." But *ṣ* also corresponds to I.E. *s* when preceded by *i, u, r* or k, agreeing in this with Iranian and partly with Armenian and Balto-Slavonic. The chief innovation in the consonant-system is the introduction of the third series, the cerebrals or linguals (better termed retroflex). The dentals were formed by the tip of the tongue striking the roots of the teeth, the cerebrals by the tip of the tongue, bent backwards, striking further back on the palate. In the oldest Sanskrit they are derived from the dentals when immediately preceded by *ṣ* or **ẓ* (which subsequently disappeared): thus **diśtas* (= Lat. dictus) became **diṣtas* and then *diṣṭáḥ; *miẓdham* (= Gk. *misthds*) became **miẓḍham* and then *mīḍhám*. Later also under the influence of a preceding *r* or *ṛ* dentals became cerebrals: such words are loans from the popular dialect, but they begin to appear in the literary language even as early as the Rigveda: thus *víkaṭaḥ* "monstrous" is derived from *víkṛtaḥ* "strange." Some words, however, contain cerebrals which cannot be explained as derived from dentals in either of these ways. It is probable that these sounds were characteristic of both the families of languages, Muṇḍā and Dravidian, which the Aryan speakers of Sanskrit found in possession of India; and the appearance of them in Sanskrit and its descendants (and in a few of the adjoining Iranian languages such as Baluchi and Pashto) can scarcely be unconnected with this fact.

The Indian grammarians emphasized the difference in the pronunciation of consonants according as they came at the beginning, in the middle or at the end of a word or before other consonants. These differences, though slight, have ended in transforming the whole Sanskrit consonant-system in its descendants, the modern Indo-Aryan languages. Final consonants were pronounced without being fully exploded: in the spoken languages these final consonants had disappeared before the middle of the 3rd century B.C. A similar pronunciation is assigned to consonants before stops: in the spoken languages these were early assimilated (*e.g.*, *suptáḥ* became *suttō*). y and v were pronounced more strongly initially than intervocalically: in the modern languages initial y– has remained or become j, but intervocalic *–y–* has been lost. [This contrast is observable even in the dialect of the Rigveda. For in the phonetically weak position of the termination and in certain accessory words intervocalic *–dh–* has lost its occlusion and become *–h–: ihí* "go" = Greek *íthi*, *śēmahē* "we lie" = Gk. keimetha. Further in all words intervocalic *–d–* has become *–ḷ–*, although other more easterly dialects still preserve it (through whose influence it was afterwards re-established in Classical Sanskrit): thus Classical nidah "nest" (from **niẓda-*) is *nīḷáḥ* in Vedic.]

Accent.—Our knowledge of the accent of Sanskrit words is derived from its marking in the more important Vedic texts and from the statements of grammarians. It was predominantly a musical or tonic, not a stress, accent. Three different types are generally distinguished, the udatta '(raised," *anudātta* "unraised" and *svarita* the rising-falling accent following the udatta. Generally the position of the *udātta* agrees, as far as can be ascertained by comparison, with that of the chief word accent of Indo-European. The rhythm of Sanskrit was purely quantitative; in verse metre depended only on the number and the length of the syllables composing a line, and was entirely independent of accent. In this respect, the Yashts of Avestan literature are similar.

GRAMMAR

Nouns.—Sanskrit makes a perfect distinction between nouns (including adjectives, pronouns and indeclinables) and verbs. The declension of nouns comprises three numbers—singular, dual and plural; and eight cases, viz., nominative, accusative, instrumental, dative, ablative, genitive, locative, vocative. In the majority of declensions ablative and genitive are not distinguished in the singular, nor dative and ablative in the plural, while the dual universally has only three separate forms,—(1) nom.–acc.–voc., (2) inst.–dat.–abl., (3) gen.–loc. These confusions were inherited from Indo-European, but the tendency to confuse still further the forms and functions of the cases continued within Sanskrit itself, the genitive especially enlarging its sphere at the expense of other cases. This process, continued in the spoken languages down to the present day, has resulted in a noun declension, which for the most part consists of two cases only—(I) a direct case founded on the Sanskrit nominative and accusative; (2) an oblique case founded on the Sanskrit genitive or, perhaps, in some forms, the dative. Among the numbers the dual by itself was reserved to express natural pairs (such as *akṣī* "the eyes," *karṇáu* "the ears"), or any two objects or persons already referred to or present in the mind of the speaker or hearer; otherwise the use of the word for "two" itself was required.

Although the idea of case was in the main expressed by the termination (as, *e.g.*, the nominative by *–s* in *dēvás* = Latin deus, the accusative by *–m* in *dēvám* = deum), it was sometimes accompanied by change in the pre-terminational element, and was connected with a shift of accent:

	Skt.	Greek	Skt.	Greek	Skt.	Greek
nom.	*pắt*	*pôs* (Doric)	dyduh	Zeds	*pitắ*	*patḗr*
acc.	*pắdam*	*póda*	*dyắm*	*Zḗn-a*	*pitáram*	*patéra*
gen.	paddh	*podós*	*diváḥ*	Dids	*pitúḥ*	cf. patrds
dat.	*padḗ*	*cf. podí*	*divḗ*	*cf. Dií*	*pitrḗ*	*cf. patrí*
loc.	*padí*	*podí*	*dyávi*	Lat. Jove	*pitári*	
voc.			*dyàuḥ*	*Zeũ*	*pítar*	*páter*

There was, however, one important class of stems, namely masc.

and neut. in –a and fem. in –*ā* (corresponding to the –*o* and –*ā* stems of Greek and Latin), in which the accent was fixed either on the stem or on the termination throughout the paradigm without any change in the form of the stem, of the type *áśvaḥ* = Gk. hippos, Lat. equos. There had, moreover, been a tendency in the pre-Sanskrit period to fix the form even of the variable stems, especially those consisting only of a root: thus the long vowel was generalized in *vāc–* "voice" (nom. vdk):

	Skt.	Latin	Avestic	Greek
acc.	*vå̊cam*	*vōcem*	*vācim*	
gen.	*vācáḥ*	*vōcis*	vacd	*opós*

But in the process of normalization the vowel declension (and especially with the stems in –a –*ā*) was predominant, and even in Sanskrit itself there was a considerable transference of consonant-stems and root-stems to this declension: *e.g.*, *pā̊da-* "foot," *dvā̊ra–* "door," ddnta– "tooth" replaced *pād–* pad–, *dant–* dat–, *dvār–* dur–. This proceeded apace in the spoken tongue, for the declension of the modern languages rests exclusively on vowel-stems and of these chiefly on the –a –*ā* stems.

As in Indo-European, the pronominal declension differed from the nominal, that of the personal pronouns radically, that of the demonstratives and others to a varying degree. In the personal pronoun each number had a different root (*t[u]vám* "thou," *yūyám* "you"), while that of the first person had different roots also for the nominative and the oblique cases (*ahám* "I," *mám* "me," vaydm "we," *asmān* "us"). The tendency of the two declensions, the nominal and the pronominal, to influence each other is observable: *e.g.*, the nominal ending of the neuter sing. nom. and acc. –*m* as in kim "what?" (=Lat. *quid*) replaced the –*d* or –*t* still found in other pronouns (tdt "that" = Lat. is-tud). In the spoken language this mutual influence continued to react until practically all distinction between the two types of declension was lost. Perhaps the most satisfactory explanation of the various elements that stand between Indo-European demonstrative pronouns and their case endings is to be found in Hittite where the original pronominal stems were appended to the sentence connective (Skt. "tasmin" = Hit. "ta [sentence connective] + smi [pronoun]"; Sk. "tas" = Hit. "ta + as"), etc.

Numerals. — The numeral-system, built upon a decimal basis, is that of Indo-European. There are separate names for the numbers up to 10; from 11 to 19 compounds of the units with the word for 10 partly correspond with those of Greek and Latin: *e.g.*, *d*(u)*vádaśa* "12" = Gk. *dṑdeka*, Lat. *duōdecim*. Above that the tens (20, 30, etc.) were in origin probably compounds expressing a number of tens, and the intermediate numbers were formed by compounds of the units nith these: *e.g.*, *páñca* "5" (Gk. *pénte*, Lat. *quīnque*), *pañcāśát* "50" (cf. Gk. pentdkonta, Lat. quinquiiginta), *páñcapañcāśat* "55." There are separate words for 100 and 1000. The special word for 100.000 (*lakṣaḥ*, whence modern *lākh*) is post-vedic. The numerals from 1 to 19 are adjectives; the rest are substantives.

Gender. — Traces of the distinction of gender between animate (=masculine and feminine) and inanimate (=neuter) are seen in the use of the neut. *udakám* "water as a medium of floating, etc.," and the fem. *å̊paḥ* "water as personified as sentient beings." But for the most part in Sanskrit gender is grammatical and largely independent of nature, except that male and female living beings are usually (though not always) respectively masculine or feminine. There were three genders — masculine, feminine and neuter. The neuter was distinguished by its termination (or lack of termination) in the nominative and accusative, and by the fact that the form of the accusative was the same as that of the nominative. But the masculine and feminine substantives were primarily distinguished only by the form of an adjective, if there were one, in agreement with them (as often, *e.g.*, in French or German). But there was a tendency to reserve certain types of stem for one or other gender. Thus the –a stems in Sanskrit are reserved only for masculine and neuter nouns (although in Greek they may still be feminine, *e.g.*, *hē hippos* "the mare"); and the –6 stems are mostly feminine. In the older language the –*i* stems might be masculine or feminine; in the later language they are almost all feminine. Similarly even in Classical Sanskrit –*i* stems are either masculine or feminine; but in the spoken language there was a growing tendency to confine them to feminine: thus words of this declension which are masculine in Sanskrit become feminines in the modern languages: agnih m. "fire" (=Lat. *ignis*) becomes Hindi *āg* f.

Verbs.—In the Vedic language the verbal system is of considerable complexity. A verb might have various stems, viz. present (sometimes more than one), aorist (three in number, root, *e.g.*, *ásthām* = Gk. *éstēn*, strong, *e.g.*, *aricam* = Gk. *élipon*, sigmatic, *e.g.*, *araikṣam* = Gk. *éleipsa*); perfect (characterized by reduplication and peculiar terminations); future (rare in the old language). The significance of the stems lay in the mode of action they expressed. Very generally speaking, the present indicated continuous action, the aorist momentary action, the perfect a state resulting from past action. The various present stems indicated various types of present-stem action, such as intensive, repetitive, inchoative, causative, desiderative, etc. Each of the first three stems had five moods — indicative expressing fact, injunctive and subjunctive expressing will and futurity, optative expressing wish, imperative expressing command. In the indicative of the present, perfect and future stems there were two tenses, present and past; the aorist stem was in the indicative confined to the past tense. Each tense had three persons and three numbers — singular, dual and plural. Finally each tense could be conjugated in tno voices with different terminations — active and middle. Among the parts of the infinite verb there was connected with each stem a participle which could be either active or middle, present, past, or perfect, and independent of tense stems a past participle, one or more infinitives (for the most part case-forms of verbal nouns), a gerundive (=future passive participle) and an indeclinable participle or gerund. The total number of possible forms belonging to any one verb is thus very great.

The idea of time was expressed in the indicative primarily by the termination: the primary endings expressing present and future time, the secondary endings past (and also, to some extent, future) time. Past time was usually still further defined by the prefixing of a particle, a or *ā*, before the verb (corresponding to the Greek and Armenian augment), *e.g.*, *dádhāmi* "I place," *ádadhām* "I placed" = Gk. *títhēmi*, *étithēn*. The active voice indicated that the action performed had reference to some person or thing other than the doer, the middle that the action had reference to the doer in some way or other: *e.g.*, active *taṇḍulā̊n nēnēkti* "he mashes the rice" (French *il* lave), middle *pā̊ṇī nēniktē* "he washes his hands" (it se lave les mains). As in Greek, the middle could also be used to express passive sense, but this use was later confined to the perfect and especially the aorist stems, while a special present stem (characterized by the suffix –*yá–* with middle terminations) was used for the present passive: *e.g.*, *labhatē* "he takes," *labhyatē* "is taken." The expression of person was inherent in the verbal form, and pronouns nere used only when emphasis was desired. As with the nouns, there were two types of stems — the athematic with variable accent and variable stem form to which the terminations were directly attached (type *ás-ti* "he is" = Gk. estz, Lat. est), the thematic with invariable accent and stem betueen nhich and the termination the vowel a was inserted (type *váh-a-ti* = Lat. veh-i-t). There was a growing tendency for verbs to be brought into this class from the other, since its conjugation was the more normal; thus yundk-ti (3rd plur. *yuñj-ánti*) "joins," contrasted with the already thematic Lat. *jung-i-t*, became later *yuñj-a-ti* (3rd plur. *yuñj-a-nti*). This type almost alone survives in the modern languages.

This verbal system was greatly simplified in Classical Sanskrit. The injunctive mood almost, and the subjunctive entirely. disappeared or were incorporated in the imperative. The aorist and perfect stems remained only in the indicative, and the aorist participle disappeared. The infinitive uas reduced to one form only (the accusative of a noun in –*tu–*, corresponding in form to the Latin supine, *e.g.*, *jñātum* "to know" = [*g*]*nōtum*), and the absolutive to two, one for simple, one for compound verbs. This left the present stem predominant; and though the aorist and the perfect survived in the indicative, their meaning was scarcely,

if at all, to be distinguished from that of the past tense of the present stem (*i.e.,* the imperfrct). Finally even in Sanskrit itself the imperfect tended to be replaced by the past participle used as a finite verb. Among the spoken languages in some areas the aorist seems to have been developed further as a past tense, but as a whole the verb of the modern languages possesses a present system based on the Sanskrit present stem and a past system based on the Sanskrit past participle.

Syntax. — In its main lines the syntax of Sanskrit is Indo-European, and the primary uses of its cases, moods and tenses can be paralleled from other Indo-European languages. Its most peculiar development was in the region of composition. Compounds, usually of not more than two members, are common in the Vedic texts. Even in the Epic their extension is considerable, and compounds consisting of three or four separate members are not rare. In the later, more artificial, language compounds may be met with nhich extend over a page or more.

Vocabulary. — Sanskrit shows a constant change and development of vocabulary. Part of this is in the natural evolution of already existing material. The main constituent of the vocabulary of Vedic Sanskrit is Indo-European, but even here there are some words which are not Indo-European. One source of such words is undoubtedly the languages which the Aryans found in India; and recently J. Przyluski has demonstrated that some (such as *bānáh* "arrow," *mayūraḥ* "peacock," *karpāsam* "cotton") were received from *Muṇḍā* or Austro-Asiatic languages. Another source for nea words was found in the spoken Aryan languages: words taken from these were given a Sanskrit form. In this way even original Sanskrit nords returned under a new form: we have already seen how zikrita–, having in the spoken language become *vikaṭa–*, was readopted in that form in the literary tongue, and retained side by side uith *vikrita–*.

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LITERATURE

The history of Sanskrit literature like the political history of ancient India suffers from the total nant of anything like a fixed chronology. In its vast range there is scarcely a work of importance the date of which can be fixed with absolute certainty. The original composition of most Sanskrit uorks can indeed be confidently assigned to certain general periods but as to many of them, there is reason to doubt whether they have come down to us in their original shape.

The history of Sanskrit literature readily divides itself into two main periods — the Vedic and the classiczl. These periods partly overlap, and some of the later Vedic norks are included in that period on account of their subject matter, and archaic style, rather than for any claim to a higher antiquity than some of the oldest works of classical Sanskrit. The first period may be put at 1500–200 B.C. and the second 500 B.C.–A.D. 1000.

THE VEDIC PERIOD

Samhitâs.—The term veda, *i.e.* (sacred) "knowledge," "lore"—embraces a body of writings the origin of which is ascribed to divine revelation (*śruti,* literally '(hearing"), and which forms the foundation of the Brāhmanical system of religious belief. This sacred canon is divided into three or (according to a later scheme) four co-ordinate collections, likewise called Veda: (1) the *Rig-veda,* or lore oi praise (or hymns); (2) the *Sāma-veda,* or lore of tunes (or-chants); (3) the *Yajur-veda,* or lore of prayer (or sacrificial formulas); and (4) the *Atharva-veda,* or lore of the Atharvans. Each of these four Vedas is a collection (*saṃhitā*) of sacred, mostly poetical, texts of a devotional nature, called *mantra.* This entire body of texts (and particularly the first three collections) is also known as the tvayi *vidyā,* or threefold wisdom, of hymn (*rich*), tune or chant (*sāman*), and prayer (*yajus*)—the fourth Veda, when included, being classed together with the Rik.

Classes **of** Priests. — The Brahmanical religion finds its practical expression chiefly in sacrificial performances: The Vedic sacrifice requires for its proper performance the attendance of four officiating priests, each of whom is assisted by one or more (usually three) subordinate priests, viz.: (1) the Hotar (or *hotri,* i e , either "sacrificer," or "invoker"), whose chief business is to invoke the gods, in prayers or hymns; (2) the Udgdtar (udgātri), or chorister, who has to perform chants (stotra) in connection with the hotar's invocations; (3) the Adhvaryu, or offeringpriest par excellence, who performs all the material duties of the sacrifice, such as the kindling of the fires; (4) the Brahman, or chief "priest," uho superintends the performance and rectifies any mistakes that may be committed. The Sāmaveda and Yajurveda form special song and prayer books, arranged for the practical use of the udgātar and adhvaryu respectively; the Rik-saṃhitā, though not arranged for any such practical purpose. contains the entire body of sacred lyrics whence the hotar draws the material for his recitations. The brahman had no special textbook, but was expected to be familiar with all the Saṃhitās as well as with the practical details of the sacrificial performance. (*See* BRAHMA AYD BRAHMAN.)

Brāhmaṇas.—The several Saṃhitās have attached to them certain theological prose works, called *Brāhmaṇa,* which also form part of the canon. Their object is to explain the relationship of the Vedic texts to the now very elaborate sacrificial ceremonial and to explain their mystic import. (See BRAHMANAS.)

Āraṇyakas and Upanishads. — Closely connected with the Brāhmaṇas are two classes of treatises called Aranyaka and *Upanishad.* The Aranyakas, *i.e.,* works "relating to the forest," intended to be read or expounded by anchorites in the quiet of the forest, resemble the Brāhmaṇas, which they supplement by dealing with special points of ritual. The Upanishads are of a more mystical nature, and form the first attempts at a systematic treatment of metaphysical questions. From their pantheistic views later developed the Vedānta philosophy. The Upanishads have to be assigned to verv different periods of Sanskrit literature. The oldest treatises of this kind are doubtless those which form part of the Saṃhitās, Brāhmaṇas and Āraṇyakas of the three older Vedas.

Different Recensions. — As the sacred texts were not committed to writing till a much later period, but were handed down orally in the Brāhmaṇical schools, it was inevitable that local differences of reading should spring up, which in course of time gave rise to a number of independent versions. Such different text-recensions, called *śākhā* (*i.e.,* branch), were at one time very numerous, but only a limited number have survived. As regards the Samhitas, the poetical form of the hymns, as well as the concise style of the sacrificial formulas, rendered these texts less liable to change.

Vedāṅgas.—Besides the purely ceremonial matter, the Brāhmaṇas also contained a considerable amount of matter bearing on the correct interpretation of the Vedic texts; and, indeed, the sacred obligation incumbent on the Brāhmans of handing down correctly the letter and sense of those texts necessarily involved a good deal of serious grammatical and etymological study in the Brāhmaṇical schools. These literary pursuits resulted in the accumulation of much learned material, which it became desirable to throw into a systematic form. These practical requirements were met by a class of treatises, grouped under six different heads or subjects, called *Vedāṅgas, i.e.,* members, or limbs, of the (body of the) Veda. In their present form these works represent a rather advanced stage of scientific development. Though a few of them are composed in metrical form — the majority belong to a class of writings called *sūtra, i.e.,* "string," consisting of strings of rules in the shape of tersely expressed aphorisms, intended to be committed to memory.

Sūtras.—The Siitras form a connecting link between the Vedic and the classical periods of literature. These treatises are included among the Vedic writings, and in point of language may be considered as the latest products of the Vedic age, but they are no longer *śruti* or revelation. They are of human, not of divine, origin. The Siitras are regarded nevertheless as works of great authority, second only to that of the revealed Scriptures;

in contrast to the latter they are called smriti, or tradition.

The six branches of Vedic science, included under the term Vediinga, are as follows:—

1. *Śikshā,* or Phonetics.—In addition to a small treatise ascribed to the great grammarian Pāṇini, the *Pāṇinīyā śikshā,* there are usually included under this head certain works, called *Prātiśākhya, i.e.,* "belonging to a certain *śākhā* or recension," which deal minutely with the phonetic peculiarities of the several Samhitiis, and are of great importance for Vedic textual criticism.

2. Chhandas, or Metre.—Tradition makes the *Chhandaḥ-sūtra* of Piṅgala the starting-point of prosody. The Vedic metres, however, occupy but a small part of this treatise; they are particularly dealt with in the Nidāna-sūtra of the Siimaveda, and in a chapter of the Rik-prātiśakhya. For later profane prosody, on the other hand, Pingala's treatise is valuable.

3. *Vyākaraṇa,* or Grammar.—Pāṇini's famous grammar is said to be the Vedāṅga; but it marks the culminating point of grammatical research rather than the beginning, and treats chiefly of the post-Vedic language.

4. Nirukta, or Etymology.—Yāska's Nirukta deals entirely with Vedic etymology and exegesis. It consists, in the first place, of strings of words in three chapters: (1) synonymous words; (2) such as are purely or chiefly Vedic; and (3) names of deities. These lists are followed by Yāska's commentary, interspersed with numerous illustrations. Yāska quotes the works of several predecessors but his is by several centuries the oldest surviving work of its kind. The above four studies deal with the correct understanding of texts, the next two with rites and their proper seasons.

5. Jyotisha, or Astronomy.—The metrical treatise which has come down to us in two different recensions under the title of Jyotisha, ascribed to one Lagadha, or Lagata, seems to be the oldest existing systematic treatise on astronomical subjects.

6. *Kalpa,* or Ceremonial.—Sacrificial practice gave rise to a large number of systematic sfitra-manuals for the several classes of priests. The most important of these works have come down to us, and they occupy by far the most prominent place among the literary productions of the sfitra-period. The Kalpa-sfitras, or rules of ceremonial, are of two kinds: (1) the *Śrauta-sūtras,* which are based on the Sruti, and teach the performance of the great sacrifices, requiring three sacrificial fires; and (2) the *Smārta-sūtras,* or rules based on the smṛiti or tradition. The latter class again includes two kinds of treatises: (1) the *Grihya-sūtras,* or domestic rules, treating of ordinary family rites, such as marriage, birth, name-giving, etc., connected with simple offerings in the domestic fire; and (2) the *Sāmayāchārika-* (or *Dharma-*) *sūtras,* which treat of customs and temporal duties, and are supposed to have formed the chief sources of the later law-books.

THE FOUR VEDAS

After this brief characterization of the various branches of Vedic literature, we proceed to take a rapid survey of the several Vedic collections.

Rigveda.—The *Rigveda-saṃhitā* has come down to us in the recension of the Śākala school, which shows that it consists of 1,028 hymns, including eleven so-called *Vālakhilyas,* probably of later date. The hymns are composed in a great variety of metres, and consist, on an average, of rather more than 10 verses each, or about 10,600 verses altogether. This body of sacred lyrics has been subdivided by ancient authorities in a twofold way, viz. either from a purely artificial point of view, into eight *ashṭakas* of about equal length, or, on a more natural principle, based on the origin of the hymns, and invariably adopted by European scholars, into ten books, or mandalas, of unequal length. Tradition has handed down the names of the reputed authors, or rather inspired "seers" (*rishi*), of most hymns. These indications have enabled scholars to form some idea as to the probable way in which the Rik-samhitii originated, though much still remains to be cleared up by future research.

Mandalas ii.–vii. are evidently arranged on a uniform plan. Each of them is ascribed to a different family of rishis, whence they are usually called the six "family-books": ii., the Gritsamadas; iii., the Viśvāmitras or Kuśikas; iv., the Vāmadevyas; v., the Atris; vi., the Bharadviijas; and vii., the Vasishfhas. Further, each of these books begins with the hymns addressed to Agni, the god of fire, which are followed by those to Indra, whereupon follow those addressed to minor deities—the Viśve Devāh ("all-gods"), the Maruts (storm-gods), etc. Again, the hymns addressed to each deity are arranged in a descending order, according to the number of verses of which they consist.

Mandala i., the longest in the whole Saṃhitā, contains 191 hymns, ascribed, with the exception of a few isolated ones, to sixteen poets of different families, and consisting of one larger (50 hymns) and nine shorter collections. Here again the hymns of each author are arranged on precisely the same principle as the "family-books." Maṇḍalas viii. and ix., on the other hand, have a special character of their own. To the Siimaveda, these two mandalas have contributed a much larger proportion of verses than any of the others. The hymns of the eighth book are ascribed to a number of difierent ṛishis, mostly belonging to the Kāṇva family. The chief peculiarity of this mandala, however, consists in the strophic character of its composition and the numerous repetitions throughout it. It is closely connected with the first half of the first mandala and they were evidently added as beginning and end to the collected ii.–vii. The ninth mandala consists entirely of hymns (114) addressed to Soma, the deified juice of the so-called "moon-plant" (*Sarcostemma viminale,* or *Asclepias acida*), and ascribed to poets of different families. They are called *pavamānī,* "purificational," because they were to be recited by the hotar while the juice expressed from the soma plants was clarifying. The hymns are by poets of the same families as ii.–vii. and it is evident that when these hymns were collected the soma hymns mere taken out and put into a single collection. There are also a few soma hymns in the later books (i., viii., x.).

Maṇḍala x. contains the same number of hymns (191) as the first, which it nearly equals in actual length. In the latter half of the book the hymns are clearly arranged according to the number of verses, in decreasing order—occasional exceptions to this rule being easily adjusted by the removal of a few apparently added verses. This mandala came into existence after the other nine were in their present form, a fact of which there is abundant evidence. It shows considerable uniformity and is all older than the latest insertions in other books of the former collectors.

It is usual to call the Rik-samhitii (as well as the Atharvan) an historical collection, as compared with the two Samhitiis put together for purely ritualistic purposes. And indeed, although the Rigveda itself, in its oldest form, may have been intended as a common prayer-book, for the whole of the Briihmanical community, it is certain that in the stage in which it has been finally handed down it includes a certain portion of hymn material (and even some secular poetry) which could never have been used for purposes of religious service. It may, therefore, be assumed that the Rik-samhitii contains all of the nature of popular lyrics that was accessible to the collectors, or seemed to them worthy of being preserved. The question as to the exact period when the hymns were collected cannot be answered with any approach to accuracy. For many reasons, however, which cannot be detailed here, scholars have come to fix on the year 1000 B.C. as an approximate date for the collection of the Vedic hymns. From that time every means that human ingenuity could suggest was adopted to secure the sacred texts against the risks connected with oral transmission. But, as there is abundant evidence to show that even then not only had the text of the hymns suffered corruption, but their language had become antiquated to a considerable extent, and was only partly understood, the period during which the great mass of the hymns were actually composed must have lain considerably farther back, and may very likely have extended over the earlier half of the second millenary, or from about 2000 to 1500 B.C.

As regards the people which raised for itself this imposing monument, the hymns exhibit it as settled in the regions watered by the mighty Sindhu (Indus), with its eastern and western tributaries, the land of the five rivers (Panj-āb) thus forming the central home of the Vedic people. But, while its advanced guard

has already debouched upon the plains of the upper Gaṅgā and Yamuni, those who bring up the rear are still found loitering far behind in the narrow glens of the Kubhā (Cabul) and Gomatī (Gomal). Scattered over this tract of land, in hamlets and villages, the Vedic Xryas are leading chiefly the life of herdsmen and husbandmen. The numerous clans and tribes, ruled over by chiefs and kings, have still constantly to vindicate their right to the land but lately wrung from an inferior race of darker hue. Not infrequently, too, the light-coloured Aryas wage internecine war with one another—as when the Bharatas, with allied tribes of the Panjāb, goaded on by the royal sage Viśvāmitra, invade the country of the Tṛitsu king Sudās, to be defeated in the "ten kings' battle," through the inspired power of the priestly singer Vasishṭha. The priestly office has already become one of high social importance by the side of the political rulers, and to a large extent an hereditary profession; though it does not yet present the baneful features of an exclusive caste.

The religious belief of the people consists in a system of natural symbolism, a worship of the elementary forces of nature, regarded as beings endowed with reason and power superior to those of man. In giving utterance to this simple belief, the priestly spokesman has, however, frequently worked into it his own speculative and mystic notions. Indra, the stout-hearted ruler of the cloud-region, receives by far the largest share of the devout attentions of the Vedic singer. His ever-renewed battle with the malicious demons of darkness and drought, for the recovery of the heavenly light and the rain-spending cows of the sky, forms an inexhaustible theme of spirited song. Next to him, in the affections of the people, stands Agni (*ignis*), the god of fire, invoked as the genial inmate of the Aryan household, and as the bearer of oblations, and mediator between gods and men. Indra and Agni are thus, as it were, the divine representatives of the king (or chief) and the priest of the Aryan community; and if, in the arrangement of the Saṃhitā, the Brāhmanical collectors gave precedence to Agni, it was but one of many avowals of their own hierarchical pretensions. Hence also the hymns to Indra are mostly followed, in the family collections, by those addressed to the Viśve Devah (the "all-gods") or to the Maruts, the warlike storm-gods and faithful companions of Indra, as the divine impersonations of the Aryan freemen, the *viś* or clan. But, while Indra and Agni are undoubtedly the favourite figures of the Vedic pantheon, there is reason to believe that these gods had but lately supplanted another group of deities who play a less prominent part in the hymns, viz., Father Heaven (Dyaus Pitar, Ζεὺς πατήρ, Jupiter); Varuna (probably οὐρανός), the all-embracing (esp. nocturnal) heavens; Mitra (Zend. Mithra), the genial light of day; and Savitar, the quickener, and Sūrya (ἥλιος), the vivifying sun.

Brāhmaṇas of *Rigveda.*—Of the Brāhmaṇas that were handed down in the schools of the *Bahvṛichas* (*i.e.*, "possessed of many verses"), as the followers of the Rigveda are called, two have come down to us, viz. those of the Aitareyins and the Kaushītakins. The *Aitareya-brāhmaṇa* and the *Kaushītaki-* (or Sinkhdyana-) *brāhmaṇa* evidently have for their groundwork the same stock of traditional exegetic matter. They differ, however, considerably in their arrangement of this matter. There is also a certain amount of material peculiar to each of them. The Kaushitaka is, upon the whole, far more concise in its style and more systematic in its arrangement—features which would lead one to infer that it is probably the more modern work of the two. While the Aitareya deals almost exclusively with the Soma sacrifice, the Kaushitaka first treats of the several kinds of *haviryajña*, or offerings of rice, milk and ghee, and then of the Soma sacrifice. Sāyaṇa, in the introduction to his commentary on the work, ascribes the Aitareya to the sage Mahidāsa Aitareya (*i.e.*, son of Itarā), also mentioned elsewhere as a philosopher; and it seems likely enough that this person arranged the Brāhmaṇa and founded the school of the Aitareyins. Regarding the authorship of the sister work we have no definite statement. Probably it is what one of the manuscripts calls it—the Brāhmaṇa of Śānkhāyana (composed) in accordance with the views of Kaushītaki.

Each of these two Brāhmaṇas is supplemented by a "forest-book," or Aranyaka. The *Aitareyāraṇyaka* is not a uniform production. It consists of five books (*āraṇyaka*), three of which, the first and the last two, are of a liturgical nature, treating of the ceremony called *mahāvrata*, or great vow. The last of these books, composed in sūtra form, is, however, doubtless of later origin. The second and third books are purely speculative, and are also styled the *Bahvricha-brāhmaṇa-upanishad.* Again, the last four chapters of the second book are usually singled out as the *Aitareya-upanishad,* ascribed, like its Brāhmaṇa (and the first book), to Mahidāsa Aitareya; and the third book is also referred to as the *Saṃhitā-upanishad.* As regards the *Kaushītaki-āraṇyaka,* this work consists of fifteen adhyiyas, the first two (treating of the mahāvrata ceremony) and the seventh and eighth of which correspond to the first, fifth, and third books of the Aitareyāraṇyaka respectively, whilst the four adhyāyas usually inserted between them constitute the highly interesting *Kaushītaki-* (*brāhmaṇa-*) upanishad, of which we possess two different recensions. The remaining portions (9–15) of the Aranyaka treat of the vital airs, the internal Agnihotra, ending with the vaṃśa, or succession of teachers. Of *Kalpa-sūtras,* or manuals of sacrificial ceremonial, composed for the use of the hotar priest, two different sets are in existence, the *Āśvalāyana-* and the *Śānkhāyana-sūtra.* Each of these works follows one of the two Brāhmaṇas of the Rik as its chief authority: the Aitareya and Kaushitaka respectively. Both consist of a *Śrauta-* and a *Grihya-sūtra.* Āśvalāyana seems to have lived about the same time as Pāṇini (? c. 400 B.C.)—his own teacher, Saunaka, who completed the Ṛik-prātiśākhya, being probably intermediate between the great grammarian and Yāska, the author of the Nirukta. Saunaka himself is said to have been the author of a *Śrauta-sūtra* (which was, however, more of the nature of a Brāhmaṇa) and to have destroyed it on seeing his pupil's work. A *Grihya-sūtra* is still quoted under his name by later writers. The *Āśvalāyana Śrauta-sūtra* consists of twelve, the Grihya of four, adhyāyas.

Regarding Śānkhāyana still less is known; but he, too, was doubtless a comparatively modern writer, who, like Āśvalāyana, founded a new school of ritualists. Hence the Kaushītaki-brāhmana, adopted (and perhaps improved) by him, also goes under his name, just as the Aitareya is sometimes called Āśvalāyana-Brāhmaṇa. The Śānkhāyana Śrauta-sūtra consists of eighteen adhyāyas. The last two chapters of the work are, however, a later addition, while the two preceding chapters, on the contrary, present a comparatively archaic, brāhmaṇa-like appearance. The Grihya-sūtra consists of six chapters, the last two of which are likewise later appendages. The Sdmbavya *Grihya-sūtra,* of which a single ms. is at present known, seems to be closely connected with the preceding work. Professor Bühler also refers to the Rigveda the *Vāsishṭha-dharmaśāstra,* composed of mixed sūtras and couplets.

A few works remain to be noticed, bearing chiefly on the textual form and traditionary records of the Rik-saṃhitā. The Prātiśākhyas have already been referred to as the chief repositories of śikshā or Vedic phonetics. Among these works the *Rik-prātiśākhya* occupies the first place. The original composition of this important work is ascribed to the same Sakalya from whom the vulgate recension of the (Śākala) Saṃhitā takes its name. He is also said to be the author of the existing *Pada-pāṭha* (*i.e.*, the text-form in which each word is given unconnected with those that precede and follow it).

Sāmaveda.—The term *sāman,* of uncertain derivation, denotes a solemn tune or melody to be sung or chanted to a rich or verse. The set chants (stotra) of the Soma sacrifice are as a rule performed in triplets, either actually consisting of three different verses, or of two verses which, by the repetition of certain parts, are made, as it were, to form three. The three verses are usually chanted to the same tune; but in certain cases two verses sung to the same tune had a different *sāman* enclosed between them. One and the same *sāman* or tune may thus be sung to many different verses; but, as in teaching and practising the tunes the same verse was invariably used for a certain tune, the term *sāman,* as well as the special technical names of *sāmans, are*

not infrequently applied to the verses themselves with which they were ordinarily connected.

In accordance with the distinction between rich or text and *sāman* or tune, the siiman-hymnal consists of two parts: the *Sāma-veda-saṃhitā,* or collection of texts (*rich*) used for making up siiman-hymns, and the *Gāna,* or tune-books, song-books. The textual matter of the Samhitii consists of somewhat under 1600 different verses, selected from the Rik-samhitii, with the exception of some seventy-five verses, some of which have been taken from Khila hymns, whilst others which also occur in the Atharvan or Yajurveda, as well as such not otherwise found, may perhaps have formed part of some other recension of the Rik. The *Sāmaveda-saṃhitā* is divided into two chief parts, the *pūrva-* (first) and the uttara- (second) *ārchika.* The second part contains the texts of the siiman-hymns, arranged in the order in which they are actually required for the stotras or chants of the various Soma sacrifices. The first part, on the other hand, contains the body of tune-verses, or verses used for practising the several *sāmans* or tunes upon—the tunes themselves being given in the *Grāma-geya-gāna* (*i.e.,* songs to be sung in the village), the tune-book specially belonging to the Pūrvārchika.

Sāmaveda-brāhmaṇas.—The title of *Brāhmaṇa* is bestowed by the Chhandogas, or followers of the Siimaveda, on a considerable number of treatises. The majority of the Sāmaveda-brāhmaṇas present, however, none of the characteristic features of other works of that class; but they are rather of the nature of sūtras and kindred treatises, with which they probably belong to the same period of literature. Moreover, the contents of these works—as might indeed be expected from the nature of the duties of the priests for whom they were intended—are of an extremely arid and technical character, though they all are doubtless of some importance, either for the textual criticism of the Samhitii or on account of the legendary and other information they supply.

If the Siimaveda has thus its ample share of Brāhmaṇa-literature, though in part of a somewhat questionable character, it is not less richly supplied with siitra-treatises, or works on exegesis, some of which probably belong to the oldest works of that class.

Yajurveda.—This, the sacrificial Veda of the Adhvaryu priests, divides itself into an older and a younger branch, or, as they are usually called. the Black (*krishna*) and the White (*śukla*) Yajurveda. Tradition ascribes the foundation of the Yajurveda to the sage Vaiśampāyana. Of his disciples three are specially named, viz.: Katha, Kaliipin and Yāska Paingi, the last of whom again is stated to have communicated the sacrificial science to Tittiri. We have three old collections of Yajus-texts, viz. the *Kāthaka,* the *Kālāpaka* or *Maitrāyani Samhitā,* and the *Taittiriya-samhitd.* The *Kāthaka* and *Kālāpaka* are frequently mentioned together; and the author of the "great commentary" on Pāṇini once remarks that these works were taught in every village. From the *Kaṭhas* and *Kālāpas* proper schools seem early to have branched off, each with their own recensions of the text. As regards the Taittiriya-samhitii, that collection, too, in course of time gave rise to a number of different schools, the text handed down being that of the Xpastambas.

The four collections of old Yajus texts, so far known to us, while differing more or less considerably in arrangement and verbal points, have the main mass of their textual matter in common. This common matter consists of both sacrificial prayers (*yajus*) in verse and prose, and exegetic or illustrative prose portions (*brāhmaṇa*). A prominent feature of the old Yajus texts, as compared with the other Vedas, is the constant intermixture of textual and exegetic portions. The Charakas and Taittiriyas thus do not recognize the distinction between Saṃhitā and Briihmana in the sense of two separate collections of texts, but they have only a Saṃhitā, or collection, which includes likewise the exegetic or Briihmana portions. The Taittiriyas seem at last to have been impressed with their want of a separate Brāhmaṇa and to have set about supplying the deficiency in rather an awkward fashion: instead of separating from each other the textual and exegetic portions of their Samhitii, they merely added to the latter a supplement (in three books), which shows the same mixed condition, and applied to it the title of *Taittirīya-brāhmaṇa.*

The *Maitrāyaṇī Saṃhitā,* the identity of which with the original Kālāpaka has been proved pretty conclusively by Dr. L. v. Schroder, who attributes the change of name of the Kālāpa-Maitriiyaniyas to Buddhist influences, consists of four books, attached to which is the *Maitri-* (or *Maitrāyaṇī*) *upanishad.* The *Kāṭhaka,* on the other hand, consists of five parts, the last two of which, however, are perhaps later additions, containing merely the prayers of the hotar priest, and those used at the horse-sacrifice. There is, moreover, the beautiful *Kaṭha-* or *Kāṭhaka-upanishad,* which is also, and more usually, ascribed to the Atharvaveda, and from which Siinkhya-Yoga ideas may have developed.

Saṃhitā of the White **Yajurveda.**—The defective arrangement of the Yajus texts was at last remedied by a different school of Adhvaryus, the Vājasaneyins. The reputed originator of this school and its text-recension is Yājñavalkya Vājasaneya (son of Vājasani). The result of the rearrangement of the texts was a collection of sacrificial mantras, the *Vājasaneyi-saṃhitā,* and a Briihmana, the *Śatapatha.* On account of the greater lucidity of this arrangement, the Viijasaneyins called their texts the White (or clear) Yajurveda—the name of Black (or obscure) Yajus being for opposite reasons applied to the Charaka texts. Both the Samhitii and Brāhmaṇa of the Vājasaneyins have come down to us in two different recensions, viz., those of the *Mādhyandina* and *Kāṇva* schools. In several points of difference the Kāṇva recension agrees with the practice of the Rik-saṃhitā, and there probably was some connection between the Yajus school of Kāṇvas and the famous family of ṛishis of that name to which the eighth mandala of the Rik is attributed.

The *Vājasaneyi-saṃhitā* consists of forty adhyiiyas, the first eighteen of which contain the formulas of the ordinary sacrifices. The last fifteen (or even twenty-two) adhyiiyas are doubtless a later addition. The last adhyiiya is commonly known under the title of *Vājasaneyi-saṃhitā* (or *Iśāvāsya-*) *upanishad.* Its object seems to be to point out the fruitlessness of mere works, and to insist on the necessity of man's acquiring a knowledge of the supreme spirit.

The last book is of the Upanishad order, and bears the special title of *Brihad-* (great) *āraṇyaka;* its last six chapters are the *Brihadāraṇyaka-upanishad,* the most important of all Upanishads. As regards the age of the Śatapatha, the probability is that the main body of the work is considerably older than the time of Pāṇini, but that some of its latter parts were considered by Pāṇini's critic Kātyāyana to be of about the same age as, or not much older than, Pāṇini.

The consolidation of the Briihmanical hierarchy and the institution of a common system of ritual worship, which called forth the liturgical Vedic collections, were doubtless consummated in the so-called Madhya-deśa, or "midland," lying between the Sarasvati and the confluence of the Yamunii and Gangii; and more especially in its western part, the Kuru–kshetra, or land of the Kurus, with the adjoining territory of the Pañchālas, between the Yamunā and Gangii. From thence the original schools of Vaidik ritualism gradually extended their sphere over the adjacent parts. The Charakas seem for a long time to have held sway in the western and north-western regions; while the Taittiriyas in course of time spread over the whole of the peninsula south of the Narmadā (Nerbudda), where their ritual has remained pre-eminently the object of study till comparatively recent times. The Viijasaneyins, on the other hand, having first gained a footing in the lands on the lower Ganges, chiefly, it would seem, through the patronage of King Janaka of Videha, thence gradually worked their way westwards, and eventually succeeded in superseding the older schools north of the Vindhya.

Atharvaveda.—The Artharvan was the latest of Vedic collections to be recognized as part of the sacred canon. That it is also the youngest Veda is proved by its language, which in vocabulary and grammar marks an intermediate stage between the main body of the Rik and the Brāhmaṇa period. In regard also to the nature of its contents, and the spirit which pervades them, this Vedic collection occupies a position apart from the others. Whilst the older Vedas seem clearly to reflect the recognized religious

notions and practices of the upper classes of the Aryan tribes, as jealously watched over by a priesthood deeply interested in the undiminished maintenance of the traditional observances, the fourth Veda, on the other hand, deals mainly with all manner of superstitious practices such as have at all times found a fertile soil in the lower strata of primitive and less advanced peoples, and are even apt, below the surface, to maintain their tenacious hold on the popular mind in comparatively civilized communities. Although the constant intermingling with the aboriginal tribes may well be believed to have exercised a deteriorating influence on the Vedic people in this respect, it can scarcely be doubted that superstitious practices of the kind revealed by the Atharvan and the tenth book of the Rik must at all times have been present among the Aryan people, and that they only came to the surface when they received the stamp of recognized forms of popular belief by the admission of these collections of spells and incantations into the sacred canon. If in this phase of superstitious belief the old gods still find a place, their character has visibly changed so as to be more in accordance with those mystic rites and magic performances and the part they are called upon to play in them, as the promoters of the votary's cabalistic practices and the averters of the malicious designs of mortal enemies and the demoniac influences to which he would ascribe his fears and failures as well as his bodily ailments. The fourth Veda may thus be said to supplement in a remarkable manner the picture of the domestic life of the Vedic Aryan as presented in the Grihya-sūtras or house-rules; for while these deal only with the orderly aspects of the daily duties and periodic observances in the life of the respectable householder, the Atharvaveda allows us a deep insight into "the obscurer relations and emotions of human life"; and, it may with truth be said that "the literary diligence of the Hindus has in this instance preserved a document of priceless value for the institutional history of early India as well as for the ethnological history of the human race" (M. Bloomfield). It is worthy of note that the Atharvaveda is practically unknown in the south of India.

This body of spells and hymns is traditionally associated with two old mythic priestly families, the Atharvans and Angiras, their names, in the plural, serving either singly or combined (Atharvāṅgirasas) as the oldest appellation of the collection. The two families or classes of priests are by tradition connected with the service of the sacred fire; but whilst the Atharvans seem to have devoted themselves to the auspicious aspects of the fire-cult and the performance of propitiatory rites, the Angiras, on the other hand, are represented as having been mainly engaged in the uncanny practices of sorcery and exorcism. The current text of the *Atharva-saṃhitā*—apparently the recension of the Saunaka school—consists of some 750 different pieces, about five-sixths of which is in various metres, the remaining portion being in prose. The whole mass is divided into twenty books. The principle of distribution is for the most part a merely formal one, in books i.-xiii. pieces of the same or about the same number of verses being placed together in the same book. The next five books, xiv.-xviii., have each its own special subject: xiv. treats of marriage and sexual union; xv., in prose, of the Vrātya, or religious vagrant; xvi. consists chiefly of prose formulas of conjuration; xvii. of a lengthy mystic hymn; and xviii. contains all that relates to death and funeral rites. Of the last two books no account is taken in the Atharva-prātiśākhya, and they indeed stand clearly in the relation of supplements to the original collection. The nineteenth book evidently was the result of a subsequent gleaning of pieces similar to those of the earlier books, which had probably escaped the collectors' attention; while the last book, consisting almost entirely of hymns to Indra taken from the Rik-saṃhitā, is nothing more than a liturgical manual of recitations and chants required at the Soma sacrifice; its only original portion being the ten so-called *kuntāpa* hymns (127–136), consisting partly of laudatory recitals of generous patrons of sacrificial priests and partly of riddles and didactic subjects.

The Atharvan has come down to us in a much less satisfactory state of preservation than any of the other Saṃhitās. The discovery in Kashmir of a second recension of the Atharva-saṃhitā, contained in a single birch-bark ms., written in the Śāradā character, has provided further material for its study. This new recension, ascribed to the Paippalāda school, consists likewise of twenty books (*kāṇḍa*), but in textual matter and arrangement it differs very much from the current text While lacking much of the latter the new version offers a good deal of fresh matter, amounting to about one-sixth of the whole. From the Mahābhashya and other works quoting as the beginning of the Atharva-saṃhitā a verse that coincides with the first verse of the sixth hymn of the current text, it has long been known that at least one other recension must have existed; but the first leaf of the Kashmir ms. having been lost, it cannot be determined whether the new recension (as seems all but certain) corresponds to the one referred to in those works.

Atharvaveda-brāhmaṇa.—The only Brāhmaṇa of the Atharvan, the *Gopatha-brāhmaṇa,* is one of the most modern and least important works of its class. It consists of two parts, the first of which contains cosmogonic speculations, interspersed with legends, mostly adapted from other Brāhmaṇas, and general instructions on religious duties and observances; while the second part treats, in a very desultory manner, of various points of the sacrificial ceremonial.

Atharvaveda-sutras.—The Kalpa-siitras belonging to this Veda comprise both a manual of Srautarites, the *Vaitāna-sūtra,* and a manual of domestic rites, the *Kauśika-sūtra.* The teacher Kauśika is repeatedly referred to in the work on points of ceremonial doctrine. The last sūtra-work to be noticed in connection with this Veda is the *Śaunakīyā Chaturādhyāyikā,* being a Prātiśākhya of the Atharva-saṃhitā, so called from its consisting of four lectures (adhyāya). Although Saunaka can hardly be credited with being the actual author of the work, considering that his opinion is rejected in the only rule where his name appears, there is no reason to doubt that it chiefly embodies the phonetic theories of that teacher, which were afterwards perfected by members of his school. Whether this Saunaka is identical with the writer of that name to whom the final redaction of the Sākalaprātiśakhya of the Rik is ascribed is not known.

Upanishads. — Another class of writings traditionally connected with the Atharvaveda are the numerous *Upanishads* which do not specially attach themselves to one or other of the Saṃhitās or Brāhmaṇas of the other Vedas. The Ātharvaṇa-upanishads, mostly composed in ślokas, may be roughly divided into two classes: those of a purely speculative or general pantheistic character, treating chiefly of the nature of the supreme spirit, and the means of attaining to union therewith, and those of a sectarian tendency. Of the former category, a limited number—such as the Praśna, Muṇḍaka and Māṇḍūkya-upanishads—have probably to be assigned to the later period of Vedic literature; whilst the others presuppose more or less distinctly the existence of some fully developed system of philosophy, especially the Vedanta or the Yoga. The sectarian Upanishads, on the other hand—identifying the supreme spirit either with one of the forms of Vishnu (such as the Nārāyaṇa, Nṛisiṃha-tāpanīya, Rāma-tāpaniya, Gopāla-tāpanīya Upanishads), or with Śiva (*e.g.,* the Rudra-upanishad), or with some other deity—belong to post-Vedic times.

THE CLASSICAL PERIOD

The Classical Literature of India is almost entirely a product of artificial growth, in the sense that its vehicle was not the language of the general body of the people, but of a small and educated class. It would scarcely be possible. even approximately, to fix the time when the literary idiom ceased to be understood by the common people. We only know that in the 3rd century B.C. there existed several dialects in different parts of northern India which differed considerably from the Sanskrit; and Buddhist tradition states that Gautama Śākyamuni himself, in the 6th century B.C., used the local dialect of Magadha (Behar) in preaching his new doctrine. Not unlikely, indeed, popular dialects, differing perhaps but slightly from one another, may have existed as early as the time of the Vedic hymns, when the Indo-Aryans, divided into clans and tribes, occupied the Land of the Seven Rivers; but such dialects must have sprung up

after the extension of the Aryan sway and language over the whole breadth of northern India. But there is no reason why, even with the existence of local dialects, the literary language should not have kept in touch with the people in India, as elsewhere, save for the fact that from a certain time that language remained altogether stationary, allowing the vernacular dialects more and more to diverge from it. Although linguistic research had been successfully carried on in India for centuries, the actual grammatical fixation of Sanskrit seems to have taken place about contemporaneously with the first spread of Buddhism; and indeed that popular religious movement undoubtedly exercised a powerful influence on the linguistic development of India.

Epic Poems.—The Hindus, like the Greeks, possess two great national epics, the *Mahābhārata* and the *Rāmāyaṇa.* The *Mahābhirata, i.e.,* "the great (poem or tale) of the Bhiiratas," is not so much a uniform epic poem as a great collection of poetry, consisting of a mass of legendary and didactic matter, worked into and round a central heroic narrative. The authorship of this work is aptly attributed to Vyāsa, "the arranger," the personification of Indian recension. Only the bare outline of the leading story can here be given.

At Hastināpura (sixty miles from the modern Delhi) in the Bharata country Dhritarāshṭra, the elder of the princes, being blind, was passed over for his brother Pāṇḍu on the death of their father. On the death of Pāṇḍu, however, Dhritarāshṭra assumed the government, assisted by his uncle Bhishma, the Nestor of the poem. Pāṇḍu had five sons, Yudhishfhira, Bhīma and Arjuna, by his chief wife Kiinti. and the twins Nakula and Sahadeva by his wife Mādrī. From their great-grandfather Kuru both families are called *Kauravas;* but for distinction that name is more usually applied to the sons of Dhritarāshṭra, while their cousins, as the younger line, are named, after their father, *Pāṇḍavas.* The Pāṇḍavas were brought up at their uncle's court like his own sons. The rivalry and varying fortunes of these two houses form the main plot of the great epic. The Pāṇḍu princes soon proved themselves greatly superior to their cousins; and Yudhishṭhira, the eldest of them all, was to be appointed heir-apparent. But they had to leave the country to escape the plots of their jealous cousins. In their exile Draupadi, daughter of King Drupada of Panchāla, won by Arjuna in open contest, became the wife of the five brothers. At the contest they met their cousin, nephew of their mother Kunti, the famous Yādava prince Krishna of Dvārakā, who ever afterwards remained their faithful friend and confidential adviser. Dhritarāshṭra now divided the kingdom between the two houses; whereupon the Pāṇḍavas built for themselves the city of Indraprastha (on the site of the modern Delhi). After a time of great prosperity, Yudhishfhira, in a game of dice, lost everything to Duryodhana, when it was settled that the Pāṇḍavas should retire to the forest for twelve years, but should afterwards be restored to their kingdom if they succeeded in passing an additional year in disguise. During their forest-life they met with many adventures, among which may be mentioned their encounter with King Jayadratha of Chedi, who had carried off Draupadi from their hermitage. After the twelfth year has expired they leave the forest, and, assuming various disguises, take service at the court of King Virāṭa of Matsya. Here all goes well for a time till the queen's brother Kichaka, a great warrior and commander of the royal forces, falls in love with Draupadi, and is slain by Bhima. The Kauravas, profiting by Kichaka's death, now invade the Matsyan kingdom, when the Pāṇḍavas side with King Virāṭa, and there ensues, on the field of Kurukshetra, during eighteen days, a series of fierce battles, ending in the annihilation of the Kauravas; only the Pāṇḍavas, Arjuna and his charioteer Krishna survived on the victorious side. Yudhishfhira now at last becomes yuva-rāja, and eventually king—Dhritariishfra having resigned and retired with his wife and Kunti to the forest, where they soon after perish in a conflagration. Learning also of the death of Krishna, Yudhishṭhira himself at last becomes tired of life and resigns his crown; and the five princes, with their faithful wife, and a dog that joins them, set out for Mount Meru, to seek admission to Indra's heaven. On the way one by one drops off, till Yudhishfhira alone, with the dog, reaches the gate of heaven; but, the dog being refused admittance, the king declines entering without it, when the dog turns out to be no other than the god of Justice himself, having assumed that form to test Yudhishṭhira's constancy. But, finding neither his wife nor his brothers in heaven, and being told that they are in the nether world to expiate their sins; the king insists on sharing their fate, when this, too, proves a trial, and they are all reunited to enjoy perpetual bliss.

The complete work consists of upwards of 100,000 couplets—its contents thus being nearly eight times the bulk of the Iliad and *Odyssey* combined. **It** is divided into eighteen books, with a supplement, entitled Harivaṃśa, or genealogy of the god Hari (Krishna-Vishnu). The portion relating to the feud of the rival houses constitutes somewhere between a fourth and a fifth of the work; and it is by no means improbable that this portion once formed a separate poem, called the *Bhirata.* While some of the episodes are so loosely connected with the story as to be readily severed from it, others are so closely interwoven with it that their removal would seriously injure the very texture of the work. This, however, only shows that the original poem must have undergone some kind of revision, or perhaps repeated revisions. That such has indeed taken place, at the hand of Brāhmans, for sectarian and caste purposes, cannot be doubted. According to Lassen's opinion, which has been very generally accepted by scholars, the main story of the poem would be based on historical events: on a destructive war waged between the two neighbouring peoples of the Kurus and Panchiilas, who occupied the western and eastern parts of the Madhyadeśa (or "middle land" between the Ganges and Jumna) respectively, and ending in the overthrow of the Kuru dynasty. On the original accounts of these events—perhaps handed down in the form of lays or sagas—the Pāṇḍava element would subsequently have been grafted as calculated to promote the class interests of the Brāhmanical revisers.

Date of **the** Epic.—The earliest direct information regarding the existence of epic poetry in India is in a passage of Dion Chrysostom (c. A.D. 80)—"even among the Indians, they say, Homer's poetry is sung, having been translated by them into their own dialect and tongue." It is generally agreed that this does not imply an Indian translation of Homer but means that the Indians had similar works. Whence Dion derived his information is not known; but as many leading names of the Mahābhārata and even the name of the poem itself are mentioned In Pāṇini's grammatical rules, not only must the Bhārata legend have been current in his time (*?c.* 400 B.C.), but most probably it was at the time of Patañjali, the author of the "great commentary" on Pāṇini (c. 150 B.C.). It cannot, however, be doubted that long before that time heroic song had been diligently cultivated in India at the courts of princes and among Kshatriyas, the knightly order, generally. In the *Mahābhārata* itself the transmission of epic legend is in some way connected with the Siitas, a social class which, in the caste-system, is defined as resulting from the union of Kshatriya men with Brāhmaṇa women, and which supplied the office of charioteers and heralds, as well as (along with the Miigadhas) that of professional minstrels. Be this as it may, there is reason to believe that, as Hellas had her *ἀοιδοί* who sang the *κλέα ἀνδρῶν,* and Iceland her skalds who recited favourite sagas, so India had from olden times her professional bards, who delighted to sing the praises of kings and inspire the knights with warlike feelings. If in this way a stock of heroic poetry had gradually accumulated which reflected an earlier state of society and manners, we can well understand why, after the Briihmanical order of things had been definitely established, the priests should have deemed it desirable to subject these traditional memorials of Kshatriya chivalry and prestige to their own censorship, and adapt them to their own canons of religious and civil law. Such a revision would doubtless require considerable skill and tact; and if in the present version of the work much remains that seems contrary to the Brāhmanical code and pretensions—*e.g.,* the polyandric union of Draupadi and the Pāṇḍu princes—the reason probably is that such features were too firmly rooted in the popular tradition to be readily eliminated; and **all** the revisers could do was to explain them away as best

they could. Thus Draupadi's abnormal position is actually accounted for in five different ways, one of these representing it as an act of duty and filial obedience on the part of Arjuna who, on bringing home his fair prize and announcing it to his mother, is told by her, before seeing what it is, to share it with his brothers. The epic in time became a great treatise on duty (*dharma*) inculcating the divine origin of Brahman institutions, the caste system and the superiority of the priestly caste not only over the people but over kings. From inscriptions we know that by the end of the 5th century A.D. the Mahābhārata was appealed to as an authority on matters of law. and that its extent was practically uhat it now is, including its supplement, the Harivaṃśa. Indeed, everything seems to point to the probability of the work having been complete by about A.D. 200. But, whilst Bhārata and Kuru heroic lays may, and probably do, go back to a much earlier age, it seems hardly possible to assume that the Pāṇḍava epic in its present form can have been composed before the Greek invasion of India, or about 300 B.C. Moreover, it is by no means impossible that the epic narrative was originally composed—as some other portions of the works are—in prose, either continuous or mixed with snatches of verse. The leading position occupied in the existing epic by Krishṇa (whence it is actually called *kārshṇa-veda,* or the veda of Krishna), and the Vaishnava spirit pervading it, make it very probable that it assumed its final form under the influence of the Bhāgavata sect with whom Vāsudeva (Krishna), originally apparently a venerated local hero, came to be regarded as a veritable god, and incarnation of Vishnu. Its culminating point this sectarian feature attains in the *Bhagavat-gītā* (*i.e.,* the upanishad), "sung by the holy one[x]—the famous theosophic episode. in which Krishna, in lofty and highly poetic language, expounds the doctrine of faith (*bhakti*) and cleims adoration as the incarnation of the supreme spirit. Of the purely legendary matter incorporated with the leading story of the poem, not a little, doubtless, is at least as old as the latter itself. Some of these episodes—especially the well-known story of Nala and Damayanti, and the touching legend of Sāvitrī—themselves form epic gems of high poetic value.

The **Rāmāyaṇa,** *i.e.,* poem "relating to Riima," is ascribed to the poet Viilmiki; and, allowance being made for some later additions, the poem indeed presents the appearance of being the work of an individual genius. In its present form it consists of some 24,000 ślokas, or 48,000 lines of sixteen syllables, divided into seven books.

(I.) King Daśaratha of Kośala, reigning at Ayodhyii (Oudh), has four sons borne him by three wives, viz., Rāma, Bharata and the twins Lakshmana and Śatrughna. Rāma wins for a wife Sītā, daughter of Janaka, king of Videha. (II.) On his return to Ayodhyii he is to be appointed heir-apparent; but Bharata's mother persuades the king now to grant her a long promised boon and insists on his banishing his eldest son for fourteen years, and appointing her son instead. Separation from his favourite son soon breaks the king's heart, whereupon the ministers call on Bharata to assume the reins of government. He refuses, however, and, betaking himself to Riima's retreat on the Chitrakūta mountain (in Bundelkhund), implores him to return; but, unable to shake Rāma's resolve to complete his term of exile, he consents to take charge of the kingdom in the meantime. (III.) After a ten years' happy residence in the forest. Rāvaṇa, the demon-king of Ceylon, carries off Sītā to his capital Laṅkā while her two protectors are away in pursuit of a golden deer sent to mislead them. While she resolutely rejects the Rākshasa's addresses, Riima sets out with his brother to her rescue. (IV.) After numerous adventures they enter into an alliance with Sugriva, king of the monkeys; and, with the assistance of the monkey-general Hanumān, and Rāvaṇa's own brother Vibhīshaṇa, they prepare to assault Lankii. (V.) The monkeys, tearing up rocks and trees, construct a passage across the straits—the so-called Adam's Bridge, still designated Riima's Bridge in India. (VI.) Riima crosses with his allies, slays the demon and captures the stronghold; Sītā successfully undergoes an ordeal by fire to clear herself of the suspicion of infidelity; they return to Ayodhyii, where, after a triumphal entry, Riima is installed. (VII.) Rāma, however, seeing that the people are not yet satisfied of Sītā's purity, resolves to put her away; whereupon, in the forest, she falls in with Vālmīki himself, and at his hermitage gives birth to two sons. While growing up there, they are taught by the sage the use of the bow, as well as the Vedas, and the Rāmāyaṇa as far as the capture of Laṅkā and the royal entry into Ayodhyii. Ultimately Rāma discovers and recognizes them by their wonderful deeds and their likeness to himself, and takes his wife and sons back with him.

The first and last books are later additions by which the poem has been turned to the glory of Vishnu. In these two books Rāma has become deified and identified with the god Vishnu, whilst in the body of the poem his character is simply that of a perfect man and model hero. The background of the epic is a purely mythological one—Rāma representing the god Indra, and Sitii—in accordance with the meaning of the name—the personified "Furrow," as which she is already invoked in the *Rigveda,* and hence is a tutelary spirit of the tilled earth, wedded to Indra, the Jupiter Pluvius. Rāvana would correspond to the demon Vritra of the Rigzeda.

One version of the same story, with, however. many important variations of details, forms an episode of the *Mahābhārata,* the *Rāmopākhyāna,* the relation of which to Vālmīki's work is still a matter of uncertainty. In respect of both versification and diction the Rāmāyaṇa is of a distinctly more refined character than the larger poem; and, indeed, Vālmīki is seen already to cultivate some of that artistic style of poetry which was carried to excess in the later artificial poems (Kāvyas), whence the title of *ādi*-kazi, or first poet, is commonly applied to him. The *Rāmāyaṇa* itself contains a prophecy like that of Horace's to the effect that it will always live on the lips of men, and it has been more than fulfilled. No story in India has attained such popularity. It has been translated into many vernaculars and through the version of Tulsi Das has exerted a tremendous influence on the spiritual life of India. To characterize the Indian epics in a single word: though often disfigured by fancies and exaggerations, they are yet noble works, abounding in passages of remarkable descriptive power, intense pathos, and high poetic grace and beauty; and while, as works of art, they are far inferior to the Greek epics, in some respects they appeal far more strongly to the romantic mind of Europe, namely, by their loving appreciation of natural beauty, their exquisite delineation of womanly love and devotion, and their tender sentiment of mercy and forgiveness.

Purāṇas and **Tantras.**—The *Purāṇas* are partly legendary, partly speculative histories of the universe, compiled for the purpose of promoting some special, locally prevalent form of Brāhmanical belief. They deal with cosmogony, stories of gods, sages and heroes, Vishnu's avatars, the solar and lunar lines of kings and other pseudo-historical matter. They are sometimes styled a fifth Veda, and may indeed in a certain sense be looked upon as the scriptures of Brkhmanical India. The term *purāṇa,* signifying "old." applied originally to prehistoric, especially cosmogonic legends, and then to collections of ancient traditions generally They are popular encyclopaedias of useful knowledge mostly with a Vaishnava tendency. They are connected in subject matter with the *Mahābhārata* and have some relationship to the law books and go back to a common source.

They are almost entirely composed in the epic couplet, and indeed in much the same easy flowing style as the epic poems, to which they are, however, as a rule greatly inferior in poetic value.

According to the traditional classification of these works, there are said to be eighteen (*Mahā-,* or great) *Purāṇas,* and as many *Upa-purāṇas,* or subordinate Puriinas. The former are by some authorities divided into three groups of six, according as one or other of the three primary qualities of external existence—goodness, darkness (ignorance), and passion—is supposed to prevail in them, viz. the *Vishṇu, Nāradiya, Bhāgavata, Garuḍa, Padma, Varāha—Matsya, Kūrma, Liṅga, Śiva,* Skanda, *Agni—Brahmāṇḍa, Brahmavaivarta, Mārkaṇḍeya, Bhavishya, Vāmana* and *Brahma-Purāṇas.* The eighteen principal Puriinas are said to consist of together 400,000 couplets. In northern India the Vaishnava Purāṇas, especially the *Bhāgavata* and *Vishṇu,* are by far the

most popular. The former is held in the highest estimation, and, especially through the vernacular versions of its tenth book, treating of the story of Kṛishṇa, has powerfully influenced the religious belief of India.

From the little we know regarding the Upa-purāṇas, their character does not seem to differ very much from that of the principal sectarian Purāṇas. Besides these two classes of works there is a large number of so-called *Sthala-purāṇas,* or chronicles recounting the history and merits of some holy "place" or shrine, where their recitation usually forms an important part of the daily service.

The *Tantras* have to be considered as partly a collateral and partly a later development of the sectarian Purāṇas; though, unlike these, they can hardly lay claim to any intrinsic poetic value. These works are looked upon as their sacred writings by the numerous *Śāktas,* or worshippers of the female energy (Sakti) of some god, especially the wife of Siva, in one of her many forms (Pārvatī, Devi, Kālī, Bhavānī, Durga). This worship of a female representation of the divine power appears already in some of the Purāṇas; but in the Tantras it assumes quite a peculiar character, being largely intermixed with magic performances and mystic rites, partly, indeed, of a grossly immoral nature. (See HINDUISM.) See the series of Tantric works edited by A. Avalon.

Artificial Epics and Romances. — About the beginning of the Christian era a new class of epic poems begins to make its appearance, differing widely in character from those that had preceded it. These later productions are of a decidedly artificial character, and must necessarily have been beyond the reach of any but the highly cultivated. They are, on the whole, singularly deficient in incident and invention, their subject matter being almost entirely derived from the old epics. Nevertheless, these works are by no means devoid of merit and interest; and a number of them display considerable descriptive power and a wealth of genuine poetic sentiment. The simple heroic couplet has been largely discarded for various more or less elaborate metres; and in accordance with this change of form the diction becomes gradually more complicated.

The generic appellation of such works is *kāvya,* which, meaning "poem." or the work of an individual poet (kavi), is, as we have seen, already applied to the *Rāmāyaṇa.* Six poems of this kind are singled out by native rhetoricians as standard works, under the title of *Mahākāvya,* or great poems. Two of these are ascribed to the famous dramatist Kalidasa, the most prominent figure of this period of Indian literature and truly a master of the poetic art. In a comparatively modern couplet he is represented as having been one of nine literary "gems" at the court of a king Vikramāditya. Whether this name refers to Chandragupta II. Vikramāditya or not, Kālidāsa must have flourished about this time, c. A.D. 400. Of the principal poets of this class, whose works have come down to us, he appears to be one of the earliest; but there can be little doubt that he was preceded in this as in other departments of poetic composition by many lesser lights, eclipsed by the sun of his fame, and forgotten. Thus the Buddhacharita, a Sanskrit poem on the life of the reformer, which was translated into Chinese about A.D. 420, and the author of which, Aivaghosha, is placed by Buddhist tradition as early as the time of Kanishka (who began to reign in A.D. 78), calls itself, not without reason, a "mahākāvya"; and the panegyrics contained in some of the inscriptions of the 4th century likewise display, both in verse and ornate prose, many of the characteristic features of the kāvya style of composition.

Of the six universally recognized "great poems" here enumerated, the first two, and doubtless the two finest, are those attributed to Kalidasa. (1) The *Raghuvaṃśa,* or "race of Raghu," celebrates the ancestry and deeds of Rāma. The work, consisting of nineteen cantos, is manifestly incomplete; but hitherto no copy has been discovered of the six additional cantos which are supposed to have completed it. (2) The *Kumāra-sambhava,* or "the birth of (the war-god) Kumāra" (or Skanda), the son of Siva and Pārvatī, consists of seventeen cantos, the last ten of which are looked upon as spurious by some scholars, mainly on account of their erotic character, not a strong argument. There is no reason to doubt that the eighth canto is by Kālidāsa but he cannot have written much of the other nine. (3) The *Kirātārjunīya,* or combat between the Pāṇdava prince Arjuna and the god Siva, in the guise of a Kirāta or wild mountaineer, is a poem in eighteen cantos, by Bhāravi, who is mentioned together with Kālidāsa in an inscription dated A.D. 634. (4) The *Śiśupāla-badha,* or slaying of Śiśupāla, who, being a prince of Chedi, reviled Kṛishṇa, who had carried off his intended wife, and was killed by him at the inauguration sacrifice of Yudhishthira, is a poem consisting of twenty cantos, attributed to Māgha (ninth cent.), whence it is also called *Māghakāvya.* (5) The *Rāvaṇabadha,* or "slaying of Rāvaṇa," more commonly called *Bhaṭṭikāvya,* was composed for the practical purpose of illustrating the less common grammatical forms and the figures of rhetoric and poetry. Bhaṭṭi, apparently the author's name, is usually identified with the well-known grammarian Bhartṛihari, whose death Professor M. Müller, from a Chinese statement, fixes at A.D. 650, while others make him Bhartṛihari's son. (6) The Naishadhiya, or *Naishadha-charita,* the life of Nala, king of Nishadha, is ascribed to Śrī-Harsha (son of Hira), who is supposed to have lived in the latter part of the 12th century. The Nalodaya deals with the same subject but the author's main object is to show his skill in tricks of style and metre. The long lost and recently discovered *Janakī-harana* of *Kumāradāsa* (eighth cent.) takes its subject (the rape of Sītā) from the *Rāmāyaṇa* strongly imitative of Kālidāsa; it is, however, the work of a poet of no mean ability. The stanzas of the *Rāghavapāṇḍavīya* are so ambiguously worded that the poem may be interpreted as relating to the leading story of either the *Rāmāyaṇa* or the *Mahābhārata.* Less ambitious in composition, though styling itself a mahākāvya, is the *Vikramāṅka-devacharita,* a panegyric written about A.D. 1085 by the Kashmir poet Bilhana, in honour of his patron the Chālukya king Vikramāditya of Kalyāṇa, regarding the history of whose dynasty it supplies some valuable information.

In this place may also be mentioned, as composed in accordance with the Hindu poetic canon, Kalhana's *Rājatarangiṇī* (c. A.D. 1150) or "river of kings," being a chronicle of the kings of Kashmir, and the only important historical work in the Sanskrit language, although even here considerable allowance has to be made for poetic licence and fancy.

Under the general term "kāvya" Indian critics include, however, not only compositions in verse, but also certain kinds of prose works composed in choice diction richly embellished with flowers of rhetoric. The feature generally regarded by writers on poetics as the chief mark of excellence in this ornate prose style is the frequency and length of its compounds; whilst for metrical compositions the use of long compounds is expressly discouraged by some schools of rhetoric.

The Drama. — The Hindus ascribe the origin of dramatic representation to the sage Bharata (the word in Sanskrit means also "actor"). We know that treatises on the dramatic art existed at the time of Pāṇini, as he mentions two authors of *Naṭa-sūtras,* or "rules for actors," Śilālin and Kriśāśva. Now the words *naṭa* and *nāṭya*—as well as *nāṭaka,* the common term for "drama" — being derived (like the modern vernacular "Nautch" = *nritya*) from the root *naṭ* (nrit) "to dance," seem to point to a pantomimic or choral origin of the dramatic art. Fortunately, however, Patañjali, in his "great commentary," speaks of the actor as singing, and of people going "to hear the actor." Nay, he even mentions two subjects, taken from the cycle of Vishnu legends: the slaying of Kamsa (by Krishna) and the binding of Bali (by Vishṇu)—which were represented on the stage both by mimic action and declamation. Judging from these allusions, theatrical entertainments in those days seem to have been very much on a level with the old religious spectacles or mysteries of Europe. It is not, however, till some centuries later that we meet with the first real dramas, which mark at the same time the very culminating point of Indian dramatic composition. Although we know the names of at least five predecessors of Kālidāsa, nothing but a few quotations from them have been preserved.

The long disputed possibility of Greek influence on the Sanskrit drama is not now maintained. although there are some superficial points of resemblance. The Hindu dramatist has little regard for

the "unities" of the classical stage, though he is hardly ever guilty of extravagance in his disregard of them. Unlike the Greek dramatic theory, it is an invariable rule of Indian dramaturgy, that every play, however much of the tragic element it may contain, must have a happy ending. A death never takes place on the stage, nor is anything indecorous allowed. The dialogue is invariably carried on in prose plentifully interspersed with those neatly turned lyrical stanzas in which the Indian poet delights to depict some aspect of nature, or some temporary physical or mental condition. The outstanding feature of the Hindu play, however, is the mixed nature of its language. While the hero and leading male characters speak Sanskrit, women and inferior male characters use various Prākrit dialects. As regards these dialectic varieties, it can hardly be doubted that at the time when they were first employed in this way they were local vernacular dialects; but in the course of the development of the scenic art they became permanently fixed for special dramatic purposes, just as the Sanskrit had, long before that time, become fixed for general literary purposes. Thus it would happen that these Prākrit dialects, having once become stationary, were soon left behind by the spoken vernaculars, until the difference between them was as great as between the Sanskrit and the Prākrits.

The *Mrichchhakatikā,* or "little clay cart," has been considered earliest of the existing dramas because of a certain clumsiness of construction, but probably does not antedate the sixth century. According to several stanzas in the prologue, the play was composed by a king Śūdraka, but it is probably the work of a poet patronized by him. Chārudatta, a Brāhman merchant, reduced to poverty, and Vasantasenā, an accomplished courtezan, meet and fall in love with each other. This forms the main plot, which is interwoven with a political underplot, resulting in a change of dynasty. The connection between the two plots is effected by means of the king's rascally brother-in-law, who pursues Vasantasenā with his addresses, as well as by the part of the rebel cowherd Aryaka, who, having escaped from prison, finds shelter in the hero's house. The wicked prince, on being rejected, strangles Vasantasenā, and accuses Chārudatta of having murdered her; but, just as the latter is about to be executed, his lady love appears again on the scene. Meanwhile Aryaka has succeeded in deposing the king, and, having himself mounted the throne of Ujjain, he raises Vasantasenā to the position of an honest woman, to enable her to become the wife of Chiirudatta. The play is one of the longest, consisting of not less than ten acts, some of which, however, are very short. The interest of the action is, on the whole, well sustained; and, altogether, the piece presents a vivid picture of the social manners of the time, whilst the author shows himself imbued with a keen sense of humour, and a master in the delineation of character.

Kālidāsa.—In Kālidāsa the dramatic art attained its highest point of perfection. From this accomplished poet we have three well-constructed plays, abounding in stanzas of exquisite tenderness and fine descriptive passages: the two well-known mythopastoral dramas, *Śakuntalā* in seven and *Vikramorvaśī* in five acts, and a piece of court intrigue, distinctly inferior to the other two, entitled *Mālavikāgnimitra* in five acts. The plot of the last named is as follows: King Agnimitra, who has two wives, falls in love with Mālavikā, maid to the first queen. His wives endeavour to frustrate their affection for each other, but in the end Mālavikā turns out to be a princess by birth, and is accepted by the queens as their sister.

Śrī Harshadeva.—Srī-Harshadeva—identical with the king (Śīlāditya) Harshavardhana of Kānyakubja (Kanauj) mentioned above, who ruled in the first half of the 7th century—has three plays attributed to him; they are probably only dedicated to him by poets patronized by him. This at least commentators state to have been the case as regards the *Ratnāvalī,* the authorship of which they assign to Bāṇa. Indeed, had they been the king's own productions, one might have expected the Chinese pilgrims (especially I-tsing, who saw one of the plays performed) to mention the fact. The *Ratnāvalī,* "the pearl necklace," is a graceful comedy of domestic manners, with well-drawn characters. Ratnāvalī, a Ceylon princess, is sent by her father to the court of King Udayana of Vatsa to become his second wife. She suffers shipwreck, but is rescued and received into Udayana's palace under the name of Sāgarikā, as one of Queen Vāsavadattā's attendants. The king falls in love with her, and the queen tries to keep them apart, but, on learning the maiden's origin, she becomes reconciled, and recognizes her as a "sister." Very similar in construction, but inferior, is the *Priyadarśikā,* in four acts, having for its plot another amour of the same king. The scene of the third play, the *Nāgānanda,* or "joy of the serpents" (in five acts), on the other hand, is laid in semi-divine regions. In spite of its shortcomings of construction the *Nāgānanda* is a play of considerable merit, the characters being drawn with a sure hand, and the humour is by no means despicable.

Bhavabhūti, a Brahman of Vidarbha, passed his literary life chiefly at the court of Yaśovarman of Kanauj (c. A.D. 700). Bhavabhiiti was the author of three plays, two of which, the *Mahāviracharita* ("life of the great hero") and the *Uttararāmacharita* with very little action ("later life of Rāma"), in seven acts each, form together a dramatized version of the story of the *Rāmāyaṇa.* The third, the *Mālatīmādhava,* is a domestic drama in ten acts, representing the fortunes of Mādhava and Mālatī, the son and daughter of two ministers of neighbouring kings, who from childhood have been destined for each other, but, by the resolution of the maiden's royal master to marry her to an old and ugly favourite of his, are for a while threatened with permanent separation. The action of the play is full of life, and abounds in stirring, though sometimes improbable, incidents. The poet is considered by native critics to be not only not inferior to Kālidāsa, but even to have surpassed him in his *Uttararāmacharita.*

Minor **Dramatists.**—Bhaṭṭa Nārāyaṇa, the author of the *Veṇīsaṃhāra* ("the binding up of the braid of hair," based on an incident in the Mahābhārata), is known to have been alive in A.D. 840. The piece is composed in a style similar to that of Bhavabhūti's plays, but is inferior to them in dramatic construction and poetic merit, though valued by critics for its strict adherence to the rules of the dramatic theory, and popular in India, owing to its partiality for the cult of Krishna. The *Hanuman-nitaka* is a dramatized version of the story of Rāma, interspersed with numerous purely descriptive poetic passages. Contrary to the general practice, Sanskrit alone is employed in it. The play is attributed to Dāmodara Miśra (11th cent.), but gives the impression of being the production of different hands. Bhāsa is traditionally one of the great dramatists of India, a predecessor of Kālidāsa, but nothing of his has survived.

The *Mudrārākshasa,* or "Rākshasa (the minister) with the signet," is unique in being a drama of political intrigue, partly based on historical events, the plot turning on the reconciliation of Rakshasa, the minister of the murdered king Nanda. with the hostile party, consisting of Prince Chandragupta (the Greek Sandrocottus, 315–291 B.C.), who succeeded Nanda, and his minister Chāṇakya. The plot is developed with considerable dramatic skill, in vigorous, if not particularly elegant, language. The play was composed by Viśākhadatta, not much later than A.D. 860.

The *Prabodha-chandrodaya,* or "the moon-rise of intelligence," composed by Krishṇamiśra about the 12th century, is an allegorical play, in six acts, the *dramatis personae* of which consist entirely of abstract ideas and symbolical figures divided into two conflicting hosts; it is full of vigour, however. It depicts the struggle between the wicked king Error and the good king Reason.

Lyrical, Descriptive and Didactic Poetry.—Allusion has already been made to the marked predilection of the mediaeval Indian poet for depicting in a single stanza some peculiar physical or mental situation. The profane lyrical poetry consists chiefly of such little poetic pictures, which form a prominent feature of dramatic compositions. Numerous poets and poetesses are only known to us through such detached stanzas, preserved in native anthologies or manuals of rhetoric, and enshrining a vast amount of descriptive and contemplative poetry. An excellent specimen of a longer poem, of a partly descriptive, partly erotic character, is Kālidāsa's *Meghadūta,* or "cloud messenger," in which a

banished yaksha (demi-god) sends a love-message across India to his wife in the Himālaya, and describes, in verse-pictures of the stately mandākrāntā metre the various places over which the messenger, a cloud, will have to sail in his airy voyage. Another much-admired descriptive poem by Kālidāsa is the *Ritu-saṃhāra,* or "collection of the seasons," in which the attractive features of the six seasons are successively set forth.

As regards religious lyrics, the fruit of sectarian fervour, a large collection of hymns and detached stanzas, extolling some special deity, might be made from Puriinas and other works. Of independent productions of this kind only a few of the more important can be mentioned here. Sankara Āchārya, the great Vedāntist, who seems to have flourished about A.D. 800, is credited with several devotional poems, especially the *Ānanda-laharī,* or "wave of joy," a hymn of 103 stanzas, in praise of the goddess Pārvatī. The *Sūrya-śataka,* or century of stanzas in praise of Siirya, the sun, is ascribed to Mayūra, the contemporary (and, according to a tradition, the father-in-law) of Bāṇa (in the early part of the 7th century). The latter poet himself composed the *Chaṇḍikāstotra,* a hymn of 102 stanzas, extolling Śiva's consort. The *Khaṇḍapraśasti,* a poem celebrating the ten avatāras of Vishṇu, is ascribed to no other than Hanumān, the monkey general, himself. Jayadeva's beautiful poem Gitagovinda, which, like most productions concerning Kṛishṇa, is of a very sensuous character, is a religious drama.

Didactic Poetry.— The particular branch of didactic poetry in which India is especially rich is that of moral maxims, expressed in single stanzas or couplets, and forming the chief vehicle of the *Nīti-śāstra* or ethic science. Excellent collections of such aphorisms have been published—in Sanskrit and German by Bohtlingk, and in English by John Muir. Probably the oldest original collection of this kind is that ascribed to Chāṇakya, but really much later.

Fables and Narratives.— For purposes of popular instruction stanzas of an ethical import were early worked up with existing prose fables and popular stories. A collection of this kind, a mirror for princes, was translated into Pahlavi in the reign of the Persian king Khusru Anushirvan, A.D. 531–579; but neither this translation nor the original is any longer extant. A Syriac translation, however, made from the Pahlavi in the same century, under the title of "Qualilag and Dimnag"—from the Sanskrit "Karataka and Damanaka," two jackals who play an important part as the lion's counsellors—has been discovered and published. The Sanskrit original, which probably consisted of fourteen chapters, was afterwards recast—the result being the Panchatantra, or "five books" (or headings), of which several recensions exist. A popular but late summary of this work, in four books, the *Hitopadeśa,* or "Salutary Counsel," has been shown by Peterson to have been composed by one Nārāyaṇa. Other highly popular collections of stories and fairy tales, interspersed with sententious verses, are: the *Vetālapanchaviṃśati,* or "twenty-five (stories) of the Vetāla" (the original of the Baitāl Pachisi), older than the 11th century, since both Kshemendra and Somadeva have used it; and the *Śuka-saptati,* or "seventy (stories related) by the parrot," the author and age of which are unknown.

SCIENTIFIC AND TECHNICAL LITERATURE

Law (*Dharma*).—Among the technical treatises of the later Vedic period, certain portions of the Kalpa-siitras, or manuals of ceremonial, peculiar to particular schools, are the earliest attempts at a systematic treatment of law subjects. These are the *Dharma-sūtras,* or "rules of (religious) law." The Dharmasfitras consist chiefly of strings of terse rules, containing the essentials of the science, and intended to be committed to memory, and to be expounded orally by the teacher—thus forming, as it were, epitomes of class lectures. These rules are interspersed with stanzas or "gāthās," in various metres, either composed by the author himself or quoted from elsewhere, which generally give the substance of the preceding rules. One can well understand why such couplets should gradually have become more popular, and should ultimately have led to the appearance of works entirely composed in verse. Such metrical law-books did spring up in large numbers, not all at once, but over a long period of time. These works are the metrical *Dharma-śāstras,* or, as they are usually called, the *Smriti,* "recollection, tradition,"—a term which, as we have seen, belonged to the whole body of Siitras (as opposed to the *Śruti,* or revelation), but which has become the almost exclusive title of the versified institutes of law (and the few Dharmasiitras still extant). Of metrical Smritis about forty are known to exist, but their total number probably amounted to at least double that figure.

Manu.—With the exception of a few of these works—such as the Agni-, Yama- and *Vishṇu-Smritis*—which are ascribed to the respective gods, the authorship of the Smritis is attributed to old rishis, such as Atri, Kāṇva, Vyāsa, Śāṇdilya, Bharadvāja. It is, however, extremely doubtful whether, as a rule, there really existed a traditional connection between these works and their alleged authors or schools named after them. The idea, which early suggested itself to Sanskrit scholars, that Smritis which passed by the names of old Vedic teachers and their schools might simply be metrical recasts of the Dharma- (or Grihya-) siitras of these schools, was a very natural one, and, indeed, is still a very probable one, though the loss of the original Siitras makes it difficult to prove. One could, however, scarcely account for the disappearance of the Dharmasiitras of some of the most important schools except on the ground that they were given up in favour of other works; and it is not very likely that this should have been done, unless there was some guarantee that the new works, upon the whole, embodied the doctrines of the old authorities of the respective schools. Thus, as regards the most important of the Smritis, the *Mānava-Dharmaśāstra,* there exist both a Śrauta- and a Grihya-siitra of the Miinava school of the Black Yajus, but no such Dharmasfitra has hitherto been discovered, although the former existence of such a work has been made all but certain by Professor Buhler's discovery of quotations from a *Mānavam,* consisting partly of prose rules, and partly of couplets, some of which occur literally in the Manusmriti, whilst others have been slightly altered there to suit later doctrines, or have been changed from the original trishtubh into the epic metre. The idea of an old lawgiver Manu Svāyambhuva—"sprung from the self-existent (svayam-bhii)" god Brahman (m.)—reaches far back into Vedic antiquity: he is mentioned as such in early texts; and in Yāska's *Nirukta* a śloka occurs, giving his opinion on a point of inheritance. But whether or not the Mānava-Dharmasūtra embodied what were supposed to be the authoritative precepts of this sage on questions of sacred law we do not know; nor can it as yet be shown that the Manusmriti, which seems itself to have undergone considerable modifications, is the lineal descendant of that Dharmasfitra.

The Mānava Dharmaśāstra consists of twelve books, the first and last of which, treating of creation, transmigration and final beatitude, are, however, generally regarded as later additions. In them the legendary sage Bhrigu. here called a Miinava, is introduced as Manu's disciple, through whom the great teacher has his work promulgated. Except in these two books the work shows no special relation to Manu, for, though he is occasionally referred to in it, the same is done in other Smritis. The oldest existing commentary on the *Mānava-Dharmaśāstra* is by Medhātithi, who is usually supposed to have lived in the 10th century. The most esteemed of the commentaries is that of Kulliika Bhaṭṭa, composed at Benares in the 15th century.

Yājñavalkya.—Next in importance among Smritis ranks the *Yājñavalkya Dharmaśāstra.* Based on the Manusmriti, it represents a more advanced stage of legal theory and definition than that work. Yājñavalkya, as we have seen, is looked upon as the founder of the Vājasaneyins or White Yajus, and the author of the Śatapatha-brāhmaṇa. The work bears some [illegible] to the *Pāraskara-grihyasūtra* of the *white Yajur Veda* but a [illegible] nection between it and the *Mānava-grihyasūtra* seems, however, likewise evident. As in the case of Manu, Slokas are quoted in various works from a *Brihat-* and a *Vriddha- Yājñavalkya.* The Yājñavalkya-smriti consists of three books, corresponding to the three great divisions of the Indian theory of law: *āchāra,* rule of conduct (social and caste duties); *vyavahāra,* civil and criminal law; and *prāyaśchitta,* penance or expiation.

Nāradasmriti.—The *Nāradīya-Dharmaśāstra,* or *Nāradasmriti,* is a more practical work; indeed, it is probably the most systematic and businesslike of all the Smritis. It does not concern itself with religious and moral precepts, but is strictly confined to law.

Whether any of the Dharmaśāstras were ever used in India as actual "codes of law" for the practical administration of justice is doubtful. No doubt these works were held to be of the highest authority as laying down the principles of religious and civil duty; but it was not so much any single text as the whole body of the Smriti that was looked upon as the embodiment of the divine law. Hence. the moment the actual work of codification begins in the 11th century. we find the junsts engaged in practically showing how the Smritis confirm and supplement each other, and in reconciling seeming contradictions between them. This new phase of Indian jurisprudence begins with Vijñāneśvara's *Mitāksharā,* which, although primarily a commentary on Yājñavalkya, is so rich in original matter and illustrations from other Smritis that it is far more adapted to serve as a code of law than the work it professes to explain. This treatise is held in high esteem all over India, with the exception of the Bengal or Gauriya school of law, mhich recognizes as its chief authority the digest of its founder, Jīmūtavāhana, especially the chapter on succession, entitled *Dāyabhāga.* Based on the Mitāksharā are the *Smritichandrikā,* a work of great common sense, written by Devāṇḍa Bhaṭṭa, in the 13th century, and highly esteemed in Southern India; and the *Viramitrodaya,* a compilation consisting of two chapters, on āchāra and vyavahāra, made in the first half of the 17th century by Mitramiśra, for Raja Virasimha, or Birsinh Deo of Orchhā, who inurdered Abul Fazl, the minister of the emperor Akbar, and author of the *Āīn-i* Akbari. There is no need here to enumerate any more of the vast number of treatises on special points of law. the more important of which will be found mentioned in English digests of Hindu law.

Philosophy.—The contemplative Indian mind shows at all times a strong disposition for metaphysical speculation. In the old religious lyrics this may be detected from the very first. Not to speak of the abstract nature of some even of the oldest Vedic deities, this propensity betrays itself in a certain mystic symbolism, tending to refine and spiritualize the original purely physical character and activity of some of the more prominent gods, and to impart a deep and subtle import to the rites of the sacrifice. The primitive worship of more or less isolated elemental forces and phenomena had evidently ceased to satisfy the religious wants of the more thoughtful minds. Various syncretist tendencies show the drift of religious thought towards some kind of unity and of the divine powers, be it in the direction of the pantheistic idea, or in that of an organized polytheism, or even towards monotheism. In the latter age of the hymns the pantheistic idea is rapidly gaining ground, and finds vent in various cosmogonic speculations; and in the Brāhmaṇa period we see it fully developed. The fundamental conception of this doctrine finds its expression in the two synonymous terms *brāhman* (neutr.), probably originally "mystic effusion, devotional utterance," then "holy impulse," and *ātman* (masc.), "breath, self, soul."

The recognition of the essential sameness of the individual souls, emanating all alike (whether really or imaginarily) from the ultimate spiritual essence (*parama-brahman*) "as sparks issue from the fire," and destined to return thither, involved some importanc problems. Considering the infinite diversity of individual souls of the animal and vegetable world, exhibiting various degrees of pcrfcction, is it conceivable that each of them is the immediate efflux of the Supreme Being, the All-perfect, and that each, from the lowest to the highest, could re-unite therewith directly at the close of its mundane existence? The difficulty implied in the latter question was at first met by the assumption of an intermediate state of expiation and purification, a kind of purgatory; but the whole problem found at last a more comprehensive solution in the doctrine of transmigration (*saṃsāra*). This doctrine not found in the *Rigveda* was probably aboriginal and adopted by the Aryan invaders. The notion of *saṃsāra* has become an axiom, a universally conceded principle of Indian philosophy. Thus the latter has never quite risen to the heights of pure thought; its object is indeed *jijñāsā,* the search for saving knowledge; but it is an inquiry (*mīmāṃsā*) into the nature of things undertaken not solely for the attainment of the truth, but with a view to a specific object—the discontinuance of *saṃsāra,* the cessation of mundane existence after the present life. The task of the philosopher is to discover the means of attaining moksha, "release" from the bondage of material existence, and union with the Supreme Self—in fact, salvation. Desire is due to ignorance or wrong knowledge of the true nature of things and is the cause of transmigration. The purpose of each philosophical school is to attain true and saving knowledge. Intense self-contemplation being the only way of attaining the all-important knowledge, this doctrine left little or no room for those mediatorial offices of the priest, so indispensable in ceremonial worship; and indeed we actually read of Brahman sages resorting to Kshatriya princes (in the Upanishads) to hear them expound the true doctrine of salvation. But, in spite of their anti-hierarchical tendency, these speculations continued to gain ground; and in the end the body of treatises propounding the pantheistic doctrine, the Upanishads, nere admitted into the sacred canon, as appendages to the ceremonial writings, the Brāhmaṇas. The Upanishads thus form literally "the end of the Veda," the Vedanta; but their adherents claim this title for their doctrines in a metaphorical rather than in a material sense, as "the ultimate aim and consummation of the Veda."

In later times the radical distinction between these speculative appendages and the bulk of the Vedic writings was strongly accentuated in a new classification of the sacred scriptures. According to this scheme they were supposed to consist of two great divisions—the *Karma-kāṇḍa,* "the work-section," or practical ceremonial (exoteric) part, consisting of the Saṃhitās and Brāhmaṇas (including the ritual portions of the Wranyakas), and the *Jñānakāṇḍa,* "the knowledge-section," or speculative (esoteric) part. These two divisions are also called respectively the *Pūrva-* ("former") and *Uttara-* ("latter," or higher) *kāṇḍa*; and when the speculative tenets of the Upanishads came to be formulated into a regular system it was deemed desirable that there should also be a special system corresponding to the older and larger portion of the Vedic writings. Thus arose the two systems—the *Pūrva-* (or Karma-) *mīmāṃsā,* or "prior (practical) speculation," and the *Uttara-* (or *Brāhma-*) *mīmāṃsā,* or higher inquiry (into the nature of the godhead), usually called the Vedanta philosophy.

Philosophical Systems.—It is not yet possible to determine, even approximately, the time when the so-called *Darśanas* (literally "demonstrations"), or systems of philosophy which subsequently arose, were first formulated. And, though they have certainly developed from the tenets enunciated in the Upanishads, there is some doubt as to the exact order in which these systems succeeded each other. Of all the systems the Vedanta has indeed remained most closely in touch with the speculations of the Upanishads, which it has further developed and systematized. The authoritative expositions of the systems have, however, apparently passed through several redactions; and, in their present form, these sūtra-works evidently belong to a comparatively recent period, none of them being probably older than the early centuries of our era. By far the ablest general review of the philosophical systems (except the Vedanta) produced by a native scholar is the *Sarva-darśana-saṅgraha* ("summary of all the Darśanas"), composed in the 14th century, from a Vedāntist point of view, by the great exegete Mādhava Āchārya.

Among the different systems, six are generally recognized as orthodox, as being (either wholly or for the most part) consistent with the Vedic religion—two and two of which are again more closely related to each other than to the rest, viz.:

(1) *Pūrva-mīmāṃsā* (*Mīmāṃsā*), and (2) *Uttara-mīmāṃsā* (Vedanta);
(3) *Sānkhya,* and (4) Yoga;
(5) *Nyāya,* and (6) *Vaiśeshika.*

Mīmāṃsā.—1. The (*Pūrva-*) *Mīmāṃsā* (First Inquiry) is not a system of philosophy in the proper sense of the word, but rather a system of dogmatic criticism and scriptural interpretation. It maintains the eternal existence of the Veda, the different parts **of**

which are minutely classified. Its principal object, however, is to ascertain the religious (chiefly ceremonial) duties enjoined in the Veda, and to show how these duties must be performed, and what are the special merits and rewards attaching to them. Hence arises the necessity of determining the principles for rightly interpreting the Vedic texts, as also of what forms its only claim to being classed among speculative systems, namely, a philosophical examination of the means of, and the proper method for, arriving at accurate knowledge. The foundation of this school, as well as the composition of the Sūtras or aphorisms, the *Mīmāṃsā-darśana*, which constitute its chief doctrinal authority, is ascribed to Jaimini. The Sūtras were commented on by Śabara Svāmin in his *Bhāshya*; and further annotations (*Tantra-vārttika* and *Śloka-vārttika*) thereon were supplied by the great theologian Kumārila Bhaṭṭa (about A.D. 700). The most approved general introduction to the study of the Mīmāṃsā is the metrical *Jaiminīya-Nyāya mālāvistara*, with a prose commentary, both by Mādhava Āchārya.

Vedānta.—2. The Vedanta philosophy or *Uttara-mīmāṃsā* (Second Inquiry) in the comparatively primitive form in which it presents itself in most of the older Upanishads, constitutes the earliest phase of sustained metaphysical speculation. In its essential features it remains to this day the prevalent belief of Indian thinkers, and enters largely into the religious life and convictions of the people. It is an idealistic monism, which derives the universe from an ultimate conscious spiritual principle, the one and only existent from eternity—the *Ātman*, the Self, or the Purusha, the Person, the Brahman. It is this primordial essence or Self that pervades all things. and gives life and light to them, "without being sullied by the visible outward impurities or the miseries of the world, being itself apart"—and into which all things will, through knowledge, ultimately resolve themselves. "The wise who perceive him as being within their own Self, to them belongs eternal peace, not to others." But, while the commentators never hesitate to interpret the Upanishads as being in perfect agreement with the Vedāntic system, as elaborated in later times, there is often considerable difficulty in accepting their explanations. In these treatises only the leading features of the pantheistic theory find utterance, generally in vague and mystic, though often in singularly powerful and poetical language, from which it is not always possible to extract the author's real idea on fundamental points, such as the relation between the Supreme Spirit and the phenomenal world—whether the latter was actually evolved from the former by a power inherent in him, or whether the process is altogether a fiction, an illusion of the individual self.

The foundation of the Vedanta system, as "the completion of the Veda," is naturally ascribed to Vyāsa, the mythic arranger of the Vedas, who is said to be identical with Bādarāyaṇa the reputed author of the Brahmd- (or *Śārīraka-*) *sūtra*, the authoritative, though highly obscure, summary of the system. The most distinguished interpreter of these aphorisms is the famous Malabar theologian Sankara Āchārya, who also commented on the principal Upanishads and the Bhagavadgītā, and is said to have spent the greater part of his life in wandering all over India, as far as Kashmir, and engaging in disputations with teachers—whether of the Saiva, or Vaishnava, or less orthodox persuasions—with the view of rooting out heresy and re-establishing the doctrine of the Upanishads. In Sankara's philosophy the theory that the material world has no real existence, but is a mere illusion of the individual soul wrapt in ignorance,—that, therefore, it has only a practical or conventional (*vyāvahārika*) but not a transcendental or true (*pāramārthika*) reality,—is strictly enforced. In accordance with this distinction, a higher (pard) and a lower (*aparā*) form of knowledge is recognized; the former being concerned with the Brahman (*n.*), whilst the latter deals with the personal Brahmā, the Īśvara, or lord and creator, who, however, is a mere illusory form of the divine spirit, resulting from ignorance of the human soul. To the question why the Supreme Self (or rather his fictitious development, the Highest Lord) should have sent forth this phantasmagory this great thinker (with the author of the Sūtras) can return no better answer than that it must have been done for sport (*līlā*), without any special motive—since to ascribe such a motive to the Supreme Lord would be limiting his self-sufficiency—and that the process of creation has been going on from all eternity. Sankara's *Śārīraka-mīmāṃsā-bhāshya* has given rise to a large number of exegetic treatises, of which Vāchaspati-miśra's exposition, entitled *Bhāmatī*, is the most esteemed. Of numerous other commentaries on the Brahma-sūtras, the *Śrī-bhāshya*, by Rāmānuja, the founder of the Sri-Vaishnava sect, is the most noteworthy. This religious teacher, who flourished in the first half of the 12th century, caused a schism in the Vedanta school. Instead of adhering to Sankara's orthodox advaita, or non-duality, doctrine, he interpreted the obscure Sūtras in accordance with his theory of *viśishṭādvaita*, *i.e.*, non-duality of the (two) distinct (principles), or, as it is more commonly explained, non-duality of that which is qualified (by attributes). According to this theory the Brahman is neither devoid of form and quality, nor is it all things; but it is endowed with all good qualities, and matter is distinct from it; whilst bodies consist of souls (*chit*) and matter (*achit*); and God is the soul. On the religious side, Rāmānuja adopts the tenets of the ancient Vishnuite Pāñcharātra sect, and, identifying the Brahman with Vishṇu, combines with his theory the ordinary Vaishnava doctrine of periodical descents (*avatāra*) of the deity, in various forms, for the benefit of creatures; and allowing considerable play to the doctrine that faith (*bhakti*), not knowledge (*vidyd*), is the means of final emancipation. This phase of Indian religious belief, which has attached itself to the Vedanta theory more closely than to any other, makes its appearance very prominently in the Bhagavadgitd, the episode of the *Mahābhārata*, already referred to—where, however, it attaches itself to Sānkhya-yoga rather than to Vedānta tenets—and is even more fully developed in some of the Purāṇas, especially the Bhāgavata. Its highest phase of development this doctrine probably reached in the Vaishnava sect founded, towards the end of the 15th century, by Chaitanya, whose followers subsequently grafted the Vedanta speculations on his doctrine. In opposition both to Sankara's theory of absolute unity, and to Rāmānuja's doctrine of qualified unity—though leaning more towards the latter—Mādhva Āchārya, or Pūrṇa-prajña (A.D. 1197–1276), started his dvaita, or duality doctrine, according to which there is a difference between God and the human soul (*jiva*), as well as between God and nature; whilst the individual souls, which are innumerable, eternal, and indestructible, are likewise different from one another; but, though distinct, are yet united with God, like tree and sap, in an indissoluble union. This doctrine also identifies the Brahman with Vishnu, by the side of whom, likewise infinite, is the goddess Lakshmi, as Prakṛiti (nature), from whom inert matter (jada) derives its energy. Here also bhakti, devotion to God, is the saving element. A popular summary of the Vedanta doctrine is the *Vedānta-sāra* by Sadānanda, which has been frequently printed and translated.

Sānkhya.—The *Sānkhya* system seems to derive its name from its systematic enumeration (sankhyd) of the twenty-five principles (tattva) it recognizes—consisting of twenty-four material and an independent immaterial principle. In opposition to the Vedanta school, which maintains the eternal coexistence of a spiritual principle of reality and an unspiritual principle of unreality, the Sānkhya assumes the eternal coexistence of a material first cause, which it calls either *mūla-Prakṛiti* (fem.), "prime Originant" (matter), or *Pradhāna*, "the principal" cause, and a plurality of individual souls, Purusha, which continually interact on one another. The system recognizes no intelligent creator (such as the *Īśvara*, or demiurgus, of the Vedānta)—whence it is called *nirīśvara*, godless; but it conceives the Material First Cause, itself unintelligent, to have become developed, by a gradual process of evolution, into all the actual forms of the phenomenal universe, excepting the souls. Its first emanation is *buddhi*, intelligence; whence springs *ahaṃkāra*, consciousness; thence the subtle elements of material forms, namely, five elementary particles (*tanmātra*) and eleven organs of sense; and finally, from the elementary particles, five elements. The souls have from all eternity been connected with matter,—having in the first place become invested with a subtle frame (*liriga-*, or

sūkshma-, śarīra), consisting of seventeen principles, namely, intelligence, consciousness, elementary particles, and organs of sense and action, including mind. To account for the spontaneous development of matter, the system assumes the latter to consist of three constituents (*guṇa*) which are possessed of different qualities, viz. sattva, of pleasing qualities, such as "goodness," lightness, luminosity; rajas, of pain-giving qualities, such as "force," passion, activity; and tams, of deadening qualities, such as "darkness," rigidity, dullness, and which, if not in a state of equipoise, cause unrest and development. Through all this course of development, the soul itself remains perfectly detached, its sole properties being those of purity and intelligence, and the functions usually regarded as "psychic" being due to the mechanical processes of the internal organs themselves evolved out of inanimate matter. Invested with its subtle frame, which accompanies it through the cycle of transmigration, the soul, for the sake of fruition, connects itself ever anew with matter, thus, as it were, creating for itself ever new forms of material existence; and it is only on attaining perfect knowledge, which reveals the absolute distinction between soul and matter, that the Purusha is liberated from the miseries of Saṃsāra, and continues to exist in a state of absolute consciousness and detachment from matter. The existence of God, on the other hand, is denied by this theory, or rather considered as incapable of proof; the existence of evil and misery, for one thing, being thought incompatible with the notion of a divine creator and ruler of the world.

The reputed originator of this school is the sage Kapila, to whom tradition ascribes the composition of the fundamental text-book, the *Sānkhya-sūtra,* or *Sānkhya-pravachana,* as well as the *Tattva-samāsa,* a mere catalogue of the principles but these are comparatively modem. Probably the oldest existing work is Īśvarakrishṇa's excellent *Sānkhya-kārikā,* which gives, in the narrow compass of sixty-nine ślokas, a lucid and complete sketch of the system.

Yoga.—The Yoga system is a branch of the preceding school, holding the same opinions on most points treated in common in their Sūtras, with the exception of one important point, the existence of God. To the twenty-five principles (tattva) of the Niriivara Sānkhya, the last of which was the *Purusha,* the Yoga adds, as the twenty-sixth, the *Nirguṇa Purusha,* or Self devoid of qualities, the Supreme God of the system. Hence the Yoga is called the *Seśvara* (theistical) *Sānkhya.* But over and above the purely speculative part of its doctrine, which it has adopted from the sister school, the theistic Sānkhya has developed a complete system of mortification of the senses—by means of prolonged apathy and abstraction, protracted rigidity of posture, and similar practices—many of which are already alluded to in the Upanishads—with the view of attaining complete concentration (yoga) on, and an ecstatic vision of, the Deity, and the acquisition of miraculous powers. It is from this portion of the system that the school derives the name by which it is more generally known.

Nyāya and *Vaiśeshika.*—The *Nyāya* and *Vaiśeshika* (the latter the older) are separate branches of one and the same school, which supplement each other and the doctrines of which have virtually become amalgamated into a single system of philosophy. The term Nyāya (*ni-āya,* "in-going," entering), though properly meaning "analytical investigation," as applied to philosophical inquiry generally, has come to be taken more commonly in the narrower sense of "logic," because this school has entered more thoroughly than any other into the laws and processes of thought, and has worked out a formal system of reasoning which forms the Hindu standard of logic.

The followers of these schools generally recognize six categories (*padārtha*): substance (dravya), quality (*guṇa*), action (karma), generality (*sāmānya*), particularity (*viśesha*), intimate relation (*samavāya*) to which was added a seventh, non-existence (*abhāva*). Substances forming the substrata of qualities and actions are of two kinds: eternal (without a cause), namely, space, time. ether, soul and the atoms of mind, earth, water, fire and air; and non-eternal, comprising all compounds, or the things we perceive, and which must have a cause of their existence. Causality is of three kinds: that of intimate relation (material cause); that of non-intimate relation (between parts of a compound); and instrumental causality (effecting the union of component parts). Material things are thus composed of atoms (*aṇu*), *i.e.*, ultimate simple substances, or units of space, eternal, unchangeable and without dimension, characterized only by "particularity (*viśesha*)." It is from this predication of ultimate "particulars" that the Vaiieshikas, the originators of the atom istic doctrine, derive their name The Nyāya draws a clear line between matter and spirit, and has worked out a careful and ingenious system of psychology. It distinguishes between individual or living souls (*jīvātman*), which are numerous, infinite and eternal, and the Supreme Soul (Paramitman), which is one only, the seat of eternal knowledge, and the maker and ruler (*Īśvara*) of all things. It is by his will and agency that the unconscious living souls (soul-atoms, in fact) enter into union with the (material) atoms of mind, etc., and thus partake of the pleasures and sufferings of mundane existence.

The original collection of *Nyāya-sūtras* is ascribed to Gautama, and that of the *Vaiśeshika-sūtras* to Kaṇāda. The etymological meaning of the latter name seems to be "atom eater," whence in works of hostile critics the synonymous terms *Kaṇa-bhuj* or Kana-bhaksha are sometimes derisively applied to him, doubtless in allusion to his theory of atoms.

Heretical Systems.—As regards the different heretical systems of Hindu philosophy, there is no occasion, in a sketch of Sanskrit literature, to enter into the tenets of the two great anti-Brāhmanical sects, the Jainas and Buddhists. Among the minor systems may be mentioned the following:

The *Chārvākas* are an ancient sect of undisguised materialists, who deny the existence of the soul, and consider the human person (*purusha*) to be an organic body endowed with sensibility and with thought, resulting from a modification of the component material elements, but their authoritative text-book, the *Bārhaspatya-sūtra,* is only known so far from a few quotations in polemics against the school. The sect was anti-Brahmanical and such moral teaching as it taught was pure hedonism.

The *Pāñcharātras,* or *Bhāgavatas,* are an early Vaishnava sect, in which the doctrine of faith, already alluded to, is strongly developed. Hence their tenets are defended by Rāmānuja, though they are partly condemned as heretical in the Brahma-sūtras.

The *Pāśupatas,* one of several *Śaiva* (Māheśvara) sects, hold the Supreme Being (*Īśvara*), whom they identify with Siva (as *paśu-pati,* or "lord of beasts"), to be the creator and ruler of the world, but not its material cause. With the Sānkhyas they admit the notion of a plastic material cause, the *Pradhāna;* while they follow Patañjali in maintaining the existence of a Supreme God.

Grammar (Vyākaraṇa).—*Pāṇini.* Linguistic inquiry, phonetic as well as grammatical, was early resorted to both for the purpose of elucidating the meaning of the Veda and with the view of settling its textual form. The particular work which came ultimately to be looked upon as the "vedāṅga" representative of grammatical science, and has ever since remained the standard authority on Sanskrit grammar in India, is Pāṇini's *Ashṭādhyāyī,* so called from its "consisting of eight lectures (*adhyāya*)," of four *pādas* each. For a comprehensive grasp of linguistic facts, and a penetrating insight into the structure of the vernacular language, this work stands probably unrivalled in the literature of any nation—though few other languages, it is true, afford such facilities as the Sanskrit for a scientific analysis. Pāṇini's system of arrangement differs entirely from that usually adopted in our grammars, namely, according to the parts of speech. As the work is composed in aphorisms intended to be learnt by heart, economy of memory-matter was the author's paramount consideration. His object was chiefly attained by the grouping together of all cases exhibiting the same phonetic or formative feature. no matter whether or not they belonged to the same part of speech. For this purpose he also makes use of a highly artificial and ingenious system of algebraic symbols, consisting of technical letters (*anubandha*), used chiefly with suffixesand indicative of the changes which the roots or stems have to undergo in word-formation. The date of

Pāṇini has been the subject of much discussion but may be safely put at about 400 B.C.

Pāṇini mentions some sixty-four predecessors which shows that this study had undergone a long process of development. Perhaps the most important of his predecessors was Sākaṭāyana, also mentioned by Yāska—the author of the Nirukta, who is likewise supposed to have preceded Piinini—as the only grammarian (*vaiyākaraṇa*) who held with the etymologists (*nairukta*) that all nouns are derived from verbal roots.

Pāṇini's Sūtras continued for ages after to form the centre of grammatical activity. But, as his own work had superseded those of his predecessors, so many of the scholars who devoted themselves to the task of perfecting his system have sunk into oblivion.

Kātyāyana.—The earliest of his successors whose work has come down to us (though perhaps not in a separate form) is Kātyāyana, the author of a large collection of concise critical notes, called *Vārttika,* intended to supplement and correct the Siitras, or give them greater precision.

Patañjali.—Kātyāyana was followed by Patafijali, the author of the (*Vyākaraṇa-*) *Mahā-bhāshya,* or Great Commentary, who flourished about 150 B.C. For the great variety of information it incidentally supplies regarding the literature and manners of the period, this is, from an historical and antiquarian point of view, one of the most important works of the classical Sanskrit literature. The Mahābhāshya is not a continuous commentary on Pāṇini's grammar, but a collection of the critical comments or *kārikās* on 1,713 of the 4,000 rules of Pāṇini. Patafijali is also called Gonardiya perhaps meaning "a native of Gonarda," a place, probably identical with Goṇḍa, a town some 20 m. northwest of Oudh—and Goṇikāputra, or son of Goṇikā.

Lexicography.—Sanskrit dictionaries (*kośa*), invariably composed in verse, are either homonymous or synonymous, or partly the one and partly the other. There are occasional attempts at alphabetical order in the former but not in the latter. There are many intended for the use of poets and are collections of rare words and synonyms, rather than lexicons of the language. The great dictionary is the famous *Amara-kośa* ("immortal treasury") by Amarasimha, who probably lived early in the 6th century. This dictionary consists of a synonymous and a short homonymous part; whilst in the former the words are distributed in sections according to subjects, such as heaven and the gods, time and seasons, etc.; in the latter they are arranged according to their final letter, without regard to the number of syllables.

Prosody (**Chhandas**).—The oldest treatises on prosody have already been referred to in the account of the technical branches of the later Vedic literature. Among more modem treatises the most important is the *Mrita-sanjīvanī,* a commentary on Pingala's Sūtra, by Halāyudha (perhaps identical with the author of the glossary above referred to). Sanskrit prosody, which is probably not surpassed by any other either in variety of metre or in harmoniousness of rhythm, recognizes two classes of metres, namely, such as consist of a certain number of syllables of fixed quantity, and such as are regulated by groups of breves or metrical instants, this latter class being again of two kinds, according as it is or is not bound by a fixed order of feet.

Music (**Saṅgīta**).—The musical art has been practised in India from early times. The theoretic treatises on profane music now extant are, however, quite modern productions. The two most highly esteemed works are the *Saṅgīta-ratnākara* ("jewel-mine of music"), by *Śārngadeva,* and the *Saṅgīta-darpaṇa* ("mirror of music"), by Dāmodara. Each of these works consists of seven chapters, treating respectively of—(I) sound and musical notes (svara); (2) melodies (*rāga*); (3) music in connection with the human voice (*prakīrṇaka*); (4) musical compositions (prabandha); (5) time and measure (*tāla*); (6) musical instruments and instrumental music (*vādya*); (7) dancing and acting (nyitta or *nritya*).

Rhetoric (**Alaṅkāra-śāstra**).—Treatises on the theory of literary composition are very numerous. Indeed, a subject of this description—involving such nice distinctions as regards the various kinds of poetic composition, the particular subjects and characters adapted for them, and the different sentiments or mental conditions capable of being both depicted and called forth by them—could not but be congenial to the Indian mind. The *Nātya Śāstra* of Bharata is possibly as early as the sixth century. Not much later is the *Kāvyādarśa,* or "mirror of poetry," by Dandin, the author of the novel *Daśakumāracharita.* The work consists of three chapters, treating—(I) of two different local styles (riti) of poetry, the Gaudi or eastern and the Vaidarbhi or southern (to which later critics add four others, the Pāñchālī, Māgadhī, Lāṭī, and Āvantikā); (2) of the graces and ornaments of style, as tropes, figures, similes; (3) of alliteration, literary puzzles and twelve kinds of faults to be avoided in composing poems. Other important works are the *Kāvyālaṅkāra,* by the Kashmirian Rudraṭa (9th century), the *Daśarūpa,* or "ten kinds of drama," by Dhanaṃjaya (10th century), the Sarasvati-*kaṇṭhābharaṇa,* "the neck-ornament of Sarasvati (the goddess of eloquence)," a treatise, in five chapters, on poetics generally (11th century), the *Kāvya-prakāśa,* "the lustre of poetry," (12th century) by Mammaṭa, a Kashmirian, and the late but important *Sāhitya-darpaṇa* (*c.* A.D. 1450).

Medicine (**Āyur-veda, Vaidya-śāstra**).—Though the early cultivation of the healing art is amply attested by frequent allusions in the Vedic writings, it was doubtless not till a much later period that the medical practice advanced beyond a certain degree of empirical skill and pharmaceutic routine. From the simultaneous mention of the three humours (wind, bile, phlegm) in a *vārttika* to Pāṇini (v. 1, 38), some kind of humoral pathology would, however, seem to have been prevalent among Indian physicians several centuries before our era. The oldest existing work is supposed to be the *Charaka-saṃhitā,* a bulky cyclopaedia in Slokas, mixed with prose sections, which consists of eight chapters, and was probably composed for the most part in the early centuries of our era. Whether the Chinese tradition which makes Charaka the court physician of King Kanishka (c. A.D. 100) rests on fact is uncertain. Of equal authority, but doubtless somewhat more modern, is the *Suśruta* (*-saṃhitā*), which Suśruta is'said to have received from Dhanvantari, the Indian Aesculapius, whose name, however, appears also atnong the "nine gems." It consists of six chapters, and is likewise composed in mixed verse and prose—the greater simplicity of arrangement, as well as some slight attention paid in it to surgery, betokening an advance upon Charaka. Both works are, however, characterized by great prolixity, and contain much matter which has little connection with medicine.

Astronomy and Mathematics.—Early Indian astronomical knowledge is summed up in the *Jyotisha Vedānga* (ed. Weber, 1862). A more scientific era is marked by the appearance of the five original Siddhāntas (partly extant in revised redactions and in quotations), the very names of two of which suggest Western influence, namely, the *Paitāmaha-, Sūrya-,* Vasishtka-, Romaka- (*i.e.,* Roman) and *Pauliśa-siddhāntas.* Based on these are the works of the most distinguished Indian astronomers, namely, Aryabhata, probably born in 476; Varāha-mihira, probably 505–587; Brahmagupta, who completed his *Brahma-sphuta-siddhānta* in 628; Bhatfa Utpala (10th century), distinguished especially as commentator of Varāha-mihira; and Bhāscara Āchārya, who, born in 1114, finished his great course of astronomy, the *Siddhānta-śiromani,* in 11 jo.

In the works of several of these writers, from Aryabhata onwards, special attention is paid to mathematical (especially arithmetical and algebraic) computations. The question whether Aryabhata was acquainted with the researches of the Greek algebraist Diophantus (c. A.D. 360) remains still unsettled, hut, even if this was the case, algebraic science seems to have been carried by him beyond the point attained by the Greeks,

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(H. J. E.; J. AL.)

SANSON, CHARLES HENRI (b. 1739), public executioner of Paris from 1788 to 1795, was great-grandson of Charles Sanson, who had received in 1688 the office of *exécuteur des hautes oeuvres de Paris,* which became hereditary in his family. Sanson's brothers exercised the same trade in other towns. In the last days of 1789 Gorsas in the *Courrier de Paris* accused Sanson of harbouring a Royalist press in his house. Sanson was brought to trial, but acquitted, and Gorsas withdrew the accusation. After the execution of Louis XVI., a statement by Sanson was inserted in the *Thermomètre politique* (13th February 1793) in contradiction of the false statements made in respect of the king's behaviour when confronted with death. He surrendered his office in 1795 to his son Henri, who had been his deputy for some time, and held his father's office till his death in 1840. There is no record of the elder Sanson's death. Henri's son Clément Henri was the last of the family to hold the office.

The romantic tales told of C. H. Sanson have their origin in the apocryphal *Mémoires pour servir à l'histoire de la Révolution Française par Sanson* (2 vols. 1829). Other *Mémoires of Sanson,* edited by A. Grégoire (ps. for V. Lombard) in 1830, and by M. d'Olbreuze (6 vols., 1862–63) are equally fictitious. The few facts definitely ascertainable are collected by G. Lenôtre in *La Guillotine pendant la Révolution* (1893).

SANSOVINO, ANDREA CONTUCCI DEL MONTE (1460–1529), Florentine sculptor and architect, was the son of a shepherd, Niccolo di Domenico Contucci, and was born at Monte Sansovino near Arezzo, whence he took his name. He was a pupil of Antonio Pollaiuolo, and at first worked in the style of 15th-century Florence. Early works are: the terra-cotta altarpiece in Santa Chiara at Monte Sansovino, and the marble reliefs of the "Annunciation," the "Coronation of the Virgin," a "Pietà," the "Last Supper," and various statuettes in the Corbinelli chapel of S. Spirito at Florence. In 1490 he was invited to Portugal by King John II. and some pieces of sculpture by him still exist in the monastic church of Coimbra. These early reliefs show strongly the influence of Donatello. The beginning of a more pagan style is shown in the statues of "St. John baptizing Christ" over the east door of the Florentine baptistery. This group was, however, finished by the weaker hand of Vincenzo Danti. In 1502 he executed the marble font at Volterra, with good reliefs of the "Four Virtues" and the "Baptism of Christ." The statues of the Virgin and John the Baptist in the cathedral of Genoa were completed in 1503. His earliest work in Rome is probably the monument of Pietro da Vicenza (1504), in the church of Ara Coeli. The monuments of Cardinal Ascanio Maria Sforza and of the bishop Hieronimus Bassus for the church of S. Maria del Popolo are among his most important works. In 1512, Sansovino executed a group of the "Madonna and Child with St. Anne," now over one of the side altars in the church of S. Agostino. From 1513 to 1528 he was at Loreto, where he cased the outside of the Santa Casa in white marble, covered with reliefs and statuettes in niches; most of the sculpture was executed by assistants. Jacopo Sansovino was his best pupil.

SANSOVINO, JACOPO (1486–1570), Italian sculptor and architect, whose palaces and churches determined the Renaissance character of Venice, was born in Florence on July 2, 1486. In 1502 he entered the Florence workshop of the sculptor Andrea Sansovino, and soon thereafter, as a sign of admiration, he adopted his master's name in exchange for his own family name of Tatti. In 1505 he accompanied Giuliano da Sangallo to Rome, studying there ancient architecture and sculpture while employed by Pope Julius II in the restoration of ancient statues. Back in Florence he carved, from 1511 to 1518, the statue of St. James the Elder as the first of 12 statues of the apostles for the piers under the dome of the cathedral; these had been commissioned originally in 1503 to Michelangelo, who only began one of them, the St. Matthew. It is the influence of this St. Matthew as well as that of Andrea Sansovino which inspired the "St. James." The "Bacchus" in the Museo Nazionale, Florence, created during the same period, was entirely un-Michelangelesque, full of the uncomplicated movement and gaiety of Hellenistic bronzes. From 1518 Jacopo worked in Rome, first on the Madonna and Child in S. Agostino and, probably slightly later, on the St. James (Sta. Maria di Monserrato), building at the same time the churches of S. Marcello in Corso and S. Giovanni dei Fiorentini.

In 1527, after the sack of Rome by the troops of Emperor Charles V, he fled to Venice, where he remained the rest of his life. Appointed chief architect of the city, he built, on the Grand canal, the Palazzo Corner (1532), still very austerely Tuscan with two stories of doubled half columns over a rustic base; in 1536 he began the library of S. Marco, with an open loggia on the ground floor and that free and festive decoration which the spirit of Venice demanded; at the same time he built the adjoining mint, with sombre rusticated half columns. The Loggetta, an open porch at the foot of the campanile of S. Marco, was built in 1540 and decorated with four bronze statues of Apollo, Mercury, Minerva and Peace, symbols of the city's power in war and in the peaceful pursuit of trade and the arts. These figures, elegant, sprightly, strongly moved within themselves, continued an older Venetian tradition that took its inspiration from Titian. The solemn portrait style of the mature Titian is found in a late work, the bronze portrait of the physician Tommaso Rangone over the entrance door to the church of S. Giuliano (1554), which Jacopo also built. The colossal statues of Mars and Neptune in the court of the ducal palace show the severe style of Jacopo's old age (1554–56), as does the monument to the doge Francesco Venier in S. Salvatore (1556–61). Among earlier works are the bronze statuettes of the four evangelists and the bronze door of the sacristy in S. Marco (1540s). The marble statue of the youthful St. John the Baptist (1554) in Sta. Maria de' Frari shows the transition from this style to that of Jacopo's old age. He died in Venice on Sept. 27, 1570.

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SAN STEFANO, TREATY OF, a treaty signed between Russia and Turkey on March 3, 1878, concluding the Russo-Turkish War. It created a very great vassal principality of Bulgaria, enlarged Serbia, and increased Montenegro to three times its size. The independence of all three States was recognized by the Porte. Russia obtained the Dobrudja, Ardahan, Kars, Bayazid and Batum, and the demolition of all the Danube fortresses. Improved conditions were promised the Armenian Christians; the autonomy of Bosnia-Hercegovina was to be admitted. But the treaty was viewed with concern by other countries.

In effect this treaty would have disintegrated the Turkish empire. The additional power falling to Russia directly and indirectly would have been tremendous. In the Balkans themselves there were protests from the Armenians and Greeks who, especially, would be sufferers in the rearrangement of territories, and from all the inhabitants of the different ceded provinces. Great Britain was especially opposed to the treaty because of the almost certainty that the Big Bulgaria would prove to be entirely under Russian influence. Austria also saw her Balkan interests threatened, and it was Austria who first demanded that the whole matter should be discussed by a European congress. The consequence was the meeting of the Congress of Berlin (*q.v.*), June 13–July 13, 1878, which entirely redrafted the Treaty of San

Stefano. (See also EASTERN QUESTION.)

SANTA ANA, in area the largest department in El Salvador, bordering Guatemala. Area 768 sq.mi. Pop. (1950) 202,453. nearly 60% rural and concentrated in the southern third of the department. Most of the department is rough land; in the southern third there are several volcanoes, including Volcán de Santa Ana (altitude 7.812 ft.), the highest mountain in the country. The northern part has many deep valleys, tributaries of Lempa valley. Santa Ana produces a substantial portion of El Salvador's coffee. mostly on fertile soils on slopes of volcanoes at altitudes between 1,800 and 4.000 ft. It also produces beans, livestock. vegetables, corn, fruits and cheese. The city of Santa Ana (*q* v.) is the departmental capital. (C. F. J.)

SANTA ANA, capital of the department of Santa Ana, El Salvador. 44 mi. by Inter-American highway and 50 mi. by railway N.W. of San Salvador. Pop. (1950) 51,702. It is situated at 2,120 ft. altitude in a rich agricultural area and a few miles north of several high volcanoes and Lake Coatepeque: famous for its beauty. mineral waters, bathing, fishing and sailing. Santa Ana has modern schools, hospitals, theatres and public buildings and a colonial cathedral of fine Spanish Gothic architecture. It is important in commerce and industry. Various textiles, clothing, foodstuffs, leather goods, liquors, cigars, pottery and wood products are manufactured. Nine miles west of Santa Ana is the city of Chalchuapa, in the midst of extensive archaeological remains, especially at the pre-Spanish town of Pampe nearby. (C. F. J.)

SANTA ANA, a city in the southeast coastal region of southern California, U.S., 35 mi. S.E. of Los Angeles (*q.v.*), 10 mi inland from the ocean shore line and approximately 40 mi. from the mountain ranges to the north and east; the county seat of Orange county and a part of the Los Angeles standard metropolitan statistical area. Santa Ana is located on the freeway that bears its name and which connects Los Angeles to San Diego; it is also served by the Orange county airport and the Los Angeles International airport. The city is within driving range of beach, mountain and desert resorts. The mixing of cool breezes from the ocean and drier winds from the desert over the coastal plains gives it an ideal climate. The public-school system includes facilities through junior college, with special provision for the training of exceptional children. The rich Santa Ana valley is noted for its oranges, avocados, dairy products. beans and cattle. The city also possesses some industry. Santa Ana was laid out in 1869 on land procured from Rancho Santiago de Santa Ana, an old Spanish land grant, and was incorporated in 1886. It has a council-manager form of government, in effect from 1952.

Pop. (1960) 100.350, (WM. H. K.)

SANTA ANNA, ANTONIO LÓPEZ DE (1794–1876), Mexican army officer and political figure, the storm centre of Mexican history for half a century, was born the son of a petty colonial official in Jalapa, Veracruz, on Feb. 21, 1794. He became a cadet in the Spanish colonial army in 1810 and for several years served on the northern frontier against Indians and border ruffians. In 1821 he supported the Plan de Iguala, from which emerged independent Mexico (see MEXICO: Colonial Period). Rebuffed for preferment under the new emperor Agustin de Iturbide—he was already considered a dangerous man—Santa Anna pronounced for the republic which overthrew the empire. After more frontier service he commanded the abortive effort to effect a revolution in Cuba from Yucatán. After helping to overthrow the president he continued his military service in 1829 by defeating an invading Spanish force at Tampico. Following a short retirement he seized power and began the first of five personal administrations, three times as representative of one party and twice as spokesman of the opposition. In 20 years he veered from liberal to ultra-conservative. He led Mexican troops to suppress the Texan revolt but was captured at San Jacinto in east Texas in 1836. He returned to retirement in Mexico through Washington, D.C., but emerged to fight the French occupation forces at Veracruz. Wounded, he lost a leg; a hero, he again became president until he was exiled to Cuba for incompetence and extravagance. In the Mexican-United States war, after a secret agreement with Pres. James K. Polk, he assumed the Mexican presidency, but as commander he prematurely rushed his troops to the north, where desert campaigning, complicated by a drawn battle with Gen. Zachary Taylor, cost him an army. Back in Mexico City he reformed the demoralized government. then engaged Gen. Winfield Scott, who was advancing from Veracruz. He mas defeated, his capital was lost. and he returned to exile in Jamaica and New Granada. In 1853 governmental chaos again recalled him to become president, but age had exaggerated his shortcomings and he was again banished in 1855. Ten years later he sought United States support with which to oust Maximilian, whom French forces had placed on the Mexican throne; at the same time he had offered his services to Maximilian. Santa Anna had prostituted his talents too often; both proposals were refused. A decade later still. a blind and broken old man, he was permitted to return to Mexico City, where he died in poverty on June 21, 1876.

Santa Anna possessed a magnetic personality and real qualities of leadership, but his lack of principles, his pride, love of military glory and extravagance, coupled with disregard for and incompetence in civil affairs, led his country into a series of disasters and himself into obloquy and tragedy. (W. H. CT.)

SANTA BARBARA, a department in northwestern Honduras. bordering Guatemala, and its capital city. Pop. (1950), department. 96,397; city, 3,218. Area (department) 1.975 sq.mi. The population is chiefly in the Ulua and tributary mountain valleys in the southern third of the department and in the Chamelecón lowland across the north central part; the mountainous areas in the northern and central portions are sparsely settled. Modern highways connect some settled areas with railways and with the Inter-Ocean highway near San Pedro Sula. About 50% of the area of the department is in farms. Products include coffee and corn, tobacco, sugar, beans, poultry and rice. (C. F. J.)

SANTA BARBARA, a seaside resort and residential city of California, U.S., 97 mi. N.W. of Los Angeles; the county seat of Santa Barbara county. While the city lies on a coastal shelf, it spreads like a fan from curving beaches to the mesas, slopes and oak-covered canyons of the Santa Ynez mountains. Protected by the Channel Islands and the mountains, Santa Barbara has a mild climate throughout the year.

The city's Museum of Xatural History has artifacts recording the area's early Indian cultures, and the Santa Barbara Historical society's holdings describe the beginnings of the Spanish presidio in 1782 and the story of the construction of the "Queen of the Missions." a neoclassical structure which was founded in 1786. The mission is now the Franciscan headquarters for the Pacific coast. John Charles Frémont (*q.v.*) raised the U.S. flag at the presidio in 1846. claiming the area for the U.S. (see CALIFORNIA: *History*). In 1850 Santa Barbara was incorporated as a city and in 1887 the railroad reached it. Descendants of original Spanish. Mexican and Yankee settlers participate in the annual Old Spanish Days fiesta, recalling Santa Barbara's early history. The city is the centre of a rich orchid, citrus, walnut and cattle-raising area with oil fields and light manufacturing. Nearby are Vandenberg air base and research industries; a campus of the University of California and the Center for the Study of Democratic Institutions. directed by Robert M. Hutchins under the auspices of the Fund for the Republic, have made Santa Barbara an educational centre. Attractions include an art museum, a music academy. botanical gardens and theatre arts, uith multiple opportunities for outdoor recreation and sports. Pop. (1960) 58.768

See *Santa Barbara, a Guide to the Channel City and Its Environs* in the "American Guide Series" (1953). (W. R. J.)

SANTA BARBARA ISLANDS, a chain of four islands lying parallel to the southern coast line of California, at an average distance of 20 mi. from the mainland. The term Channel Islands is sometimes used to designate these islands and four others, including Santa Catalina (*q.v.*). All are part of the state of California.

Santa Cruz is the largest of the Santa Barbara Islands, covering nearly 98 sq.mi. The terrain varies from sea-level valleys to sharp-sloped wooded peaks which exceed 2,400 ft. Two ranches and a small military installation have constituted its maximum population. Sheep and cattle raising are the primary enterprises;

the island abounds with wild and semiwild sheep which are descendants of former domestic flocks. Prior to the advent of prohibition in 1920 the island was also noted for its fine wines.

Anacapa. the smallest of the group, is a razorbacked volcanic ridge which stretches 4½ mi. but averages less than ½ mi. in width. It is broken into three segments, one of which supports a coast guard station and lighthouse.

Santa Rosa, a cattle ranch, shows a marked change in topography. Its 84 sq.mi. are mostly open grasslands, intersected by numerous spring-fed canyons.

San Miguel is a rapidly eroding uninhabited island made up of 15 sq.mi. of weather-cut ravines and shifting sands. It was once valuable for raising livestock, but heavy overgrazing in the mid-1800s surrendered its soil to the ever-present winds. There are large sea elephant and sea lion colonies on the westernmost tip.

The island chain has plant and animal life not found on the mainland, and there are often differences in characteristics of a plant or animal on one island as compared with the same type on another island.

Juan Rodriguez Cabrillo. who explored the coast of California in 1542–43, is believed to have been buried on one of these islands. He found them populated with the now extinct Canaliño Indians. Two of the eight islands termed Channel Islands. Santa Barbara and Xnacapa, were included in the Channel Islands National monument established in 1938. (EA. W.)

SANTA CATALINA, an island near the coast of California, 24 mi. S.S.W. of Los Angeles harbour. The most highly developed of the eight Channel Islands off the coast of southern California, it is 20 mi. long, 8 mi. wide at its greatest width. and has an area of 74 sq.mi. Structurally, Santa Catalina is a small mountain range rising from the continental shelf to a maximum elevation of 2,125 ft. above sea level at Mt. Orizaba. Mountain spurs and canyons transverse to the main range form many interesting headlands and protected coves at the shore line. The climate is of Mediterranean type with warm, dry summers, mild winters and light winter rains. It is generally cooler in summer and milder in winter than the adjacent mainland.

Santa Catalina has been a tourist centre for decades, drawing tens of thousands of visitors annually to its gentle climate, beaches, boating and scenery. Notable attractions are the famous undersea "gardens" near Avalon bay. where luxuriant marine life may be viewed from glass-bottomed boats, and Catalina Bird park. . The island's waters, visited throughout the year by thousands of boating enthusiasts and sportfishermen from nearby mainland ports, are noted fishing grounds, Avalon, population (1950) 1,506, near the southeastern end of the island, is the only city and is the centre of the tourist industry. It has frequent boat and air service from both Long Beach and Los Angeles.

Santa Catalina was discovered in 1542 by Juan Rodriguez Cabrillo, Portuguese navigator in the service of Spain. Sebastián Vizcaino, also sailing under the flag of Spain, rediscovered the island in 1602 on the eve of the feast of St. Catherine and named it Santa Catalina in honour of the saint. A part of the republic of Mexico after 1822, it became part of California with the signing of the Treaty of Guadalupe Hidalgo ending the Mexican War in 1848. Its development as a tourist centre dates from 1919, when it was purchased by William Wrigley. (R. A. K.)

SANTA CATARINA, a southern state of Brazil, bounded on the north by Paraná, on the east by the Atlantic ocean, on the south by Rio Grande do Sul and on the west by the Argentine territory of Misiones. Area 36,601 sq.mi. Pop. (1950) 1,560,502; (1956 est.) 1,852,257.

Immediately behind the coast the Great Escarpment rises like a mountain wall, and the state contains very little level land. Only along the lower Itajai river and around Joinvile and São Francisco are there narrow bits of wet lowland. Santa Catarina Island, on which the state capital, Florianópolis (*q.v.*), is situated. is a ridge of steep hills. The Great Escarpment in the state is broken into a series of steps, deeply dissected by the Itajaí-Açu and its tributaries. Above the scarp, the surface of the Paraná plateau slopes gently westward, drained by the Uruguai river. The coastal zone is hot and rainy, but on the plateau frosts are sometimes experienced in the winter. The southernmost extension of the tropical rain forest occurs along the coast, but in the frost zone at higher altitudes the forest comprises a mixture of broadleaf deciduous trees and taller Araucaria pines. Among the latter are grassy openings, originally covered with tall prairie grasses.

The first settlements by the Portuguese from São Paulo were on the prairies of the highlands and on Santa Catarina Island off the shore., The dense coastal forests were left empty until the arrival of German colonists after 1850. Blumenau, in the valley of the Itajai, was one of the first German towns. and Brazilians of German origin have non spread out from Blumenau throughout the coastal zone and in the valleys of the plateau. Colonies of Italians and Poles also settled in this state.

The economy of the area is varied. The farmers grow maize, to be fed to hogs, and also wheat, potatoes, tobacco. rice and a variety of fruits and vegetables. The chief industries include meat processing, vegetable and fruit canning, textile milling, maté processing (from fhe leaves of the yerba maté tree), sawmilling and brewing. A paper factory is in operation at Blumenau. The best coal in Brazil is mined 69 mi. N.W. of Tubarão along the southern coast. (P. E. J.)

SANTA CLARA (locally VILLA CLARA), capital of Las Villas province, Cuba, about 160 mi. E.S.E. of Havana. It is situated near the geographic centre of the island on the Central highway and is the junction point of the main railroads of Cuba. Initially dependent on the livestock industry, it flourished on sugar and tobacco in the 20th century. Pop. (1953) 77,398.

The city was founded in 1689 by 18 families from Remedios, escaping constant dangers of pirates. It occupies the site of the ancient Indian Cubanacan, which according to some authorities Columbus mistakenly took to be the headquarters of Kublai Khan. (D. R. D.)

SANTA CLARA, a city of Santa Clara county in west central California. U.S., 48 mi. S. of San Francisco and immediately adjacent to the city of San Jose (*q.v.*) on the southeast; a part of the San Jose standard metropolitan statistical area. Santa Clara has a mean temperature of 57° F. and an annual rainfall of 15.19 in. Founded in 1777 as the eighth of the Spanish Franciscan missions in California—hence its title "the Mission city"—it n-as incorporated as a city in 1852 and adopted the council-manager form of government in 1952. The Spanish influence is evident in place names, architecture and the restored mission. The city's economy historically rested upon the processing of prunes, apricots and other fruits and vegetables of the rich Santa Clara valley. In 1941, however. manufacturing for the first time surpassed agriculture in importance and World War II accelerated the industrial trend; after 1950 the population increased considerably. Leading classes of products from the manufacturing plants are Fiberglas, millwork, electrical machinery, chemicals, fabricated metals, processed foods and paper products. The University of Santa Clara. the oldest institution of higher learning in the west, was founded by the Jesuits in 1851 as a college and became a university in 1885. It has five colleges: arts and sciences, business administration, graduate, engineering and law.

Pop. (1960) 58,880. (J. J. HA.)

SANTA CRUZ, ÁLVARO DE BAZAN, 1ST MARQUIS OF (1526–1588). Spanish admiral, born at Granada on Dec. 12, 1526, of an ancient family. In 1564 he aided in the capture of Velez de Gomera, was appointed in 1568 to command the galleys of Naples and was thus brought into close relations with Don John of Austria during the formation of the Holy League (1570). In the operations at Lepanto (Oct. 7, 1571) Bazan was always in favour of the more energetic course: his prompt action averted disaster when the allied line was broken. He accompanied Don John at the taking of Tunis (1572). When Philip II of Spain enforced his claim as heir to the crown of Portugal (1580–81), Santa Cruz held a naval command. In 1583 he was sent against the prior of Crato, an illegitimate representative of the Portuguese royal family. nho nith his friends held the island possessions of Portugal in the Atlantic. His victory off Terceira decided the struggle in favour of Spain. A zealous advocate of war against England, he made to Philip, on Aug. 9, 1583, the first

definite suggestion of the Armada. The king's political and financial embarrassments caused many delays, and Santa Cruz, who was to have commanded, was hindered from acting with effect. He was at Lisbon without the means of fitting out his fleet when Drake burned the Spanish ships at Cádiz (1587). Santa Cruz's independence of judgment finally offended the king and he was held responsible for failures and delays. He died on Feb. 9, 1588, at Lisbon. He was the designer of the great galleons which were employed to carry the trade between Cádiz and Vera Cruz in Mexico.

See C. Fernández Duro, ***La Armada Invencible,*** 2 vol. (1884–85); A. Altolaguirre y Duvale, ***Don Alvaro de Bazán . . . estudio histórico-biográfico*** (1888); ***W.*** Stirling Maxwell, ***Don John*** of ***Austria . . .*** 2 vol. (1883).

SANTA CRUZ, ANDRÉS (1792–1865), Bolivian statesman, was born on Nov. 30, 1792, near La Paz, the son of a Spanish colonial official and an Inca princess. Choosing an army career, he served briefly with the Spanish forces, but fought with the patriots after 1820. When Antonio José de Sucre (*q.v.*) was forced out as president of Bolivia, Santa Cruz was elected to that post, taking the oath of office in May 1829. For two years thereafter he ruled as a virtual dictator, and in 1831 a congress elected him to a new four-year term. Between 1831 and 1835 Santa Cruz earned an enviable reputation as his government promoted industry, commerce, public improvements and education. He became involved in the struggle for power in Peru, the outcome of which was the creation of the short-lived Peruvian-Bolivian confederation, which was opposed by Brazil, Chile and Argentina. Chile opened hostilities against the confederation in Aug. 1836, and at Yungay. in 1839, Santa Cruz's forces were defeated. He resigned from the presidency, was exiled and forbidden to return to Bolivia. He died in France Sept. 23, 1865. ***See*** also BOLIVIA: History.

(J. J. J.)

SANTA CRUZ, a very sparsely inhabited province of southern Argentina, comprising a large part of the area generally known as Patagonia (*q.v.*). The province, which was created by a decree of the federal government in 1956 (with effect from Jan. 1, 1957), is bounded north and south by the 46th and 52nd parallels. It stretches from the Atlantic ocean to the Chilean frontier in the cordillera of the Andes. Pop. (1956 est.) 57,518. Area 94,186 sq.mi. Santa Cruz is a region of constant winds and dust storms which sweep over its dry table lands and its arid. precipitous coast. Rainfall is slight. In spite of the latitude, however, the climate is relatively mild, the temperature being moderated by the proximity of the ocean. The western rim of the province includes forested Andean foothills and a number of beautiful lakes, notably Lake Argentino. nhich can be reached by traveling up the Santa Cruz river from the port of Santa Cruz. Huge glaciers descend from the cordillera into this lake.

There are sheep ranches in the sheltered canyons that cross the desert, but little agriculture. The province's principal line of communication is the shipping service which links its Atlantic ports, where the produce of the interior (mainly wool and sheepskins) is collected for dispatch to Buenos Aires. The southernmost port is Rio Gallegos, the provincial capital. which is a centre for the sheep trade and has a meat-packing plant and a tallow-making industry. It is also the outlet for Argentina's chief coal field at Rio Turbio (160 mi. inland), with which it is connected by railway. The other principal ports are Santa Cruz (about 135 mi. N. of Gallegos) and Puerto Deseado (about 185 mi. N. of Santa Cruz). A railway runs inland from Deseado to Colonia las Heras. Across the northern border, in the province of Chubut, are the military zone and the oil fields of Comodoro Rivadavia. (GE. P.)

SANTA CRUZ, a department in the lowland region of eastern Bolivia, bounded north by Beni, east by Brazil, south by Paraguay and Chuquisaca, and west by Chuquisaca and Cochabamba. It is a frontier area of extraordinary economic potential lying between the Andes and the Mato Grosso plateau. Pop. (1950) 286,145. Area 143,097 sq mi. The topography is generally level, with a few gently rising elevations, notably the Chiquitos highlands. Average annual rainfall, coming largely from October through March, ranges from 100 in. in the north to 50 in. in Santa Cruz city and less farther south. The department is drained by two river systems, flowing north. which converge in the northeastern corner of Beni. The first comprises the Rio Grande, Piray, Yapacani and Maraco, upper tributaries of the Mamoré; the second comprises the San Miguel, Blanco, Baures and Paraguá, tributaries of the Iténez (Guaporé). A few smaller streams flow eastward into the Paraguay. About 40% of the department is prairie and the remainder is woodland. Except for the northern part, which is flooded during the rainy season, the region is quite healthful and has an agreeable climate. The prairie affords good pasturage. and the cleared forest land is unusually fertile. Rice, sugar cane, coffee, cotton, manioc, corn, citrus fruits, vegetables and tobacco are the most commonly produced items, but agriculture in the 1960s was still in an infant stage of development owing to the historic isolation of the area. The region supports 500,000 cattle and large numbers of horses. The population is about one-third of Spanish colonial descent and two-thirds mestizos and Indians.

Post-World War II developments included the completion of three important transportation facilities: a highway 312 mi. in length connecting the department with Cochabamba and the Altiplano; the Corumbá (Braz.)-Santa Cruz railway, providing an outlet to the Atlantic ports of Brazil; and another railway extending from the Argentine frontier to Santa Cruz. Oil exploration and production in the Camiri area were significantly advanced by several foreign companies together with the Bolivian government corporation (Yacimientos Petroliferos Fiscales Bolivianos). Pipelines extend to Sucre and Cochabamba. Petroleum deposits are found throughout much of the sub-Andean zone of Bolivia. Agriculture was enhanced by the introduction of immigrants, chiefly Okinawans and Japanese, and by land reform laws.

The city of Santa Cruz (pop. [1950] 34,837), founded by the Spanish explorer Nuflo de Chávez in 1560, is the capital and only town of consequence in the department. It is situated on the Piray at 1,575 ft. elevation. Local industries comprise sugar mills, distilleries, sawmills, tanneries, furniture and leather goods factories and food-processing plants. The railways converge on Santa Cruz; it is the terminus of the Cochabamba highway, and air service facilities are available. (J. L. TR.)

SANTA CRUZ, a city of California, U.S., 80 mi. S. of San Francisco on the northern promontory of Monterey bay; the county seat of Santa Cruz county. The scenic beauty of the area and its mild climate are its foremost attractions. The area is enhanced by clumps of redwoods which increase to forest proportions in the Santa Cruz mountains just north of the city. The state of California has incorporated much of this area into a state park.

The city was founded by the Franciscans in 1791 and became one of the mission links whereby Spanish civilization was extended all the way from San Diego to San Francisco. The U.S. flag was raised over the town in 1846 and the town was chartered as a city in 1876. The city's growth has been steady with a marked increase after 1950 resulting from the increasing industrialization of the area. In agriculture, Santa Cruz has made marked progress, especially in horticulture. Strawberries are grown almost the year around, and loganberries are perfectly acclimated, having originated there. Artichokes are produced in abundance, as are cherries, apples and grapes. The area also excels in the production of bulbs.

One of the features of Santa Cruz attractive to thousands of tourists is its magnificent sweep of beach. To accommodate these crowds the city has built several facilities, including a long wharf which extends a half mile into the bay. The bay also affords a considerable income from fishing. Santa Cruz has a council-manager form of government, in effect from 1948, and a public junior college called Cabrillo. For comparative population figures see table in CALIFORNIA: Population. (B. L. B.)

SANTA CRUZ DE TENERIFE, a seaport and the capital of Tenerife and of the Canary Islands; in 28° 28' N. and 16° 15' W., on the east coast. Pop. (1950) 75,412 (mun. 103,110). Santa Cruz occupies a small plain which is bounded by rugged volcanic rocks, and seamed by watercourses which are dry almost throughout the year. Scarcely any vegetation, except cactuses and

euphorbias, is to be seen in the neighbourhood.

Almost the entire town was rebuilt in the 19th century. when its population more than trebled. There are many good public buildings, including a school of navigation. technical institute, library, natural history museum and hospital. An aqueduct 5 mi, long brings pure water from the mountains of the interior. Dromedaries from the adjacent islands of Lanzarote and Fuerteventura are used to convey merchandise and in agriculture. The town was bombarded by the British fleet under Robert Blake in 1657, and by Horatio Nelson. who lost his arm during the attack. in 1797. Some British flags lost on that occasion hang in one of the churches. Santa Cruz is an important coaling station and commercial centre *See* CANARY ISLANDS.

SANTA ELENA PENINSULA, in southwestern Guayas province. Ecuador. On the peninsula there is Ecuador's one important oil field. La Libertad has a small refinery. Also on the peninsula there are salt-extracting works and a popular seaside resort. Ores of sulfur. platinum and gold are said to exist but in the early 1960s had not been developed. The peninsula offers fine recreational facilities at Salinas. 75 mi. W. of Guayaquil. due to its ocean beaches and arid climate. It is the northernmost extension of the west-coast desert of South America, only 2° 12' S. of the equator. (P. E. J.)

SANTA FE, a province of central Argentina, between the Chaco in the north and the province of Buenos Aires in the south. Pop. (1960) 1,865,537. Area 51.354 sq.mi. The two chief cities are the provincial capital, Santa Fe, and Rosario (*qq.v.*), which is the third largest city in the republic. The province lies almost entirely within the great humid pampas region and has no wooded land in the south except along the river courses. In the north there are extensive forests of commercially valuable woods. interspersed with grassy *campos*. The surface is a level alluvial plain and the soil is among the most productive in the country. The climate is healthy and moderate, with mean annual temperatures ranging from 63° F. in the south to 68° in the north. Annual rainfall varies from 28 to 35 in. and is more abundant in the river littoral region than in the interior.

The leading crops are alfalfa (lucerne), maize, wheat and flax (the order of importance changes according to world prices and government subsidies), together nith oats, rye and barley. In the northern part of the province peanuts, tobacco, sugar cane and cotton are gromn. Although agriculture is the chief source of wealth, the livestock industry is well developed. The ratio of agriculture to cattle raising varies with alterations in prices and subsidies, as both are competing for the same land. In addition to beef and dairy cattle. large numbers of pigs are raised. The principal industries are based on dairy and forest products, and there are large sugar refineries, flour mills, breweries and distilleries.

The provincial capital has exceptionally good communications nith the surrounding country. It is served by the Mitre and Belgrano railways (300 mi. to Buenos Aires) and is the centre of a highway network which includes roads southward to Rosario (100 mi.) and northnard to Formosa (500 mi.). The capital has an airport. But the traditional line of communication is by the Paraná river. Ocean-going steamers can reach the town of Santa Fe, which has adequate docks to receive them, and the province's long littoral has many small ports nhere the farmers of the interior can load their products onto the steamers that ply up and down the Paraná. The ports are linked by regular river services with Buenos Aires (downstream) and Corrientes and Paraguay (upstream). (GE. P.)

SANTA FE, Argentine city and capital of the province of the same name, located on a channel of the Paraná river approximately 300 mi. N.W. of Buenos Aires. Pop. (1960) 208,350. It was founded in 1573 by a group of settlers under Juan de Garay as Santa Fe de Vera Cruz, several years before the final establishment of Buenos Aires, as a supporting port for the Spanish settlement at Asunción, Parag. During the colonial period it served as a centre for Jesuit missionary activity; the Jesuit college and church date from 1660. Until mid-19th century the city marked the northern limit of provincial expansion and served as a strategic outpost against the Indians of the Chaco region. During the national period the city was one of the centres which attempted to counteract the growing dominance of Buenos Aires. The Argentine constitution was adopted by an assembly at Santa Fe in 1853. In the mid-1850s the first agricultural colonies of European immigrants in Argentina were established north and west of the city The national University of the Littoral is a 20th-century addition to the culture of Santa Fe. Modernization of the port facilities in 1911 made it possible for ocean-going vessels to reach the city, and considerable river trade is carried on with Paraná, capital of Entre Rios, located across the Paraná river from Santa Fe. Railroads and highways link the city nith the Chaco frontier and with the provinces of Santiago del Estero and Córdoba. There is an airport at Sauce Viejo just outside the city. Although Rosario remains the major port of the province, Santa Fe serves as an outlet for the cotton, flax and grain from the northern area.

(Js. R. S.)

SANTA FE, capital of New Mexico, U.S., in the northern part of the state, on the Rio Santa Fe, the seat of Santa Fe county. Located at the foot of the Sangre de Cristo range at an altitude of 7,000 ft., it has a dry. sunny and invigorating climate. The average annual rainfall is 14.49 in. and the average monthly mean temperature ranges from 28 8° F. in January to 69° in July.

Santa Fe was the site of prehistoric Indian pueblos, of which few remains above ground were left when the Spanish came early in the 17th century. The city, the oldest seat of government in the United States, was founded in 1610 as the capital of the province of New Mexico and was officially named La Villa Real de la Santa FC de San Francisco. "Royal City of the Holy Faith of St Francis." For the next 200 years its history was closely related to the history of the Spanish in the southwestern U.S. *(see* NEW MEXICO. *History)*. By 1630 there was a population of 250 Spaniards, 700 Indians and 50 half-breeds; the Spanish were driven out in 1680 but returned in 1692. During the 18th century a considerable trade in sheep, wool, pelts and wines developed, chiefly with Chihuahua in Mexico and with the Indians of the plains; the city later became the centre of an extensive commerce with the United States *(see* SANTA FE TRAIL).

After Mexican independence in 1821, Santa Fe was a part of that country; US. troops took possession of the city in 1846 and it continued to be the capital, first of the territory and then of the state of New Mexico. A railroad built in the 1880s bypassed Santa Fe and its population remained static until New Mexico achieved statehood. Thereafter the number of government employees increased and beginning about that time Santa Fe also became known as a centre for painters and writers as well as for archaeological studies in that area. It has never been an industrial city; its economy in modern times is sustained to some extent by government and largely by the tourist and vacation trade It has a council-manager form of government, in effect since 1955.

The original Spanish plaza is still the heart of the city. Located there is the old governor's palace, built in 1610, occupied continuously until 1909 by the Spanish, Indian, Mexican and U S. governors of New Mexico and now housing the collections of the Historical Society of New Mexico and the exhibits of the Museum of New Mexico and the School of American Research Near the plaza is the chapel of San Miguel (early 17th century) and "the old house" of Indian construction, possibly antedating the Spanish occupation. St. Francis cathedral dates from 1869 and occupies the site of a church built in 1622; it was built by Archbishop John B. Lamy, the "Bishop Latour" of Willa Cather's novel *Death Comes for the Archbishop.* In the northeastern part of the city are the ruins of Ft. Marcy, built by Gen. Stephen W. Kearny in 1846. A stone in the plaza marks the end of the old Santa Fe trail. The modern structures are mainly in the distinctive "Santa Fe" type of architecture, developed (largely since 1910, through the efforts of a small group of persons connected with the School of American Research and the state museum) by combining features from the terraced dwellings of the Pueblo Indians, the crumbling Franciscan missions, and the haciendas of the Spaniard and Mexican. The Art gallery of the Museum of New Mexico is an example of the school (reproducing in a blend the façades of six early New Mexico missions).

Within a 75-mi. radius of Santa Fe are the Indian pueblos of 'Tesuque. San Juan, Santa Clara, San Ildefonso and Taos (one of the few remaining pueblos where the Indians still live in terraced houses); Chimayo, a Spanish plaza (village) famous for its handwoven blankets; the Puyé cliff dwellings and those of Rito de los Frijoles; the Pecos River canyon; the hot springs of Ojo Caliente; the petrified forest near Cerrillos; and the turquoise mines near Bonanza.

The city is served by several highways and by air lines and has bus connections with the railroad at Lamy, 18 mi. S.

For comparative population figures see table in NEW MEXICO: *Population.*

See Paul Horgan, *The Centuries* of *Santa Fe* (1956); Oliver La Farge and Arthur N. Morgan, *Santa Fe* (1959).

SANTA FE TRAIL, the famed wagon trail from Independence. Mo.. to Santa Fe, N.M.. and an important commercial route for 59 years, from 1821 to 1880. when the last section of the railroad was completed. It is possible that in 1541 the Spaniard Francisco Vásquez de Coronado traveled portions of what became the trail. and it is known that in 1806 Zebulon Montgomery Pike. the U.S. government explorer. passed over sections of it. A commercial venture was attempted by William Morrison, an Illinois merchant, who sent Jean Baptiste LaLande with trading goods to Santa Fe in 1804. Neglecting to account to Morrison. LaLande settled in Santa Fe. where Captain Pike saw him in 1807. That the Spaniards were hostile to foreign traders is shown by the reception given Robert McKnight's trading expedition of 1812. Arriving after a revolt against the Spaniards had been suppressed, McKnight and members of his party were imprisoned in Spanish jails until after Mexico won independence from Spain in 1821.

The earliest successful commercial expedition was that of William Becknell. who in 1821 made a profitable journey with $300 worth of goods on pack animals and returned the next year to open the trail with wagons. Although Becknell has been called father of the trail, a number of other traders, John McKnight, Hugh Glenn, Jacob Fowler and Stephen Cooper, followed close on his heels.

The Missouri river terminus was first Franklin. Mo.. then Independence. and later Westport, now Kansas City, Mo. When the early traders set out in May of each year they at first used horses, but these were replaced in subsequent years by teams of mules or oxen. sometimes five or six pairs to a wagon. Though Santa Fe had gold and silver, together with furs, skins and a plentiful supply of wool, the simplest manufactured goods were in great demand. On the westward route the huge wagons were crammed almost to overflowing with hardware and assorted dry goods. After arriving in July and reaching an understanding with Mexican customs officials, most traders sold their cargoes and departed in August with a net profit that ranged from 20% to 40%, though there were some who sold for a loss.

A significant portion of the goods carried to Santa Fe was shipped on to interior parts of northern Mexico and to California. Before 1843 there were no yearly shipments of goods worth more than $450,000, according to Josiah Gregg. Yet it is safe to assume, from other records. that the trade increased.

From its terminus in Missouri the main trail followed almost a straight line for nearly 800 mi. The first of four sections of the journey was from Independence over grasslands to the green meadows and woods of Council Grove in what is now Kansas. Here the freighters organized their train for protection against marauding Indians and made any necessary repairs, aided by a resident blacksmith. From Council Grove to the river crossing nest of the Big Bend on the Arkansas was a second division. The traders then moved from the ford on the Arkansas across the arid. desolate Cimarron desert, and finally, in the fourth section of the trip. to the more hospitable grasses and cedars east of Santa Fe.

An alternative route, to avoid the hot, dry Indian country of the Cimarron, was to follow the Arkansas river westward to an adobe stockade near modern La Junta. Colo.. called Bent's Fort. the leading trading post of the American southwest. Thence the mountain route turned southward through the Raton pass to meet the main trail. This route, though mountainous, had the advantages of better water supply. opportunities for trading at Bent's Fort and less danger from Indians. Yet there were few Indian attacks on any portion of the trail. Josiah Gregg reported that only 11 men were killed by Indians in the period before 1843. Traveling in parallel columns, the nagons could easily form a circle to protect livestock and repel attacking warriors.

The Santa Fe trail was not the one-way wilderness highway of the pioneer settler and his family. Rather it was the two-way route of international trade. Contemporaries have described in their journals the variety of merchants and frontiersmen who sought adventure and profit on the road to Santa Fe. These men opened and maintained a prairie thoroughfare that brought bullion into the United States (especially needed in the years following the panic of 1837). gave Missouri its celebrated mules and helped dispel the notion that the southwest was a great American desert. The traders came to know the varied routes of the southnest and reported weaknesses of the Mexican military forces. Indirectly they hastened United States expansion and prepared the nay for assent to U.S. control nhich came in 1846, when Col. Stephen W. Kearny entered Santa Fe without opposition at the beginning of the Mexican War. Under C.S. rule the Santa Fe trade continued to flourish. especially after U.S. mail by stagecoach was instituted in 1849. In the period after the Civil War the yearly freight expeditions persisted until the tracks of the Santa Fe railroad in 1880 ended the heyday of the wagon caravans.

See Josiah Gregg, *Commerce* of *the Prairies,* 2 vol. (1844 and numerous later editions), the classical account of the trail; R. L. Duffus, *The Santa Fe Trail* (1930), a readable and entertaining account.

(W. R. J.)

SANTAL, the name of a tribal people living in the southeastern districts of Bihar and adjoining parts of West Bengal and Orissa. In 1941 the Santals numbered 2,732,266. They speak Santali, a dialect of Kherwari, a Munda language. In physical type they belong to the Proto-Australoid group. characterized by short stature. dark skin. wavy to curly hair and broad flat nose.

Many Santals are employed seasonally or permanently in the coal mines near Asansol or the steel factories in Jamshedpur, while others work during part of the year as paid agricultural labourers. In the villages, where tribal life continues, the most important economic activity is the cultivation of rice. Each village has a hereditary headman who, assisted by a council of elders, administers the affairs of the village; he also has some religious and ceremonial functions. Two priests perform the duties of sacrificing on behalf of the villagers. Groups of villages are linked together in a larger territorial unit termed a pargana. which also has a hereditary headman. Traditionally men of the pargana met together annually to hunt and to settle disputes involving the members. and the custom persists where game may be found.

The Santals have a patrilineal exogamous clan organization. The clans: 12 in number. are each divided into a number of subdivisions. Membership in the clan and subclan carried certain injunctions and prohibitions with 'regard to style of ornaments, food. house type and religious ritual. Marriage, endogamous with respect to the tribe as a whole, is normally arranged by the parents; payment of a bride price and the marking of the bride's head with vermilion are essential features of the ceremony. Marriage is generally monogamous; polygyny, though permitted, is rare.

Religion centres around the worship of spirits by means of periodic public sacrifices to avert disease and ensure rainfall. The ancestral spirits of the headmen are objects of an important cult.

See W J Culshaw, *Tribal Heritage: a Study of the Santals* (1919); N Datta-Majumdar. "The Santal a Study in Culture Change." Government of India, Department of Anthropology, *Memoir No* 2, *1955 (1956).*

(D. M SP.)

SANTALACEAE, the sandalwood family, dicotyledonous, semiparasitic shrubs, trees and herbs of tropical and temperate regions. There are 30 genera and about 400 species. *Santalum album* is the true sandalwood (*q.v.*). The bastard toadflax, the North American species of *Commandra,* is sometimes parasitic. The other North American species is oil nut or buffalo nut (*Pyrularia pubera)* of the Appalachian region. The *Thesium humi-*

fusum, likewise called the bastard toadflax, is native to Great Britain and is a herbaceous root parasite.

SANTAL PARGANAS (SANTHAL PARGANAS), a district of Bihar, India. Area 5,461 sq.mi. Pop. (1951) 2,322,092. In the east a sharply defined belt of hills stretches for about 100 mi.; west of this a rolling tract of long ridges with intervening depressions covers about 2,500 sq.mi., while there is a narrow strip of alluvial country about 120 mi. long, lying for the most part along the loop line of the Eastern railway running roughly parallel to the Ganges in the north and east of the district. The principal range in the east is that of the Rajmahal hills, which cover about 2,000 sq.mi.; they nowhere exceed 2,000 ft. The alluvial tract has the damp heat and moist soil of the lower Ganges basin, while the undulating and hilly portions are swept by the hot westerly winds of Bihar and are very cool in the winter. Coal is worked in the small Jaintia field. Pakaur is the chief centre of the shellac-making industry.

The early history of British administration is a record of the measures taken to pacify and civilize the Paharias of the Rajmahal hills, who under Mohammedan rule had been turbulent robbers and marauders. The Santals, who numbered 829,025 in 1941, began to migrate there from Chota Nagpur and the adjoining districts in the late 18th century. The oppression of landlords, the exactions of Hindu moneylenders and the consequent loss of land caused a rebellion (the Santal War) in 1855–56. This led to the establishment of a form of administration congenial to the immigrants; and a land settlement was afterward carried out on conditions favourable to the cultivators. The Daman-i-Koh, meaning "the skirts of the hills," a government estate of 1,356 sq.mi., was established as a reserve for them and other aboriginals, such as the Paharias. The district is traversed by both the loop line and the chord line (running parallel to the southwest border) of the Eastern railway. It contains the old Mohammedan city of Rajmahal and the modern commercial mart of Sahibganj (pop., 1951, 25,669), both on the Ganges; and the Hindu place of pilgrimage of Deoghar (Deogarh; pop., 1951, 25,510). The administrative headquarters are at Dumka, or Naya Dumka (pop., 1951, 13,582).

See W. B Oldham, *Santal Parganas Manual* (1898); F. B. Bradley-Birt, *The Story of an Indian Upland* (1905).

SANTA MARIA, a town in Rio Grande do Sul state, Braz., located near the head of the Jacui valley, 150 mi. W. of Pbrto Alegre. Pop. (1950) 44,949. It is an important railroad centre at the crossing of the main line running from São Paulo to the Uruguay border and the main line running from Pbrto Alegre to the Argentine border. It is also served by an airfield and is the junction of several major highways. Industries include railroad shops, breweries, tanneries and meat-processing plants. Santa Maria carries on a large trade in livestock. alfalfa, rice, wine, fruit, maté, coal and timber. The town was once called Santa Maria da Bocca do Monte (St. Mary of the Mountain's Mouth) because of its position at the foot of the Serra Geral. (P. E. J.)

SANTA MARTA, a Caribbean port city of Colombia. capital of the department of Magdalena, on a small bay 40 mi. E.N.E. of the mouth of the Magdalena river. Pop. (1951) 37,005. Santa Marta was founded by Rodrigo de Bastidas in 1525 and is the oldest city of Colombia. From there Gonzalo Jiménez de Quesada led the celebrated expedition inland to found Santa Fe de Bogotá (see BOGOTA). Connected by swampy channels and lakes nith the river, Santa Marta became a port for colonial New Granada. Like its more famous neighbour. Cartagena (*q.v.*), it was occasionally attacked and sacked by foreign corsairs. Simón Bolivar, hero of the independence wars, died at an estate on the edge of the town in 1830. Santa Marta's commerce overtook that of Cartagena in the mid-19th century but then experienced a decline, chiefly because the channels to the Magdalena were inadequate for steamboats. In the 1880s Santa Marta began shipping bananas grown in the hinterland to the south; the United Fruit company dominated the industry after 1899. Its success was especially striking after the completion of the Santa Marta-Fundacibn railroad. This industry was almost killed by the Sigatoka plant disease in the early 1940s but subsequently revived. The city is the seat of a bishopric and has a cathedral. (T. E. N.)

SANTA MAURA (LEUCADIA, LEUKAS, LEVKAS), one of the Ionian Islands (20 mi. north to south, 5–8 mi. east to west; area 114 sq.mi.; pop. [1951] 29,225) off the coast of Acarnania (Greece), south of the entrance to the Gulf of Arta. It is a rugged mass of limestone and bituminous shales (partly Tertiary), rising to 2,000 and 3.000 ft. with limited areas of level ground. The grain crop suffices only for a few months' local consumption; but much olive oil is produced. The vineyards (in the west especially) yield red wine (bought mainly by Rouen. Cette, Trieste and Venice); the currant, introduced about 1859, became the principal source of wealth; and cotton, flax, tobacco and valonia are grown. The salt trade, formerly of importance. suffered from customs regulations. The chief town, Amaxichi (more usually Santa Maura. after the neighbouring fort), is at the northeast end opposite the lagoon. In the southwest is the village of Vasiliki, whence the currant crop is exported.

Cyclopean and polygonal walls at Kaligoni (south of Amaxichi) probably mark the ancient acropolis of Neritus (or Nericus), and the later Corinthian settlement of Leucas. From this point a Roman bridge seems to have crossed to the mainland. Between the town and Fort Santa Maura extends a Turkish aqueduct partly destroyed with the town by the earthquake of 1825. Forts Alexander and Constantine commanding the bridge are relics of the Russian occupation; the other forts are of Turko-Venetian origin. The magnificent cliff, 2.000 ft. high, at Cape Ducato at the south end of the island, still bears the ruined temple of Apollo Leucatas (hence the modern name). At the annual festival of Apollo a criminal was obliged to plunge from the summit into the sea, where, however, an effort was made to pick him up; and it was by the same leap that Sappho and Artemisia, daughter of Lygdamis, are said to have ended their lives.

A theory has been proposed by Dorpfeld that Leukas is the island described in the Odyssey under the name of Ithaca; arguing that the Homeric description of the island and its position, and also the identification of such sites as the palace of Odysseus the harbour of Phorcys, the grotto of the Nymphs and the island Asteris, where the suitors lay in wait for Telemachus, suit Leukas better than the island called Ithaca (*q.v.*). The strait separating it from the mainland is liable to silt. In 1903, however. a canal was completed 50 ft. broad and 17 ft. deep. The island was occupied by Axis troops in 1941.

See P. Goessler, *Leukas-Ithaka* (1904); W. Dorpfeld, *Alt-Ithaka,* 2 vol. (1927).

SANTA MONICA, an oceanside resort and residential city in northwestern Los Angeles county, Calif., U.S., and a part of the Los Angeles standard metropolitan statistical area. It is known throughout the state for its excellent ocean beaches and its suburban homes.

Santa Monica was given its name by Spanish soldiers, who applied it to a spring near the modern city. Between 1828 and 1872 it was a portion of a large ranch owned by Don Francisco Sepulveda. In 1872 the area was acquired by Col. R. S. Baker for use as a sheep farm.

The city appeared three years later, in 1875, as a result of the railroad craze of the 1870s. Santa Monica was selected as the Pacific coast terminus of the Los Angeles to Independence railroad, built to compete with the dominant Southern Pacific. The railroad advertised the advantages of the location as a resort area, an auction of land was held and the settlement of Santa Monica began. Although the only rails laid connected Santa Monica and Los Angeles, population continued to flow in. As early as Nov. 20, 1885, Santa Monica was incorporated as a sixth-class California city. It became a freeholder city through a charter ratified and approved in 1906. A council-manager form of government was established by freehold charter granted March 25, 1947. Industrial development has been limited, but the aircraft industry and various light industries were established.

Pop. (1960) 83,249. (J. M. Wo.)

SANTANA, PEDRO (1801–1864), a leader of the revolution by which the Dominican Republic gained its independence of Haiti, made himself president of the new nation at various inter-

vals from 1844 to 1861. He joined the uprising against Haiti in Feb. 1844. made himself supreme chief in July and had congress elect him president in November. He was forced to retire in 1848 but was recalled to repel the Haitian invasion of 1849. After defeating the enemy. he reassumed dictatorial powers, but permitted the inauguration of his political associate. Buenaventura Báez, to the presidency in September. In 1853 Santana again had himself elected president and, except for two years (1856–58), governed the republic until he negotiated its return to Spain in 1861. Although disappointed with Spanish rule, he fought the rebellion of 1863. Unable to overcome the resistance, he resigned his command in June 1864 and died a few days later. ***See*** also DOMINICAN REPUBLIC: History. (K. M. S.)

SANTANDER, FRANCISCO DE PAULA (1792–1840), Colombian political figure, an able soldier and administrator with most of the gifts of a statesman, was born April 2, 1792, at Rosario de Cúcuta, Colom., near the Venezuelan frontier. At the inception of independence in 1810, Santander left law school to join the patriot army. Promoted rapidly, he escaped the Spanish reconquest of 1816 by fleeing to the eastern lowlands, and returned as brigadier general in the invading force of Simón Bolivar (*q.v.*). Santander was vice-president of Nueva Granada in the republic of Colombia from 1819 to 1821, at which time the constituent congress named him vice-president of Colombia. Re-elected in 1826, Santander continued to be the acting president of Colombia until Sept. 10, 1827. He shaped the government, and found the men, money and supplies for President Bolivar's campaigns in Colombia, Peru and Bolivia. His measures to hold Colombia together after the fighting had ended, however, were undercut by Bolivar, who returned from Peru late in 1826 to end the Venezuelan rebellion. Bolivar retained Venezuela in Colombia only on the basis of obedience to his person, a demand that ended relations between Santander and Bolivar. Santander was exiled in 1828 after the attempt to assassinate Bolivar, but evidence shows only that he knew of the plot. tried to dissuade the conspirators and gave no warning. After dissolution of Gran Colombia in 1830. Santander returned as president (1832–36) of the state of Nueva Granada and then served as senator until his death.

Proud, sensitive, exact in his accounting, Santander typified the best tradition of the colonial official. Legalistic yet flexible, regalistic and centralist, he helped form the tradition of nonmilitaristic governments in Colombia. Colombians justly call him the "man of laws." He was equally important as a defender and focus of Granadian nationalism, especially during 1816–19 and 1827–32. In his last years he restrained the liberal elements of Granadian society who viewed the electoral victory of centrists and conservatives in 1836 as the return of colonial evils. His death, on May 6, 1840, was followed promptly by outbreak of the major civil conflict of 1840–42. ***See*** also COLOMBIA: History. (R. L. GE.)

SANTANDER, an interior department of the republic of Colombia. Pop. (1951) 747,706. Area 11,706 sq.mi. The topography is extremely rugged; the Eastern cordillera of the Andes traverses the department from north to south. Toward the west it includes an extensive area of rainy tropical lowlands, extending to the Magdalena river, that did not become subject to colonization till about mid-20th century. Santander is the principal petroleum-producing department of Colombia, with production centring around Barrancabermeja. Among the agricultural crops tobacco is outstanding, and the manufacture of cigars and cigarettes is an important industry. Coffee is grown on the temperate midslopes of the Andes. A railroad connects the capital city, Bucaramanga (pop., 1951 [mun.], 102,887), with the Magdalena at Puerto Wilches. San Gil. Socorro, Málaga and Vélez are other principal cities, all lying between 3,000 and 7,000 ft. above sea level. (Js. J. P.)

SANTANDER, a maritime province of northern Spain, bounded north by the Bay of Biscay, east by the province of Biscay. south by Burgos and Palencia and west by León and Oviedo. Pop. (1950) 405,420. Area 2,108 sq.mi. Santander was part of the Roman province of Cantabria which, after passing under the empire of the Goths, became the principality of Asturias (*q.v.*). The portion called Asturia de Santa Juliana, or Santillana, was included in the kingdom of Old Castile and, on the subdivision of the old provinces of Spain in 1833, became the province of Santander. The province is traversed from east to west by the Cantabrian mountains (*q.v.*), which in the Picos de Europa reach a height of over 8,600 ft. and send off numerous branches to the sea. The province is traversed from north to south by the railway and high road from Santander by Palencia to Madrid; the highest point on the railway (Venta de Pazozal) is 3.229 ft. above the sea. Other railways connect Santander with Bilbao on the east and with Cabezona de la Sal on the west. The province saw some of the heaviest fighting of the civil war of 1936–39; it was occupied by nationalists in 1937.

SANTANDER, the capital of the Spanish province of Santander, seat of a bishop and one of the chief seaports of Spain; 316 mi. N. of Madrid by rail, on the Bay of Santander, an inlet of the Bay of Biscay. Pop. (1950) 85,640 (mun. 100,069). It is on the inside of a rocky peninsula, Cabo Mayor, which shelters a harbour from 2 to 3 mi. wide and 4 mi. long. Santander is divided into an upper and a lower town. The Muelle is officially named Paseo de Pereda in honour of the great novelist. The harbour was improved after 1850. In the civil war of 1936–39 Santander was attacked by nationalist columns from Biscay, Soncillo and Navarre, well supplied with tanks. It fell Aug. 16, 1937.

SANTAREM, a city of Brazil in Pará state, on the right bank of the Tapajós near its entrance into the Amazon. Pop. (1950), town, 14,061; *município,* 60,229. It is the most important town on the Amazon between Belém and Manaus and is a port of call for all river steamers. Santarém is 434 mi. from Belém by air. The red tile roofs of the whitewashed buildings of the business district give the town an attractive appearance from the river. Most valuable exports of the region are rosewood oil, rubber, lumber and jute. Santarém is a noted distributing centre for native handicraft articles. A few miles south of the city the escarpment of the Santarém plateau rises to an elevation of 400 ft. This plateau, which is crossed by a motor road to Belterra, is one of the most active areas of agricultural colonization in the Amazon valley. Rice, corn, beans, mandioca and malva are the principal crops. The shallow strips of fertile black soils on this high surface also contain large numbers of aboriginal baked clay artifacts.

The Tapajós is navigable for steamers to the rapids 170 mi. above Santarém and for small boats nearly to Diamantino (Mato Grosso). A considerable trade comes from Mato Grosso state and the settlements along the river banks.

Santarém was founded in 1661 as the site of a Jesuit mission to a Tapajó Indian settlement (aldeia) and was formed around a fort built by Pedro Teixeira. It became a city in 1848. A group of Confederate exiles settled in Santarém after the U.S. Civil War; some of their descendants still live in the area, but most of the original settlers returned disillusioned to the United States. (Js. J. P.)

SANTARÉM, a city on the right bank of the Tagus river, Portugal, 51 mi. N.E. of Lisbon by rail. Pop. (1950) 13,114. The older part contains the ruined castle of Alcaçova, famous in the middle ages as a royal residence. Below is Ribeira de Santarém, a comparatively modern river port, and on the opposite bank is Almeirim, a village which was also a royal residence until 1755, when it was almost entirely destroyed by earthquake. Santarém has some trade in fish and agricultural produce. including wine and olive oil. Its chief buildings are an ecclesiastical seminary; the late Gothic church of the Convento da Graça, which contains the tomb of Pedro Alvares Cabral, the first Portuguese to visit South America (1500); the Igreja do Milagro, an early Renaissance church; and the church of Santa Iria (St. Irene), from which the name of the city is derived. There is a fine bridge.

Santarém is the Roman Scallabis, renamed Praesidium Iulium by Julius Caesar. From its position in the Tagus valley it became an important fortress during the wars between the Moors, Portuguese and Spaniards. Alphonso VI of Castile first took it from the Moors in 1093, but it was recaptured and occupied by them until 1147, when Alphonso I of Portugal recovered it. The

Almohades endeavoured to win it back in 1184, but were defeated. The Miguelites were defeated there in 1834 *(see* PORTUGAL: *History)*. The administrative district of Santarém coincides with the eastern part of the ancient province of Estremadura; pop. (1950) 460,193; area 2,583 sq.mi.

SANTA RITA DURÃO, JOSÉ DE: *see* DURÃO, JOSÉ DE SANTA RITA.

SANTAROSA, ANNIBALE SANTORRE DI ROSSI DE POMAROLO, COUNT OF (1783–1825), Piedmontese insurgent and leader in the revival (Risorgimento) of Italy, was born at Savigliano, near Coni, on Nov. 18, 1783. When in 1821 the Austrian army was moved south to coerce the Neapolitans, Santarosa conspired to obtain the intervention of the Piedmontese in favour of the Neapolitans by an attack on the Austrian lines of communication. The conspirators sought the co-operation of the prince of Carignano, afterward Ring Charles Albert. On March 6, 1821, Santarosa and three associates had an interview with the prince, and on the 10th they carried out the military *pronunciamiento* which proclaimed the Spanish constitution. The movement had no real popular support, and very soon collapsed. Santarosa was arrested, but escaped and fled to France and later to England. He accompanied his countryman Giacinto Collegno to Greece in Nov. 1824. He was killed when the Egyptian troops attacked the island of Sphacteria, near Navarino, on May 8, 1825.

SANTA ROSA, a department in southern Guatemala. Area 1.141 sq.mi. Pop. (1957) 141,244. Its capital is Cuilapa (pop. [1960] 3.963). In the highlands there are plantations of coffee, and the farmers raise maize and beans. In the Pacific lowlands the products include sugar cane. rice and sesame. Large herds of beef cattle are fed on hay. In the northeast corner of the department is the beautiful Lake Ayarza. The capital is served by the Inter-American highway, and a branch descends to the coastal lowlands. (P E. J.)

SANTA TECLA, officially NUEVA SAN SALVADOR, capital of the department of La Libertad, El Salvador. Pop. (1958) 37,-927. It was founded in 1854 at the southern base of Volcán de San Salvador, at an altitude of 2,953 ft., to replace the national capital, San Salvador, devastated by an earthquake. It enjoyed that distinction only briefly, however, for in 1859 the government was moved back to a rebuilt San Salvador. Santa Tecla. 7½ mi. by Inter-American highway from San Salvador, is in the most densely settled part of the department and in an important coffee, livestock, corn, vegetable and fruit producing area. (C. F. J.)

SANTAYANA, GEORGE (1863–1952), U.S. philosopher, poet, novelist and literary critic, combined the wisdom of the old world and the new and created his own many-sided world of the mind. He was born in Madrid of Spanish parents on Dec. 16, 1863, and went to the U.S. in 1872. He received his B.A. degree from Harvard university in 1886 and taught philosophy continuously at Harvard from 1889 until 1912, with the exception of a year spent as an advanced student at Cambridge university. In 1912 he resigned his Harvard professorship and returned to Europe, where for many years he traveled extensively. Having settled at a convent in Rome early in World War II, he remained there till his death, which took place on Sept. 26, 1952.

Santayana's reputation rests chiefly on the richness and perceptiveness of his account of human experience in its ethical, social, religious and artistic aspects; on the skill with which he wove such diverse philosophical themes as naturalism, Platonic realism and idealism into the texture of his system; and on the exquisite, poetic quality of his prose style. His system, however, lacks speculative originality and the unity conferred by a single great speculative insight. The several themes of his philosophy are incongruous or perhaps even conflict with one apother; his basic naturalism is difficult to reconcile both with his realism of essences (or universals) and with his idealistic interpretation of mind or spirit. Yet despite these weaknesses of structure his philosophy is comprehensive, penetrating and to a degree systematic. His greatness resides in the catholicity of his interests; in his sensitivity to values in diverse realms of human experience; and in the freedom of his imaginative powers.

Santayana's first published essay in philosophy mas *The Sense of Beauty* (1896). It is a major contribution to aesthetics—perhaps the most important American work in this field. The essay is concerned with "the nature and elements of our aesthetic judgments"; "it is" he adds, "a theoretical inquiry and has no directly hortatory quality." The main thesis of the essay is that aesthetic judgments are the expression of artistic taste and that "to make a judgment is virtually to establish an ideal." Santayana's emphasis on the ideal or formal aspects of aesthetic judgment is combined with an appreciation of the importance of its material or sensuous aspect.

The Life of Reason (1905–06) is a major work consisting of five volumes: *Reason in Common Sense, Reason in Society, Reason in Religion, Reason in Art* and *Reason in Science.* "The life of reason." which Santayana describes as "a presumptive biography of the human intellect," is an interpretation of the role of reason in the manifold activities of the human spirit. The first suggestion for such a work occurred to Santayana in his student days as a result of reading Hegel's *Phenomenology of Spirit;* and, indeed, *The Life of Reason* resembles the *Phenomenology* of Hegel in its conception, though not in its execution. The life of reason, for Santayana as for Hegel, is not restricted to the rational in the sense of the purely intellectual activities of man (though it includes them). The recurrent theme of the five volumes comprising *The Life of Reason* is that reason in all its manifestations is a union of instinct and ideation; it is instinct become reflective and enlightened.

Scepticism and Animal Faith (1923) marks an important departure from his earlier philosophy and serves as "a critical introduccion" to his new system developed in *The Realms of Being,* a four-volume work composed of *The Realm of Essence* (1927/28), *The Realm of Matter* (1930), *The Realm of Truth* (1937) and *The Realm of Spirit* (1940). Santayana displayed in these later works the penetrating insight, the breadth of philosophical vision and the stylistic elegance characteristic of his earlier writings and, at the same time, enhanced his stature as a philosopher by achieving greater theoretical precision, clarity and coherence. *Scepticism and Animal Faith* conveys better than any other single volume of his works the essential import of his philosophy and can be commended as an introduction to and *résumé* of his later system. This essay formulates his skepticism and his theory of immediately apprehended essences and describes the role played by "animal faith" in various forms of knowledge.

"The realm of essence" is the domain of the mind's certain and indubitable knowledge. Essences are universals which possess being or reality but do not exist. The realm of essence comprises colours, tastes, odours and other data of sense as well as the ideal objects of thought and imagination. "The realm of matter" is the world of natural objects; belief in matter rests—as does all belief concerning existence—on animal faith. Naturalism, the dominant theme of his entire philosophy, appears in his later work in his insistence that the realm of matter is prior to the other realms of being.

Santayana's other writings include *Lucifer: a Theological Tragedy* (1924); *Interpretations of Poetry and Religion* (1900); *Three Philosophical Poets: Lucretius, Dante, and Goetke* (1910); *Winds of Doctrine* (1926); *Egotism in German Philosophy* (1940); *Philosophical Opinion in America* (1918); *Clzaracter and Opinion in the United States* (1920); *Soliloquies in England* (1922); *Poems* (1923); *The Unknowable* (1923); *Dialogues in Limbo* (1925); *Platonism and the Spiritual Life* (1927); *Some Turns of Thought in Modern Philosoplzy* (1933); *The Last Puritan,* a novel (1936); *Obiter Scripta* (1936); *Persons and Places,* 2 vol. (1944–45); *The Idea of Christ in the Gospels* (1946); *Dominations and Powers* (1951).

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SANTEE-WATEREE-CATAWBA RIVER SYSTEM, a 538-mi.-long inland waterway in the southeastern U.S., begins in North Carolina in the Blue Ridge mountains as the Catawba

river. The headwaters of the Catawba originate near Mt. Mitchell (6,684 ft.), highest point in the United States east of the Mississippi river. The Catawba flows into South Carolina to Great Falls, a distance of 220 mi., where it becomes the Wateree river. Lakes or reservoirs formed by dams on the Catawba are Rhodhiss lake (15 mi. long); Hickory lake (10 mi.); Lake James (10 mi.); Lookout Shoals lake (10 mi.); Mountain Island lake (11 mi.); and Catawba lake (20 mi.). The Santee river is formed 30 mi. S.E. of Columbia, S.C., where the Wateree joins the Congaree river. The Congaree, in turn, is formed at Columbia by the junction of the Saluda and Broad rivers, both of which originate in the eastern segments of the southern Blue Ridge. The stream is known as the Wateree river between Great Falls and its junction with the Congaree river, a distance of 75 mi. The Wateree is navigable for 58 mi. below Camden, S.C. Eight miles northwest of Camden a hydroelectric dam forms Wateree pond (sometimes called Wateree reservoir; 15 mi. long). Near Stateburg, S.C., is Wateree swamp, a densely wooded area which abounds in mink, raccoon, otter, squirrel, opossum, deer, fox, quail and wild turkey.

The Santee, the most important river in South Carolina, flows 143 mi. S.E. into the Atlantic by two mouths, the North Santee and the South Santee, about 15 mi. S. of Georgetown. It flows through comparatively high hills which aid in the erection of dams and has been subjected to extensive navigational and hydroelectric development. Two large dams are Santee dam (48 ft. high, 7.5 mi. long), which forms Lake Marion or Santee reservoir (40 mi. long); and Pinopolis dam (140 ft. high, 2.2 mi. long), on the Cooper river, which forms Lake Moultrie, the latter receiving water diverted from Lake Marion. Lower sections of the Santee river, near its mouth, are lined by old rice plantations now devoted to cattle, vegetable, pulpwood and hunting activities.

(M. C. P.)

SANTIAGO, a province in north central Chile. Although one of eight provinces formed in 1826, Santiago has been subjected to several alterations in outline and administrative subdivisions. Area 6,727 sq.mi. Pop. (1960) 2.429.539, of whom 646.731 live in Santiago (*q.v.*), the provincial and national capital. The province embraces Andean cordillera, longitudinal valley and coastal range and valley terrain. Winter season rains and snow-melt in the Maipo watershed supply the water used for power development and farm and urban needs. River canyons provide summer recreation areas and access to winter resorts (Farellones, Lagunillas and Refugio Alemán). Santiago is a major industrial and agricultural province; in the 1950s its factories employed more than half of Chile's industrial personnel and produced more than half the value of manufactured goods. The bulk of industrial and commercial activity is concentrated in the capital, but there are important farm supply, marketing and product-processing activities at San Bernardo, location of major railroad shops; Puente Alto. a paper and gypsum-processing centre; and Melipilla. Talagante and Buin. In agriculture, dairy and beef production are important. and the main crops (by acreage) are wheat, alfalfa, clover, barley. maize, grapes, potatoes and beans.

Marketing is facilitated by the proximity of urban centres and by the best-developed road system in Chile. Road and rail carriers make almost every point in the province accessible; service to other provinces is good

San Antonio, the chief port and fishing centre. has a flourishing traffic in copper from O'Higgins province (*q.v.*) and such regional products as malting barley, wine and legumes. Nearby are such fashionable beach resorts as Santo Domingo. Cartagena and Algarrobo (Valparaíso province). Mining is conducted at Las Condes-Naltagua (copper). El Volcán (gypsum) and Polpaico (limestone for cement). Chacabuco and Maipu are famed battlefields of the war for independence.

(J. T.)

SANTIAGO (SANTIAGO DE CHILE), capital of the republic of Chile and of the province of Santiago (*q.v.*), is the centre of the nation's political, economic, cultural and ecclesiastical life. The city's preponderance of power and prestige is suggested by its population. Pop. (1960) 646,731 (mun.).

The city was founded by Pedro de Valdivia on Feb. 12, 1541. Its nucleus occupied a defensively advantageous position to the west of Cerro Santa Lucia and between the Mapocho river (north) and a periodic channel of the Mapocho (south), now the Avenida Bernardo O'Higgins, called the Alameda. The westward-sloping alluvial land over which the city has spread ranges in elevation from about 1.600 to 2,100 ft. Dominating the central city is Cerro San Cristóbal (2.779 ft.), which lies to the northeast of Cerro Santa Lucia and north of the Mapocho. A few miles to the west are the coastal ranges, remote and modest ridges compared to the 8,000-ft. cordilleran buttress uhich looms above the city on the east. The higher summits of the Andes form a massive backdrop.

Santiago, originally Santiago del Nuevo Estremo, was elevated to city status and given a coat of arms in 1552. In 1609 the royal *audiencia* was transferred to the community, and in 1651 an episcopal see was created. Few traces of early architecture have survived earthquakes and the pressures of city modernization. The 16th-century churches and convents were shattered in the earthquakes of 1647 and 1730. The cathedral, also damaged in the disasters, burned down in 1769. Only San Francisco among existing churches preserves part of the original colonial structure. The Valparaíso road was finished and the Mapocho bridged by mid-18th century. Efforts to control the river were nullified by the floods of 1609, 1684, 1779 and 1783.

The cathedral, completed in 1619, was reconstructed several times; the Moneda (since 1848 the executive residence), Aduana and Cabildo were finished between 1773 and 1807, and the Alameda was transformed from river bed to principal thoroughfare soon after independence. Nevertheless, major changes in the city's appearance did not occur until after mid-19th century, when wealthy miners and landowners began to build monumental houses. The municipal theatre was constructed in 1857 (reconstructed 1873). It and much of the contemporary architecture were French-inspired.

Broad-scale municipal improvements were notable in the 1870s. Streets were paved and lined with trees, streetcars were introduced, the water system was improved, and the central market was constructed. Numerous plazas were created, but the transformation of rocky Cerro Santa Lucia into a park was the finest gift to posterity. In the 1890s the Mapocho was effectively canalized and the splendid riverside Parque Forestal planted. Later urban improvements are notable in the middle- and upper-class residential districts, which spread upslope from the city nucleus. chiefly after 1930. Industrial development has been greatest in the western part of the city, where low-cost housing projects and spontaneous housing developments are commonly found. In this area city expansion has been greatest toward San Bernardo. In the nuclear part of Santiago, the *Centro,* modern structures of 8–12 stories are clustered. These buildings tend to combine several funcfions: shops, restaurants and theatres open to the street and to street-level galleries; offices, hotels and apartments occupy higher floors. The Plaza de Armas, with its bandstand. statuary and fountains, the flanking cathedral and old public buildings, is a link with the past. Nearby are the congress and supreme court buildings. To the southwest, in the civic centre, the hloneda is surrounded by tall ministry and commercial buildings. Groups of multistoried structures, chiefly residential, lie farther west; other clusters arise east of Cerro Santa Lucia and along major avenues. The pattern of public transportation is adequate, but peak period congestion is serious. Among the public services common to great cities Santiago's spirited volunteer fire department is unique.

City parks include San Cristóbal, which contains gardens, the zoological park, a funicular and the shrine to the Virgin of the Immaculate Conception. The once fashionable Cousifio park remains so only for the independence day military review (Sept. 18). The Quinta Normal de Agricultura contains a boating lagoon, exhibition and rodeo grounds and the museum of natural history. In the Parque Forestal is the Palace of Fine Arts. The museum of contemporary art is located on Cerro Santa Lucia; nearby is the national library building, where archives and historical and archaeological collections are housed.

The University of Chile (founded 1843), the Catholic university

(founded 1888) and the military academy are the best-known educational institutions. There are good civilian and military technical schools.

Santiago is Chile's major and most diversified manufacturing centre. Textiles, food products, shoes and clothing and beverages represent about 60% of manufactures in value. Although the city is the chief market, rail and highway carriers reach most of the country. Passenger rail and bus service with other cities is good. There is a modern international airport.

Summers (October to March) are warm; winter temperatures are not excessively low, but the combination with the atmosphere's high relative humidity produces a penetrating cold. The warm month (January) mean temperature is 69° F.; cold month (July) mean temperature is 46.4" F. Fog is common in winter, and atmospheric pollution (smog) is noticeable most of the year. Precipitation, chiefly a winter phenomenon, averages 15.3 in. per year. Snow, uncommon in the lowlands, forms a mantle upon the cordillera in the winter. (J. T.)

SANTIAGO DE COMPOSTELA (SANTIAGO), a city of northwest Spain, in the province of Corunna; at the northern terminus of a railway from Tuy, near the confluence of the Sar and Sarela rivers, and 32 mi. S.W. of the city of Corunna. Pop. (1950) 52,675 (mun.). The Galician region, of which the city is the centre, is composed of hills which have been strongly folded and faulted and where in consequence metal veins occur. In the ages when metal began to be known in the west people from the Mediterranean moved along the coasts of western Europe. and with these movements was associated the cult of the megaliths In those days navigation was precarious and sailors made for one of a number of small ports which had a common focus inland. Santiago was probably a focus for the numerous ports on the Galician rias. (Cf. Canterbury and St. David's.) At Padron, one of the ports of Santiago, there are two great stones called Barca and Patron (the "ship" and the "skipper"). The tradition of the sanctity of the old stone monuments lingered for centuries and the legend arose that St. James the Apostle had, after his martyrdom in Palestine, been borne thither for burial and that the body was brought ashore at Padron.

After the Moorish conquest the northwest comer was the only part of Spain that retained its independence and it was the region from which the reconquest of Spain for Christendom was begun. This produced a great enthusiasm for the Christian religion, an enthusiasm fanned by the reputed discovery of the bones of St. James at Compostela. A church was built over the relics and a bishopric transferred thither. The city thus became a centre for pilgrims and when the royal family of Castile became connected by marriage with that of Burgundy, which was associated with the Cluniac monks, the site gained an international significance. The road (Route de St. Jacques) of the pilgrims became famous and many of the great romances of the middle ages developed from the tales told by the pilgrims to while away the tedium of the long journey to this remote corner of Spain. (Cf. the Canterbury Tales.) There were also many pilgrims from those western fringes of Europe which had been connected with Galicia ages before in the early days of metal. The city was formerly the capital of Galicia, and is still the seat of a university and of an archbishopric, which long disputed the claim of Toledo to the primacy of all Spain. Its chief industries, apart from agriculture, are brewing, distillation of spirits and the manufacture of linen, paper, soap, chocolate and matches. The city has also been long celebrated for its silversmiths' work.

In 1078 the erection of the present cathedral was begun and it was consecrated in 1211. It is a cruciform Romanesque building. The Puerta Santa is kept closed, except in jubilee years, when it is opened by the archbishop. Perhaps the chief beauty of the cathedral is the Portico de la Gloria, behind the western classic portal. It is a work of the 12th century, and probably the utmost development of which round-arched Gothic is capable. The shafts, tympanums and archivolts of the three doorways which open onto the nave and aisles are a mass of strong sculpture.

The Hospicio de los Reyes, on the north of the Plaza Mayor, for the reception of pilgrims, was begun in 1504 by Enrique de Egas under Ferdinand and Isabella.

SANTIAGO DE CUBA, a city and seaport of Cuba, on the southern coast of the eastern end of the island, capital of the province of Oriente and next to Havana the most important city of the republic. Population of the city (1953) 163,237.

Santiago is situated about 6 mi. inland on a magnificent landlocked bay (6 mi. long and 3 mi. wide), connected with the Caribbean sea by a long, narrow, winding channel with rocky escarpment walls. in places less than 200 yd. apart. The largest vessels have ready entrance to the harbour but direct access to the wharves is impossible for those of more than moderate draft (about 14 ft.). Smith Key. an island used as a watering place, divides it into an outer and an inner basin. To the east of the sea portal stand the Morro, a picturesque fort (begun 1633) on a jutting point 200 ft. above the water, and the Estrella; and to the west the Socapa. West of the harbour are low hills, to the east precipitous cliffs, and north and northeast, below the superb background of the Sierra Maestra, is an amphitheatre of hills over which the city straggles in tortuous streets. The houses are mostly of one story. In the cathedral Diego Velbzquez (c. 1460–1524), conqueror of Cuba, was buried. It has suffered much from earthquakes and has been extensively repaired. Probably the oldest building in Cuba is the convent of San Francisco (a church since the secularization of the religious orders in 1841), which dates in part from the first half of the 16th century. On a hill overlooking the city is a beautiful schoolhouse of native limestone, erected by the U.S. military government as a model for the rest of the island. There is superb mountain scenery on the roads to El Caney and San Luis in the thickly populated valley of the Cauto. In the barren mountainous country surrounding the city are valuable mines of iron, copper and manganese. On these the prosperity of the province largely depends. There are also foundries, soapworks, tanyards and cigar factories. Mineral ores, tobacco and cigars, coffee, cacao, sugar, rum and cabinet woods are the main articles of export.

History.—Santiago is less important politically under the republic than it was when Cuba was a Spanish dependency. The place was founded in 1514 by Diego Velázquez, and the capital of the island was removed thither from Baracoa. Its splendid bay and easy communication with the capital of Santo Domingo, then the seat of government of the Indies, determined its original importance. From Santiago in 1518–19 departed the historic expeditions of Juan de Grijalva, Hernan Cortes and Pánfilo de Narváez. Cortes was the first mayor of Santiago. So important already was the city that its ayuntamiento had the powers of a Spanish city of the second class. In 1522 it received the arms and title of ciudad, and its church was made the cathedral of the island. But before 1550 the drain of military expeditions to the continent, the quarrels of civil, military and ecclesiastical powers and of citizens and the emigration of colonists to the Main produced a gradual decline. In 1589 Havana became the capital. Santiago was occupied and plundered by French corsairs in 1553 and again by a British military force from Jamaica in 1662. The capture of that island had caused an immigration of Spanish refugees to Santiago that greatly increased its importance, and the illicit trade to the same island—mainly in hides and cattle—that flourished from this time onward was a main prop of prosperity. From 1607 to 1826 the island was divided into two departments, with Santiago as the capital of the eastern department. After 1826 Santiago was simply the capital of a province. In July 1741 a British squadron from Jamaica under Adm. Edward Vernon and Gen. Thomas Wentworth landed at Guantbnamo and during four months operated unsuccessfully against Santiago. The climate made great ravages among the British, who lost perhaps 2,000 out of 5,000 men. The bishopric became an archbishopric in 1788. when a suffragan bishopric was established at Havana. After the cession of Santo Domingo to France, and after the French evacuation of that island, thousands of refugees settled in and about Santiago. They founded coffee and sugar plantations and gave a great impulse to trade. There were destructive earthquakes in 1675, 1679, 1766 and 1852. The most notable military and naval events (in Cuba) of the Spanish-American War (*q.v.*) of 1898 took place at and near Santiago.

SANTIAGO DEL ESTERO, a province in northern Argentina. separated from Tucumán in 1820. It is bounded by the provinces of Salta and Chaco in the north and Córdoba in the south. Pop. (1960) 477.156. Area 52.222 sq.mi. Santiago del Estero lies within the Argentine section of the Gran Chaco (*q.v.*) and has the ,general characteristics of that region. Almost the entire surface is a lowland plain. a large part of which is covered with scrub forest. Some of the trees, notably the quebracho. are of considerable commercial value. There are extensive saline areas in the southwest. The climate is extremely hot in summer, the temperature rising to 118° F. Frosts occur occasionally in winter. Rainfall is slight (about 20 in. a year) and quickly evaporates. Therefore agriculture is possible only where the land can be irrigated from the rivers Salado and Dulce. or where seasonal flooding by the rivers take place. The existence of large swamps (esteuos) bordering the Dulce in the vicinity of the provincial capital, Santiago del Estero, explains the name of town and province. The main crops in the irrigated districts are maize. wheat. linseed and cotton. Cattle are raised on the rough Chaco pastures.

The province is crossed by several railways which connect it with many parts of Argentina and with Bolivia and Chile. The railway via Salta to the Chilean port of Antofagasta on the Pacific coast was designed to facilitate exchange of the products of the Chaco for the minerals of Chile's northern desert (copper and nitrate). (Ga. P.)

SANTIAGO DEL ESTERO, Argentine city, capital of the province of the same name. locafed 700 mi. N.W. of Buenos Aires. Pop. (1960) 103.115. Although the climate is extremely hot and dry, the surrounding plains produce considerable wheat. cotton, flax. corn and alfalfa. Founded in 1553 by Spaniards arriving from Peru and moved to its present location on the Dulce river three years later, it is the oldest continuous settlement in Argentine territory.

Highways and excellent rail connections link the city with Córdoba. Tucumán and the Argentine northwest and with the ports of Santa Fe and Rosario. (Js. R. S.)

SANTIAGO DE LOS CABALLEROS (SANTIAGO), a province and its capital city in northern Dominican Republic. A relatively large province (1,201 sq.mi.), it is bounded on the north by the Cordillera Septentrional (to 3.993 ft.) and on the south by the Cordillera Central (to 10.417 ft.). The heart is a wide. east-west plain, known as the Cibao region. which is intersected by the Rio Yaque del Norte. This fertile and populous region makes the province a leading rice and corn producer and the centre of the nation's tobacco industry. Coffee growing and lumbering are also important. The province was established in 184.5. Pop. (1960) 287.941.

The city of Santiago de los Caballeros is situated at about 500 ft. elevation on the banks of the Rio Yaque. Pop. (1960) 83.523. It was founded about 1500 by Bartholomew Columbus and was inhabited by 30 knights of the Order of St. James (Santiago). It was rebuilt near the original site after the 1564 earthquake. Its location near the centre of the Cibao, the most productive region of the nation. has made it a vital hub of coinmunications and trade. Its factories manufacture cigars and cigarettes, coffee, pharmaceuticals. furniture and other products. (D. R. D.)

SANTIAGO MOUNTAINS, a narrow range in the southwestern U.S., extending southeastward across central Brewster county in the Big Bend section of Texas. Formerly the entire 90-mi. chain from near Alpine to the Boquillas canyon of the Rio Grande was mapped as Santiago mountains. but increasing usage restricts the name to the 35-mi. range between Del Norte gap and the Del Norte mountains to the northwest and Dog canyon and the Dead Horse mountains to the southeast, with the portion continuing from Dog canyon across the Boquillas into Mexico frequently known as the Sierra del Carmen. Santiago peak (6.521 ft.), a truncated butte of intrusive rocks, rises some 1.500 ft. above the mountain crest of vertical and overturned Cretaceous limestone strata, which averages about 1,500 ft. above the Marathon basin on the east. Annual precipitation. ranging from 5 to 15 in.. supports an open arid scrub on the lower slopes and a pinyon-juniper association higher up. The drainage system of Maravillas creek practically surrounds the range. Intermittent arroyos and a few springs help support sheep and cattle. U.S. highway 385 from Marathon crosses the range at Persimmon gap (through which went the Comanche trail) to enter the Big Bend National park. (D. D. B.)

SANTIAGO RODRÍGUEZ, a province in northwestern Dominican Republic. Area 394 sq.mi. Pop. (1960) 40.399. It occupies the northern slope and foothills of the Cordillera Central and is drained by several tributaries of the Rio Yaque del Norte, the nation's largest river. Because of semiarid conditions in much of the region, livestock raising rather than cultivation is a principal activity. Crops include cassava. plantains, peanuts, coffee and tobacco. Some lumbering is done in the mountains. The province was created in 1951 from Montecristi province.

The capital. Santiago Rodriguez (pop. [1960] 3,590), was called Sabaneta until 1936. (D. R. D.)

SANTILLANA, ÍÑIGO LÓPEZ DE MENDOZA, MARQUÉS DE (1398–1458), Spanish poet and one of the great figures of his time in both politics and literature, was born at Carrión de los Condes. Palencia. Aug. 19, 1398. and died at Guadalajara. March 25. 1458. As lord of the vast Mendoza estates, he took a leading part in opposing John II and led expeditions against the Moslems. He found time, however, to manage his lands benevolently. patronize the arts, build up an important library and write poetry of high quality. In part his poetry is typical of the 15th century. didactic and stoical in outlook. Latinized in style, often allegorical. He showed originality in collecting proverbs and in writing 42 sonnets, the first in Spanish: these. although angular and uncertain, have an occasional fine line and great historical importance. He is chiefly read for his ten *serranillas,* charming light lyrics in the traditional manner. describing encounters between the knight and the shepherdess; and for his *Proemio*, or preface to his collected works. the first document of literary history and poetic principle in Spanish.

See R. Lapesa, La *obra literaria* del *Marqués* de *Santillana* (1957). (C. C. SH.)

SANTO DOMINGO, a geographic name of several usages in the island of Hispaniola. West Indies. This was the original name of the capital of the Dominican Republic. the oldest European city in the western hemisphere. Christopher Columbus established the first European settlement in the new world on the northern coast of Hispaniola on his second voyage in 1493. After he returned to Spain, his brother Bartholomew founded the city of Santo Domingo on the southern coast in 1496. This name! officially changed in 1936 to Ciudad Trujillo, was restored in 1961 after the assassination of Rafael Trujillo Molina.

Santo Domingo is also the name sometimes given to the entire island of Hispaniola. During the colonial period it was the name given to the Spanish portion. and when the French occupied the western third of the island they called their colony St. Domingue. Also during the colonial period both Spanish and French names were applied to the whole island. The name was frequently corrupted incorrectly to San Domingo in English-speaking countries. The former Spanish colony. officially the Dominican Republic since 1844, is still frequently referred to as Santo Domingo. The former French colony became the Republic of Haiti in 1804.

Santo Domingo is the official name of the federal district of the Dominican Republic. comprising the wide coastal plain and hilly interior region surrounding the capital city of the same name. This district was set up in 1935 out of the former Santo Domingo province and corresponds to the old commune of Santo Domingo. Its 570 sq.mi. area consists of sugar cane plantations and cattle estates. as well as the capital city, and its population (1960) was 367,053. Boca Chica beach resort is located about 20 mi. E. of the capital. See also DOMINICAN REPUBLIC; HAITI; HISPANIOLA. (D. R. D.)

SANTO DOMINGO, capital of the Dominican Republic. on the southeast coast of the island of Hispaniola. Pop. (1960) 367.053. It was founded in 1496 when Bartholomew Columbus moved the first Spanish settlement in Hispaniola to the Ozama river on the south coast. It was called Santo Domingo until 1936,

when the name was changed to Ciudad Trujillo in honour of Rafael Leonidas Trujillo Molina; its original name was restored in 1961 after Trujillo was assassinated and his regime was overthrown. It is the oldest permanent city founded by Europeans in the new world and the seat of the oldest archbishopric; it claims the oldest university (St. Thomas Aquinas, now Santo Domingo university) in the western hemisphere. Until the conquest of Mexico and Peru. Santo Domingo was the centre from which the Spanish possessions in the Americas were governed, but by the end of the colonial period it was a relatively unimportant provincial town. In 1655 its inhabitants defeated a force which was sent by the British government to seize the colony and which later conquered Jamaica

It has retained in part many of the aspects of a Spanish colonial town, with straight, narrow streets intersecting at right angles and low houses abutting on the sidewalk. The cathedral, in Spanish Renaissance style, dates from 1514 and contains the reputed tomb of Christopher Columbus. There are remains of the city walls, with their fortified gates. and of the palace of Diego Columbus. (See COLUMBUS, CHRISTOPHER.)

Santo Domingo has grown rapidly since World War II. and there was much reconstruction after the devastating hurricane of 1930 There are fine public buildings and parks and luxurious tourist hotels. It is the chief seaport of the Dominican Republic; and the harbour, at the mouth of the Ozama river, has been improved so that large vessels can tie up at the dock. It also has modern airports and is connected by air services with the United States and other foreign countries.

See also DOMINICAN REPUBLIC; HISPANIOLA. (D. G. Mo.)

SANTORIN (corruption of St. Irene) or THERA, a volcanic island in the Aegean sea, the southernmost of the Sporades. Officially it is a province in the Greek department of the Cyclades (*q.v.*); divided into 9 communes. Pop. (1951) 9,332.

In shape Santorin forms a crescent and encloses a bay on the north, east and south; on the western side lies the smaller island of Therasia. The encircling wall thus formed, elliptical, and 18 mi. round its inner rim. is broken in two places — toward the northwest by a strait a mile in breadth, where the water is not less than 1,100 ft. deep, and southwest by an aperture about 3 mi. wide, shallow, with Aspronisi (White Island) in the middle. From the bay, cliffs rise perpendicularly to as much as 1,000 ft.; but toward the open sea, both in Santorin and Therasia, the ground slopes and has been converted into broad level terraces of tufaceous agglomerate, which, though bare and ashen, produce the famous Santorin wine. The tufa itself is exported as cement.

Toward the southeast the limestone peak of Mount Elias (1,857 ft.) existed before the volcano was formed. In the middle of the bay lie three small volcanic islands, Palaea-, Mikra- and Nea-Kaümene (Old, Little and New Burnt islands). The highest, Nea-Kaümene, was thrown up in 1707 and 1866 to 351 ft. above the sea. The cliffs show horizontal bands of black lava, white and yellow tufa and other volcanic strata, red, purple, brown and green, with but little herbage. The modern town of Thera (or Phera) is built at the edge of these cliffs, overlooking the bay at a height of 900 ft.

The foundations of the houses and in some cases their sides are excavated in the tufa, so that they are hardly traceable except by their chimneys. Because of the absence of timber they are roofed with barrel vaults. Both wood and occasionally uater are imported from neighbouring islands, for there are no wells and the rain water, collected in cisterns, sometimes fails. The next largest village, Apanomeria ("Upper Part"), near the north entrance, is crowded together in a whitewashed mass above the reddest rocks in the island.

Geology. — Most geologists agree that the whole of the bay was once covered by a single volcanic cone, represented by the outward slope of Santorin and Therasia, with its crater at the Kaumene Islands, and that the bay results from explosion and subsidence.

The Kaumene Islands arose subsequently, and Palaea-Kaumene is considered to be prehistoric. Principal eruptions in historic times were those of 196 B.C. (Strabo 57), when flames arose from the water between Thera and Therasia for four days and an island appeared; of A.D. 726, when again an island was thrown up; of 1570, when Mikra-Kaumene arose; of 1650, which destroyed many lives by noxious exhalations and ended in the upheaval of an island in the sea to the northeast of Santorin, which is now a reef below sea level; that of 1707, when Nea-Kaumene arose; and that of 1866, when Nea-Kaumene was extended toward the south and enlarged threefold.

In the southern parts both of Santorin and Therasia prehistoric dwellings were found at some height above the sea, and there was evidence that these date from a period antecedent to the formation of the bay. This was demonstrated by their position underneath the layer of tufa which covers the islands and by these layers of tufa being broken off precipitously in the same way as the lava rocks, a fact which could only be explained by the supposition that they all fell in together.

In Greek legend the island of Thera originated from a clod of earth presented to the Argonauts by Triton. A colony was left there by Cadmus (Herod. iv, 147.). Subsequently a colony from Sparta, including Minyan refugees from Lemnos, was brought by Theras, who gave the island his own name, in place of Calliste. But the chief event in Thera's history was the planting of its famous colony of Cyrene on the north coast of Africa by Battus in 631 B.C, in accordance with a command of the Delphic oracle. Thera, as a member of the league of the Cyclades, was from 308 to 145 B.C. under the protectorate of the Ptolemies.

The ancient capital occupied a site on the eastern coast now called Mesavouno, between Mount Elias and the sea. It has been excavated since 1895 by Baron Hiller von Gartringen. There are extensive cemeteries; a Heroum of Artemidorus; an Agora; a Royal Portico; a temple of Dionysus and the Ptolemies, later dedicated to the Caesars; the Ptolemaic barracks; and a gymnasium. The main street has narrow lanes to right and left; one leads to the sanctuary of the Egyptian gods. Near the street there is a small theatre beneath the seats of which is a cistern into which rain water drains from the auditorium: water was evidently scarce then as now. Farther southeast are the temples of Ptolemy Euergetes III and of Apollo Carneius; finally, where the rocks fall precipitously, a gymnasium of the Ephebi. Numerous rock carvings and inscriptions have been discovered, as well as statues and vases. Near the west foot of Mount Elias is the temple of Thea Basileia, perfect even to the roof, now dedicated to St. Nicolas Marmorites.

The name Santorin was given after the fourth crusade, when the island formed a portion of the duchy of the archipelago.

SANTOS, a city and seaport of Brazil, in the state of São Paulo, 210 mi. S.W. of Rio de Janeiro and 49 mi. by rail S.E. of São Paulo city. Pop. (1960) 262,048; (1950) 198,405. Santos covers an alluvial plain on the inner side of an island (São Vicente) formed by a tidal channel called the Santos channel or Guarujá river. The commercial district is several miles from the mouth of the channel, but the residential sections extend across the plain and line the beach facing the sea.

Santos is only a few feet above sea level, and its swampy island is drained by deep cement conduits. The channel is free from obstructions, and in front of the city it widens into a bay deep enough for the largest vessels. The water front, once beds of mud and slime and source of many fever epidemics, is faced by a wall of stone and cement. The docks are 4 mi. long and can accommodate about 50 steamers at one time; belt conveyors load several thousand bags of coffee per hour. The British-built but Brazilian-government-owned railway to São Paulo transports the bulk of the state's coffee to Santos. The trains of this profitable railway are hauled up and down the steep coastal range (the Serra do Mar) by cables. A paved highway, including the magnificent Via Anchieta, links Santos with São Paulo.

Santos, the world's leading coffee port, is dominated by its leading export, the aroma of which permeates the city. Its chief public building houses the Coffee exchange, a stock company in which the state government is liable for a part of its liquidating commitments. Santos exceeds Rio de Janeiro in annual tonnage of shipping. Each year 8,000,000 to 13,000,000 bags of coffee are

shipped. The warehouses can store about 5,000.000 bags. and many have modern machinery. Other exports include cotton. sugar, bananas (grown near Santos), castor oil, beef, oranges, hides and some manufactures.

An annual rainfall of about 77 in. and a mean temperature of 69° F. combined formerly to create unhealthful conditions, but the building of drainage canals, extension of sanitation, paving of streets, construction of better houses and port improvements have made Santos a healthful city. A suburban seaside resort, Guarujá, attracts many visitors from inland parts of Brazil.

The first settlement on the São Paulo coast was made in 1532 at São Vicente, about 6 mi. S. of Santos on the island. Other settlements followed, including Santos (1543), and later a small fort was built at the harbour entrance as a protection against Indian raids from the north. The name of the city was taken from the Hospital dos Santos, established by the city's founder. Brás Cubas, and named after a hospital in Lisbon, Port. São Vicente did not prosper, and was succeeded by São Paulo as the capital (1681) and by Santos as the seaport of the colony. Santos was sacked by the English privateer Thomas Cavendish in 1591. (R. M. M)

SANTQS-DUMONT, ALBERTO (1873–1932), Brazilian aviation pioneer. was born in the state of Minas Gerais, Braz.. on July 20. 1873. Educated in France, he spent most of his life in that country. Becoming interested in aerial flight, he made a balloon ascent in 1897 and then began to construct dirigible airships. After many failures he built one which in 1901 won the Deutsch prize and a prize from the Brazilian government for the first flight in a given time from St. Cloud to the Eiffel toner and return. In 1903 he erected at Neuilly the first airship station, where he kept his fleet of dirigibles. Shortly after the successful flight by the Wright brothers in 1903, Santos-Dumont turned his attention to heavier-than-air machines. After experimenting with a vertical-propeller model, he built in 1906 a machine on the principle of the box kite. With it he won the Deutsch-Archdeacon prize in October, and in November he flew 220 m. in 21 sec. In 1909 he produced his famous "demoiselle" or "grasshopper" monoplane, the forerunner of the modern light plane. In 1928. after many years of residence in France, he returned to Brazil. He died July 24, 1932.

See his autobiography, *My Airships: A Story of My Life* (1904).

SANTOS MONTEJO, EDUARDO (1888–), Colombian newspaper editor and political figure, was born Aug. 28. 1888, at Bogotá Colom. He received his lam degree from the National University of Colombia and then studied literature and sociology for two years at the University of Paris. In 1913 he founded *El Tiempo,* Colombia's leading newspaper. Santos began his political career in 1921 as a Liberal and thereafter remained a major party figure. He held every elective office, including the presidency (1938–42). as well as many diplomatic and cabinet posts. Politically. he represented the more conservative element of the Liberal party and long headed the most uncompromising Liberal opposition to the Conservative party. Although he did not play an active political role after 1954. he strongly supported, through *El Tiempo,* the national front. *See* also COLOMBIA: *History.* (*R*. L. GE.)

SANUTO (SANUDO), **MARINO,** the younger (1466–1533), Venetian historian, son of the senator Leonardo Sanuto, was born on May 22. 1466. Marino Sanuto was elected to the *maggior consiglio* when only 20 years old, and became a senator in 1498. He collected a fine library. which was rich in manuscripts and chronicles both Venetian and foreign, including the famous Altino chronicle, the basis of early Venetian history.

His chief works are: *Itinerario in terra ferma* (ed. by M. Rawdon Brown, 1847); *I commentarii della guerra di Ferrara,* an account of the war between the Yenetians and Ercole d'Este (1829); *La Spedizione di Carlo VIII* (manuscript in the Louvre): *Le Vite dei Dogi,* vol. xxii of Muratori's *Rerum Italicarum Scriptores* (1733). The *Diarii,* his most important work which cover the period from Jan 1 1496. to Sept. 1533, were edited by various scholars and published at Venice (58 vol. 1879–1903). Because of the relations of the Venetian republic with the whole of Europe and the east it is practically a universal chronicle.

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SAN VICENTE, a department in El Salvador, bordering the Pacific ocean, and its capital city. Area 466 sq.mi. Pop. of the department (1950) 87,577. of which 70% was rural; population is concentrated in the highland valleys of the western part of the department. On the southwestern border rises San Vicente volcano, altitude 7.156 ft. The department produces rice, sugar, cotton. livestock, cheese and vegetables.

San Vicente city (pop.. 1950, 10,950), about 30 mi. E. of San Salvador in an area of volcanic hot springs and geysers, was founded in 1635 on the site of Tehuacan, an ancient Indian settlement. An important commercial city, it manufactures leather goods. textiles. liquors and hats. (C. F. J.)

SÃO FRANCISCO, a river of eastern Brazil, rises in the Serra da Canastra, southwest Minas Gerais. It flows in a general north-northeasterly direction across the great central plateau of Brazil and turns northeastward through the *sertão* (semiarid interior plains) and then southeast in a great bend, entering the Atlantic about 60 mi. N.E. of Aracajú, Sergipe state. Along its course the São Francisco forms the Pernambuco-Bahia and Alagôas-Sergipe state borders. The river has a total length of 1.987 mi. and a fall of 2,700–2,800 ft. It is navigable from Pirapora. in the state of Minas Gerais. for 984 mi. to a point downstream from Juàzeiro, Bahia, and from Piranhas, in the state of Alagôas, 148 mi to the sea. The upper and loner sections of the river are separated by a stretch of nearly 300 mi. in which the São Francisco drops. first gradually and then abruptly, from the plateau toward the coastal plain. The upper portion of this stretch, nearly 100 mi. long above Petrolândia, comprises a series of rapids known as the Sobradinho, navigable at high water. In the lower portion are the spectacular São Francisco falls, where the river plunges through a narrow gorge—in one place only 51 ft. wide—and over three successive falls. altogether 265 ft. This obstructed part of the river is about 190 mi. long, and consists of a series of rapids above the falls and a deep canyon with whirlpools for some distance below. The Paulo Afonso falls are about 193 mi. from the river mouth. Sandbars at the mouth prevent the entry of deep-draft ocean vessels. The river is nearly 1 mi. wide at Penedo, 22 mi. from the Atlantic. Above Juàzeiro its width varies from a narrow channel during drought periods to several miles at flood stage in the rainy season (December to March.) Below Pirapora the only bridge spanning the São Francisco connects Juàzeiro nith Petrolina, in Pernambuco state.

The principal tributaries of the São Francisco are: to the south and east, the Paraopeba, Velhas and Verde-Grande; to the north and west, the Indayá, Abaeté, Paracatú. Urucuia, Carinhanha. Corrente and Grande. Several of these are navigable for long distances by small boats. Estimates of the aggregate navigable channels of the São Francisco river system range from about 1.000 mi. to over 4.000 mi.

The São Francisco river has been a major artery of travel between northeastern and central Brazil since colonial times. Along most of its course it flows through a sparsely settled pastoral region, frequently subject to prolonged drought. It serves to link the highway and railroad that converge at Pirapora with routes running north and east from Juàzeiro and Petrolina. However, river transport is slow and difficult because of shifting channels and great variations in depth and current speed in different seasons. During the dry season steamboats may take two weeks to run from Pirapora to Juizeiro and over a month to return.

The Brazilian government has undertaken a series of related, long-range development programs in the São Francisco valley designed to improve navigation on the river, to reduce disease in the area, to provide flood control and irrigation to make the valley more attractive for agricultural settlement. and to harness the great hydroelectric potential of the Paulo Afonso falls. A major accomplishment was the virtual elimination of malaria, formerly endemic in the upper valley. Construction on the Paulo Afonso hydroelectric project began in 1949. It is expected that the power

available from the project will eventually be distributed throughout most of the states of northeastern Brazil. (R. E P.)

SÃO LEOPOLDO, a city in Rio Grande do Sul. Braz.. located 20 mi. N. of Pôrto Alegre. Pop. (1950) 18,380. This was the first German colony (1824) established in southern Brazil. It is now a rail centre with factories producing pig iron, tanned leather, matches and aluminum ware. São Leopoldo is also served by river boats and is on the main all-weather highway that connects Pôrto Alegre with São Paulo. It is located in the midst of an agricultural country producing rice, hogs, cattle, maize, potatoes. beans. manioc, tobacco and a great variety of old world fruits and vegetables. There are Jesuit and Protestant seminaries in the city. (P. E. J.)

SÃO LUÍS, chief city and capital of the state of Maranhão, Braz., is located on the west side of São Luis Island 300 mi. E.S E. of Belém. Pop. (1950) 79.731. The island is really a long narrow peninsula between the drowned mouths of the Mearim and Itapecuru rivers (São Marcos bay on the nest and São José bay on the east), and it is cut off from the mainland by a shallow side channel, the Canal do Mosquito. It was founded on this strategic site in 1612 by a French naval officer. Daniel de la Touche de La Ravardikre, and named in honour of Louis SIII. It was captured by the Portuguese in 1615; from 1641 to 1644 it mas held by the Dutch. Because of its position where two systems of navigable rivers converge. São Luis has long controlled the commerce of the main part of Maranhão, and it is the chief port for the products of Teresina in Piauí, with which it is connected by rail. Its exports include babaçu (babassu) oil. castor beans, balsam. hides and skins, lumber, cotton, sugar, rice and maize. In the city there are sugar refineries. a brandy distillery (*caxaça*) and plants for the processing of babaçu oil and cacao, for the preserving of fruit and for the manufacture of hammocks and margarine. Since 1679 it has been the seat of a bishopric, and its buildings preserve much of the Portuguese colonial atmosphere, especially the large 17th-century cathedral. Its Institute of History and Geography is one of the oldest in Brazil. São Luis has been the birthplace of many distinguished Brazilian writers and poets. The city was formerly called São Luiz do Maranhão or simply Maranhão. (P. E. J.)

SAÔNE, a river of east France, 298 mi. long, rising in the Faucilles mountains (Vosges), 15 mi. S.W. of Epinal at a height of 1,300 ft. and uniting with the Rhône at Lyons. The name is derived from *Sauconna,* a 4th-century name. Rising in the Vosges Hercynian massif, it meanders in the wide depression on Jurassic and Tertiary rocks between the Plateau of Langres, the CBte d'Or and the mountains of Charolais and Beaujolais on the west, and the western slopes of the Vosges and Jura and the plain of Bresse and the plateau of Dombes on the east. Near Allerey the Saône unites with the Doubs (left), which rivals it in volume and exceeds it in length at this point. At Chalon-sur-Saône it turns south, and passes Mbcon. Below Tréveux its valley narrows, winds past the Mont d'Or group and joins the Rhone at Lyons. The SaBne is canalized from Corre to Lyons, a distance of 233 mi., the normal depth of water being 6½ ft. At Corre (confluence with the Coney) it connects with the Eastern canal, at Heuilley (below Gray) with the Saône-Marne canal, at St. Symphorien (above St. Jean-de-Losne) with the Rhône-Rhine canal. and at St. Jean-de-Losne with the canal de Bourgogne and at Chalon with the Canal du Centre. (*See* RHÔNE.)

SAÔNE-ET-LOIRE, a *département* of east-central France formed from the districts of Autunois, Brionnais, Chalonnais, Charollais and Mbconnais, previously belonging to Burgundy. It is bounded north by the department of Côte d'Or, east by that of Jura, southeast by Ain, south by Rhône and Loire, west by Allier and Nièvre. Pop. (1954) 511,182. Area. 3,331 sq.mi. The department extends down into the valley of the Loire on the west and into that of the Saône on the east, both with Pliocene deposits, from a high, but discontinuous, central north-to-south axis, stretching from the CBte d'Or (Jurassic) to the Beaujolais (largely granitic). The chief break in the highlands is used by the railway through the Charollais from Dijon through Beaune to Digoin on the Loire, and by the canal from Châlon-sur-Saône to Dijon. On the east the department extends beyond the SaBne to include a large part of the region of Bresse which focuses chiefly on Châlon. The heights of the Morvan (2,959 ft. in the department) rise on the northwestern border.

The average temperature at Mbcon (52° or 53° F.), the most temperate spot in the department, is slightly higher than at Paris, the winter being colder and the summer hotter. At the same town the yearly rainfall is about 33 in., but both the rigour of the climate and the amount of rain indreases in the hilly districts.

Agriculture prospers in Saône-et-Loire. Wheat, oats and maize are the chief cereals; potatoes, clover and other fodder. and mangold-wurzels are important, and beets, hemp, colza and rape are also grown. Excellent pasture is found in the valleys of the SaBne and other rivers. The vine, one of the principal resources of the department, is cultivated chiefly in the neighbourhood of Chblon and Mâcon. Of the wines of Mbconnais, the vintage of Thorins is in high repute. The white Charollais oxen are one of the finest French breeds; horses. pigs and sheep are reared. and poultry farming is a thriving occupation in the Bresse. The industrial importance of the department is great, chiefly owing to its coal and iron mines; the chief coal mines are those near Creusot, Autun and Chapelle-sous-Dun. A pit at Épinac is more than 2,600 ft. in depth. Iron is mined at Mazenay and Change, and manganese is found at Romankche and there are quarries of various kinds. There are well-known warm mineral springs containing chloride of sodium and iron at Bourbon-Lancy. The iron and engineering works of Schneider and Company at Le Crcusot are the largest in France. The department also has many distilleries, potteries, porcelain works (Digoin and Charolles), tile works, oil works and glass factories, and manufactures leather goods, esparto goods, sugar and fecula. Its commerce between the north and the midi is facilitated by navigable streams — the Loire, SaBne. Doubs and Seille — the Canal du Centre. which joins Chalon-sur-Saône with Digoin on the Loire, and the canal from Roanne to Digoin and the lateral Loire canal, both following the main river valley. The chief railway of the department is the P.L M.

Saône-et-Loire forms the diocese of Autun; it is part of the district of the 8th army corps (Bourges) ; its educational centre is Lyons and its court of appeal that of Dijon. It is divided into 5 arrondissements — Mbcon, Louhans, Chalon-sur-Saône, Autun, Charolles — 51 cantons, and 590 communes. Mbcon, Chalon-sur-SaBne. Autun, Le Creusot, Cluny, Montceau-Les-Mines, Louhans, Charolles (*qq.v.*), Tournus and Paray-le-Monial are the chief towns in the department. St. Marcellès-Châlon has a Romanesque church, once attached to an abbey where Peter Abélard died; Anzy has a Romanesque church and other remains of an important monastery; Sully has a chbteau of the 16th century; and Semur-en-Brionnais and Varennes-l'Arconce fine Romanesque churches. Prehistoric remains of the Old Stone Age have been found at Solutré near Mâcon, and have given the name Solutrian to a period of prehistoric time.

SÃO PAULO, a state of Brazil, bounded north by Mato Grosso and Minas Gerais, east by Minas Gerais, Rio de Janeiro and the Atlantic, south by the Atlantic and Paraná and west by Mato Grosso. Pop. (1950) 9,134,423. Area 95.452 sq.mi. The state has a coast 373 mi. long, skirted by the well-wooded western slopes of the Serra do Mar. The narrow coastal zone is broken by lagoons. tidal channels and mountain spurs. Above is an extensive plateau with wide grassy plains, 1,500 to 3.000 ft. above sea level. Isolated ranges of low elevation break the surface in places, but in general the state may be described as an undulating tableland sloping toward the Paraná river, its western boundary. The extreme eastern part. however, has an eastward slope and belongs to the Paraiba basin. A number of large rivers flow westward to the Paraná, including the Grande (part of the state's northern boundary), Tietê (traversing the whole state), Aguapei, Peixe and Paranapanema (part of the southern boundary). The Pardo and Turvo are important tributaries of the Grande. Much of western São Paulo is still unsettled. The coastal zone has a hot climate and a heavy rainfall. On the plateau rainfall is ample, but

the air is drier and more bracing, the sun temperature being high and the nighfs cool.

São Paulo is the heartland both for coffee planting and for industry in Brazil; it has been called a locomotive pulling the other states like empty freight cars. Brazil's most populous state, São Paulo in the 1950s contained more than 17% of the nation's population, although only 3% of its area. The value of São Paulo's agricultural production was 40%, that of its industrial production 60%, of the total for Brazil. It grew more than half of the country's leading crop, coffee. It accounted for almost half of Brazil's foreign trade. Figures for income, hydroelectric power, banks, motor vehicles and daily newspapers ranged between 30% and 40% of the national total. The literacy rate was appreciably higher than the average for Brazil. The dynamic capital, São Paulo, dominates the life of the state; with a population of more than 3,000,000 it overtook Rio de Janeiro in the 1950s as Brazil's largest city.

Political importance came with São Paulo's economic growth. The nation's first three civilian presidents after the downfall of Emperor Pedro II in 1889 were Paulistas. Later, São Paulo and Minas Gerais reached a "rotation" agreement regarding the presidency. This broke down in 1930 when Wáshington Luis from São Paulo, tried to impose a Paulista successor during the severe coffee crisis that accompanied the world depression. Getúlio Vargas from Rio Grande do Sul was then swept into office with army backing. Paulistas resented his measures against their state and rose against his regime in July 1932. Although São Paulo's industry was swiftly converted to military production, and 50,000 men were placed in the field, the revolt was put down in three months. Thereafter the state recouped only a part of its political influence.

In the mid-19th century, intensive coffee planting began near Campinas, northwest of the capital. The coffee frontier then moved steadily northward, westward and, in the 20th century, southward into Paraná. The best land occurs in the streaks of *terra roxn* (red-purple earth), a deep, porous soil containing humus. Periodic overproduction of coffee and exhaustion of the older coffee lands led to land subdivision and diversification of agriculture after the 1930s. In order of market value, the leading crops after coffee were, in 1956, cotton, rice, corn, sugar, beans. potatoes, tomatoes, bananas, peanuts, oranges and manioc. Cereals are grown despite somewhat unfavourable climatic conditions. Cotton enjoyed a boom during the American Civil War; then, after nearly disappearing, the industry revived to meet the demand of Brazilian cotton factories. Sugar cane was planted with the first Portuguese settlement and remained the leading crop until the advent of coffee. Stock raising is important in northern and western parts of the state. After 1929 much coffee land was converted to pasturage, and the number of cattle increased fivefold within 25 years. Herds have been improved by imported stock, and horses and mules are also bred; another profitable animal industry is the breeding of swine. Truck farming and dairying have developed with urbanization. The state has excellent agricultural schools and experiment stations at Piracicaba and Campinas and a zootechnic station in the capital.

Immigration is one of the keys to Sio Paulo's economic progress. Coffee was first cultivated by Negro slaves. When these were emancipated in 1888, European workers were already arriving as replacement, aided by private and official subsidies. Between 1870 and 1952 over 2,500,000 immigrants entered, half of them as permanent residents. The principal foreign groups were Italians, Portuguese, Spaniards and Germans. After federal immigration restrictions were imposed in 1934, migration from other Brazilian states met São Paulo's labour needs. Many immigrants were attracted from farms to cities, especially the capital, where they furnished industrial labour. Nearly 200,000 Japanese arrived in the 20th century; they showed greater cohesion as rural settlers, as evidenced by their efficient agricultural co-operative at Cotia, near the capital.

São Paulo is the industrial centre of Brazil, with most of the state's factories located in the capital or within 75 mi. of it. Manufacturing was stimulated during World War I, and Paulistas used their political influence with the federal government to obtain a tax exemption for the port of Santos and protective tariffs. In the 1960s the state had over 52,000 industrial firms employing more than 900,000 persons; although the vast majority were small enterprises, 213 plants had 500 or more employees. The output of pig iron, cast iron and steel was over 600,000 tons annually. Other heavy industries included the assembly of motor vehicles and manufacture of farm machinery. Raw materials for many industries, such as textiles, ceramics, cement, furniture and food processing, are locally available. The principal source of power is hydroelectric. South America's first nuclear energy power plant was purchased for São Paulo in England in 1957. Although poor in minerals, São Paulo produces significant quantities of alumina, mineral water and dolomite.

The state has an extensive network of federal, state and private railroads of varying gauges. These converge upon the capital and upon the cable railway of the pioneer Santos-Jundiai line which links São Paulo with its port. Santos in the early 1960s was the nation's busiest port and the largest coffee-shipping port in the world. Cananéia, Iguape, Sio Sebastiio and Ubatuba are engaged in the coasting trade only; the first two are known for the rice grown in their vicinity. In addition to 4,600 mi. of railroads, São Paulo has 63,000 mi. of highways and 46 airports.

The capital of the state is São Paulo (*q.v.*), and its second city in importance is Santos (*q.v.*). Other leading cities and towns are as follows (population figures, 1950 census, are for municipalities that include large rural areas and even separate villages; distances are by rail from the capital):

Near the capital: Sio Caetano do Sul (59,832; 7 mi.), Santo André (127,032; 11 mi.) and São Bernardo do Campo (29,295; 12 mi.), industrial subcentres on the Santos-Jundiai line; Guarulhos (34.683; 13 mi.).

Along the Paraiba river and the Central do Brasil line, east-northeast from São Paulo to Rio de Janeiro, cradle of the coffee culture in transition to diversified farming and industry: Mogi das Cruzes (61,553; 30 mi.); Taubaté (52,997; 94 mi.), in a rich and healthful agricultural district with important industries; Guaratinguetb. (36,657; 128 mi.).

Along the Santos-Jundiai line: Jundiai (69,165; 37 mi.), in a hilly region with an excellent climate where grapes and some grain and coffee are grown, an industrial centre and terminus for the Paulista lines and a branch of the Sorocabana; Bragança Paulista (51,623; 65 mi.), on a narrow-gauge branch line and in a region of good soil.

On the Paulista and Araraquara lines northwest from Jundiai through the historic coffee region: Campinas (*q.v.*); Limeira (46,-281; 103 mi.), a pioneer district for immigrant coffee workers in the 1840s and now a centre for orange growing and manufacturing; Rio Claro (47,073; 121 mi.); Araraquara (62,688; 196 mi.); Barretos (50,249; 320 mi.), a centre for the cattle industry; Sio José do Rio Prêto (65,852; 345 mi.).

On the Paulista line (western branch) and the Noroeste line in the newer coffee and cotton lands: Bauru (65,452; 251 mi.), a railway junction; Marília (86,844; 330 mi.), a modern pioneer city incorporated in 1929; Tupã (56,682; 377 mi.); Araçatuba (59,452; 426 mi).

On the Mogiana line north-northwest from Campinas toward Minas Gerais: Ribeirão Prêto (92,160; 264 mi.), in a rich coffee district with a medical school belonging to the state university; Franca (53,485; 333 mi.).

On the Sorocabana lines northwest and west of São Paulo (connecting with the southern states and Uruguay and with Mato Grosso and Bolivia to the west): Sorocaba (93,928; 65 mi.). a prosperous manufacturing and commercial city on the Sorocaba river; Itu (30,883; 76 mi.), a historic town with numerous factories and water power from the Tietê; Piracicaba (87,835; 115 mi.), a manufacturing and commercial centre with agricultural school; Presidente Prudente (60,903; 491 mi.).

São Paulo was settled in 1532 by the Portuguese under Martim Afonso de Sousa, who established a colony near Santos at São Vicente, now a resort town. It was originally called the *capitania* of São Vicente (organized 1534) and included the whole of Brazil south from Rio de Janeiro. After the founding in 1554 of São

Paulo city (which succeeded Sbo Vicente as capital of the captaincy in 1681), the Paulista plateau was for a long time the main region of inland settlement in Brazil. Seventeenth-century expeditions (*bandeiras*) roaming the interior from bases on the plateau were largely responsible for the boundaries of the modern nation. From time to time parts of São Vicente were cut off to form other captaincies, from which developed the present southern states. After national independence, Sbo Paulo was a province under the Brazilian empire (1822–89). (R. M. M.)

SAO PAULO, the largest city of Brazil. capital of the state of the same name, largest industrial centre of the nation and seat of an archbishopric, is on the Tietê river 49 mi, by rail N.W. of the port of Santos and 308 mi. by rail S.W. of Rio de Janeiro. Pop. (1950) 2.017.025; (1958 est.) 3,315,553. São Paulo is connected by rail and highway with Rio de Janeiro and many inland cities. It is connected with Santos. its port, by a cable railway and a four-lane highway over the steep coastal escarpment. Its airport is one of the busiest in the world. São Paulo is surrounded by many functionally specialized satellite towns, and it dominates a vast agricultural hinterland. Part of the city occupies ridges that command broad vistas, and part is on alluvial land along the Tietê and smaller rivers. The elevated regions provide healthful residential districts. Although the surrounding lands are clayey with sandy deposits. they are extensively used for truck farming. Nearby hills and reservoirs and the beaches at Santos and Guarujá provide pleasant resort areas. The city is just within the tropics and has high sun temperatures in summer, but its elevation (2.400 ft. above the sea) gives it a temperate climate which occasionally reaches freezing in winter.

São Paulo grew rapidly in modern times. Its population of less than 25.000 in 1872 reached 250.000 in 1901 and 1,000,000 in 1933. To create an adequate source of hydroelectric power, nearby rivers were dammed and their waters pumped over the coastal mountains to supply the Cubatão power plant. In 1956 Sbo Paulo's hydroelectric plants had a capacity of more than 2.000.000 h.p. Because of its great activity, the city has been called the "Chicago of South America." In the 1950s the annual number of licences issued for new buildings averaged more than 16.000. The historic Triangle. or city centre, contains only a portion of São Paulo's characteristic skyscrapers. Traffic is handled by viaducts and by a loop-and-spoke system of broad radial and pcrinietric avenues; but in general urban growth has been swift and uncontrolled. A municipal department of urbanism was created only in 1947. Residential districts of the \yell-to-do. such as Avenida Paulista and Jardim América, are attractively laid out, the more recent of them by private firms influenced by English town planning. They contrast sharply with the crowded slums of the industrial Braz and Mooca districts. Recreation facilities include a stadium seating 80.000 spectators. the Jockey club racecourse and an autodrome, one of the world's largest.

São Paulo has a long history, few traces of which are visible in the modern metropolis. The Jesuits under Manuel da Nóbrega founded it as an Indian settlement in 1554, on the anniversary of the conversion of St. Paul. From this saint the city takes its name. The site was a hill at the confluence of two streams which could be defended against hostile Indians. Three 16th-century paths on the hilltop formed the Triangle which permanently identified the city centre. In the 17th century Sbo Paulo was a base for expeditions (*bandeiras*) that searched the continent for Indian slaves and precious minerals. Although it succeeded São Vicente as capital of the captaincy in 1681 and was raised to the status of city in 1711, São Paulo remained an agrarian town into the 19th century. In 1822 Emperor Pedro I declared national independence there, at a site marked by the museum and monument of Ipiranga. Traditions of the *bandeiras* and colonial autonomy were invoked in 1932, when São Paulo became the seat of an unsuccessful revolt against the regime of Pres. Getúlio Vargas.

The city's modest fortunes before the mid-19th century derived from commerce, sugar growing and diversified agriculture. At that time the spread of coffee planting to the rich red soil of the province opened a source of wealth which contributed to the city's sudden growth after 1880. Favoured by its climate, its strategic location in the transportation network and the availability of a port, Sbo Paulo became a centre for commerce, banking and industry. Immigrants arrived in large numbers as workers and entrepreneurs. For a time Italians outnumbered native Brazilians in the city. Other prominent groups were Portuguese. Spaniards. Germans, east Europeans, Levantines and Japanese. Although immigration fell off after 1934, many foreign quarters have kept their identity. Only about 7% of the inhabitants are Negroes. in contrast to the heavy Negro population of northeastern Brazil.

Industrial development began in the late 19th century. In a few decades São Paulo aith its neighbouring municipalities, notably Santo André, became the foremost industrial centre of South America. Southern Brazil, more prosperous and densely settled than the north. furnished a market for manufactures The territory nithin easy commercial reach of Sbo Paulo contains only 20% of the area of the nation but roughly 50% of iti population, 75% of its highways and railways and 90% of its electric power. In the 1960s Sbo Paulo state produced nearly two-thirds of the value of Brazilian manufactures and the city alone about one-third. Some heavy industry existed—for producing steel. manufacturing plant equipment and assembling trucks and automobiles, for example—but was secondary to the production of light consumer goods, Most of the firms had no more than 20 employees. The branch of industry employing most workers was textiles. followed by mechanical and electrical appliances, building and furniture, foodstuffs and chemical and pharmaceutical products. Except for foreign subsidiaries, industries tend to be owned by families and small groups. In 1952 Brazil's first intercity oil pipeline was opened between Santos and São Paulo, and in 1955 the Cubatão oil refinery, the nation's largest. began operation.

Throughout the 19th century São Paulo was a prominent cultural and intellectual centre. This was largely because of the opening in 1827 of a law academy, one of the first two in Brazil. where many of the nation's most eminent men were educated. This cultural leadership continued in the 20th century. In 1922 Modern Art week, celebrated by a group of young writers, artists and musicians in the Municipal theatre, introduced modernism in the arts to Brazil. The municipal department of culture, founded in 1934, won international recognition for its many activities. São Paulo is a leading centre for libraries (which include the skyscraper municipal library), publishing houses, theatres and museums. The Museum of Modern Art organized the first Biennial exhibition in the Americas (1951). The permanent fairgrounds for the fourth centennial of the city (1954) are distinguished for their modern architecture.

São Paulo has a well-developed system of primary and secondary schools. public and private, and a variety of vocational schools. The literacy rate for persons over six years of age rose from 45% in 1887 to 85% in 1946. The state university. established in 1934. incorporated pre-existing schools of law, polytechnic training, pharmacy and dentistry, agriculture. medicine and others. Faculties of economics, architecture and engineering were added later. An affiliated institution is the school of sociology and politics, founded in 1933 by industrialists and civic leaders as the first advanced course in the social sciences in South America. Another is the Butantã institute, a world-famous research centre for the study of snakes and the production of antitoxins and antivenins. A Catholic university was created in 1946.

Roman Catholicism is the prevailing religion, although Protestant. Jewish and spiritist groups are of some importance.

(R. M. M.)

SÃO SALVADOR, Brazil: *see* SALVADOR.

SAPAJOU, an alternative name for the American capuchin monkeys (*q.v.*), comprising the genus *Cebus*. *See* also PRIMATES.

SAPAN (SAPPAN WOOD). a soluble red dyewood (Malay *sapang*), from a tree belonging to the leguminous genus *Caesalpinia* (*C. sappan*), a native of tropical Asia and the Indian archipelago. The wood is somewhat lighter in colour than Brazil wood and its other allies. but the same tinctorial principle, brazilin, appears to be common to all.

SAPINDACEAE, the soapberry family, a large family of

dicotyledonous plants, with about 150 genera and 2,000 species, chiefly tropical, consisting of trees, shrubs and vines. The leaves are mostly alternate and compound, occasionally simple, while the flowers, mostly small, are irregular or unsymmetrical, mostly polygamodioecious, the fruits various. Important fruit trees include the litchi (*q.v.;* Litchi chinensis) of China; longan (Euphoria *longan*) of China and India; the rambutan (*Nephelium lappaceum*) and pulasan (*Nephelium* mutabile) of the Indo-Malayan region; the akee (*q.v.;* Blighia *sapida*) of Africa; and others. The seeds of Schleichera oleosa yield macassar oil, while the aril surrounding the seeds is edible. Other species yield important timbers, and the bark of still others is rich in saponin. The pride of India or China tree (Koelreuteria) is cultivated in Europe and North America as an ornamental.

SAPIR, EDWARD (1884–1939), U.S. linguist and anthropologist, who made important contributions in the field of American Indian languages, was born on Jan. 26, 1884, in Lauenburg, Pomerania. His parents took him to the United States in 1889 and he was educated at Columbia university (Ph.D., 1909). In 1910 he was named chief of the division of anthropology at the Canadian National museum; in 1925 he joined the staff of The University of Chicago; and in 1927 he moved to Yale university, New Haven, Conn., where he remained as professor of anthropology and general linguistics until his death on Feb. 4, 1939.

Sapir early became interested in linguistics and, chiefly through the influence of Franz Boas (*q.v.*), in American Indian languages, the study of which he continued widely and intensively most of his life. His profound grasp of problems in the Indo-European languages, his quick recognition of contrasts in structure and his ability to abstract the essential characteristics from masses of complex data enabled him to maintain a detached, synoptic view of language even while at work on minute linguistic problems in languages widely different from one another both genetically and structurally. His mind was vigorous, poetic and searching, his style crisp and lucid; by personal contact as well as through his published words he was often productive of work in others. Sapir was a scientist of extraordinary breadth who kept the study of linguistic phenomena in proper perspective as part of the study of man. His book Language (1921) is one of the most stimulating ever written on the subject.

A collection of Sapir's essays, edited by David G. Mandelbaum, appeared in 1949 under the title Selected Writings in Language, *Culture,* and Personality. See also LINGUISTICS. (MY. F.)

SAPODILLA, a tropical evergreen tree, *Achras* sapota (zapote), of the sapote family (Sapotaceae; g.~.)and its delicious fruit. Sapodilla, the name used in southern Florida (the only part of the U.S. where this tree can be grown successfully), doubtless is an adaptation of the Spanish *zapotillo,* "small zapote." In Spanish-speaking countries the name chicozapote is commoner, and in certain English-speaking countries, notably India, naseberry (a corruption of *nispero,* Spanish for the medlar; *q.v.*) is used.

While the fruit is of no great commercial importance in any part of the world, it is much appreciated in many tropical and subtropical areas. It is spheroid to ovoid in shape, rusty brown on the surface and two to four inches in rough diameter. The flavour, very sweet and difficult to describe, has been compared to a combination of pears and brown sugar. The seeds. two to five in number, shining black and the size of flattened beans, are surrounded (when the fruit is ripe) by translucent, yellowish-brown, juicy flesh. When immature, the flesh contains tannin and milky latex and is quite unpalatable. The milky latex, chief source of gum chicle (*q v*), once important in the chewing-gum industry, is extracted by tapping the trunk.

Sapodilla trees occur wild in the forests of southern Mexico and northern Central America. As a cultivated species the tree is medium-sized and of slow growth. The reddish wood is very hard and durable (elaborately carved lintels a thousand years old are still to be seen in some Mayan ruins). The leaves, two to five inches long, are glossy and light green in colour, ovate to elliptic in outline; the flowers are small and inconspicuous. Propagation is usually by means of seed, but superior trees can be reproduced by grafting.

Although sapodilla is probably the best of its family in economic importance, many other economically promising members—among them the star apple (*q.v.*) and the popular zapote, sapote or marmalade plum—are found in the Sapotaceae. (W. Po.)

SAPONINS AND SAPOGENINS. Saponins are water-soluble plant substances characterized by special properties, namely, the ability to lower the surface tension of water and hence to cause foaming, the ability to destroy red blood corpuscles (hemolysis) and the ability to kill fish, all at relatively low concentrations. They probably are present in all plants, having been identified in more than 75 families and more than 500 species. They may be distributed throughout the plant or occur in high concentration in one part of the plant; *e.g.,* the root or bulb, leaves, bark, flowers, fruit flesh or seeds. Their function in the plant is not known. Some appear to serve as a storage form of carbohydrate (*q.v.*) in the plant, whereas others seem to be waste products of plant metabolism.

Common names for plants containing high concentrations of saponins are soap root, soap wort, soap bark, soap plant and amole. These names are indicative of their use as cleansing agents by peoples throughout the world since ancient times. They do not form a scum in hard water, and even in comparatively modern times were preferred to soap for laundering fine fabrics, such as silk shawls. They formerly were used as foaming agents in foam-type fire extinguishers and as wetting agents in agricultural sprays. but were displaced for these purposes by the less expensive synthetic detergents and wetting agents. Saponin solutions are used in photographic emulsions to permit even spreading on the base, and in multilayered coatings to permit spreading and adhesion of successive layers.

Aboriginal peoples throughout all parts of the world have used saponins for catching fish. A quantity of a plant having a high saponin content is crushed and stirred into a pool. After a short time the fish rise to the surface and are taken easily. It is estimated that from 300 to 400 species of plants have been used for this purpose. As early as the 13th century, in order to prevent extermination of fish, laws were passed forbidding the use of fish poisons. Saponins cause death in fish probably by disabling the breathing mechanism of the gills. Although saponins are hemolytic and toxic to warm-blooded animals when injected into the blood stream, they are not absorbed from the intestines. Hence fish killed by saponins can be eaten with safety. The nontoxicity to man on ingestion is evident when one considers that the foaming properties of certain beverages, such as root beer, result from the presence of saponins.

Chemically the saponins belong to a large class of substances known as glycosides (see GLYCOSIDES, NATURAL). When a water solution of a saponin is heated in the presence of a strong acid, the saponin molecule is split into fragments with the addition of the elements of one molecule of water at every point at which scission takes place (hydrolysis). The products are a molecule of sapogenin and several molecules of one or more kinds of sugar (see CARBOHYDRATES). For example, in the hydrolysis of digitonin, one of three different saponins isolated from foxglove leaves, each molecule combines with five molecules of water to yield one molecule of a sapogenin, called digitogenin, one molecule of xylose and four molecules of galactose.

Because several different saponins may occur in the same plant, and because the saponins are amorphous and not readily crystallized. it has been difficult to isolate them in a pure state, and at mid-20th century relatively little work had been done on the chemistry of the saponins themselves. The sapogenins, on the other hand, are crystalline compounds that are purified readily. and a large amount of work had been expended in attempts to determine the way in which the constituent atoms are linked together.

The sapogenins thus far isolated belong to two main types. One type contains 27 carbon atoms with varying numbers of hydrogen and oxygen atoms. They have at least one alcoholic function (hydroxyl group), and contain a carbon framework like that present in the animal and plant alcohols known as sterols. Hence they are called steroid sapogenins. The saponins from foxglove

leaves, sarsaparilla root, yucca and agave belong to this class. Some steroid sapogenins, such as diosgenin, prepared commercially from a Mexican yam, have become valuable raw materials for the synthesis of the female hormone, progesterone, and the adrenal cortical hormone, cortisone.

The second type of sapogenin contains 30 carbon atoms, along with varying amounts of hydrogen and oxygen. They are called triterpene sapogenins because there are three times as many carbon atoms in the molecule as in a terpene molecule (see TERPENES). Like the steroid sapogenins, they contain at least one alcoholic function (hydroxyl group), but in addition they contain an acid function (carboxyl group) and sometimes are called acid sapogenins. Saponins yielding triterpene sapogenins appear to be more widely distributed than those yielding steroid sapogenins. Moreover, the same triterpene sapogenin may occur free, as well as combined with sugars as a saponin.

Oleanolic acid can be obtained by hydrolysis of saponins present in guaiac bark, sugar beets or calendula flowers. It also occurs free in clove buds, in the waxy coatings of olive and mistletoe leaves and in grape skins.

A further point of interest is that the triterpene alcohols, which occur in plant resins, are related closely in structure to the triterpene sapogenins. By replacing the acid function. COOH. of oleanolic acid by the group CH_3, a compound is obtained which is identical with beta-amyrin, a triterpene alcohol isolated from Manila elemi and other resins. (C. R. N.)

SAPOTACEAE, a family of tropical dicotyledonous plants, most of which are trees with leathery leaves. There are 35 genera and about 600 species, many of which are of economic importance as sources of gutta-percha (*q.v.*), balata, shea butter, ironwood, etc.

Chrysophyllum cainito is the West Indian star apple. *Mimusops huberi* is the Brazilian milk tree. *Achras* sapota (zapota) of tropical America, cultivated in all tropical countries, yields the excellent fruit known as the sapodilla (*q.v.*) or naseberry, and the important chicle (*q.v.*), the basis of much chewing gum. *Lucuma nervosa* is the eggfruit or canistel of South America, now naturalized in Florida and the West Indies. The zapote, sapote or marmalade plum is *Calocarpum mammosum* (sapota), one of the commonest fruit trees in Central America.

The important commercial product gutta-percha is chiefly derived from various species of Palaquium and Payena growing in the Malay peninsula and archipelago.

SAPPHIC METRE, certain forms of quantitative verse, named after their supposed originator, the Aeolic poetess Sappho (cf. ALCAICS). For two of her famous metres see CHORIAMBIC VERSE.

Characteristic of all these metres is the emergence of a choriambus (- ⏑ ⏑ -). or perhaps a dactyl (- ⏑ ‾), in the midst of what appears to be a series of feet of other lengths, especially trochees (- -) (*q.v.*). The best-known employment of lines of this sort is in the Sapphic stanza, three Sapphic hendecasyllables followed by an Adonic. thus:

ism sătis terris nĭvĭs atque dirae
grandinis misit pater et rubenti
dextera sacras iaculatus arces
terruit urbem.

This is used occasionally in Latin by Catullus, frequently by Horace, who introduced some small modifications (fourth syllable always long, fifth syllable almost always the end of a word), and by later writers; in the middle ages it was much used for hymns, notably by Gregory the Great.

In modern languages, the Sapphic stanza has been imitated, sometimes with fair success, as by Swinburne:

Heard the flying feet of the Loves behind her
Make a sudden thunder upon the waters,
As the thunder flung from the strong unclosing
Wings of a great wind.

But it remains an exotic, not well suited to modern methods of versification.

SAPPHIRE, a transparent to translucent variety of corundum (*q.v.*), or native aluminum oxide, has been highly prized as a gem stone since about 800 B.C. Its colour normally ranges from very pale blue to deep indigo; the most valued is a medium deep cornflower blue. The colour is due mainly to the presence of small amounts of iron and titanium. Colourless, gray, yellow, pale pink, orange, green, violet and brown varieties of gem corundum also are known as sapphire. Ruby (*q.v.*) is essentially the same mineral, but this name is restricted to corundum that is deep pink, red or purple.

Sapphire generally occurs as pyramidal, rhombohedral, tabular or barrel-shaped crystals. Repeated twinning and lamellar parting are characteristic. The lustre is vitreous to adamantine, but somewhat pearly on parting surfaces. Most sapphire contains abundant inclusions of microscopic size, and reflections of light from these yield a faint ahitish sheen, known as "silk." Tiny, regularly arranged mineral inclusions and elongate cavities are responsible for the asterism shown by star sapphire. Such translucent, milky appearing stones, when properly cut, seem to contain a floating luminous star with six rays.

Much sapphire is unevenly coloured in bands, zones or blotches. It also is dichroic, so that in most varieties the colour changes according to the direction of view in transmitted light. Alexandrite-sapphire appears blue in daylight and reddish or violet in artificial illumination, somewhat like true alexandrite (*q.v.*), a variety of chrysoberyl.

Sapphire is a primary constituent of many igneous rocks, especially syenites, pegmatites and various basic types, and also is found in schists and metamorphosed carbonate rocks. Most commercial production has come from alluvial gravels and other placer deposits, where the sapphire commonly is associated with ruby, garnet, spinel, topaz. tourmaline, zircon and other gem minerals. The best-known occurrences, including some lode deposits, are in Ceylon, Indochina, Burma. Thailand. Australia (Victoria. Queensland, New South Wales). India. Madagascar. the U.S.S.R.. South Africa and the United States (Montana, North Carolina).

Most transparent sapphire is facet cut, generally in the brilliant style. Such gems have considerable sparkle, but they exhibit little fire because of their modest dispersion. Skillful cutting of unevenly coloured stones yields gems with a uniform appearance derived from only small portions of relatively deep colour. Star sapphire and other nontransparent varieties are cut en cabochon rather than faceted.

Despite its great hardness (9), some sapphire is carved or engraved, especially in the orient. Careful heating and cooling under various conditions can induce essentially permanent colour changes in sapphire; *e.g.*, from yellow to colourless or greenish blue and from violet to pink. Other colour changes result from exposure to certain kinds of intense radiation.

Synthetic Sapphire.— Synthetic sapphire has been produced commercially since 1902. Clear, sound material of various colours is manufactured in the form of carrot-shaped boules and slender rods Much is consumed by the jewelry trade. but most synthetic sapphire is used in place of natural sapphire and other materials for the manufacture of jewel bearings. gauges, dies, needle points, thread guides and other specialized components. Some also is used as a high-grade abrasive.

Synthetic star sapphire, with luminous stars more regular and distinct than in most natural stones, is made for gem uses. The asterism is obtained through controlled exsolution of impurities, generally rutile (titanium dioxide) in the form of tiny needles that assume preferred orientations within the host crystals of corundum. See also GEM: Synthetic Gems. (R. H. J.)

SAPPHO (or as she calls herself PSAPPHO), the greatest poetess of Greece, was a native of Lesbos. In spite of her fame almost every detail in her history is doubtful. Only a few of the many and often conflicting statements made about her by ancient authors can be checked by her oan writings. It would seem probable that she came of an aristocratic Mytilenean family (another account connects her nith Eresus) and was born round about 600 B.C., so that she was contemporary with Pittacus and with the poet Alcaeus, with whom she may have exchanged verses.

No less than eight versions of her father's name are recorded by Suidas, of which Scamandronymus, the form given by Herodotus (ii. 135), may be taken as the most acceptable. Her mother is said to have been named Cleis, and if the fragment inc. lib., 17 is rightly ascribed, the statement is supported by the fact that her daughter also was a Cleis.

There is more certainty about her brothers, or at any rate about two of the three. Charaxus and Larichus. She speaks of Larichus as being cupbearer. a position filled by youths of good family, and Charaxus (though not mentioned by name in the extant remains) is evidently the "brother" referred to in $\alpha 3$. We learn from Herodotus and others that he sailed to Egypt and bought a courtesan, Rhodopis. out of slavery, for which Sappho attacked him. a3 seems to be a prayer for his safe return from overseas and a reconciliation nith his sister and $\alpha 4$b perhaps contained a prayer that Doricha may not entangle him again.

The poetess's family is of less interest than the pupils, friends and rivals with whom we meet repeatedly in the fragments of the poems. with their references on the one hand to Atthis, once loved but now estranged, Anactoria. gone far away, Dica, "lovelier than soft Gyriuno," on the other to Andromeda, who stole Xtthis away, Gorgo and others.

In $\alpha 11$ there seems to be a hint of some enmity towards the house of Penthilus. with which Pittacus was connected by marriage, but it happens most frequently that where we have names the thought cannot be followed far, and that in the longer pieces, where affection is most touchingly, or distaste most cuttingly expressed. no names have survived.

Apart from the relations just referred to we know next to nothing of the life of Sappho. She is said to have been banished, like other aristocrats, and to have gone to Sicily. but this flight has left no trace in the remains unless the reference to Aphrodite of Panormus in $\alpha 7$ *App.* be such. As for the story of her passion for Phaon and her leap from the Leucadian rock, it bears every sign of being pure fiction. There are two references to the advance of old age; we cannot tell whether her own or another's. Of the end of her life we know nothing at all.

Sappho's poems are said by Tullius Laurea to have been arranged in nine books. Suidas says there were nine books of lyrical poems, but epigrams, elegeia, etc., besides. The author of P Oxy, 1800, also counts a separate book of elegeia. but his figure for the books of lyrical poems is lost.

From the fragments we know of only eight books of lyrical poems. It appears that these books were, as far as possible. arranged according to metre (book 1, for instance. containing only pieces in the so-called Sapphic stanza, and so on), but in the case of one book (the Epithalamia, perhaps book 8) according to subject. The language seems to be no literary dialect, but the ordinary speech used by the contemporaries of the poetess, and so to differ in a greater or less degree from almost all the other Greek poetry that has come down to us. The conjunction of extreme simplicity of language with intensity of emotion, from which the poetry derives its peculiar effect. as well as the perfection of the form, has hitherto completely baffled translators, Swinburne among the rest.

Until comparatively recent times the poetry of Sappho survived only in the quotations made by ancient authors. The number of the fragments thus preserved was not inconsiderable, but their text was often seriously depraved, and, with two exceptions—the complete or nearly complete poems cited by Dionysius of Halicarnassus and "Longinus"—their extent was insignificant.

At the end of the 19th century there were recovered from the soil of Egypt papyrus rolls and vellum codices, written at dates ranging from the and to the 6th or 7th centuries A.D. which contain authentic texts of Sappho. terribly mutilated indeed, but remarkable for the integrity of their tradition.

Of the older editors. who were concerned only with the quotations. none but Theodor Bergk need be mentioned (Poetae *lyricae graecae,* 4th ed , 1882). The only complete collection of all the known material is in Σαπφοῦς μέλη (Sapphous *Mele;* 1925) by E. Lobel.

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SAPPORO, the capital of the prefecture of Hokkaido, Japan. situated 43° 4′ N. and 141° 21′ E., on the Ishikari river with Otaru as its outer port. With a population of 523,839 (1960), it is the largest Japanese city north of Tokyo. The average temperature is 43° F. and the snow season lasts from October to April, making Sapporo a popular centre for skiing and winter sports. Sapporo is the administrative, business and educational centre of Hokkaido.

The city was laid out in 1871 on the American plan, with wide tree-lined boulevards intersecting each other at right angles. Sapporo was made the prefectural capital of Hokkaido in 1886. and owed its early development chiefly to the colonization bureau of the government. Hokkaido university pays special attention to agricultural science. The manufacture of food-stuffs (including flour, dairy products and "Sapporo beer"), sawmills, printing and publishing constitute the chief industries. (R. B. H.)

SAPROPEL is an unconsolidated sedimentary deposit rich in bituminous substances. It is distinguished from peat in being rich in fatty and waxy substances and poor in cellulosic material. When consolidated into rock, sapropel becomes oil shale, bituminous shale or boghead coal. The principal components are certain types of algae which are rich in fats and waxes. Minor constituents are mineral grains and decomposed fragments of spores, fungi, bacteria and nonvascular plants. The organic materials accumulate in water under reducing conditions.

See also SEDIMENTARY ROCKS. (P. D. T.)

SAPROPHYTES, the name given in botany to plants which grow upon decaying organic matter, the products of the decay of which they absorb.

Many fungi (*q.v.*) are saprophytic, as are some orchids (*q.v.*) and other flowering plants.

SAPRU, SIR TEJ BAHADUR (1875–1949), Indian jurist and scholar who played a prominent role in India's constitutional progress, was born on Dec. 8, 1875. Educated at Agra college, he was a member of the United Provinces legislative council (1913–16) and of the imperial legislative council (1916–20). A liberal in politics, he was trusted both by the British government and the Indian intelligentsia for his integrity and wisdom. He was a law member of the viceroy's council (1920–23), and India's delegate to the imperial conference (1923) and to all the three round-table conferences (1930–32), as well as to the joint parliamentary select committee on Indian constitutional reforms. He mas chiefly responsible for bringing about the Gandhi-Irwin pact (1931) which enabled Gandhi to attend the second round-table conference, and the Poona pact (1932), ahich resulted in the modification of the communal award and ending of Gandhi's epic fast. He died on Jan. 20, 1945, at Allahabad. (L. R. S.)

SAPSUCKER, the name given to American woodpeckers of the genus *Sphyrapicus;* there are three North American species—S. varius, the yellow-bellied sapsucker of eastern U.S.; S. ruber, the red-breasted sapsucker, and *S. thyroideus,* the Williamson sapsucker, the two latter inhabiting the western mountain ranges of Canada and the U.S.

All species have a habit of girdling trees with rows of holes. S. *ruber* has a dull red head and breast; this tint is confined to the head and (in the males) throat in *S varius,* and to the throat alone in the male *S.* thyroideus, which has a bright yellow belly.

SARABAND, a slow dance, generally believed to have originated in Spain in the earlier half of the 16th century. The most probable account of the word is that the dance was named after Zarabanda. a celebrated dancer of Seville. Its music is in triple time, generally nith three minims in the bar. Many examples oc-

cur in the Suites and Partitas of Handel and J. S. Bach.

SARACENS, the medieval Christians' name for their Moslem enemies, especially those in Europe. Earlier the Greeks and Romans called *Saraceni* the nomad Arabs of the Syro-Arabian desert who harassed the frontier of the empire.

SARAGOSSA, province. Spain: *see* ZARAGOZA.

SARAGOSSA, the capital of the Spanish province of Zaragoza and formerly of the kingdom of Xragon. lies on the right hank of the Ebro river, 212 mi. by rail northeast of Madrid. Pop. (1960 est.) 291,181 (municipal).

The city is built in a highly cultivated valley. irrigated by innumerable streams which distribute the waters of the Imperial canal. This fertile country contrasts with the surrounding arid Aragonese plain which is exposed to the sweep of violent gales, hot in summer and icy in winter. Saragossa itself preserves much of the character of an old Aragonese city, especially in the area enclosed by the Calle del Coso, the curving highway which follows the line of the old fortifications and bounds the old town on the south. Between the Coso and the river is a network of narrow streets cut by two modern arteries. The easternmost. the Calle de Don Jaime I. connects the Coso with the seven-arched stone bridge, Puente de Piedra, dating from 1447, which links Saragossa proper with the suburb of Altabas. and from which there is a fine view of the town. To the west is the Calle de Don Alfonso I, which runs down to the Plaza del Pilar, where stands one of the two cathedrals. The life of the city is concentrated in these three streets, and in the Plaza de España, into which the Coso runs and from which the broad Paseo de la Independencia leads out to a well-planned late 19th-century residential area to the south. Newer suburbs have sprung up south and southwest of the town.

Of Saragossa's two cathedrals. to each of which the chapter is attached for six months of the year, La Seo is the older (1119–1550). It is chiefly Gothic in style, but the lower walls of the apse are Byzantine. The other cathedral. El Pilar. which owes its name to the pillar upon which, traditionally, the Virgin appeared to St. James on the banks of the Ebro. was built over the ancient temple of Santa María la Mayor in the second half of the 17th century. It was designed by Herrera el Mozo, and the walls of the Angel chapel were decorated by Goya and Francisco Bayeu. Other beautiful churches are Santa Engracia in the Paseo de la Independencia, and San Pablo (1259), which is Mudejar Gothic in style.

La Lonja. the exchange building, in plateresque Gothic style, the palace of the counts of Luna, where the court of justice sits, and the palace of the Condes de Sastago y Argillo are notable public buildings. The Aljaferia palace, to the west of the town. is one of Spain's most beautiful examples of Arab civil architecture and was formerly the court of the hloorish kings of Zaragoza. The university of Saragossa was founded in 1474, and the medical school is its most famous faculty.

Saragossa is an important railway junction, connected with Valladolid, Madrid and Valencia. and with Catalonia and the Basque provinces, and also with France, via the Somport tunnel. Partly because of its rail connections it has developed as an industrial centre. making machinery, glass. leather, chocolate. soap and cement. It is also a centre for trade in the agricultural products of Aragon.

History.—Saragossa (Celtiberian. *Salduba*) became a Roman colony in 25 B.C., and was renamed Caesarea Augusta or Caesaraugusta, from which Saragossa is derived. The chief commercial and military station in the Ebro valley, and the seat of one of the four *conventus juridici* (assizes) of Hither Spain, it was captured in 452 by the Suebi and in 476 by the Visigoths, whose rule lasted until the Moorish conquest in 714. In 777 its Moorish ruler, the viceroy of Barcelona. appealed to Charlemagne for aid against the caliph of Cordova, Abd-er-Rahman I. Charlemagne besieged the Cordovan army in Sarakosta, as the city was then called, but was compelled to withdraw because of a rebellion in Saxony. The Moors were finally expelled by Alfonso I of Aragon in 1118. As capital of Xragon, Saragossa prospered greatly until the second half of the 1 jth century. when the court was transferred to Castile.

In 1710, during the War of the Spanish Succession, the British and Austrian armies defeated the forces of Philip V at Saragossa.

In the Peninsular War (*q.v.*) the city reached the zenith of its fame. An ill-armed body of citizens, led by José de Palafox y Melzi (*q.v.*), held the hastily entrenched city against Marshal Lefebvre-Desnouettes from June 1 j to Aug. 1 j. 1808. The siege was then raised, but mas renewed on Dec. 20, and on Jan. 27, 1809, the invaders entered the city. Even then there was desperate resistance, and not until Feb. 20 were the defenders compelled to capitulate. Thousands perished, mainly through famine and disease. Among the defenders was the famous "Maid of Saragossa." Maria Agustin, whose exploits were described by Byron in *Childe Harold.* In the Spanish Civil War, Saragossa took the Nationalist side. (L. G. L.)

SARAGOSSA, COUNCILS OF (*Concilia Caesaraugustana*). In or about 380 a council of Spanish and Aquitanian bishops adopted at Saragossa eight canons bearing more or less directly on the heresy of Priscillianism (*see* PRISCILLIAN). A second council (592) solved problems raised by the conversion of the West Goths from Arianism to orthodox Christianity.

The third council, in 691. issued five canons on discipline. From Sept. 1 j65 to Feb. 1566 a provincial synod made known the decrees of Trent.

SARAJEVO, capital of the Bosnia and Hercegovina People's Republic, Yugoslavia. Pop. (1961) 142,423, chiefly Serbs and Croats. It lies in a valley 1,800 ft. above sea level.

Though it is still half oriental and wholly beautiful with its hundred mosques. its ancient Turkish bazaar, picturesque wooden houses and cypress groves, it was largely rebuilt after western fashion in 1878. Sarajevo is the seat of a Roman Catholic bishop, an Orthodox metropolitan and the highest Moslem religious authority in Yugoslavia. Notable in the town are the *Begava Djamia* (Džamia), or mosque of Husref Bey, founded in 1465, the Roman Catholic and Orthodox cathedrals, the hospitals, the town hall. the museum and the university. founded in 1946. Near the bazaar is the oldest church in Bosnia. containing a 14th-century picture of the Virgin. The industries include potteries, silk and flour mills, a sugar beet factory. timber and, under state control, a brewery, tobacco. embroidery and carpet factories. Weaving on hand looms is an important industry.

Founded in 1262 by the Hungarian general Cotroman, and named Bosnavar or Vrhbosna, Sarajevo was enlarged two centuries later, and takes its name from the palace (Turkish, *serai*) which he founded. During the wars between Turkey and Austria, ownership was often contested; and it fell before King Matthias I of Hungary in 1480, and before Prince Eugene of Savoy in 1697. Fires laid it waste in 1480, 1644, 1656, 1687 and 1789.

Sarajevo was chosen as the seat of Turkish government in 18 jo instead of Travnik. In 1878 it became the seat of the Austro-Hungarian administration of Bosnia-Hercegovina and subsequently of the Bosnian diet. Under Austrian rule it was largely modernized, but the schools established also served as a focus of Serb nationalist feeling.

Students at Sarajevo perpetrated the murder of the archduke Francis Ferdinand (*q.v.*) which led to World War I. (*See* also DIMITRIJEVIC, DRAGUTIN; JOVANOVIĆ, LJUBA.) In Nov. 1918 the diet at Sarajevo proclaimed union with Yugoslavia.

During World War II, it was nominally included in the kingdom of Croatia and suffered considerable damage from Allied bombing. In 1944 it was reincorporated into Yugoslavia.

SARAN, a district in the Tirhut division of Bihar, Republic of India. Area, 2,669 sq.mi. Pop. (1961) 3,585,531. It is a vast alluvial plain with a general southeasterly inclination as indicated by the flow of the rivers. The principal rivers, besides the Ganges. are the Gandak and Gogra. which are navigable throughout the year. The district has long been noted for its high state of cultivation and dense population. It yields large crops of rice, besides other cereals, pulses, oil seeds. poppy and sugar cañe. The indigo industry, once important, declined, and sugar refining largely took its place. The production of saltpetre is of some importance. Saran is exposed to drought and flood. It suffered from famines in 1874 and 1897. and from floods in 1921, when 20 in. of rain fell in a single night.

A scheme for irrigation from the Gandak river, started in 1878, proved a failure, and the canals were long closed to irrigation. But a Gandak valley project was made a part of India's five-year plan of 1951. At Manjhi there are the remains of a fort. with ramparts still 30 ft. high, which date back to about the 6th century A.D. The administrative headquarters were established at Chapra pop. (1951) 64.309.

SARANAC LAKE, a village of northeastern New York, U.S., is located on Flower lake in the Adirondack mountains, 8 mi. N.W. of Lake Placid on the boundary line between Essex and Franklin counties. Nearby are the Saranac and St. Regis chain of lakes. It is a summer and winter resort with a considerable influx of visitors during the summer season. The U.S. Eastern Amateur Ski association was originally formed there and skiing is a major winter activity. The Mt. Van Hoevenberg bobsled run, operated by the New York state conservation department, is located a short distance from Saranac Lake.

Settlement dates from 1819 and the village originated as an isolated lumbering community and a centre for Adirondack guides. Situated at an altitude of 1.600 ft , Saranac Lake became a pioneer area for the open-air treatment of tuberculosis. The Trudeau sanitarium, founded in 1884 as the Adirondack Cottage sanatorium by Edward L. Trudeau, was the first semicharitable institution of its kind in the U.S. Other sanitariums were established in the vicinity, one of the largest being the New York State Ray Brook institution. In 1957 the American Management association acquired the property of the Trudeau sanitarium, consisting of 90 ac. and about 50 buildings, and established an academy where management personnel pursue advanced training. Robert Louis Stevenson spent the winter of 1887–1888 as a patient at Saranac Lake and it was there he began *The Master of Ballantrae.* Saranac Lake was incorporated in 1880 and in 1929 adopted the village-manager plan of government. For comparative population figures *see* table in NEW YORK: *Population.* (D. E A.)

SARASATE Y NAVASCUES, PABLO MARTIN MELITON (1844–1908), Spanish violinist, was born at Pamplona on March 10. 1844. At 12 he began to study at the Paris conservatoire, where he became the pupil of Jean Alard. He paid the first of many visits to London in 1861 and later toured widely in Europe and America. He was one of the first and most fascinating violinists of his time, his playing being remarkable equally for purity and saeetness of tone and for facility of execution. He composed virtuoso pieces for his instrument filled with the spirit of the Spanish dance. Among works written for him are Lalo's *Symphonie Espagnole* and Bruch's Second Concerto. He died at Biarritz on Sept. 20, 1908.

SARASIN or SARRAZIN, **JEAN FRANÇOIS** (1614–1654), French author, son of Roger Sarasin, treasurer-general at Caen, was born at Hermanville near Caen. He was on terms of intimate friendship with Paul Scarron, with whom he exchanged verses. with Gilles Ménage, and with Paul Pellisson. In 1639 he supported Georges de Scudéry in his attack on Pierre Corneille with a *Discours de la tragédie.* He accompanied Léon Bouthillier, comte de Chavigny, secretary of state for foreign affairs, on various diplomatic errands until 1643–44. He joined in the pamphlet war against Pierre de Montmaur, against whom he directed his *Bellum parasiticum* (1644). He died at Pézénas, on Dec. 5, 1654. The most considerable of his poems were the epic fragments of *Rollon conquérant* and *La guerre espagnole,* with *Dulot vaincu* and the *Pompe funèbre* in honour of Vincent Voiture. As a poet he was overrated, but he wrote excellent pieces of prose narration, the *Histoire* du *siége de Dunkerque* (1649) and the unfinished *Conspiration de Walstein* (1651).

His *Oeuvres* appeared in 1656, *Nouvelles Oeuvres* (2 vol.) in 1674. His *Poésies* were edited in 1877 by Octave Uzanne with an introductory note. A new edition of his *Oeuvres* was published in 1926 by Paul Festugieres. Much of his correspondence is preserved in the library of the Arsenal, Paris. *See* Albert Mennung's *Jean François Sarasins Leben und Werke* (2 vol., Halle, 1902–04).

SARASOTA, a resort city on the west coast of Florida, U.S., is located 50 mi. S. of Tampa on Sarasota bay; the seat of Sarasota county. It is connected by causeways with white-sand beaches on four islands, lying between the bay and the Gulf of Mexico. Its origin is unknown; Sarasota, variously spelled. appeared on maps in the 1700s. Its development from a fishing hamlet began in 1885 when Scotch promoters, headed by Sir John Gillespie, induced 60 families from Scotland to settle there. A quarter of a century later Mrs. Potter Palmer, Chicago social leader, purchased several tracts of land, helped popularize it as a resort and promoted the economy by establishing a model cattle ranch. The city was incorporated in 1914 and has a council-manager form of government in effect since 1946. The economy depends primarily on tourism, cattle raising and the growing of winter vegetables.

Sarasota is the site of the Ringling museums consisting of a large gallery of baroque art, including the most extensive collection in the western hemisphere of the works of Rubens; the Asolo Theatre (1790) brought from near Venice and used for dramatic and musical productions; the John Ringling home, a $1,000,000 replica of a doge's palace, containing rare Venetian art; and a museum of the circus. The first three were a bequest to the state by John Ringling; the museum of the circus was built by the state in 1948 as a memorial to him. Recreation and sports programs include fishing for tarpon and other salt water fish, baseball and golf. The city has a symphony orchestra and art schools.

For comparative population figures *see* table in FLORIDA: *Population.* (A. J. H.)

SARASWATI, a river in the Punjab frequently mentioned in the Rig-Veda. Its meaning. "abounding in pools," suggests that it was at that early period a larger river than now. It is lost in the desert sands toward Rajputana. Corresponding phonetically to the Iranian Haraqaiti (the modern Helmand), the name may have been applied to the Indus by the invading Aryans before they reached the eastern Punjab, but it soon ceased to refer to that river. As the Sarsuti, its present name, it joins the Ghaggar, the dry bed of the Hakra, the lost river of the Indian desert which can still be traced to its junction with the Indus. With the Drishadwati the Saraswati formed the west boundary of Brahmavarta, and was the holy stream of Vedic India. 4s "fluent" it became the personified goddess of eloquence, learning and wisdom, wife of Manu, mother of the Vedas, and a daughter of Brahman. From her the Sarsut Brahmans claim their name *(see* BRAHMA AND BRAHMAN). Another Saraswati, in Gujarat, also loses itself in the sand.

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SARATOGA, BATTLES OF. The plan of campaign for the British in America in 1777 sought to isolate New England by occupying the Hudson valley. Gen. John Burgoyne, the author of the plan, coming down from Canada via Lakes Champlain and George, was to meet Viscount Howe, marching up from New York, at Albany. A third, but much smaller force, under Barry St. Leger, was to advance from Oswego down the Mohawk valley and join the other two columns. The plan failed because Howe, the British commander-in-chief, marched on Philadelphia, George Germaine, Viscount Sackville, the secretary of state, having failed to give him definite instructions. Burgoyne, with about 8,000 men, including seven regiments of British regulars and 3,000 Germans, reached Ticonderoga (July 1), which was evacuated by its weak garrison (July 6). He reassembled his army after the pursuit at Skenesborough and marched through the woods and swamps to Fort Edward, which was evacuated by the American commander Maj. Gen. Philip Schuyler, who retreated across the Hudson to Stillwater, 30 mi. above Albany (July 31). The march was most laborious, involving the construction of 40 bridges, and necessitated a long halt at Fort Eduard. Burgoyne should have taken his army back to Ticonderoga, and transferred it to Fort George, where a direct road led to Fort Edward. Had he taken this route, he might have reached Albany by the 16th.

A German detachment, on the advice of "Colonel" Skene, who was also responsible for the recent march, was sent to Bennington to seize horses and supplies, but was surrounded and almost annihilated by the Green Mountain militia, under John Stark (Aug. 16). Burgoyne now became uneasy; he had left nearly 1,000 men to garrison Ticonderoga; he had heard from Howe of

his intention to invade Pennsylvania; and St. Leger was held up before Fort Stanwix (actually St. Leger retreated Aug. 22). But he considered himself bound by his orders to press on to Albany. Having collected 30 days' rations, he crossed the Hudson (Sept. 13) and encamped near Saratoga. The Englishman Gates, who had displaced Schuyler in command (Aug. 19), was encamped 4 mi. away, on Bemis's Heights, with 12,000 men and was daily receiving reinforcements. Burgoyne advanced to the attack (Sept. 19). But Arnold came out with 3,000 men to meet him at Freeman's Farm. After four hours' fierce fighting, Arnold retired, and Burgoyne encamped on the battlefield, but he had lost over 500 men, including a large number of officers, victims of Morgan's sharpshooters, Burgoyne heard (Sept. 21) from Clinton, who had been left in command at New York, that he was about to make a diversion up the Hudson. He sent a dispatch to Clinton (Sept. 27) asking for orders. The answer was never received. Clinton started with a small force (Oct. 3) and captured two forts on the west bank, but he never had any intention of penetrating to Albany.

Burgoyne had now under 5,000 "effectives" left, and his supplies were running short. He reckoned that they might last till the 20th. He led out 1,500 men on reconnaissance (Oct. 7), but the Americans made a fierce counterattack, and led by Arnold, inflicted a severe defeat upon the British army. Next day Burgoyne began his retreat, but Gates, with 20,000 men, surrounded him at Saratoga. Burgoyne opened negotiations on the 14th and the Convention of Saratoga was signed (Oct. 17), Burgoyne insisting that it was not a capitulation, and finding a precedent in the Seven Years' War.

See **F. J. Hudleston, Gentleman Johnny Burgoyne (1928).**

SARATOGA SPRINGS, a city of Saratoga county, New York, U.S., is located in the Adirondack foothills about 30 mi. N. of Albany and 12 mi. W. of the Hudson river. The city is in a region of great historic interest, and is a health and pleasure resort noted since colonial days for the medicinal mineral springs which gave the community its name. Located in the city is Skidmore college for women (1911). Saratoga lake (6 mi long) is 3 mi. S.E. The city is renowned for its thoroughbred and harness races, which attract thousands of summer visitors, and has a National Museum of Racing and a Hall of Fame containing mementos of great horses and riders of the past.

The name comes from an Indian word written in the original Saratoga patent as Ochserantongue or Sarachtogie and is believed to mean "at the beaver dam" or "the place of beavers." It has also been spelled Saraghoga and interpreted "place of swift water."

The 122 springs (heavily charged with carbonic acid gas and containing in varying proportions bicarbonates of lime, sodium, magnesium, chloride of sodium and other minerals) are in a New York state reservation of 1,100 ac. The first iodine in the U.S. was discovered there in 1828. Sir William Johnson is said to have been the first white person who used the waters for medicinal purposes (1767). The therapeutic value of the springs had been known long before to the Indians. A log house for lodging visitors was built in 1771; in 1791 Gideon Putnam bought a large tract of land and put up the first inn; in 1793 Valentine Seaman published a book about the waters which spread the knowledge of their curative properties. Other hotels were built early in the 19th century and by 1820 the springs had become a popular resort. The American Civil War cut off the patronage from the south and brought depression; but soon afterward, with the rebuilding of the United States hotel and the establishment of racing (the August races of the Saratoga Association for the Improvement of the Breed of Horses, organized 1863, drew large attendances) Saratoga Springs again became popular. In the 1870s and 1880s it was one of the most fashionable watering places of North America ("the Queen of Spas"). Commercial exploitation of the springs (bottling the water and liquefying the carbonic acid gas) diminished their flow until they almost disappeared, and the resort was again depressed until the state intervened. first prohibiting pumping of the springs, later acquiring the property (1909) and placing it in charge of the conservation commission (1916).

The Saratoga country was a favourite camping ground of the Iroquois. It became a theatre of hostilities between the English, and the French colonists and their Indian allies. In 1693 a French expedition was checked in a sharp conflict near Mt. McGregor by an English and colonial force. In 1745 the settlement on the Hudson directly east of the present city of Saratoga Springs (called Saratoga at first, later Old Saratoga and now Schuylerville) was attacked by the French and Indians, who massacred many of its inhabitants. The battles of Saratoga (*q.v.*) in the Revolutionary War were fought at Bemis Heights, 12 mi. S.E. of Saratoga Springs. Most of the battlefield was acquired by the state of New York, and congress in 1926 authorized its establishment as a national military park. Saratoga Springs was incorporated as a village in 1826 and as a city in 1915.

Industry is of minor importance and includes chemicals, wallpaper, clothing and bait. For comparative population figures see table in NEW YORK: *Population.* (G. L. F.)

SARATOV, an *oblast* of the Russian Soviet Federated Socialist Republic, U.S.S.R., is larger than the former Saratov government area. It lies on the right bank of the Volga river, with the *oblasts* of Ulyanovsk and Penza on the north, Boronedzh Tambov on the west, Stalingrad on the south, and the West Kazakstan and Kuibyshev on the east. Its area is 38,687 sq.mi. and its pop. (1959) 2,167,000 (urban 1,169,000; rural 998,000). The Saratov geographic region occupies the eastern part of the great central plateau of Russia, which slopes gently to the south until it merges imperceptibly into the steppe region; its eastern slope, deeply cut into by ravines, falls abruptly to the Volga. The higher parts range from 700 to 900 ft. above the sea, while the Volga flows at an elevation of 20 ft. only at Khvalynsk in the north, and thus the river banks have a hilly appearance.

Every geological formation from the Carboniferous to the Miocene is represented, though the older formations are concealed under Cretaceous deposits of fossiliferous marls, flint-bearing clays and iron-bearing sandstones. The boulder clay of the Finland and Olonets ice sheets penetrates into the east of the region, and loess and other post-glacial deposits are found in the southeast. Iron ore is abundant and chalk, lime and white pottery clay are obtained in some parts.

The region is comparatively well drained; the upper course of the Sura, a tributary of the Volga, lies in the north, and the upper Medvedyitsa and Khoper flow south and drain into the Don. They are navigable in spite of their shallows, and ready-made boats are brought in pieces from the Volga, and put together on their shores. The forest has almost disappeared; houses are made of clay and dung is used for fuel.

The climate is severe and continental, with a recorded range of temperature of 119° F. in some parts; at Saratov the average January temperature is 12.4° F., the average July temperature 71.5° F. The Volga at Saratov is frozen for 162 days in the year. Rainfall is scanty and irregular, varying between 8 and 16 in. in normal years and much less in drought years, the rain falling mainly in spring and early summer. The region is arid and rapid desiccation is progressing. In the north and west are sandy black-earth soils, interspersed with dark gray forest lands and gray wooded clays (Volsk, Khvalynsk, the northern part of Petrovsk). In Petrovsk. Serdobsk, Atkarsk and Balashov are clayey black earths, while Balashov contains a strip of rich black earth with a high humus content, although even here there are patches of salt land and salt marshes.

The yield of the soil in Saratov region has become stabilized at a low level because, although the soil contains about 6–10% of humus, its friability disappears after a few years of persistent planting with cereals. The great variability of crop yield, sometimes so low as to reduce the district to starvation (*e.g.*, in 1921), and the appearance of salting indicate the need for more intensive methods of agriculture. Attempts are being made to increase the friability of the soil, to put large areas under grass for several years, and to introduce plough culture and better types of crop rotation, with less fallow, and to introduce the sowing of the more drought resisting types of grain. Marmots, mice and insects are great pests to agriculture. Experimental stations have been

established at eight points and the agronomical faculty of the University of Saratov has an experimental institute. In the Novo-Uzensk district east of the German Volga republic the soil and drought problem is even more acute; here are light brown and brown clayey soils, with some chestnut brown soil and sands and salty areas. In good years crops are successful, in drought years famine is severe. For 50 years the peasants there have been practising a form of irrigation and plans have been made for lagoon irrigation of an extensive area above the town of Novo-Uzensk and near the settlement of Alexandrov-Gai, utilizing the waters of the Great Uzen.

Winter rye is the main crop, summer wheat, millet, oats and sunflower seed come next and potatoes are increasingly grown. Barley forms a very small percentage of the harvest. The region was slow in recovering from the terrible years of 1917–21.

There is a fair amount of stock raising in the district; sheep and working cattle occupy the first place, and horses and pigs are also bred, but on the whole this is a diminishing industry. Cucumbers. melons, watermelons, and vegetables are grown around Saratov, Volsk, Atkarsk and Kamyshin, and in the Novo-Uzensk district. Beetroot cultivation is increasing.

Poultry raising of an export character is carried on, but dairy produce is not much developed. Fishing and the preparation of caviare are important at Kamyshin. A more intensive development of cattle breeding for meat and dairy purposes would lead to greater development of local production of bran and cattle foods, with a probable development of the bacon industry in dependence on by-products from the dairying industry. Flour milling is the main industry. oil pressing from oleaginous seeds is an export industry and there is some tobacco manufacture. There are metalworks dependent on the local iron, and a shale-using electric plant at Saratov. The shale is obtained from the Kashpir beds near Syzran and is brought cheaply by water.

The railway net includes the line from Tambov to Kamyshin, with a branch linking with Penza a line from Tambov to Saratov, one from Volsk on the Volga going through Petrovsk and Atkarsk to Balanda. part of the Penza-Syzran line, and the branch from the Volga through Xovo-Uzensk to Alexandrov-Gai. The region is thus better supplied than the Kuibyshev region and has a good deal of transit trade between shipping and railway lines.

The rate of literacy is considerably higher than in the Kuibyshev region, though it is low among uomen. Saratov university helps to spread a higher standard of culture in the district. The chief towns are Saratov, Kuznetsk (*qq.v.*), Balachov and Volsk; the remaining centres have fewer than 20 000 inhabitants.

The district of Saratov has been inhabited since at least the Neolithic period. The inhabitants of a later epoch left numerous bronze remains in their kurgans (burial mounds) but their ethnological position is still uncertain. In the 8th and 9th centuries the seminomad Burtases peopled the territory and recognized the authority of the Khazar princes.

SARATOV, a city of the Russian S.F S.R., in the oblast of Saratov, in 51° 3j' N., 46" 1' E., on the Volga river, and on the plateau slopes near that river. Landslips from the Sokolov hill (560 ft.) often occur. Two ravines divide the city into three parts. The streets are wide and regular, with broad squares, and there are some fine buildings. Pop. (1959 est.) 581,000.

Industries developed in Saratov include iron smelting, shipbuilding, the making of nails and bolts, sawmilling, flour milling and railway repair shops. A large combine harvester plant was established there.

The shallowness of the Volga river opposite the city and the immense shoals along its right bank proved drawbacks, but Saratov became a river port of some importance. Linked by rail with other shipping points, it built up an extensive collecting and entrepôt trade. The importance of Saratov, a major transfer centre for petroleum, was increased after World War II, a pipe line to Moscow for the transportation of gas being completed in 1946. During the war Saratov had been expanded in order to exploit the sources of the natural gas which had been discovered.

A university nas established there in 1919, and there are institutes and other educational institutions, and various museums.

Saratov was the capital of the Saratov government until 1928 and of the Lower Volga territory from that date until 1934. It came under the control of the Russian S.F.S.R. in 1943.

Saratov was founded at the end of the 16th century, 7 mi. above the modern site, to which it was removed about 1605. Sary-tau or Yellow mountain on which it stands has been inhabited from remote antiquity.

SARAWAK, a British crown colony on the northwest coast of Borneo lying between lat. 0° 50′ and 5° N. and long. 109° 36' and 115° 40' E. Area 47,071 sq.mi. (about the size of England). Pop. (1960) 744.391. It has a coastline of about 450 mi. on the China sea and is bounded on the northeast by British North Borneo and on the southeast by Indonesian Borneo.

Climate and Physical Features. — The climate is tropical but not unhealthy. The thermometer rarely rises above 90° F. and often falls to 70° F. at night. The heat is usually tempered by a breeze but humidity is generally high. The annual rainfall varies between 100 and 200 in. There are no marked seasonal changes but there is more rain from October to March than in the other six months. The alluvial coastal plain varies from 5 to 50 mi, in width The rest of the country consists of forest-covered hills and mountains, a long irregular range forming the spine of the island of Borneo with peaks up to 5,000 and 6.000 ft. These are mostly of sandstone but there are extrusions of limestone forming sheer cliffs and pinnacles. There are many rivers. chief among them being the Rejang, Baram, Limbang and Batang Lupar All of these are navigable; the first-named by ocean-going ships for a distance of 170 mi. (See BORNEO. *Physical Geography.*)

Ethnology. — The main indigenous groups are the Iban (Sea-Dayak), Malay, Melanau. Land-Dayak, and the miscellaneous group of tribes knoan as Kayans, Kenyahs, Kelabits, Muruts and others. The Malays are Mohammedans. the others pagans (animist) except where converted to Christianity. Nonindigenous peoples are Europeans, Chinese. Javanese and Indians. The 1960 census disclosed that Europeans formed 0.2% of the total, Malays 17.4% and Chinese 30.8%. Chinese were formerly encouraged to settle but immigration has in recent years been severely restricted.

Administration. — The governor is assisted by an executive council. The legislative body is a council known as the Council *Negri.* Both these councils contain unofficial as well as official members and consist of persons of all races living in the territory. Administration is conducted by a civil service composed of British and of native officers. The higher posts in the service are at present mainly held by British officials but promotion is open to all.

Local government has been established in most parts of the country. This is in. the hands of local authorities in the rural areas and municipal boards in the towns. All local government bodies have their own treasuries, their revenue consisting of rates levied by the authority supplemented by grants from the central government.

The judicial system comprises a supreme court, circuit courts and magistrates courts administering the ordinary law of the territory, and native courts which apply the native or customary law in appropriate cases.

The governor of Sarawak is also the high commissioner for the state of Brunei, a Malay state under British protection and ruled by a Malay sultan, the land boundaries of which march with those of Sarawak.

History.—Sarawak was known to the explorers and map makers of the 16th century, but its history as a state begins with the arrival of James Brooke (*q.v.*) in 1840. Then part of the sultanate of Brunei, the country was in rebellion against the rapacity of the sultan's officials. Brooke restored order, and a year later was publicly installed at Kuching as rajah of the territory then known as Sarawak which extended from Cape Datu to the Samarahan river, an area of about 7.000 sq.mi.

The rajah immediately began to introduce the elements of good government. He abolished slavery, suppressed head-hunting, and, uith the help of a young naval officer who afterward became Admiral Sir Henry Keppel, expelled pirates from the Saribas and Batang Lupar rivers. Accretions of territory took place from

time to time throughout the 19th century, generally because the native peoples preferred the reasonably good government of Rajah Brooke to the oppression of the Malay nobles, and the country finally attained its present size in 1905.

James Brooke, who had been created a K.C.B. in 1863, was succeeded in 1868 by his nephew Sir Charles Johnson Brooke (1828–1917). In 1888 a treaty was concluded which placed the state under British protection and in return gave the United Kingdom the right to control its foreign relations while leaving the internal administration of the country entirely in the hands of the rajah. The rajah's title was formally recognized by Edward VII in 1904. The third rajah, Sir Charles Vyner Brooke, G.C.M.G. (1874–), succeeded his father in 1917.

In 1941 to mark the centenary of Brooke rule a proposal for a new constitution with a representative legislature was proclaimed, but the Japanese invasion intervened. Such was the disruption, misery and ruin caused by three and a half years of Japanese occupation that the rajah decided, with the consent of his council, to cede the country to the British crown; and on July 1, 1946, the cession was accepted.

The first governor of the new colony, Sir Charles Arden Clarke, was appointed in Oct. 1946.

Social Services.—Primary education is gradually being brought within the reach of all, though the difficulty of the terrain and scattered population make the process a slow one. Teachers are trained at a college in Kuching. Post-primary education is provided on a small scale by one government and a few mission schools. In 1952 there were 41 government schools, 94 run by local authorities, 71 mission schools and 226 Chinese schools. Medical and health services are made available by the government by means of hospitals and dispensaries, many of the latter being mobile and consisting of powered boats operating on the rivers and streams.

The Red Cross society has a branch in Sarawak, and institutions for the care of special sections of the community include a boys' home for juvenile delinquents, a leper settlement, a mental hospital and homes for the aged and destitute at Sibu and Kuching. The Boy Scout and Girl Guide associations find supporters among young people of all races.

Trade and Industry.—The chief exports are mineral oil, rubber, sago flour, pepper, cutch (a tanning extract) and timber. Gold is mined in small quantities and coal of good quality has been found but is somewhat inaccessible. There are several minor industries. Some 13,000 sq.mi. of land are in cultivation, including about 11,000 under rice. Fishing and fish curing are the means of livelihood of many Malays and Chinese.

Imports in 1952 were valued at $382,946,000 and exports at $438,563,000.

Government revenue (1951) totalled $47,349,000 and expenditure $22,517,000. Local currency is the Malayan dollar valued at 32.67 cents U.S. and at 2*s*. 4*d*. in sterling in 1952.

Towns.—The chief towns are Kuching (pop. [1960] 50,585), the capital, having a large Chinese trading community, the main government offices. Anglican and Roman Catholic cathedrals, museum, wharves, warehouses and dockyard; Sibu (pop. [1960] 29,615); and Miri (pop. [1960] 13,347), the centre of the Sarawak oil fields. Other administrative centres with settlements of a few thousand persons are Simanggang, Sarikei, Binatang, Mukah, Bintulu and Limbang.

Communications.—Internal communication is chiefly by water, there being no extensive road system and no railways. There are some 450 mi. of roads in and around the towns and a trunk road from Kuching to Simanggang was under construction in 1953.

There is a modern airfield near Kuching and there are landing grounds in a few other places. A regular air service and good steamship services operate between Sarawak, Singapore and North Borneo.

There are exterior wireless links, and an extensive system of wireless telegraph stations throughout the territory

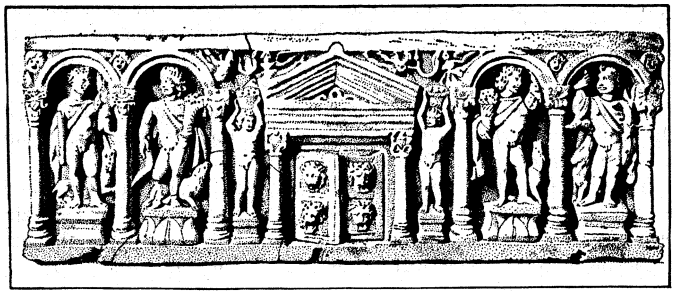
(C. W. DA.)

SARCOPHAGUS, the name given to a coffin in stone, which on account of its caustic qualities, according to Pliny (H.N. xxxvi. 27), consumed the body in 40 days (Gr. *σαρκοφάγος,* literally "flesh-eating," from *σάρξ,* flesh, *φαγεῖν,* to eat); also by the Greeks to a sepulchral chest, in stone or other material, which was more or less enriched with ornament and sculpture. One of the finest examples known is the sarcophagus of Tutankhamun (c. 1550 B.C.) made of granite and ornamented with angels with outspread wings. Of later date are the green porphyry sarcophagus and the terra-cotta sarcophagus from Clazomenae; both of these date from the early 6th century B.C., and are in the British Museum. The finest Greek examples are those found at Sidon in 1887 by Hamdy Bey, which are now in the Imperial Museum at Constantinople. (See GREEK ART.) Of Etruscan sarcophagi there are numerous examples in terra-cotta; occasionally they are miniature representations of temples, and are sometimes in the form of a couch on which rest figures of the deceased; one of these is in the British Museum. The earliest Roman sarcophagus is that of Scipio in the Vatican (3rd century B.C.), carved in peperino stone.

BY COURTESY OF THE METROPOLITAN MUSEUM OF ART

AN ETRUSCAN TERRA COTTA URN OF THE THIRD CENTURY. B.C., IN THE FORM OF A SARCOPHAGUS

Of later Roman sarcophagi, there is an immense series enriched with figures in high relief, of which the chief are the Niobid example in the Lateran, the Lycomedes sarcophagus in the Capitol, the Penthesilea sarcophagus in the Vatican, and the immense sarcophagus representing a battle between the Romans and the barbarians, in the Museo delle Terme. In later Roman work there was a great decadence in the sculpture, so that in the following centuries recourse was had to the red Egyptian porphyry, of which the sarcophagi of Constantia (A.D. 355) and of the empress Helena (A.D. 589), both in the Vatican, are fine examples. Later, during the Byzantine period, there is a large series, either in museums or in the cloisters of the Italian churches. They are generally decorated with a series of niches with figures in them, divided by small attached shafts with semicircular or sloping covers carved with religious emblems, one of the best examples



BY COURTESY OF THE METROPOLITAN MUSEUM OF ART

THE FRONT OF A SMALL ROMAN SARCOPHAGUS, OF THE THIRD CENTURY B.C., DEPICTING THE FOUR SEASONS

being the sarcophagus of Sta. Barbara, dating from the beginning of the 6th century, at Ravenna, where there are many others.

SARDANABALUS, SARDANAPALLUS or SARDANAPALOS, according to Greek fable, the last great king of Assyria, was undoubtedly Ashurbanipal (*q.v.*). The Greeks took him to be the most effeminate of a line of effeminate princes, but adequate evidence from Assyria proves him to have been quite the opposite. Greek legend has Sardanapalus, frightened by a siege, burning himself and his wives to death in his palace. This was actually the fate into which the mighty Assur-bani-pal frightened his rebellious half-brother, Shamash-shumukin, in the siege of Babylon in 648 B.C.

SARDICA, COUNCIL OF, an ecclesiastical council convened in 343 by the emperors Constantius and Constans, to attempt a settlement of the Arian controversies, which were then at

their height. Of the 170 bishops assembled, about 90 (principally from the West) were Athanasians, while on the other side were 80 Eusebians from the east. The anticipated agreement, however, was not attained; and the result of the council was simply to embitter the relations between the two great religious parties, and those between the western and eastern halves of the empire. For as Athanasius and Marcellus of Ancyra appeared on the scene, and the western bishops declined to exclude them, the Eusebian bishops of the east absolutely refused to take part, and contented themselves with formulating a written protest addressed to numerous foreign prelates.

Especial importance attaches to this council through the fact that Canons 3–5 invest the Roman bishop with a prerogative which became of great historical importance, as the first legal recognition of his jurisdiction over other sees and the basis for the further development of his primacy.

The canons are printed in C. Mirbt, *Quellen zur* Geschichte des *Papsttums* (1901), p. 46 f.; Hefele, Conciliengeschichte, ed. 2, i, 533 et *seq.*

SARDINE, the young of the pilchard (*q.v.*), and also used for other related small herrings when similarly preserved in oil.

SARDINIA (Ital. Sardegna), the second largest island in the Mediterranean, 9,301 sq.mi. in area. Politically it is part of Italy. It lies only 7½ mi. south of the French island of Corsica, from which it is separated by the Strait of Bonifacio. Terranova Pausania (or Olbia) at the northeast end of Sardinia is 145 mi. southwest of Civitavecchia, on the Italian mainland.

Physical Features. — Sardinia differs from the mainland and from Sicily in being geologically a much older country with large expanses of old primary rocks. With Corsica it forms part of a range of mountains rising over 13,000 ft. from the flat floor of the sea. Sardinia is a mountainous island, but there are no clearly defined mountain ranges and no permanent snow or glaciers. It consists largely of a patchwork of rolling plateaus, which do not break down into fertile hills, as is so often the case on the mainland of Italy; except for a few small coastal areas, there is only one plain. the Campidano, which stretches for 60 mi. from Cagliari in the south to Oristano in the west.

The mountains of the eastern half of the island are largely granite. In the northeast, in the Gallura district, which is entirely composed of granite, the highest point is Monte Limbara (4,393 ft) southwest of Terranova; farther south the Gennargentu chain rises to 6,016 ft. in the twin summits of Bruncu Spinta and Punta la Marmora. The northwestern part of Sardinia, Nurra, is volcanic, as are the mountains south of it which come close to the west coast; the highest point is Monte Ferru (3,448 ft.). The southwestern groups of Iglesiente and Sulcis contain the two chief mining districts of the island. Sarrabus in the southeast is a domelike granite region, largely uninhabited and partly covered with trees.

There are only two rivers of any size, the Tirso (94 mi.), which drains most of the middle of the island to the Gulf of Oristano on the west coast, and the Coghinas (65 mi.) which flows through a narrow valley to the north coast. Even they are practically dry by the end of summer.

Climate. — The main causes of Sardinia's poverty and backwardness have been summer drought and violent winds, especially the northwesterly maestrale and the hot moist scirocco. The January and July mean temperatures at Sassari in the north (735 ft.) are 47.3° F. and 75.6" F., and at Cagliari in the south (246 ft.) 48.9" and 76.6". Rainfall reaches 40 in. only in the mountains of Gennargentu and north of Iglesias and is less than 25 in. on all the lower ground. At Cagliari it is only about 19 in. It practically all occurs in late autumn and spring. (M. M. C.)

Flora and Fauna. — There are about 1,950 species of vascular plant mostly of the Mediterranean type (*Silene*, Dianthus, *Genista*, Cistus, etc.) though about 40 seem to have migrated from the steppes of northern Africa in Pliocene times and about 60 show links with Africa and Sicily. The flora is more nearly Corsican than Sicilian. The woody vegetation of lowland and hill (up to 2,900 ft.) consists mainly of evergreen shrubs. the forests having been destroyed by man, leaving, in the dry uncultivated parts, macchia containing mastic, strawberry tree, myrtle, tree heath, etc. In the south a tree spurge, *Euphorbia* dendroides, and in the Nurra the dwarf palm. form part of the macchia. Rock heaths with Helichrysum, Genista, etc., occur here and there among the scrub.

In the montane region (above 2.900 ft.) the trees and shrubs are mostly deciduous. Sweet chestnuts and oaks form most of the forests, though the chestnuts are limited in distribution. The commonest of the three oaks is the holm oak which forms extensive forests in the southwestern and southeastern (e g. Sarrabus) hills and is accompanied in the higher places by the peony. Paeonia *officinalis* and sometimes by tree heath. The cork oak grows specially in the north, in the Gallura area and in the mountains from Mt. Nieddu and Mt. Leruo to opposite Nuoro where the holm oak begins. The sessile oak, adapted to the higher mountains and mostly avoiding the limestones, forms forests chiefly round the Gennargentu massif and Mt. Santa Vittoria, also in the Catena del Marghine. There are alpine mats with thyme, thrift, etc., among the highest peaks.

The wild sheep Ovis musimon, known in Sardinia in classical times, is now found nowhere else but Sardinia and Corsica and is there protected. There are also special varieties of red deer. wild boar, hare and rodents, a Sardinian weasel (*Mustela* boccaniela) and a wild cat (Felis ocreata). The domestic donkeys are very small. Unexpectedly there are no bears. wolves, otters, squirrels or moles; no Italian sparrows or magpies. The Sardinian partridge (Alectoris barbara), unknown anywhere else in Europe but found in Tunisia, Algeria and Morocco, is also protected in the nature reserve at Golfo Aranci. There is a variety of trout like that in Algeria, Asia Minor and Persia. No poisonous or smooth snakes or slow worms are found but one lizard, Lacerta *fitzingeri,* one newt, *Molge rusconii* (a north African form) and one toad. Bufo viridis. Many of the 100 species of beetles are endemic and at least 12 species of butterflies and moths and two genera of land and fresh-water snails are found nowhere else. (X.)

ARCHAEOLOGY AND HISTORY

Prehistoric and Pre-Roman Civilizations. — The earliest evidence of human occupation in Sardinia dates from the time when metal was coming into use in the western Mediterranean. Although some stations (*e.g.*, Macomer in central Sardinia) have yielded lithic industries without metal, a pure Neolithic phase is not so far distinguishable from the Chalcolithic stage. The first habitations were perhaps cave dwellings (*e.g.*, San Bartolomeo and other grottoes near Cagliari and in western Sardinia). but it was not long before the Proto-Sardinians began to live a farming life in hut villages. Cult places in caves (San Michele near Ozieri) and religious monuments (a square platform built of large stones at Monte d'Accoddi, northwest of Sassari) are known. The dead were buried in artificial grottoes, which show an antechamber and one or more cells, generally rectangular in plan, sometimes with pillars and roughly carved symbols or figures. These tombs are called by the Sardinians domus de gianas ("witches' houses") and form more or less extensive cemeteries. the best known of which was excavated at Anghelu Ruju near Alghero. Cist graves in stone circles were found in northern Sardinia (Arzachena), and a few small dolmens still existing in the island must go back to the same period. Menhirs are not infrequent and may be related to sanctuaries and burial places. A good idea of the material civilization and common life is furnished by the funerary equipment at Anghelu Ruju, which includes flint blades, stone axes, maceheads, arrowheads, copper daggers and implements, personal ornaments. Stone "idols" are also present and may be interpreted as attendants of the dead. They show the female form in a quite schematic rendering which recalls similar although not identical figures from the Aegean. Pottery comprises undecorated, impressed and incised wares, differing in shape and ornament, among which curvilinear and "spiral-ribbon" patterns are frequent. The typical bell beakers demonstrate a direct link with the Spanish beaker culture.

This Sardinian Copper Age was still flourishing in the first half of the second millennium B.C., and was apparently influenced and transformed very slowly by the impulse of the Bronze Age civilizations which were already ancient in the near east. Minoan and Mycenaean influence was not as direct as in Sicily, but com-

mercial intercourse with Crete may be proved from the beginning of the Late Minoan period, toward 1 joo B.C (copper pig-ingots with linear A signs found at Serra Ilixi) In any case the breaking of a real Bronze Age culture in Sardinia cannot be perceived till near the end of the second millennium, and in spite of the oriental influence its substantial local ancestry seems indisputable. Its peak is not to be dated earlier than the 8th or 7th century B C., that is to say in the period of historical Phoenician and Greek colonization in the western Mediterranean. And it survived in more or less degenerated forms down to the Carthaginian and Roman conquest of the island.

Since the Proto-Sardinians did not know of any system of writing. native historical records are not available. The Greek sources adumbrate a kind of fabulous golden age in Sardinia before the arrival of the Carthaginian invaders, with intensive cultivation and building. In fact, the monuments suggest a period of cultural flowering and prosperity which may hardly be noticed in any later phase of the history of the island. About 1,000 stone towers, the so-called nuraghi (sing. nuraghe), are still a peculiar feature of the Sardinian landscape. They belong to the Sardinian Bronze Age civilization, which is therefore called nuraghi culture by scholars. These towers are in the shape of a truncated cone and built of large stones laid in more or less regular courses; they contain superposed round chambers capped by tall pointed corbelled roofs and connected with a winding staircase. Such a tower is nothing more than the chief element of complex buildings comprising bastions and turrets with corridors. round chambers and cisterns; *e.g.* those excavated at Abbasanta (the so-called Nuraghe Losa), at Torralba, and at Barumini. The nuraghi are sometimes interlinked in defensive systems (*e.g.* Giara di Gèsturi). But in many cases fortified villages of partially stone-built round huts appear in close connection with the nuraghi, which may therefore be considered as residential castles of chieftains including storerooms, foundries and even places for religious use. Other isolated buildings are in the form of rectangular temples (Serra Orrios), monumental wells (Sàrdara, Serri, Ballao) and fountains (Lomarzu). The graves show a development of earlier local types. The subterranean chamber tombs become bigger, imitating more closely the internal structure of civil habitations. On the other hand grandiose megalithic grave monuments are encountered, deriving from simpler dolmen-corridors or cists, with a rectangular cell covered by a corbelled roof and with a panelled portal slab in the centre of an exedra facade, — the so-called "giants' tombs." Objects for everyday life and for religion. yielded copiously by the dwellings and sanctuaries or found in hoards, include bronze implements and weapons. ornaments, decorated and coarse pottery. However, there is a kind of production which calls for special attention, namely the bronze votive statuettes portraying men, chiefly warriors, women, animals, more infrequently mythological beings and small models of ships or buildings.

The race which built the nuraghi was probably a definite ethnical unity, having its roots in the first prehistoric population of the island. In as far as Sardinian place names produce evidence for a knowledge of the lost language of the Proto-Sardinians, these appear to be of Palaeo-Mediterranean origin with some Iberian affinities. Perhaps Ligurian elements settled on the northern coasts, but there is no doubt that no Indo-European invasion reached the island before the Roman conquest. Classical authors mention some names of native peoples; *e.g.*, the *Ioleis* or *Ilienses*. Archaeological evidence from the nuraghi culture suggests a strongly organized power of tribal states. The working of metal from the local mines may be reckoned to have been the chief source of wealth. However, the presence of Phoenician trade settlements along the Sardinian coasts since the 8th century B.C. must have vigorously contributed to Proto-Sardinian prosperity.

The Phoenician shippers and traders, driven westward in search of metal, included the mining zone of Sardinia in their system of commercial routes and founded trading posts, which became the important towns of Caralis (Cagliari), Nora, Bithia, Sulci. Tharros, Cornus. Attempts at colonization by the Greeks (Olbia in northwestern Sardinia) were unsuccessful because of the jealous opposition of the Phoenicians. After Carthage had attained leadership over the western Phoenicians, the struggle for supremacy in the west caused a more direct control to be exercised over the colonists on the island. After a long period of peaceful coexistence with the indigenous peoples, the Carthaginians began, about 500 B.C., the military conquest of the most productive parts of Sardinia. This drove the proudest of the Proto-Sardinians to a fierce life in a reduced mountain zone, a development that left a noticeable mark upon the character of the later Sardinians. The thriving Phoenician and Carthaginian civilization, with its orientalizing and half-grecizing elements, is copiously documented by the finds of cemeteries, as at Tharros, Sulci and Cagliari, and by the religious and civil monuments of Nora and Cagliari.

Roman Period. — During the first Punic War the Romans tried to take Sardinia. However, not earlier than the end of the war, in 238 B.C., they took advantage of a revolt of Carthaginian mercenaries to demand the surrender of the island. The native tribes opposed the Romans, but were conquered after several bloody campaigns; the island became a province under the government of a praetor or propraetor, to whose jurisdiction Corsica was added soon afterward. A rebellion in 21 j B.C., fostered by the Carthaginians, was quelled by T. Manlius Torquatus. After this the island began to furnish considerable supplies of corn; it was treated as a conquered country. not containing a single free city. and the inhabitants were obliged to pay a tithe in corn and a further money contribution. There were saltworks as early as about 150 B.C. There were two insurrections of the mountain tribes, in 181 and in 114 B.C., but even in the time of Strabo there was considerable brigandage.

In the division of provinces made by Augustus. Sardinia and Corsica fell to the share of the senate, but in **A.D.** 6, Augustus, because of the frequent disturbances, took them over and placed them under a praefectus. In **A.D.** 67 Nero restored Sardinia to the senate (but not Corsica) in exchange for Achaea, and the former was then governed by a *legatus pro praetore;* but Vespasian took it over again before **A.D.** 78, and placed it under an imperial procurator as praefectus. It returned to the senate, not before **A.D.** 83 but certainly before the reign of M. Aurelius, when we find it governed by a proconsul, as it was under Commodus; the latter, or perhaps Septimius Severus, took it over again and placed it under a procurator as praefectus once more. A bronze tablet discovered in 1866 near the village of Esterzili is inscribed with a decree of the time of Otho with regard to the boundaries of three tribes, the Gallienses, Patulienses and Campani, who inhabited the eastern part of the island. Caralis was the only city with Roman civic rights in Sardinia in Pliny's time (when it received the privilege is unknown). A Roman colony had been founded at Turris Libisonis (Porto Torres) and others, later on, at Usellis and Cornus. We hear little of the island under the empire, except as a granary and as remarkable for its unhealthiness and the audacity of its brigands. It was often used as a place of exile. (**MA.** P.)

Vandal and Byzantine Rule. — After they had crossed over into Africa from Spain in 429 the Vandals occupied Sardinia in 456 and held it till its conquest in 534 by the Byzantines under Duke Cyril. Apart from an attempt to retake the island made in 468 by Marcellinus under the emperors Leo I (of the east) and Anthemius (of the west), the Vandal rule was pacific. It allowed of a period of cultural revival, largely motivated by the enforced residence for about 20 years at Cagliari of 120 North African bishops, who had been banished by King Thrasamund. Among the exiled bishops were St. Fulgentius and the bishop of Hippo, who had brought with him the relics of St. Augustine, which were recovered in 720 by the Lombard king Liutprand and taken to Pavia.

The "African" cultural renaissance in Sardinia is testified by the remains of the monastery built by Fulgentius near the basilica of S. Saturnino, Cagliari, as well as by the code of St. Hilary in the capitular library of St. Peter, Rome, and in the Laudian manuscripts of the Bodleian library. Oxford.

Under the Eastern Roman empire Sardinia was one of the seven provinces of the prefecture of Africa of the praetorium. It was under a *praeses* for civil affairs and a ***dux*** for military. In the

8th century the two posts were held successively by the same person. In 552–553 the island was occupied by the Goths under Totila. but after the end of Gothic rule in Italy, Sardinia long remained under the Eastern empire. Letters from Gregory the Great written at the end of the 6th century denounce Byzantine misgovernment and give evidence of pressure being exercised by the Lombards on the Sardinian coast. A Greek inscription found at Portotorres in 1927 shows that this pressure persisted in the early 8th century. when the first Arab attempts to conquer the island (711) were made. These vain attempts were repeated throughout the 8th century and. with greater persistence, in the 9th, when the Arabs sought to take advantage of the extreme difficulty of communication between Byzantium and the island resulting from their capture of Sicily in 827–31. The defense was entrusted to. and stubbornly prosecuted by, the islanders themselves. probably under local leaders, and an autonomous government was set up, at first *de facto* and later *de jure,* when the island was divided into four districts (*giudicati*). Einhard records that in 815 the Sardinians sent ambassadors to the emperor Louis the Pious to seek an alliance against the common enemy. In 851 Pope Leo IV requested the Sardinians to send forces to garrison Rome against the Arabs.

The Giudicati and Italian Influence. — The four Sardinian *giudicati* of Cagliari. Arborea. Torres and Gallura appear clearly defined territorially and politically only in the 11th century, after the defeat in Sardinian waters in 1016 of the Arab chief Mugajd by combined Sardinian. Pisan and Genoese forces. From that time Sardinia became a field for expansion for these republics, as well as for Marseilles and Gaeta, and was opened to the monastic immigration encouraged by the Roman see, which now claimed sovereignty over the island. Of the many competitors for its exploitation: Pisa and Genoa were the most successful and, through alliances with the *giudici,* secured politico — mercantile zones of influence — Pisa mostly in the north and west, Genoa in the south and east. Pisa got for her own archbishop the right to the apostolic legation and the primacy of Sardinia and Corsica. Subsequently Genoa, to counteract its rival, subsidized Barisone I, *giudice* of Arborea, to enable him to acquire for himself the investiture of the whole *Regnum Sardiniae.* This attempt failed, Barisone was arrested for bankruptcy and the *regnum* was granted to Pisa by Frederick Barbarossa. The peace of 1169 brought about a temporary truce between the two republics, soon broken by dissensions among the *giudici,* who sought help and protection now from one of the two city-states: now from the other. The *giudicato* of Cagliari passed through marriage to Pisan families (Massa, Visconti. Donoratico) and finally to the same republic that provided the capital with the notable fortifications that still stand. The *giudicato* of Torres passed from the protection of Pisa to that of Genoa until the marriage of Adelasia, heiress of Gallura and Logudoro, *en seconde noce* to Enzio of Hohenstaufen, natural son of Frederick II. Enzio took the title *rex Sardiniae* but, as he was imprisoned by the Bolognese in 1249, his rule was carried on by vicars. With the battle of Meloria (1284) the influence of Pisa was limited to the districts of Cagliari and Gallura; Genoa controlled the other districts. also through its noble families (Spinola, Malaspina, Doria). Throughout the 11th, 12th and 13th centuries. however, Pisan influence predominated. in the arts almost exclusively, as shown by the many churches built at this time. especially the basilicas of S. Gavino, Portotorres, and Sta. Maria! Xrdara. Important documents on the economic life of the period survive in the *condaghe* or patrimonial registers of ecclesiastics, drawn up in the vernacular. with annotations concerning income and expenditure and property titles.

Aragonese Domination. — In 129j Boniface VIII granted to James II of Aragon the *Regnum Sardiniae et Corsicae,* but Sardinia was effectually conquered by the Aragonese only in 1326, with the help of the *giudicato* of Arborea, which! however, kept its independence and defended itself strenuously against the same Aragonese throughout the 14th century. A war that broke out about 1350 between the *giudice* Mariano IV and King Peter IV of Aragon was won by the latter. who. at the first extraordinary meeting of parliament received from Mariano an oath of fealty (1355). A few years later war was started again by Mariano and carried on heroically by his daughter, Eleonora of Arborea, who signed a new peace treaty with King John I of Aragon (1386). After the death of Eleonora (1404) the *giudicato* was reduced to a fief of Aragon (1410) and. after a last vain attempt at insurrection had been suppressed at the battle of Macomer (1478), brought wholly under the Aragonese crown. Under Aragonese rule, and then under that of Spain. the feudal regime was restored: the administration was unified and placed under a viceroy residing at Cagliari. A Sardinian parliament with three branches (stamenti) — military, ecclesiastical and royal — was set up. Despite the provisions extended by hlphonso V of Aragon to the whole island for the observance of the code of rights promulgated by Mariano IV of Arborea and perfected by Eleonora (1392) — the *Carta de Logu* (university library. Cagliari) — the island's economy. flourishing under the *giudici,* declined. The population, oppressed by taxation, decreased and the island fell into a state of lethargy. (R. Du.)

Modern History. — Sardinia remained a Spanish province until the War of the Spanish Succession. In 1708 Cagliari was bombarded by an English fleet and on its capitulation the island became Austrian. The supreme council of the island was immediately transferred from Madrid to Vienna and Austria was confirmed in possession by the Treaty of Utretcht in 1713. Cardinal Giulio Alberoni, Philip V's minister, hoped to make Sardinia a jumping-off point for the recapture of Spain's former Italian possessions, and in 1717 he dispatched a squadron from Barcelona which recaptured the island. The victory was, however, short-lived. In 1720 by the Treaty of London the Quadruple Alliance united Sicily to Naples under Austrian rule and compensated Victor Amadeus II of Savoy for his loss of Sicily by making him king of Sardinia.

The house of Savoy took an interest in their new kingdom and sought to establish their authority over the feudal nobles and over the church. In 1726 Pope Benedict XIII confirmed the king in the right of presentation to bishoprics and yielded the papal prerogative of investiture to the crown. Throughout the 18th century efforts were made to improve the social and economic conditions of Sardinia: schools in Italian were started in order to link the island more closely with the mainland, empty lands were repopulated with Piedmontese, Ligurians and Corsicans, agriculture was encouraged, the salt pans improved, and some revival of old industries and the introduction of new ones were attempted. In 1793 the French attacked Sardinia and bombarded Cagliari, but were repelled by the islanders. The *stamenti* then presented a memorandum to the king asking for a measure of local autonomy and the opening of all posts. except that of viceroy, to all citizens. Their request was rejected but the movement which it represented found support in a popular revolt rising out of the economic discontent of the people. The revolt lasted for about two years, but faded out on the flight to France of the popular leader, Gian Maria Angioj. In 1799 Charles Emmanuel IV took refuge in Sardinia after his expulsion from Piedmont by the French. His successor Victor Emmanuel lived in Cagliari from 1806 till 1814, when he left his brother Charles Felix there as viceroy. During the next tuo years Charles Felix embarked on various reforms affecting agriculture. taxation, public health and the administration of justice, but it was Charles Albert who took real account of Sardinia's needs. In 1835 he abolished feudal rights, and, though in practice some continued to exist, the ensuing division of seignorial lands among private owners and communes formed the basis of the 19th and 20th century agrarian economy of Sardinia. Charles Albert sought to improve administration and finance, to reform the army. to establish charitable institutions, to improve schools, to open up roads, to improve communications with Genoa and Turin, and in general to spread the language and culture of the mainland. In 1847, at the request of the *stamenti,* Sardinia was united to the other provinces of Piedmont with the same standing in the kingdom; this position was confirmed by the *statuto* of 1848 and Sardinians sat in the Piedmontese parliament. The islanders played an active part in the Italian struggle for unity and independence, and from 1861 Sardinia formed a part of the kingdom of Italy.

On the outbreak of war between Italy and the Allies in 1940 Sardinia had a garrison of between 200,000 and 250,000, including the 9th German motorized division. The island's airfields were used as bases for attack in the Mediterranean. In 1943 Allied air attacks on the island began and increased in intensity as the time for the invasion of Sicily drew near. The Germans had increased the number of air squadrons in Sardinia, but in July Allied air attacks made many airfields unusable. The Allies had expected that a serious attack might have to be made on Sardinia, but early in Oct. 1943 Winston Churchill noted that on Sept. 19 it had fallen as a mere incident in the Italian campaign. It was occupied by a small number of Allied troops, some anti-Fascist exiles returned, and in a short time life had returned more or less to normal.

THE PEOPLE

The census of Nov. 1951 showed that Sardinia had a population of 1,276,023, an increase of 23% on the figure for 1936 (Italy 10.5%). The density of population is 136.2 per sq.mi. (Italy 408.6); in the northeast province of Nuoro it is only 91.5. Apart from the small mountain region of the Valle d'Aosta (74.7 per sq.mi.), the low regional figure was equalled only in the Trentino-Alto Adige. As in Sicily, the vast majority of the people live in compact villages and small towns, mostly in settlements containing 1,000–2,000 people; there are few towns of any size, only one, Cagliari (pop. 1951, 127,381), with more than 100,000 inhabitants.

The birth rate fell from 28.3 per 1,000 in 1936 to 25.7 in 1952 (Italy 18.0), the death rate also fell from 14 to 9, so that the natural increase in 1952 was 16.7 (Italy 7.9). The rate of infant mortality fell to 69 per 1,000 live births in 1951, a great improvement on 89 in 1936 but still very high compared with rates of 41 in Tuscany and 45 in Emilia-Romagna. It was estimated that before the systematic attack on the anopheles mosquito made by British, U.S. and Italian experts in 1947–48 more than 190,000 people were seriously affected by malaria and that 2,000,000 working days were lost annually through the disease. By 1952 there were scarcely any new cases and the number of recrudescent cases was very small. But tuberculosis remained a scourge; in 1952 the death rate was 782 per 1,000,000 of the population, the only region with a higher rate being Trentino-Alto Adige with 849 (Italy 613). The high incidence of infant mortality and of tuberculosis and other diseases like trachoma is undoubtedly connected with poverty and with the unhygienic living conditions which are particularly bad in the remote rural settlements.

Government. — Sardinia is one of the five regions on which a special form of local self-government was conferred by the Italian constitution of 1948 (see also SICILY: Government); the regional statute was adopted by an Italian constitutional law in Feb. 1948. Some measure of local self-government existed after the late summer of 1943, when Sardinia was occupied by the Allies, mainly because the island was cut off from the mainland of Italy and to a great extent left to its own resources. A sense of the need to establish definite contact led the Italian government in March 1944 to appoint a high commissioner for the island, as had been done in Sicily in January, and regional autonomy was granted to Sardinia by an amendment to the Sicilian statute of May 15, 1946.

As in Sicily, the administration of Sardinia was put in the hands of the president of the region, the elected regional assembly, and the giunta, the executive committee of the assembly, the state retaining control of justice, communications and the armed forces. But the assembly's legislative powers are less extensive than those of the Sicilian assembly. The Sardinian assembly was not given authority to legislate on educational matters, it can only "adapt the provisions of the national laws to its particular needs" in every grade of education, nor has it exclusive power, like the Sicilian assembly, to legislate on all questions concerning agriculture, land reclamation. industrv and commerce. In fact. in view of the extreme poverty of Sardinia and of the great need for agrarian reform (see below), it was very important that the statute contained a special provision for the drawing up of a plan by the state and the region together for the economic and social reconstruction of Sardinia. The important executive function of maintaining public order was not (as it was in Sicily) conferred by the statute on the president and the giunta. The Italian government may delegate to the region the right to safeguard public order, in which case this function will be exercised by the president within the limits of directions laid down by the national government.

The president is elected by the assembly from among its members, represents the region, promulgates its laws and together with the *giunta* constitutes the government. He has the right to attend meetings of the Italian council of ministers and to speak though not to vote when Sardinian affairs are discussed, but he does not, like the Sicilian president, hold the rank of minister.

The financial provisions of the statute are framed with regard to the island's poverty. In addition to the proceeds of local taxation, to be raised in conformity with national principles, Sardinia receives a definite proportion of certain state taxes; *e.g.*, nine-tenths of the taxes of lands and buildings in the region and of the taxes on state monopolies. The region also receives rents paid for hydroelectric concessions, and the state has undertaken to make special grants for particular projects of public works and land improvement.

The first regional assembly was elected in May 1949. There are three provinces, Cagliari, Nuoro and Sassari.

ECONOMIC CONDITIONS

Agriculture. — More than half the employed population of Sardinia is engaged in agriculture, and most of the total area of the island is covered by agricultural and forest land. In general, the agrarian economy has remained unchanged for centuries; a certain amount of cereals is grown, but the chief source of livelihood is livestock. Arable farming is regarded mainly as an adjunct to pastoral, and the land is often only plowed to improve the grazing; tree culture (chiefly vines and olives) is confined to a few limited coastal zones and to the areas lying immediately round the centres of habitation. In 1952 48% of the agricultural and forest land was rough permanent pasture (Italy 14.4%), 27.8% arable (Italy 47.3%) and only 3.5% under tree crops (Italy 8.8%). Even in the naturally fertile Campidano most of the land is divided between permanent grazing and arable alternating with grazing.

More than half the farms are 3 ha. ($7\frac{1}{2}$ ac.) or less, more than a quarter under 1 ha., and they often lie far from the towns and villages in which 92% of the people live. The consequent difficulty of farming tlie land well is aggravated by these small farms, being broken up into numerous tiny strips often lying several miles apart and interspersed with bits of other properties. Large estates are few in number and consist mainly of rough pasture and forest. In 1939 only 4.3% of the agricultural income of Sardinia came from estates with an income of over 80,000 lire. Agriculture is dominated by the pathological splitting up of property, by extreme poverty of mobile capital and by very limited investment in farming. There is practically no mechanized cultivation and primitive methods of shallow plowing are still practised; a wooden plow pulled by an ox can still be seen working alongside an iron plow drawn by a horse.

The higher regions produce cork trees, oaks, pines, acacias and sweet chestnuts, but there are only a few remote places where these trees have survived in any numbers the depredations of 19th century speculators and the attacks of the huge herds of sheep and goats. Some effort was made in the 1930s to increase the forest area, chiefly with holm-oak coppices, but reafforestation is made difficult by drought and wind, and the planting of young trees gave way to the slower process of seeding. The most important non-forest tree is the olive. The climate is suited to olive trees, which grow at altitudes up to 2,300 ft., and even a little higher in sheltered valleys, and produce good quality oil particularly in the northwest.

Crops. — Little more wheat is grown than is needed for home consumption, and it is mostly hard wheat which can stand the long dry summers. The yield is low, 9.8 quintals (1 quintal = approx. 225 lb.) per hectare in 1952 (average 16.8 for Italy, 31.3 for Lombard~), and could be raised not only by the use of selected seed, chemical fertilizers and machinery, but by improving the milling which in some districts is still done with grindstones turned by donkeys. Barley does well, and some is grown for fodder, but its yield is also low. Vines can be grown at altitudes up to 3,000 ft.,

but most vineyards are on the edge of the lowlands. Output is small (616,000 hl. in 1952) partly because most of the wines produced have poor keeping qualities, partly because of the lack of storage cellars.

Livestock.—The principal source of wealth is livestock. sheep and goats; Sardinia has more of both than any other region, and nearly a quarter of all the sheep and goats of Italy. The number of cattle compares reasonably well with the average for Italy, the ratio to the population in 1952 being 16.5% compared with 18.4% for Italy. Cattle are mainly bred for work: the local crossbreeds, Sardo-Modicana and Bruno-Sardo. give poor yields of milk but are good workers. Sheep produce the milk from which large quantities of cheese are made and exported to North America and France as well as to the Italian mainland. Mutton is less important, but Sardinian lamb is in demand on the mainland. The wool is coarse in quality. but makes a strong cloth impervious to wet.

Land Reform —In 1940 the Italian government had plans for land reclamation covering about one-third of the island's total area; work had been carried out on a small scheme involving about 54.000 ha. mostly in the marshy Campidano, which was known as one of the plague spots of Italy. The new agricultural settlements of Mussolinia (now Arborea) and Terralba were established and mixed farming on north Italian lines was carried on by settlers from north Italy on farms of 20 ha. each. By 1948 good results were being obtained. The wheat yield averaged 1 j quintals per hectare compared nith Sardinia's average of 8 or 9 quintals, the breed of cattle had improved and from vines grown on the surrounding hills good wines were being produced and exported. Italian agricultural experts knew, however. that not only would the Italian state have to finance any plan of reform. but skilful persuasio would be needed to overcome the obstinate refusal of Sardinian farmers to accept suggestions from outside, particularly if it involved reduction in the size of their flocks and herds and a change from extensive to intensive farming.

Fisheries.—Tunny fishing is of some importance, but is not carried on by Sardinians, who have no liking for the sea, but by Sicilians.

Industry. — The mining industry of Sardinia is of great antiquity. there are workings dating from the Bronze Age, and mining was carried on later by the Phoenicians, the Romans and by the Pisans in the middle ages. The most important minerals now mined are zinc and lead of which Sardinia supplies about 80% and 93% respectively of Italy's production, but antimony, copper, iron, manganese. molybdenum. nickel, cobalt and tin are also mined in small quantities. The chief lead and zinc mines are in Iglesiente in the southwest and much of the smelting is done in the island. There are two coal fields, one in Sulcis in the southwest, around Carbonia, uhere about 1,000,000 tons of coal of poor quality with a high sulphur content are mined annually. The other field in Seui. near Tortoli on the east side of Sardinia, produces better quality coal. but only about 50,000 tons a year. After Italy lost the Istrian coal fields to Yugoslavia under the 1947 treaty, Sardinia produced most of Italy's coal, but the quality is too poor for it to be much used in industry. The granite of Sardinia is used locally and exported. The salt pans at Cagliari and Carloforte are important.

Communications and Ports. — Sardinia is reasonably well-served by railuays. State railway lines of normal gauge connect Terranova with Cagliari, with Porto Torres and Sassari via Chilivani, and with Iglesias via Decimomannu. Narrow-gauge lines run from Tortoli and Sorgoni to Cagliari. from Nuoro via Macomer to Bosa and via Ozieri to Chilivani, and from Palau to Sassari and Alghero, and there are also private lines connected with the mines. There are four main north-south roads and four east-west.

There are few seaports. but some of them have excellent natural harbours. The three chief commercial ports are Cagliari, Terranova Pausania and Porto Torres. Cagliari's harbour is entirely artificial. and the port oues most of its importance to the proximity of the lead and zinc industry and to the export of salt. Terranova handles the bulk of the mail and passenger traffic with Italy. Porto Torres, which lies at the western end of the north coast on the gulf of Asinara, is the port of export for Sassari, the second town in Sardinia, and for iron ore from the mines in Nurra. At the northeast end of Sardinia a group of islands shelter the naval station of La Maddalena, on the south coast of the island of the same name and connected by a causeway with the island of Caprera, famous as the home of Giuseppe Garibaldi. (M. M. C.)

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SARDIS, more correctly SARDES (αἰΣάρδεις), the capital of the ancient kingdom of Lydia. the seat of a *conventus* under the Roman Empire. and the metropolis of the province Lydia in later Roman and Byzantine times. was situated in the middle Hermus valley, at the foot of Mt. Tmolus. a steep and lofty spur of which formed the citadel. It was about 2½ mi. south of the Hermus. The earliest reference to Sardis is in Alcman (Bergk, *Fr.* 24, *c.* 650 B.C.); in the Iliad the name Hydē seems to be given to the city of the Maeonian (*i.e.*, Lydian) chiefs. and in later times, Hydē was said to be the older name of Sardis, or the name of its citadel. It is, however, more probable that Sardis was not the original capital of the Maeonians, but that it became so amid the changes which produced the powerful Lydian empire of the 8th century B.C. The city was captured by the Cimmerians in the 7th century, by the Persians and by the Athenians in the 6th, and by Antiochus the Great at the end of the 3rd century. Once at least, under the emperor Tiberius. in A.D. 17, it was destroyed by an earthquake; but it was always rebuilt, and was one of the great cities of Asia Minor till the later Byzantine period. As one of the Seven Churches of Asia, it was addressed by the author of the Apocalypse in terms which seem to imply that its population was notoriously soft and faint-hearted. Its importance was due, first to its military strength, secondly to its situation on an important highway leading from the interior to the Aegean coast, and thirdly to its commanding the wide and fertile plain of the Hermus.

The early Lydian kingdom was far advanced in the industrial arts (see LYDIA), and Sardis was the chief seat of its manufactures. The most important of these trades was the manufacture and dyeing of delicate woollen stuffs and carpets.

In the Hellenistic and Roman periods Sardis was eclipsed by Pergamum (the Attalid capital), by Ephesus (the capital of the province of Asia) and probably also by Smyrna. After Constantinople became the capital of the east a new road system grew up connecting the provinces with the capital. Sardis then lay rather apart from the great lines of communication and lost some of its importance. It still, however, retained its titular supremacy and continued to be the seat of the metropolitan bishop of the province of Lydia, formed in A.D. 295. It is enumerated as third, after Ephesus and Smyrna, in the list of cities of the Thracesian *thema* given by Constantine Porphyrogenitus in the 10th century; but in the actual history of the next four centuries it plays a part very inferior to Magnesia ad Sipylum and Philadelphia (see ALASEHIR), which have retained their pre-eminence in the district. The Hermus valley began to suffer from the inroads of the Seljuk Turks about the end of the 11th century; but the successes of the Greek general Philocales in 1118 relieved the district for the time, and the ability of the Comneni, together with the gradual decay of the Seljuk power, retained it in the Byzantine dominions. The country round Sardis was frequently ravaged both by Christians and by Turks during the 13th century. Soon after 1301 the Seljuk amirs overran the whole of the Hermus and Cayster valleys, and a fort on the citadel of Sardis

was handed over to them by treaty in 1306. Finally in 1390 Philadelphia, which had for some time been an independent Christian city, surrendered to Sultan Bayezid's mixed army of Ottoman Turks and Byzantine Christians, and the Seljuk power in the Hermus valley was merged in the Ottoman empire. The latest reference to the city of Sardis relates its capture (and probable destruction) by Timur in 1402. Its site is now practically deserted.

The ruins of Sardis, so far as they are now visible, are chiefly of the Roman time; but though few ancient sites offered better hope of results, the necessity for heavy initial expenditure was a deterrent (*e.g.*, to H. Schliemann). On the banks of the Pactolus two columns of a great Ionic temple, now known to be that of Cybele-Artemis were still standing. More than one attempt to excavate this temple, the last by G. Dennis in 1882, was made and prematurely brought to an end by lack of funds. In 1910–1914 and also in 1922, the temple site and part of the necropolis were studied by H. C. Butler and others, of the American Society for the Excavation of Sardis.

See reports in *Am. Journal of Archaeology*, 1911–27, and the volumes of *Sardis*, especially I. and II. (H. C. Butler) on the history of the excavations down to 1914, and VI. pts. 1–2 (E. Littmann-W. H. Buckler) on the Lydian inscriptions; results and bibliography in Pauly-Wissowa R. *Enc.* XIII. 2123 f. (Biirchner-Deeters-J. Keil); for the city's history in early Christian times, W. M. Ramsay, *Letters to the Seven Churches* (1904), V. Schultze, *Altchristliche Stadte* II. 2,145 f. (1926).

SARDOU, VICTORIEN (1831–1908), French dramatist, was born in Paris on Sept. 5, 1831. The Sardous were settled at Le Cannet, a village near Cannes, where they owned an estate, planted with olive trees. A night's frost killed all the trees and the family was ruined. Victorien's father, Antoine Léandre Sardou, came to Paris, and earned his living in a succession of employments. Victorien had to make his way as best he could. A play of his, *La Taverne des étudiants*, produced at the Odeon on April 1, 1854, was withdrawn after five nights. Many disappointments followed; some plays were rejected, others were accepted and not performed.

Sardou was now in actual want, and his misfortunes culminated in an attack of typhoid fever. He was dying in his garret, surrounded with his rejected manuscripts. A lady named Mlle. de Brécourt nursed him back to health, and introduced him to Mlle. Déjazet. Then fortune began to smile on the author. It is true that *Candide*, the first play he wrote for Mlle. Déjazet, was stopped by the censor, but *Les Premières Armes de Figaro*, *Monsieur Garat*, and *Les Prés Saint Gervais*, produced almost in succession, had a splendid run, and *Les Pattes de mouche* (1860: afterwards anglicized as *A Scrap of Paper)* obtained a similar success at the Gymnase. *Fédora* (1882) was written expressly for Sarah Bernhardt, as were many of his later plays. He soon ranked with Augier and Dumas. He ridiculed the vulgar and selfish middle-class person in *Nos Intimes* (1861: anglicized as *Peril)*, the gay old bachelors in *Les Vieux Garçons* (1865), the modem Tartufes in *Séraphine* (1868), the rural element in *Nos Bons Villageois* (1866), old-fashioned customs and antiquated political beliefs in *Les Ganaches* (1862), the revolutionary spirit and those who thrive on it in *Rabagas* (1872) and *Le Roi Carotte* (1872), and the then threatened divorce laws in *Divorçons* (1880).

He struck a new vein by introducing a strong historic element in some of his dramatic romances. Thus he borrowed *Theodora* (1884) from Byzantine annals, *La Haine* (1874) from Italian chronicles, *La Duchesse d' Athènes* from the forgotten records of mediaeval Greece. *Patrze* (1869) is founded on the rising of the Dutch *gueux* at the end of the 16th century. The scene of *La Sorcikre* (1904) was laid in Spain in the 16th century. The French Revolution furnished him with three plays, *Les Merveilleuses, Thermidor* (1891) and *Robespierre* (1902). The last named was written expressly for Sir Henry Irving, and produced at the Lyceum theatre, as was *Dante* (1903). The imperial epoch was revived in *La Tosca* (1887) and *Madame Sans Gêne* (1893). Later plays were *La Piste* (1905) and *Le Drame des poisons* (1907).

Sardou married his benefactress, Mlle. de Brécourt, but eight years later he became a widower, and soon after the revolution of 1870 was married again, to Mlle. Soulié. He was elected to the French Academy in 1878. He died at Paris on Nov. 8, 1908.

See L. Lacour, *Trois théâtres* (1880); Brander Matthews, *French Dramatists* (New York, 1881); R. Doumic, *Ecrivains d'aujourd'hui* (Paris, 1895); F. Sarcey, *Quarante ans de théâtre* (vol. **vi.**, 1901).

SARGASSO SEA, a relatively still tract in the central North Atlantic ocean strewn with floating seaweed of the genus *Sargassum* (originally named *Sargaço* by the Portuguese). This tract, bounded approximately by 20° and 35° N. and 30° and 70° W., is roughly elliptical and lies inside of a clockwise setting current system of which the Gulf stream forms part of the western rim. The precipitation is low, evaporation is high and winds are light. Its waters are remarkably clear, warm and saline. *Sargassum*, or gulfweed, belongs to the brown algae and bears small but prominent berrylike bladders *(see* ALGAE: *Classification of Algae: Phaeophyta)*. The pelagic weed drifts with wind and current but apparently maintains itself vegetatively with possibly minor replenishment by coastal plants drifting in from the southwest. The weed supports specialized animals of a type more characteristic of the littoral zone than the open ocean. some of which are found nowhere else. The Sargasso sea was first reported by Columbus who crossed it on his initial "West Indies" voyage; however, Columbus implies in the journal of his first voyage that he had evidence of earlier voyagers through the area and the seaweeds therein, and it is possible that the Carthaginians reached the Sargasso sea as early as 530 B.C. The widely credited story of ships becoming helplessly embedded in the weed has been disproved. The "Michael Sars" oceanographic expedition in 1910 helped delimit the weed area and provided new evidence that the Sargasso sea was the spawning ground of the common eel.

(C. A. Bs.)

SARGENT, JOHN SINGER (1856–1925), Anglo-U.S. painter, was born of American parents in Florence, Italy, on Jan. 12, 1856. Sargent's portraits enjoyed the highest possible reputation during his lifetime, but fell into great disfavour after his death. His work has since been re-evaluated and restored to a position of high esteem. The scintillating bravura of his technique disarmed his contemporaries; his imitators. who saw only the surface aspect of his painting. were sadly lacking his perception, with the unfortunate result that Sargent too was accepted as nothing more than a flashy technician. He had, however, an extraordinary facility for revealing the inner aspects of his sitters' personalities, far exceeding that of any of his followers.

Sargent's father, Fitzwilliam Sargent, a native of Massachusetts, went for his medical training to Philadelphia where he married Mary Newbold Singer. Two years before Sargent's birth his parents went to Europe, a trip which culminated in their permanent establishment abroad.

Sargent showed his special aptitudes from his earliest childhood. which was spent in Nice, Rome, Dresden and other parts of Europe with periodic returns to Florence. He took drawing lessons of a desultory kind, interrupted by the exigencies of schooling and a life of constant travel. His mother, who loved to sketch in water colours, recognized and encouraged his unusual gifts.

Sargent's awakening to the enchantment of visual expression came to him. he once mentioned. at Miirren, Switz., in the summers of 1868 to 1870. His early drauings were painstaking efforts to show every variation in rock forms, or in the verdure that sprang from their crevices. In 1873 he won a prize for drawing at the Florence Accademia. In 1876 he visited the United States for the first time and established his U.S. citizenship.

Sargent's formal art training was received in the Paris studio of Carolus Duran and at the École des Beaux-Arts. His first exhibited work was a portrait of Miss Frances Watts, a neighbour at Nice, at the 1877 Salon.

Sargent himself later declared, perhaps with characteristic modesty, that he was by no means a brilliant pupil, and that he only acquired his amazing technical skill by continued concentrated effort. What he did recognize, with instant appreciation and lifelong acknowledgment, was the scientific precision of the method taught by Duran, who had based his theories on a close study of

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DETAIL OF THE CHILD FROM "DAUGHTERS OF EDWARD D. BOIT" BY JOHN SINGER SARGENT. IN THE MUSEUM OF FINE ARTS, BOSTON, MASS.

Frans Hals and Velázquez. Sargent made this technique his own, and it gave him, at the start, the assured mastery of his materials.

His second picture, "En route pour la Pêche" (Corcoran gallery, Washington, D.C.), exhibited in the Salon of 1878, won an honourable mention. The following year he exhibited a portrait of Duran, which he had painted in 1877 at the age of 21, which was instantly acclaimed. Shortly after, he made a pilgrimage to Spain, producing in the Prado gallery various studies which, after his death, were sold at phenomenal prices. On returning from Spain he showed the influence of Velázquez. "El Jaleo" (Fenway court, Boston) was a dramatic rendering of a Spanish café scene. More penetrating in its psychological insight was the "Pailleron Children," son and daughter of Édouard Pailleron, the poet and playwright. In Venice in 1880 he had a studio in the Palazzo Rezzonico and painted the tragically beautiful portrait "Mrs. Charles Gifford Dyer" (Art institute, Chicago) and his Chilean friend Señor Subercaseaux in a gondola. Criticized for "its four corners and a void," the "Daughters of Edward Darley Boit," painted in 1882, was a truly remarkable achievement in asymmetrical balance. Henry James, who praised the picture, said the artist had done "nothing more felicitous."

Among his friends in Nice was the English essayist and novelist Violet Paget (Vernon Lee) whose brilliantly conceived portrait (Tate gallery, London) Sargent did in 1881. Another of the Nice group was Ben del Castillo, a Cuban-American, through whom Sargent met Virginie Avegno from Louisiana, who had come to Paris, married Pierre Gautreau and become a celebrated figure in French society. He painted a full-length portrait of her (Metropolitan Museum of Art, New York city) in a black evening gown, daringly décolleté, contrasting with what he called her "lavender or blotting-paper colour" skin. When shown at the 1884 Salon criticism by both the press and the Gautreau family led Sargent to remove the picture to his studio where it remained as "Madame X" until 1915. Sargent decided to try his luck in London, spent the summer in England and bought the studio of James A. Whistler in Chelsea.

In England he painted the Vickers, Robert Louis Stevenson and an enchanting children's group, "Carnation, Lily, Lily, Rose," shown at the Royal Academy, London, in 1887 and bought for the Tate gallery.

In 1887 he again visited the United States, primarily to paint Mrs. Henry Marquand at Newport, R.I., and Mrs. Adrian Iselin in New York. While in Boston he painted an exacting portrait of Mrs. Jack Gardner. At the St. Botolph club. Sargent had his first one-man show in the United States. In 1890 he was commissioned to do the frieze of the prophets for the Boston Public library. Extensions of this commission kept him busy with the library murals until 1919. In Dec. 1890 he went to Egypt to gather information about ancient religion as background material for the Boston murals, and while in Cairo he painted the "Egyptian Girl," his only full-length female nude. In 1889 Sargent was made a chevalier of the Legion of Honour, in 1891 an associate of the National Academy, New York, and in 1894 an associate of the Royal Academy of London. In 1897 he became an officer of the Legion of Honour and a full academician in both New York and London. His portrait of the noted Spanish dancer Carmencita, painted in New York in 1890, was acquired for the Luxembourg museum in Paris.

Sargent numbered among his sitters princes and princesses, musicians, actors. teachers, uriters, statesmen and diplomats. The great group portraits of the duke of Marlborough and his family (1905), the Ladies Acheson (1902), the daughters of the Hon. Percy Wyndham (1900), the Misses Hunter (1902); a noble series of single portraits, notably those of the duke and duchess of Connaught (1908), the duke (1901) and duchess of Portland (1902), Lord Russell of Killowen (1900) and Francis Penrose, Esq. (1898); and the portraits of innumerable beautiful women, the duchess of Sutherland (1904), the countess of Warwick (1904), Lady Agnew (1893), Lady Ian Hamilton (1896) and Mrs. Hammersley (1893), increased his ever-growing prestige. It became a distinction to be painted by him, and hundreds clamoured for the honour. Universities offered him degrees and he won many medals and awards. Unmoved by this acclamation, which included the offer of an English knighthood, he retained the serene simplicity of manner that made him so exceptional and so distinguished a figure.

Sargent was never a popular painter, in the sense of being generally understood. Painting is a language not easily read; its apparent simplicity and directness of appeal are misleading. Pictures as brilliant, uncompromising and authoritative in their presentation of character as Sargent's inevitably awakened much resentment along with admiration. His accomplishments were no less inscrutable for being so frank in expression. They became more tantalizing because they looked so amazingly easy to imitate. Sargent was imitated. but never with distinction. Referred to as a psychologist or a satirist, he was accused of deliberately accentuating the less pleasing qualities in his sitters. "I chronicle," he once said, "I do not judge." Though his outlook on life was essentially indulgent, his sense of humour was irrepressible, and the rectitude of his realism struck at the deep-rooted preference of humans to be seen not as they are but as they should like to be.

Sargent painted what he saw, but he caught. subconsciously perhaps, fugitive betrayals of passing thought: a restless movement, a smile, a glance. This subtle power of definition has been, in all ages, the peculiar gift of great portrait painters. The astonishing variety and scope of his work implies that he was almost indifferent to the form in which he worked. Before the strange, the unexpected, the bizarre, his resource and his freshness were unfailing. No invention was permitted to degenerate into a formula; he never repeated himself.

At the height of his fame, in 1910, he decided to give up the painting of portraits; having grown tired of the tyranny of sitters, he had begun to lose interest in his work. This decision was typical of his artistic integrity. Only in exceptional instances was he afterward induced to paint portraits. He was never wealthy, though he lived on a generous scale, and was always ready to help a student or artist. Deliberately, he avoided the scattering of his energies; an omnivorous reader. a passionate musician. an excellent host and an entertaining guest, he found his leisure all too adequately filled.

During his first summer of freedom, in a holiday spirit. he began to play with water colour, the medium in which he had done his earliest work. The results may be seen in the brilliance, lightness and certainty of touch of the 80 sketches bought by the Brooklyn museum.

In 1916, when the Boston library murals were nearly done, he was commissioned to do the rotunda of the Boston Museum of Fine Arts, and in 1922 he painted two murals for the Widener library at Harvard University. As a man of 60 living in a rapidly changing world, Sargent did not have the vision to accomplish

the two last tasks in a manner adequate to the times. Thus his mural work which had at first widened his reputation now served to weaken it.

A quieter life in London was better suited to Sargent's temperament than the social exactions of Boston. In London he was to know an honour no living painter had ever experienced: a magnificent series of his portraits, bequeathed to the nation by Asher Wertheimer. were hung in the National gallery. It was later placed in a wing in the Tate gallery along with other works by Sargent — the portraits of Lord Ribblesdale (1902), Coventry Patmore (1895), Octavia Hill (1899), the actress Ellen Terry as Lady Macbeth (1899) and others. Sargent is represented in the principal galleries oi the world. but the Metropolitan museum in New York and the Boston Museum of Fine Arts are particularly rich in fine examples.

In surveying Sargent's immense achievement. the most striking characteristic is his extraordinary vitality. The beautiiul suavity of his style. acquired through the discipline of years. never lost its spontaneity. He shirked no labour; he would paint a head 20 times over in order to establish an appearance of fluency and ease. His insight into character m-ent far beyond ordinary perception. either of artists or of laymen; at its best it was as miraculous as his technical skill. He was entirely lacking in sentimentality; he never painted a beauty or charm that was not in direct relation with his subject. This severity was his strength in contradistinction to much art of the period which perpetuated the worship of purely irrelevant sweetness.

Subjects mere drawn from every class oi society. In their variety. boldness and wit, and in the distinction of their presentation, they epitomize his age. The human panorama. in its every maniiestation, he found endlessly diverting. Delineating it as he did with uncompromising directness. his work, in its unflinching yet happy realism, bears the stamp of truth.

A tall commanding presence. nith a close-cut beard at a time when nine men out of ten were clean-shaven he made an instant impression upon those who met him. During the last years of his liie, with his great size, his dark hair and beard turned silver-white, his florid complexion and an air about him of singular freshness and calm, he had a look as of some serene and beneficent Jove.

Sargent never married. He had been a devoted son and brother, and was survived by his two sisters. Emily Sargent and Mrs. Francis Ormond. He died on April 15, 192j. His body was interred at Brookwood cemetery. Surrey. Memorial services were held at Westminster abbey and a memorial tablet was placed in the crypt of St. Paul's cathedral, London.

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(J. HN.; F. A. SW.)

SARGON, more correctly SARRU-KINU ("the legitimate king"), an Assyrian general who, on the death of Shalmaneser IV. during the siege of Samaria, seized the crown on the 12th of Tebet 722 B.C. He claimed to be the descendant oi the early kings, and accordingly assumed the name. of a famous king of Babylonia who had reigned about 2,000 years before him. His first achievement was the capture of Samaria. 27.200 of its inhabitants being carried into captivity. Meanwhile Babylon had revolted under a Chaldaean prince, Merodach-baladan. who maintained his. power there for 12 years. In 720 B.C. Yahu-bihdi of Hamath led Arpad. Damascus and Palestine into revolt: this was suppressed, and the Philistines and Egyptians were defeated at Raphia (mod. er-Raia). In 719 B.C. Sargon defeated the Minni to the east oi Armenia, and in 717 overthrew the combined iorces of the Hittites and Moschi (Old Testament Meshech). The Hittite city of Carchemish was placed under an Assyrian governor, and its trade passed into Xssyrian hands.

The following year Sargon was attacked by a great confederacy of the northern nations—Ararat. the Moschi, Tibareni, etc.—and in the course oi the campaign he marched into the land of the Medes in the direction of the Caspian. In 715 B.C. the hlinni were defeated, and one of their chieis. Dāyuku or Daiukku (Deioces), transported to Hamath. In 714 B.C. the army of Rusas oi Ararat was annihilated, and a year later five Median chieis, including Arbaku (Arbaces) became tributary. Cilicia and the Tibareni also submitted as well as the city of Malatia, eastern Cappadocia being annexed to the Assyrian empire. A league was formed between Merodach-baladan and the princes of the west, but before the coniederates could move, an Assyrian army was sent against Ashdod, and Edom, Moab and Judah submitted to Sargon, who was free to turn his attention to Babylonia, and Merodach-baladan was driven from Babylon, where Sargon was crowned king. Shortly after this Sargon sent a statue oi himself to Cyprus and annexed the kingdom oi Commagene. He was murdered in 705 B.C., probably in the palace he had built at Dur-Sargina, now Khorsabad, which was excavated by P. E. Botta.

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SARK (SERCQ), one of the smaller Channel Islands, lying 7 mi. east of Guernsey, is 3 mi. long and 1½ mi. in extreme breadth. Area 1.9 sq.mi.; pop. (1951) 528. It is divided into Great Sark (the more northerly) and Little Sark, connected by the Coupée, an isthmus more than 100 yd. long but only 6 ft. wide. with precipices going down 300 it. on each side to the sea. The coastal scenery is of considerable beauty. Creux, the harbour of Sark, on the east side, communicates with the interior solely by two tunnels, one dating from 1588, the other from 1868. There is another harbour (opened 1949) at La hfasseline. The island is highest (375 it.) about the centre of Great Sark, where stand the church, a few dwellings and a mill. Groups of houses at La Ville, Valette, Collinette, Dixcart and in Little Sark, suggest much earlier settlements. About the 6th century the Celtic saint, St. Magloire, founded a monastery there. There is little record of permanent settlement until the 16th century, when Elizabeth I granted the island as a manor to Helier de Carteret who, as its first seigneur, repeopled the island. dividing the land among 40 iarmers. De Carteret set up a scheme of government — partly manorial, partly parochial—which still prevails; the lordship of the island is still in the hands of a hereditarv seigneur (or dame in the event of female inheritance). The island is-included in the bailiwick of Guernsey, but has a court of justice of its own. There is also a court of chief pleas. whose members are the holders of the 40 original properties, and whose president is the seneschal. the principal government officer and judge of the island, appointed by the seigneur. Farming, fishing and the tourist trade are the chief occupations.

(B. C. DE G.)

SARMATAE or **SAUROMATAE** (the second form is mostly used by the earlier Greek writers, the other by the later Greeks and the Romans), a people whom Herodotus (iv. 21, 117) puts on the eastern boundary of Scythia (*q.v.*) beyond the Tanais (*Don*). He says expressly that they were not pure Scythians, but, being descended from young Scythian men and Amazons (iv. 110–117), spoke an impure dialect and allowed their women to take part in war and to enjoy much freedom. Hippocrates classes them as Scythian. From this we may infer that they spoke a language cognate with the Scythic. The greater part of the barbarian names occurring in the inscriptions of Olbia, Tanais, and Panticapaeum are supposed to be Sarmatian, and as they have been well explained from the Iranian language now spoken by the Ossetes of the Caucasus, these are supposed to be the representatives of the Sarmatae and can be shown to have a direct connection with the Alani (*q.v.*), one of their tribes. By the 3rd century B.C. the Sarmatae appear to have supplanted the Scyths proper in the plains of south Russia, where they remained dominant until the Gothic and Hunnish invasions. Their chief divisions were the Rhoxolani (*q.v.*), the Iazyges (*q.v.*), with whom the Romans had to deal on the Danube and Theiss, and the Alani. M. I. Rostovtzev has put serious difficulties in the way of the assumption that Sauromatae and Sarmatae were actually the same people; see his *Iranians and* Greeks *in S. Russia* (1922), and *Skifiya i Bospor* (192j).

SARMIENTO, DOMINGO FAUSTINO (1811–1888),

Argentine educator. writer and statesman, the "schoolmaster president." representative of liberal and anticlerical elements receptive to ideas from abroad. was born in the interior province of San Juan on Feb. 15, 1811. Sarmiento liked to compare his career as a self-made man with that of Abraham Lincoln, whom he greatly admired. Throughout his long public career as provincial legislator, cabinet minister and governor, diplomatic representative. president and national senator. Sarmiento's motto mas "to govern is to educate." That motto emphasized the role he believed public education must play in creating a nation of industrious and responsible citizens. In his efforts to build a new Argentina Sarmiento's principal model was the United States, but he used ideas from other countries also, adapting them to his country's needs.

Exiled to Chile for political activities (1840–52), Sarmiento became an important figure in Chilean journalism and politics as a newspaper editor and as an intimate friend and supporter of Manuel Montt (*q.v.*). In 1812, under Montt's sponsorship. Sarmienro became the founding director of the first normal school in South America, the second such school in the western hemisphere. In 1845 the Chilean government sent Sarmiento abroad to study educational methods in Europe and the United States. He returned in early 1848 a fervent admirer of Horace Mann's educational ideas and convinced that the United States was the nation Latin America should emulate. Subsequently. Sarmiento .participated in Gen. J. J. de Grquiza's overthrow of the dictator Juan Manuel de Rosas (*q.v.*) at Caseros on Feb. 3, 1852, and during the next decade enhanced his reputation as a publicist and educator while also playing an active role in Argentine politics.

For three years (1865–68) Sarmiento represented Argentina in Washington. He spent little time there, however, preferring instead to travel extensively through the United States studying everything that might be useful to his country. In 1868 Sarmiento was elected to the presidency, although he did not return to Argentina until after the election was over. Despite a war with Paraguay, Sarmiento's administration (1868–74) laid the foundations for later national progress by fostering public education. immigration, commerce! agriculture and the construction of transportation and communication facilities. After 1874, though he continued to be active in public affairs. education remained his primary interest until his death on Sept. 11, 1888, in Asuncion, Parag.

Many pages of the 52 volumes of Sarmiento's published works are devoted to educational themes. His *Facundo* (1845), a sociological interpretation of Argentine dictatorship. has been translated into several languages as one of the masterpieces of Latin-American literature. The celebration of the 50th anniversary of Sarmiento's death (1938) occurred when reactionary indigenous fascists were launching bitter attacks on Argentine civil liberties and democratic principles. Defenders of those institutions have fostered public interest in Sarmiento's career by publicizing his efforts in support of those institutions and his opposition to dictatorial regimes.

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SARNIA, county seat of Lambton county, Ontario. Can., on the St. Clair river and Lake Huron. Sarnia is well served by highways and railroads and has transriver communication with Port Huron, Mich., via the St. Clair railway tunnel, the Bluewater bridge and ferry service. The site was visited by French explorers as early as 1627. The first French settlers arrived in 1807. but Malcolm Cameron was the real founder of an English-speaking settlement in 1833. In 1836 it was named (Port) Sarnia, the Roman name for the island of Guernsey, upon the suggestion of Sir John Colborne, lieutenant governor of Upper Canada and formerly lieutenant governor of Guernsey. Oil was discovered in Lambton county in 1858; by 1899 there was a refinery at Sarnia and the city became a petroleum centre. Sarnia has extensive harbour facilities. oil refineries (crude oil is supplied by pipeline from western Canada), extensive petrochemical industries, a salt industry, a grain elevator and a diversity of small manufacturing industries. Oil products are transmitted to central Ontario by two pipelines. The publicly owned Polymer corporation, built in 1942, pioneered the manufacture of synthetic rubber in Canada. Pop. (1961) 50.976. (G. FN.)

SARNO (anc. *Sarnus*), a town of Campania, Italy, in the province of Salerno. 15 mi. N.E. of that city and 30 mi. E. of Naples by the main railway. Pop. (1957 est.) 29,526 (commune). It lies at the foot of the Apennines, 92 ft. above sea level, near the sources of the Sarno (anc. *Sarnus*), a stream connected by canal with Pompeii and the sea. Teias was defeated here by Narses in A.D. 552. Sarno has the ruins of a medieval castle, which belonged to Count Francesco Coppola, who took an important part in the conspiracy of the barons against Ferdinand of Aragon in 1485. Walter of Brienne is buried in the ancient church of S. Maria della Foce rebuilt in 1701. The travertine which forms round the springs of the Sarno was used even at Pompeii as building material.

SARPEDON, in Greek legend, son of Zeus and Laodameia, Lycian prince and hero of the Trojan war. He fought on the side of the Trojans and was slain by Patroclus. Apollo rescued his body and, by the command of Zeus, handed it over to Sleep and Death, by whom it was conveyed for burial to Lycia, where a sanctuary (Sarpedoneum) was erected in his honour. In later tradition. Sarpedon was the son of Zeus and Europa and the brother of Minos. Having been expelled from Crete by the latter, he and his comrades sailed for Asia, where he finally became king of Lycia.

SARPI, PAOLO (baptized PIETRO) (1552–1623), 'C'enetian state theologian and antipapal pamphleteer, was born in Venice on Aug. 14. 1552. After the premature death of his father. he came into the care of an uncle and a Servite friar. Capella, under whose influence he entered the Servite order in his 15th year. Sarpi's talents were outstanding and his intellectual curiosity unlimited. In the field of physics and even of anatomy he is credited with important discoveries, but his writings on scientific subjects are lost. In 1570, at Mantua, he caused a sensation by a brilliant defense of more than 100 theses, upon which Duke Gonzaga secured his transfer from Venice to Mantua where the friar often exhibited his skill in debate by defending the most daring propositions. In 1579 he became provincial of his order, and in 1588 its procurator general in Rome. Three attempts to get him a bishopric proved unsuccessful, in spite of Venice's backing; his relations with leading Protestants were well known in Rome. Sir Henry Wotton, the English envoy, described him as "a true Protestant in a monk's habit." These disappointments further exacerbated his long-standing antipapal feelings. In the conflict between Venice and Paul V over the signoria's interference with papal jurisdiction and ecclesiastical immunity, Sarpi, since 1606 its official theologian. encouraged resistance. The threatened censures, he urged. must be ignored; they were invalid, for the pope was exceeding his powers. Fear of Venice's breaking with Rome and the risk of civil war in Italy induced the neighbouring states to intervene and a compromise was reached on April 21. 1607, chiefly through France's mediation. On Oct. 5, 1607, Sarpi was the object of a murderous attack; there is no evidence of the crime having been engineered in Rome, and Paul V reprobated it energetically. Though excommunicated in the same year. Sarpi continued to say mass. He died on Jan. 16, 1623, unreconciled, it seems. with the church.

Sarpi's literary remains consist largely of pamphlets written by himself or under his inspiration during the conflict between Venice and Paul V. He is now chiefly remembered for his exceedingly biased *Istoria del concilio tridentino* ("History of the Council of Trent") published in London in 1619, under the pseudonym of Pietro Soave Polano, by Marcantonio de Dominis, archbishop of Spalato, a fugitive from the Inquisition. The book created a sensation: it was the first detailed account of a council which Sarpi described as "a large-scale, highly successful deception maneuver" of the papal curia. But the work is important. for its author seems to have had access to documents that were later lost.

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SARRACENIA (SIDESADDLE FLOWER): *see* PITCHER PLANTS.

SARRAUT, ALBERT PIERRE (1872–), French politician, prime minister at the time of German remilitarization of the Rhineland (1936). He was born at Bordeaux, on July 28, 1872. Early associated as journalist with the radical *Dépêche de Toulouse*, of which his brother Maurice was to become editor, he was elected deputy in the Aude *département* in 1902 and was junior minister in several governments from 1906 onward. He was governor general of Indochina. 1911–14. After being under-secretary of state for war for a year, he went back to Indochina at the end of 1916 for a second term of three years. He was minister of colonies in four successive governments from Jan. 1920 to March 1924 and was appointed ambassador to Turkey, in March 1925. The next year. however. he was elected senator. He was minister of the interior under Raymond Poincaré, July 1926–Nov. 1928, three times navy minister and three times minister of colonies in six different cabinets between Feb. 1930 and Oct. 1933. Sarraut was prime minister for a short time in 1933 (Oct. 26–Nov. 27). He was minister of the interior in Gaston Doumergue's government formed after the riots of Feb. 6. 1934. In Jan. 1936 he formed a caretaker government till the elections of June. He favoured a vigorous reaction to Germany's military reoccupation of the Rhineland (March 7). but failed to overcome hesitation in the cabinet and parliament. He was again minister in all governments from June 1937 till June 1940. Sarraut withdrew from public life at that date but edited the *Dépêche* after his brother was murdered on Dec. 2, 1943, until his own deportation to Germany on June 6, 1944. In 1950 he was chairman of the conference between France and the Indochina state at Pau and then became president of the assembly of the French union. (D. R. GE.)

END OF VOLUME NINETEEN

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